Gastro-intestinal fistulas : management and results of treatment

Citation for published version (APA):

Rinsema, W. (1992). *Gastro-intestinal fistulas : management and results of treatment*. [Doctoral Thesis, Maastricht University]. Rijksuniversiteit Limburg. <https://doi.org/10.26481/dis.19920306wr>

Document status and date:

Published: 01/01/1992

DOI:

[10.26481/dis.19920306wr](https://doi.org/10.26481/dis.19920306wr)

Document Version:

Publisher's PDF, also known as Version of record

Please check the document version of this publication:

- A submitted manuscript is the version of the article upon submission and before peer-review. There can be important differences between the submitted version and the official published version of record. People interested in the research are advised to contact the author for the final version of the publication, or visit the DOI to the publisher's website.
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- The final published version features the final layout of the paper including the volume, issue and page numbers.

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GASTRO-INTESTINAL FISTULAS

Management and results of treatment

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PROEFSCHRIFT

ter verkrijging van de graad van doctor
aan de Rijksuniversiteit Limburg te Maastricht,
op gezag van de Rector Magnificus, Prof. Mr. M.J. Cohen,
volgens het besluit van het College van Dekanen,
in het openbaar te verdedigen
op vrijdag, 6 maart 1992 om 16.00 uur

door

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CIP GEGEVENS KONINKLIJKE BIBLIOTHEEK DEN HAAG

Rinsema, Willem

Gastro-intestinal fistulas : Management and results of treatment / Willem Rinsema. - Maastricht : Datawyse. - Ill.

Proefschrift Maastricht. - Met lit. opg. - Met samenvatting in het Nederlands.

ISBN 90-5291-073-1

NUGI 742

Trefw.: gastro-intestinale fistels

Boekverzorging: Datawyse Maastricht, Ruud Leliveld

Omslagontwerp: Dhr. J. Reparon

Druk: Krips Repro Meppel

Publication of this thesis was financially supported by
"ConvaTec post education services" the Netherlands.

to my parents
to Ineke and Jelle

Contents

INTRODUCTION

Scope of this thesis	9
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Chapter 1

REVIEW OF THE LITERATURE UP TO 1980

1.1 Treatment policy	11
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Chapter 2

GASTRO-INTESTINAL FISTULAS IN 114 PATIENTS TREATED IN THE MAASTRICHT UNIVERSITY HOSPITAL BETWEEN 1977 AND 1987

2.1 Patients and fistulas	19
2.2 Supportive measures and related results	26
2.3 Delayed definitive surgery and related results	29
2.4 Results of treatment	29
2.5 Discussion	35

Chapter 3

MANAGEMENT OF FISTULAS ACCORDING TO CAUSE, MULTIPLICITY AND OUTPUT

3.1 Postoperative fistulas	39
3.2 Spontaneous fistulas	50
3.3 Multiple fistulas	57
3.4 High-output fistulas	60

Chapter 4

MANAGEMENT OF FISTULAS ACCORDING TO LOCATION

4.1 Stomach	63
4.2 Duodenum	68
4.3 External fistulas of the jejunum or ileum <i>Acta Chir Scand 156: 457-462, 1990</i>	77
4.4 External fistulas of colon or appendix	86
4.5 Entero-vaginal fistulas	91
4.6 Entero-vesical fistulas	96
4.7 Other fistulas	101

Chapter 5

SUPPORTIVE CARE

5.1	Nutrition: enteral nutrition or parenteral nutrition?	111
5.2	Skin and fistula care	120
5.3	Reinfusion of secretions from high-output proximal stomas or fistulas	
	<i>Surg Gynecol Obstet 167: 372-376, 1988</i>	129
5.4	Medication: Somatostatin, H2-blockers, antibiotics	135
5.5	Diagnostics, abscess drainage	138

Chapter 6

GENERAL DISCUSSION

	Summary	149
	Samenvatting	153
	References	158
	Acknowledgements	173
	Curriculum Vitae	175

Introduction

SCOPE OF THIS THESIS

A gastro-intestinal fistula is an abnormal communication between a part of the gastrointestinal tract and the skin (external), between two parts of the gastrointestinal tract (internal), or between a part of the gastrointestinal tract and another hollow organ (internal). External or internal fistulization frequently leads to a rapid, life threatening deterioration of the general condition of the patient with malnutrition, sepsis, electrolyte disturbances and dehydration. A few decades ago, these fistulas were associated with a high morbidity and mortality (Edmunds, 1960). Although early definitive surgery had a mortality of over 50 per cent, conservative treatment was insufficient for control of the fistula, to treat sepsis or to overcome the associated metabolic changes, skin damage etc. At present, advanced techniques for diagnosis and supportive care allow a more conservative approach, especially for external postoperative fistulas. Good results can be achieved if the surgeon is aware of the potential catastrophic nature of certain fistulas and is familiar with the principles and techniques of primary conservative treatment. The aim of this thesis was to analyse the results of a consecutive series of patients with fistulas treated in our department with an adopted conservative approach over a period of 10 years (1977-1987). Based on this process we discuss the aspects of modern fistula treatment, for instance CT-scanning and Somatostatin®. Common locations of fistulas, pathogenesis and related primary diseases will be discussed and a treatment regimen is recommended based on the results of treatment of our patients and those reported in the literature.

DEFINITIONS

Fistula: non-physiological communication between two hollow organs (internal) or between one hollow organ and the skin or vagina (external).

Primary conservative treatment (PCT): measures intended to create optimal conditions for spontaneous closure of a gastrointestinal fistula or for delayed definitive surgery: skin and fistula care, nutrition, control of sepsis, diagnostic evaluation.

Immediate operative treatment (IOT): a definitive operation, performed within one week after the development of a fistula.

No treatment (NT): no conservative or operative treatment is started, because of fistula or patient related factors.

Definitive operation: operative procedure intended to eliminate the fistula: suture closure, resection with end-to-end anastomosis.

Delayed definitive operation: definitive operation performed under stable conditions if conservative treatment did not result in spontaneous closure of the fistula.

Non-definitive operation: operative procedures performed during conservative treatment not intended to close the fistula, but to create optimal conditions for spontaneous closure or delayed surgery: abscess drainage, construction of a divided stoma, resection with exteriorization, partial or total bypass, operative placement of a catheter for enteral nutrition (jejunostomy), etc..

Postoperative fistula: a fistula which develops as a postoperative complication after surgery and is related to leakage of the anastomosis or unrecognized operative injury with secondary leakage.

Spontaneous fistula: fistula as a result of a diseased segment of bowel or other hollow organs.

CHAPTER 1

Review of the literature up to 1980

INTRODUCTION

Gastro-intestinal fistulas challenge the diagnostic and therapeutic acumen of the surgeon. The fistula- 'population' and the methods of treatment changed during the decades. Before 1945 most of the gastro-intestinal fistulas were spontaneous, caused by advanced intra-abdominal disease, a strangulated herniation or a penetrating trauma due to bullet or knife. After 1945, as first shown by the classical work of Edmunds et al (1960), most fistulas developed after surgery (67%) and were associated with a high mortality (overall 43%). Between 1900 and 1980, four timeperiods can be distinguished in the evolution of fistula treatment. In each period important changes in treatment methods and surgical or supportive techniques evolved. The optimal treatment changed from early definitive surgery towards primary conservative treatment. The more aggressive use of supportive techniques made conservative treatment more successful and the overall mortality decreased to around 20%.

THE PERIOD BEFORE 1945

Before 1900, the literature on fistulas largely concerned case reports on spontaneous fistulas or fistulas after penetrating trauma. One of the first descriptions of a fistula is attributed to Aretaeus of Cappadocia, 30-39 A.D. (Lichtman, 1944), who incised an abscess in the right lower quadrant of the abdomen. This resulted in an external fistula which closed spontaneously. Thilesus reported in 1670 on a patient who had a biliary fistula due to spontaneous perforation of gallstones through the abdominal wall (Horhammer, 1916). In 1735, Claudius

Amyand described a faecal fistula in a hernia in which the appendix was incarcerated (Lichtman, 1944). Beaumont (1833) studied the gastric physiology in a chronic gastric fistula after a gun shot wound. Between 1900 and 1945, as a consequence of an increased incidence of fistulas and consequently the growing interest, larger groups of patients were published (Rankin, 1932; Lewis, 1933; Mayo, 1941; Lichtman, 1944). Most fistulas developed spontaneously and were related to inflammatory disease (58-80%) and seldom (0-19%) as a postoperative complication. An exception was Ransom (1935), who reported on 94 external fistulas predominantly as surgical complications (51%).

Early surgical intervention was associated with a postoperative mortality of about 50% because of the poor general condition of the patients and the local inflammatory process precluding effective wound healing (Macnaughton, 1941). Therefore conservative treatment, sometimes as long as one year, was the therapy of choice. Major problems during conservative treatment were: insufficient skin protection, control of fistula effluent, malnutrition, dehydration, acid-base disturbances and loss of electrolytes (Dixon, 1938). Several methods were used to protect the skin such as tannic acid (Dixon, 1938), beef extract (Potter, 1929), kaolin paste (CoTui, 1930), Bradford frame (Potter, 1932). The fistula opening was blocked with buttons of wood or leather, chewing gum or a double metallic button (Dowd, 1917). A suction device was used to protect the skin and collect the effluent (Cameron, 1923; Tenopyr, 1937).

Sometimes, circumstances were favourable and the effluent of the fistula could be collected and re-infused in a distal stoma or fistula (Wilkie, 1924; MacNaughton, 1941). Dehydration was treated by infusions via peripheral veins or hypodermoclysis with a saline solution of 0.9%. Nutrition was provided to a limited degree by a peripheral infusion of a glucose solution 10% and casein (Brunschwig, 1939), glucose solution 2% by rectal drip (Baker, 1932) or, if possible, via a jejunostomy. The techniques of conservative treatment were often insufficient to control the fistula output, to overcome sepsis and to keep the patient in a good nutritional condition. As a consequence, early surgery was a desperate attempt to treat a patient with sepsis and malnutrition and resulted in a very high mortality.

In general, resection with anastomosis was advocated as surgical method of choice in patients with a stable general condition and little local soiling or inflammation (Dixon, 1938). In patients with an unstable condition i.e. overt inflammation, a partial or complete bypass was recommended to anticipate uncontrollable local spillage and progressive deterioration (Keyes, 1941; Dixon, 1946). The overall mortality ranged from 3 to 50 % (Lichtman, 1944; Dixon,

1944; MacNaughton, 1941) and largely depended on the origin of the fistula (Dixon, 1938).

THE PERIOD 1945 TO 1960

This period showed a further shift in cause to postoperative fistulas with a more complicated and fatal course. McKirdy (1954) treated 18 patients with external small bowel fistulas, 13 (72%) occurred postoperatively, Edmunds (1960) described 157 external gastrointestinal tract fistulas, 105 were postoperatively (67%).

The treatment policy remained unchanged, as stated by Dixon in 1946: 'It is almost universally wrong to attempt to repair an external faecal fistula surgically shortly after its inception. Better results will be obtained if a period of waiting and conservative treatment is indulged in first'. There was a good understanding of the sequence of factors involved in the rapid deterioration which led to death of patients with high output fistulas: dehydration, electrolyte imbalance, nutritional deficiency, infection, chronic shock (McKirdy, 1954). Surgery directed to closure of the fistula was only performed if the patient was in an optimal condition and resection of the involved segment of bowel with end-to-end anastomosis was the method of choice. A complete bypass, as advocated by Harbison (1950) and Keyes (1951) was only considered if the local operative area was not suitable for direct treatment of the fistula, due to persistent acute or subacute inflammatory reaction, uncontrollable effluent or a poor general condition (Dixon, 1946). Major progress was achieved in fluid and electrolyte resuscitation, parenteral nutrition and control of infection (McKirdy, 1954). It was possible to give 1600 calories per day by peripheral infusion of glucose solution 10% and casein hydrolysates, but daily changes of the infusion sites were necessary to prevent thrombophlebitis (Hull, 1950). McKirdy (1954) described a technique of central infusion with a catheter in the vena femoralis. The advantage was that oral feeding could be stopped, resulting in a decrease of fistula production, and that daily changes of the infusion site were no longer necessary. The use of antibiotics (sulfonamides, penicillin, streptomycin) seemed advantageous in the treatment of sepsis (Dixon, 1946; Edmunds, 1960) and they were liberally used. The alterations, improvements and pitfalls in fistula treatment are clearly illustrated by Edmunds, Williams and Welch who reported external gastrointestinal fistulas of the stomach, small bowel and colon, treated between 1945 and 1960 in the Massachusetts General Hospital. Despite the use of antibiotics the overall mortality remained high (45%) and was even higher in the patients with gastric and duodenal fistulas (62%) or high-output

small bowel fistulas (54%). In their retrospective study of 157 external gastrointestinal fistulas, the authors analysed factors that might be responsible for the high mortality. This paper is of utmost importance because Edmunds and colleagues were the first who accurately defined the patients and related aspects.

The patients were divided in three subgroups with prognostic and therapeutic significance, depending on the anatomical location and the maximum amount of drained fluid: 1. fistulas originating from stomach, duodenum or gastro-jejunal anastomosis, 2. fistulas arising from jejunum or ileum draining over 100 cm³ fluid per day, 3. fistulas from the ileum draining less than 100 cc. daily, and the colon. Two types of operations were distinguished: non-definitive, in which complications of the fistula were treated and definitive, in which the fistula was eliminated by resection or closure.

The main complications were fluid and electrolyte imbalance, malnutrition and generalized peritonitis, with a mortality of 78, 61 and 67 % respectively.

The authors concluded that modern techniques of replacement therapy and antibiotics had not significantly decreased the mortality over 20 years. They suggested that this was directly related to the changed fistula cause towards postoperative leakage. Prevention was considered essential to improve the results of treatment. For the established small-bowel fistulas they advised early (after one to three weeks) resection of the fistula and the affected segment of intestine. Fistulas of the colon often showed spontaneous closure. Therefore conservative treatment was satisfactory in many instances. Definitive surgery was indicated after six weeks for fistulas which failed to close or were likely to persist (distal obstruction, active disease at the intestinal opening, large fistulas, foreign bodies).

THE PERIOD 1960 TO 1970

In this period fistulas were most frequently caused by postoperative complications (Table 1.1).

The treatment policy remained the same: primary conservative treatment directed to control of body fluids and electrolyte balance, adequate nutrition and skin care and treatment of sepsis (Lorenzo, 1964; Dudrick, 1968). The parasurgical care by means of respiratory support, antibiotics, enteral and parenteral nutrition and haemodynamic monitoring rapidly improved. Resection of the fistula and bowel segment with end-to-end anastomosis was the definitive procedure of choice (Nemhauser, 1967).

The overall mortality was still high (38-50 %) but complicated fistulas of the stomach and duodenum decreased, probably due to preventive measures such as

TABLE 1.1. Cause of the fistula and result of treatment (1960-1970)

Author (s)	n	Cause (%)			Closure (%)		Failure (%)	
		Postop	IBD	Rest	Spont	Tot	F+	Died
Edmunds, 1960	157	66	2	32	25	54	4	43
Chapman, 1964	56	86	0	14	32	53	0	45
Miller, 1966	28	100	0	0	7	50	0	50
Nemhauser, 1967	19	95	0	5	0	31	0	36
Halversen, 1969	55	84	0	16	18	56	0	43
Lorenzo, 1969	18	61	22	16	0	50	0	38

IBD = inflammatory bowel disease; F+ = fistula open

duodenal stump drainage (Edmunds, 1960). Apparently, the skills in primary conservative treatment were insufficient for a successful treatment of these more complicated postoperative fistulas.

Soeters et al (1977) evaluated the patient group treated according to the recommendations of Edmunds in the Massachusetts General Hospital from 1960 to 1970. They found a high closure rate (78%) and a low mortality (15%), despite the fact that none of the patients received significant parenteral nutrition. The improved results were probably related to the many colonic fistulas (52/119). Soeters et al concluded that treatment based on 'sound surgical principles', with the supportive modern intensive care, should further decrease the mortality of the patient and improve closure rate of fistulas.

Two developments were responsible for a more successful conservative care of fistulas: *a* fistula treatment according to a protocol (Chapman, 1964); *b* further evolution of the application of parenteral nutrition (Dudrick, 1968).

In 1964, Chapman concluded that the lack of a specific protocol for management had contributed to the rapid deterioration of the patients with fistulas. In his opinion the keys to a successful fistula management were: '1) get control of the fistula, 2) combat sepsis, and 3) maintain adequate nutrition from the beginning'. He formulated four priorities of treatment by means of a time table (Table 1.2).

Parenteral nutrition was started within 48 hours after recognition of the fistula. Chapman et al found that patients, who received more than 2000 calories per

TABLE 1.2. Priorities in the treatment of intestinal fistulas according to Chapman et al (1964)

FIRST PRIORITY: (0 to 12 hours)

- a. Correct blood volume deficiency
- b. Drain obvious and easily accessible abscesses
- c. Control fistula, protect skin: sump or bag

SECOND PRIORITY: (0 to 48 hours)

- a. Correct electrolyte imbalance
- b. Replace daily electrolyte and fluid losses
- c. Begin intravenous nutritional program

THIRD PRIORITY: (1 to 6 days)

- a. Passage of feeding tube beyond fistula
- b. Feeding jejunostomy
- c. Continuous search for and drainage of obvious abscesses if they appear

FOURTH PRIORITY: (after 5 to 14 days +)

Major surgical intervention:

- a. To find occult sepsis
 - b. To close or bypass fistula
-

day, had a mortality of 16%, whereas patients receiving less than 1000 calories per day had a mortality rate of 58%. In stable conditions an attempt was made to change the parenteral nutrition partly or completely to enteral nutrition via a small-bore catheter or jejunostomy and by continuous infusion. After about 5 days the fistula size and location was delineated by careful X-ray. Repeatedly, a search was made for abscess cavities, that were drained and unroofed adequately. As a rule, the authors did not use antibiotics but used only antibiotics in case septicaemia or bacteraemia were evident. If a patient remained febrile and was 'losing ground', exploration of potential sites of infection was advocated (occult sepsis). Otherwise, a definitive operation was performed if the patient was in a stable condition without sepsis.

Dudrick et al (1968) published their first results with long-term parenteral nutrition in beagle puppies and thereafter in patients with chronic complicated gastrointestinal disease. They placed parenteral nutrition in a scientific background and showed that growth and positive nitrogen balance could be achieved by continuous infusion of a standardized solution, consisting of 20% glucose,

5% fibrin hydrolysate, electrolytes, trace elements and vitamins. It was possible to infuse 2400 to 4500 calories per day for 10 to 200 days. The catheter was introduced percutaneously in the superior caval vein via the subclavian route. The procedure was done according to a standard protocol to overcome long-term complications (catheter sepsis and thrombosis).

THE PERIOD 1970 TO 1980

During this period not only more aggressive and complicated operative procedures were performed, but these were frequently combined with chemotherapy and radiotherapy (Roback, 1972; Soeters, 1979). The incidence of fistulas increased and fistulas frequently developed in patients with more advanced and complicated disease. Two reviews on fistula treatment led to a world-wide knowledge and application of the principles of primary conservative treatment (Fischer, 1975; Webster-Carey, 1976). Hyperalimentation of up to 5000 calories in 24 hours was given according to the principles of Dudrick (1968). Early operations were restricted to procedures that drain the abscess or indirectly influence the fistula output, for instance the construction of a proximal diverting colostomy (Athanasakiakes, 1975). Fischer (1975) emphasized, that if fistulas had not closed after 2 months of adequate parenteral nutrition, spontaneous closure should be unlikely, and the patient should be operated upon. The definitive operation of choice was resection of the diseased bowel segment and end-to-end anastomosis.

Treatment of fistulas according to a standard protocol (Chapman, 1964), and further improvement of intensive patient care methods, made conservative treatment more successful (decrease in mortality of 45 to 15%) and an increase in spontaneous closure (25 to 70%). However, these improvements were not as spectacular as expected (Irving, 1977), probably influenced by the more complicated fistula population. (Soeters, 1979).

CONCLUSION

Before 1945 most gastrointestinal fistulas developed spontaneously and were related to advanced benign or malignant disease. These fistulas were treated conservatively, despite the fact that spontaneous closure was unlikely, because in these depleted patients immediate operative treatment had an even worse outcome. Three decades later most fistulas were postoperative and were treated conservatively according to a protocol. Improvements in parasurgical care and

supportive methods made conservative treatment successful. The goal of treatment was to control the fistula, and to create circumstances for spontaneous closure or for delayed definitive surgery. Only under exceptional circumstances (a spontaneous fistula in a well-nourished patient or uncontrollable output) either immediate operative treatment was indicated, or the decision was made to refrain from treatment.

1.1 TREATMENT POLICY

When reviewing the literature on fistulas three different treatment approaches become apparent: primary conservative treatment, immediate operative treatment, or no specific treatment at all. Most frequently the choice was conservative treatment including measures to create optimal conditions for spontaneous closure of a fistula or for delayed definitive surgery: skin- and fistula-care, nutrition, control of sepsis, bowel rest, diagnostic procedures. Immediate operative treatment implied definitive surgery aimed at closure of the fistula shortly (a few days) after the development or discovery of the fistula. Definitive surgery may consist of suture closure or resection with end-to-end anastomosis. No treatment of fistula patients implies that early after the development or recognition of the fistula the decision was made not to start conservative or operative treatment aimed at fistula closure because of patient-related or fistula-related factors.

From 1977 to 1987 we treated patients with a fistula according to this policy and in the next chapters the results are presented and evaluated. During the period under study several new developments such as computed tomography and somatostatin influenced and refined the methods and results of conservative treatment. As from the last years of the study these techniques are mandatory for the conservative treatment of fistulas. Therefore these techniques will also be considered in the treatment protocol and in the chapter on supportive care (Chapter 5).

CHAPTER 2

Gastro-intestinal fistulas in 114 patients treated in the Maastricht University Hospital between 1977 and 1987

2.1 PATIENTS AND FISTULAS

From 1977 to 1987 a total of 114 patients with 138 external and internal fistulas were treated. According to the treatment policy the patients were initially treated conservatively. Only exceptionally, patients were immediately operated upon or were not treated at all. The indications for immediate operation or for no treatment are described in Chapter 2.1.3.

Conservative treatment was started in 96 patients (116 fistulas), immediate operation was performed in 11 patients (13 fistulas), and no specific treatment of any kind was instituted in 7 patients (9 fistulas). There were 60 male and 54 female patients, with a median age of 58 years (range 12-86 years). Twenty-one patients had multiple fistulas: 17 patients were conservatively treated, 2 patients were operated upon and 2 patients were not treated. The distribution of patients over the years is shown in Figure 2.1.

Location of the fistulas

The fistulas were classified according to location and treatment method. The location is determined by the site of origin of the fistula. There were 106

FIGURE 2.1. The distribution of patients over the years

external fistulas and 32 internal fistulas. Most fistulas originated from the small bowel (45/136) (Table 2.1).

Cause and primary disease

In most patients fistulas were due to surgical complications (58%) or inflammatory disease (27%). In the remaining 17 patients the fistulas were caused by cancer, irradiation and ischaemia or the cause was unknown (Table 2.2).

The primary disease was most frequently a malignancy (42 patients) or inflammatory bowel disease (22 patients). The remaining patients had various intra-abdominal diseases (ileus, leiomyoma, choledocholithiasis). Finally 2 patients had fistulas after abdominal trauma (Table 2.3).

Treatment

Ninety-six patients with 116 fistulas were primarily treated conservatively. The group consisted of 54 male and 42 female patients, in age ranging from 12 to 84 years (mean 56 yrs). Seventeen patients had multiple fistulas. There were 94 external fistulas and 22 internal fistulas. Most frequently the fistula was caused

TABLE 2.1 Location of external and internal fistulas, subdivided according to method of treatment: primary conservative treatment (conservative), immediate operative treatment (operative) and no treatment (none)

Location	Fistulas n = 136	Treatment		
		Conservative n = 116	Operative n = 13	None n = 9
External (cutaneous)				
oesophagus	5	5		
stomach	6	6		
duodenum	8	7	1	
pancreas	2	2		
biliary tract	1	1		
small intestine	45	44		1
appendix	3	3		
colon	16	12		4
small intestine / colon	1			1
External (vaginal)				
small intestine	2	1	1	
colon	6	4	2	
rectum	9	7	1	1
bladder	2	2		
Internal				
stomach / colon	1	1		
small intestine / small intestine	3	2	1	
small intestine / colon	12	9	2	1
small intestine / bladder	2	2		
colon / colon	1	1		
colon / bladder	11	6	4	1
colon / ureter	1	1		
gallbladder / duodenum	1		1	

TABLE 2.2 Cause of fistulas subdivided according to the method of treatment: primary conservative treatment (conservative), immediate operative treatment (operative) and no treatment (none)

Cause	Patients n = 114	Conservative n = 96	Operative n = 11	None n = 7
Surgical Complication				
Suture line failure	27	26	1	
Secondary failure*	39	37		2
Inflammatory Disease				
Crohn's disease	15	14		1
Diverticulitis	13	7	6	
Appendicitis	2	2		
Cholecystitis	1		1	
Other causes				
Malignancy	8	4	2	2
Radiation	6	5	1	
Ischaemia	1	1		
Unknown	2			2

* Secondary failure = defined as fistulas that develop postoperatively, but are not related to suture line failure

by a postoperative complication (63/96), and in 23 patients by inflammatory disease (24%).

Eleven patients (4 male and 7 female patients with 13 fistulas) were immediately operated. The age ranged from 49 to 77 years (mean 66 yrs). Five fistulas were external and 8 internal. Two of these patients had multiple fistulas (Table 2.4).

Seven patients with 9 fistulas had no treatment specifically directed to the fistula, because of fistula-related or patient-related factors making successful treatment impossible or superfluous. In four of these patients (numbers 8,91,98, 102) a definitive operation was performed after a prolonged period without specific supporting measures (Table 2.5).

TABLE 2.3. Primary disease of patients with fistulas, subdivided according to method of treatment: primary conservative treatment (conservative), immediate operative treatment (operative) and no treatment (none)

Primary disease	Patients n = 114	Conservative n = 96	Operative n = 11	None n = 7
Malignancy	42	35	3	4
Inflammatory bowel disease	22	21		1
Ulcer	9	8	1	
Cholecystitis	1		1	
Pancreatitis	2	1		1
Diverticulitis	17	11	6	
Appendicitis	3	3		
Vascular disease	5	5		
Rest	12	12		
Unknown	1			1

TABLE 2.4 Characteristics of the 11 patients who had immediate operative treatment

Pnt. nr.	Age (yrs)	Sex	Primary disease	Cause	Location
4	72	M	diverticulitis	diverticulitis	sigmoid-bladder
26	68	F	diverticulitis	diverticulitis	sigmoid-bladder
29	49	M	diverticulitis	diverticulitis	sigmoid-bladder
44	55	M	diverticulitis	diverticulitis	sigmoid-bladder
57	77	M	diverticulitis	diverticulitis	jejunum-jejunum jejunum-colon
65	64	F	diverticulitis	diverticulitis	sigmoid-vagina
28	63	F	ovarian cancer (perit.carc.)	cancer	jejunum-vagina jejunum-rectum
53	73	F	cervical cancer IIB	cancer	vagina-sigmoid
64	60	F	cervical cancer IIB	radiation	rectum-vagina
30	75	F	duodenal ulcer (bleeding)	suture line failure (BII)	duodenal stump
69	76	F	cholecystitis	cholecystitis	galbladder-duodenum

TABLE 2.5 Characteristics of the seven patients in whom no treatment was performed

Pnt nr.	Age (yrs)	Sex	Primary disease	Cause	Location	Remarks
42	48	F	adenocarcinoma coecum	cancer	coecum-skin (2x)	irresectable, cachectic,died
63	86	F	cancer	surgical damage	rectum-vagina	Hartmann procedure
98	59	F	adenocarcinoma	cancer	colon-skin	persisted 114 d.
102	76	M	cancer stomach	unknown	colon-skin	persisted 350 d.
8	50	F	M.Crohn	M.Crohn	jejunum-skin ileum-sigmoid	persisted > 1 year
91	44	M	pancreatitis	sump	jejunum-colon-skin	persisted > 120 days
9	80	F	unknown	unknown	bladder-colon	sepsis, dehydration

The considerations that led to the decision not to treat are illustrated in the case reports.

PATIENT nr. 9: A 80-years old, mentally debilitated woman was admitted in a septic and dehydrated condition. She was initially treated with antibiotics for recurrent urinary infections. Laboratory examination revealed a leucocytosis (22.10.⁹/L.) and a pyuria. A bladder fistula, detected by cystoscopy, was probably caused by a malignancy of unknown origin or by diverticulitis. Her physical condition was so bad that even a minor operation was considered to be unjustified. She died two days later. Postmortem examination was not performed.

PATIENT nr. 42: A 48-years old woman was operated upon for an obstructing adenocarcinoma of the coecum. The tumor was irresectable and an ileotransversostomy was performed (Dukes D). Postoperatively she developed two fistulas in the right groin, producing faecal material. Biopsies of the fistulas for histological examination revealed adenocarcinoma. Her condition rapidly deteriorated both physically and mentally and further therapy was impossible. She was discharged from hospital and died a few weeks later.

PATIENT nr. 63: A 86-years old woman was operated upon for an obstructing adenocarcinoma of the rectum (Dukes B2). She underwent a Hartmann procedure (resection of the sigmoid, a colostomy and closure of the rectal stump) and eventually recovered without complications. After two weeks, she had a rectal and vaginal bleeding. Proctoscopic examination of the rectal stump revealed a recto-vaginal fistula. The colostomy produced well and oral nutrition was

re-established. After a few weeks the fistula spontaneously closed without supportive measures or operation.

THE OTHER FOUR PATIENTS had a low output fistula that persisted for a prolonged period of time, but had no adverse effect on digestion and absorption, so that no specific therapeutic or supportive measures were necessary. The patients were on a normal diet and were treated on an out-patient basis. PATIENT nr. 8 developed the fistula after a gynaecological operation, but did not seek medical advice until the fistula persisted for more than one year. A small bowel passage showed the typical signs of Crohn's disease in the ileo-coecal region and a resection with anastomosis was performed without complications. PATIENT nr. 91 developed a pancreatic pseudocyst after acute pancreatitis and a distal pancreatectomy with splenectomy was performed. The recovery was uneventful, but a drain site continued to produce. After 120 days, an external colonic fistula could be visualized by fistulography and a resection with anastomosis was performed. A recurrent fistula closed spontaneously. PATIENT nr. 98 had a laparotomy for an adenocarcinoma of the hepatic flexure, and an ileo-transversostomy was performed. Postoperatively a fistula developed that originated from the carcinoma. The fistula persisted for 114 days without specific therapy or support and ultimately a successful resection was performed. PATIENT nr. 102 underwent a subtotal gastrectomy for gastric cancer. Postoperatively, an abdominal dehiscence occurred, which was treated with a Marlex mesh. During removal of the mesh a laceration of the colon was closed and protected with a colostomy in the hepatic flexure. A fistula developed and persisted for nearly a year without supportive measures. Finally a colonic resection was performed and a new fistula closed spontaneously.

Output of the fistula

Thirty-two patients suffered from a high-output fistula and 41 patients from a low-output fistula. In 23 patients (30 fistulas) the output could not be adequately measured: 13 patients had internal fistulas, 9 patients vaginal fistulas, and one patient had both an internal and an external fistula. These 23 patients will be considered further as 'unspecified'.

2.2 SUPPORTIVE MEASURES AND RELATED RESULTS

Skin and fistula care

Skin and fistula care in every patient with a cutaneous fistula included the protection of the surrounding skin against the proteolytic activity of the effluent, collection of the effluent etc.. Fifty-six patients received local care and stoma care for skin protection by means of barrier sheets only (Stomahesive®), with or without flange, according to the principles outlined in Chapter 5.2.

Sumpsuction was used in 40 patients with 47 external fistulas, in 13 of them the fistula closed spontaneously (33%). This does not differ from the overall result (26%).

Nutritional support

Total parenteral nutrition was administered in 72 patients (75%). This regimen was changed to complete enteral nutrition in 11 patients. The other 24 patients (25%) received enteral nutrition (Table 2.6).

The principles of parenteral and enteral nutrition are described in Chapter 5.1 (Supportive care, Nutrition). The overall result of treatment for both nutritional modalities was similar, with a total closure of 72% for parenteral nutrition (TPN) and 67% for enteral nutrition (TEN). However, both subgroups are hardly comparable. Most fistulas treated with TPN were proximal (85%), and occurred postoperatively (78%). Most fistulas treated with TEN were distal (83%), and developed spontaneously (71%) (Table 2.6).

In 11 patients (12 fistulas) nutritional support was partly or completely changed from parenteral to enteral. All fistulas were external, mainly originated from the proximal part of the gastro-intestinal tract, and occurred postoperatively. These 11 patients concerned a favourable subgroup of the patients treated with TPN, with a spontaneous closure of 45% (mean 33 days, range 16-53) and a total closure of 82%. Parenteral nutrition was used in 31 of the 32 patients with high output fistulas, and in 32 of the 41 patients with low output fistulas. For various reasons the fistula output could not be measured in 23 patients ('unspecified output'). Only 9 of these patients were treated with TPN, versus 14 patients with TEN. Considering the total amount of patients treated with TPN, no specific differences in closure rate or mortality could be detected between low output and high output fistulas. Twelve of the 17 patients with multiple fistulas were treated with parenteral nutrition and 5 patients with enteral nutrition. The results of treatment, in these patients with multiple fistulas, were not essentially different from the overall results of treatment.

TABLE 2.6 Nutritional support in 96 patients with primary conservative treatment, with regard to location, cause, primary disease, output and result of treatment

	Parenteral	Enteral	Change parenteral to enteral
Patients (fistulas)	72 (87)	24 (29)	11 (12)
Patients with multiple fistulas	12	5	1
Fistulas: external/internal	73 / 14	21 / 8	12 / 0
Patients: proximal/distal	61 / 11	4 / 20	9 / 2
Cause:			
- Surgical complications (%)	56 (78)	7 (29)	11
- Inflammatory disease (%)	14 (19)	9 (38)	0
- Other causes	2 (3)	8 (33)	0
Primary disease:			
- IBD (%)	20 (28)	1 (4)	2
- Cancer (%)	27 (38)	8 (33)	8
- Other (%)	25 (34)	15 (63)	1
Output:			
- High (%)	31 (43)	1 (4)	5
- Low (%)	32 (44)	9 (38)	5
- Unspecified (%)	9 (13)	14 (58)	1
Results of treatment (%)			
Closure:			
- Spontaneous (%)	29 (40)	5 (21)	5 (45)
- Delayed definitive surgery (%)	23 (32)	11 (46)	4
- TOTAL	52 (72)	16 (67)	9 (82)
Failure:			
- Alive, open fistula	3	6	0
- Death	17	2	2
- TOTAL	20 (28)	8 (33)	2

Detection and drainage of abscesses

An abscess was diagnosed and drained in 27 patients. The abscess was demonstrated with CT-scan (available in our hospital since 1978) in 9 patients, by contrast-radiography in 6 patients, by ultrasonography in 1 patient, and in the remaining 11 patients the diagnosis was based on the clinical features (wound abscess communicating with an intra-abdominal collection, body temperature, abdominal pain). Surgical drainage was performed in 15 patients, generally by a local approach, only one patient had a recurrent abscess. CT-directed drainage was performed in 6 patients and was successful (no recurrence) in 5 patients. An intra-abdominal collection in 6 patients spontaneously draining through the wound, was drained by a sump introduced via the wound (Table 2.7). Seven patients with abscesses died (7/27), 5 patients died of sepsis and 2 of a primary disease and an unrelated disease. Three patients died of sepsis because drainage was insufficient or otherwise unsuccessful, others died of sepsis despite drainage of that area being adequate. In those cases an abdominal septic focus was not found and the patients presumably died of multiple organ failure.

TABLE 2.7 Method of detection and drainage of intra-abdominal abscesses

Detection/drainage	Total	Operation	CT	Sumpdrain
CT-scan	9	5	4	—
Contrast examination	6	5	1	—
Ultrasound	1	—	1	—
Clinical features	11	5	—	6
	Success	14	5	5
	Failure*	1	1	1

*Failure defined as recurrent abscess

Non definitive surgery

Non definitive surgery was performed in 48 of the 96 conservatively treated patients. Indications for non definitive surgery were abscess drainage in 27 patients, enteral diversion in 16 patients (15 colostomy, 1 jejunostomy), exploratory laparotomy for uncontrolled sepsis in 3 patients, abdominal dehisc-

cence in one patient and the demand for vascular access because of progressive renal failure (Scribner shunt) in one patient. In 2 of the 3 patients operated upon for uncontrolled sepsis an operation was performed for a leaking duodenal stump and a Foley catheter was placed to create a controlled external fistula. The third patient had a laparotomy for continuing sepsis. In this patient no intra-abdominal focus could be detected. The primary disease in the 15 patients with a diverting colostomy was cancer in 9 patients, diverticular disease of the sigmoid with colo-vesical fistulation in 5 patients and an aneurysma of the abdominal aorta in one patient. A proximal diversion has the advantage of an easier control of the fistula, thus enabling enteral nutrition. Fourteen of the 15 patients with a colostomy had enteral nutrition. Spontaneous fistula closure did not occur. In 7 patients a delayed definitive operation was performed and all fistulas were closed, six patients went home with an open fistula and 2 patients died.

2.3 DELAYED DEFINITIVE SURGERY AND RELATED RESULTS

Conservative treatment in 96 patients resulted in spontaneous closure in 34 patients and a persisting fistula in 62 patients (Fig. 2.2). Delayed definitive operation was performed in 47 patients after a prolonged period of primary conservative treatment. Forty-one patients had a persisting fistula for a mean period of 72 days (range 17 to 222 days). In 6 patients the fistula closed after a mean period of 30 days (range 14 to 65 days), but a definitive operation had to be performed to remove the diseased bowel segment (Crohn's disease, 5 pts., radiation enteritis, 1 pt.). The indications, operative procedures and results of *delayed definitive surgery* in these 47 patients are summarized in Table 2.8.

Resection with primary anastomosis was performed in 40 patients and successful in 36 patients. Recurrent fistulas developed in 6 patients, and were treated as shown in Fig. 2.3. Bricker deviation resulted in successful closure of a vesico-vaginal fistula in 2 patients, but a concomitant recto-vaginal fistula, also caused by radiation damage, was treated with a diverting colostomy.

2.4 RESULTS OF TREATMENT

Overall results (114 patients)

The total closure of fistulas comprises the spontaneous closure and operative closure. Treatment was considered a failure when the patient was discharged

FIGURE 2.2. Results of conservative treatment in 96 patients with 116 fistulas

FIGURE 2.3. Results of delayed definitive surgery in 41 patients with persistent fistulas and 6 patients with closed fistulas and distal stenosis

* Persistent recto-vaginal fistula.

TABLE 2.8 Indication, method and result of delayed definitive surgery in 47 patients after primary conservative treatment

Indication (n)	Method (n)	Results	
		Success	Failure
High-output fistula (8)	Resection/anastomosis (8)	7	1
Low-output fistula (21)	Resection/anastomosis (16)	13	3
	Suture closure (3)	2	1
	Cholecystectomy (1)	1	—
	Exteriorization (1)	—	1
Internal fistula (8)	Resection/anastomosis (8)	8	—
Uncontrolled fistula (4)	Resection/anastomosis (2)	2	—
	Bricker* (2)	2*	—
Stenosis (6)	Resection/anastomosis (6)	6	—

Resection/anastomosis = resection with primary anastomosis; * A concomitant rectovaginal fistula persisted; Bricker = uretero-entero-cutaneostomy with cystectomy.

with an open fistula, or when the patient died with an open fistula. The mortality can be distinguished in mortality related to sepsis, to primary disease or to unrelated causes. In case of sepsis-related mortality the patient died of uncontrolled sepsis, directly or indirectly related to the fistula. In unrelated mortality, the death of the patient has no relation with primary disease or fistula, for instance myocardial infarction or pulmonary embolism. Total closure was achieved in 83 patients (73%), and treatment failed in 31 patients, 21 of them died and 10 were alive with an open fistula (Table 2.9).

Results of primary conservative treatment (96 patients)

In this subgroup of patients conservative treatment resulted in successful closure of the fistula in 68 patients, spontaneous closure in 36% and surgical closure in 35%.

Treatment failed in 28 patients (29%) (Table 2.10). Nine patients were discharged with an open fistula after an average period of fistula treatment of 47 days (range 24-200). Most of these fistulas were distal fistulas, communicating between distal colon or rectum and the vagina (5 patients) or bladder (one patient). In these 6 patients advanced malignancy or the frozen pelvis after

TABLE 2.9 Overall results of treatment in 114 patients with 138 fistulas (%)

Total closure		83 (73)
Spontaneous closure		29 (25)
Spontaneous closure and resection of the stenotic area		6 (5)
Closed after definitive surgery		48 (42)
Failure of treatment		31 (27)
Alive, open fistula		10 (9)
Died, sepsis related	11 (10)	
Died, disease related	7 (6)	
Died, unrelated	3 (2)	
	———— +	
Mortality	21 (18) →	21 (18)

TABLE 2.10 Results after primary conservative treatment of 96 patients (%)

Total closure		68 (71)
Spontaneous closure		28 (30)
Spontaneous closure and successful operation		6 (6)
Closed after definitive surgery		34 (35)
Failure of treatment		28 (29)
Alive, fistula open		9 (9)
Died, sepsis related	11 (11)	
Died, disease related	5 (5)	
Died, unrelated	3 (3)	
	———— +	
Mortality	19 (20) →	19 (20)

radiotherapy made a definitive operation technically hazardous, and a proximal diverting colostomy was constructed. The remaining 3 patients had a postoperative fistula between small bowel and skin. Nineteen patients (22 external fistulas and one internal) died during primary conservative treatment after an average period of 88 days (range 16-370 days) (Table 2.11).

Most of these fistulas were a postoperative complication and were situated proximally in the digestive tract. The primary disease was cancer in 11 out of

TABLE 2.11 Results of primary conservative treatment of 96 patients with 116 fistulas

	Alive Fistula closed N = 68	Alive Fistula open N = 9	Mortality N = 19
Patients (96)			
Male/female	38 / 30	3 / 6	13 / 6
Age (years)	54 (12-84)	68 (56-84)	60 (16-85)
Multiple fistulas	12	2	3
Fistulas (116)			
External/Internal	62 / 20	10 / 1	22 / 1
Proximal/Distal	59 / 23	3 / 8	18 / 5
Cause			
Postoperative	44	3	16
Spontaneous	24	6	3
Primary Disease			
IBD	18	1	2
Cancer	18	6	11
Ulcer	6	—	2
Vascular disease	2	2	1
Rest	24	—	3
Output			
High output	22	1	9
Low output	31	2	8
Unspecified	15	6	2
Nutrition			
Parenteral (TPN)	43	3	15
Enteral (TEN)	16	—	2
Changed TPN to TEN	9	6	2

19 patients. The mortality was related to uncontrolled sepsis in 11 patients with postoperative fistulas. Often conservative treatment did not successfully control the local fistula situation, resulting in persistent abscesses and sepsis. A delayed definitive operation was performed in 2 patients, one died after 210 days of fistula treatment and the other died after 33 days. The remaining patients suffered from generalized sepsis and organ failure, precluding major surgical intervention. Post-mortem examination was carried out in 8 patients and in 6 of these patients intrathoracic or intra-abdominal pus collections were found. In 5 patients mortality was related to cancer, with 2 postoperative fistulas, 2 spontaneous fistulas and one fistula related to radiation therapy. All 5 patients had advanced local or generalized malignant disease, and the extent of the malignancy determined survival after the development of the fistula. One of them had a pancreaticoduodenectomy for a malignant Schwannoma of the duodenum. The patient had postoperative fistulas for which several operations were performed. Fistula treatment extended over a period of 11 months and the patient ultimately died from disseminated malignancy and liver metastases.

Results of immediate operative treatment (11 patients)

The results of immediate operative treatment were favourable: successful closure of the fistula was achieved in 10 patients (Table 2.12).

The indications for immediate operative treatment were mainly: a chronic fistula in a stable patient (not septic), and an uncontrollable fistula of the vagina. Only one patient with a duodenal stump leakage had an immediate operative repair for uncontrolled sepsis. This patient died of recurrent fistulization with sepsis. Six patients had a chronic fistula, in 5 patients caused by diverticulitis and communicating with the bladder. The uncontrolled fistulas were communicating between the bowel and the vagina and most frequently (3/5) caused by cancer. Resection with primary anastomosis was possible in 7 patients and was successful in all.

Results of no treatment (7 patients)

In 7 patients with 9 fistulas (Table 2.5) no treatment was instituted. One patient died of extensive malignant disease after 2 days, a second patient could leave the hospital with an open fistula and died after a few weeks. A third patient had spontaneous closure of the fistula. In four patients the fistula persisted without any therapy during an extended period varying from 114 to 365 days. These patients had ultimately successful treatment with resection of the bowel segment.

TABLE 2.12 Indication, operative procedure and result of surgery in 11 patients with immediate operative treatment

Nr.	Indication	Technique	Result	Remarks
4	Chronic fistula, stable	Res/EEA	healed	
26	Chronic fistula, stable	Res/EEA	healed	
29	Chronic fistula, stable	Res/EEA	healed	
44	Chronic fistula, stable	Res/EEA	healed	
57	Chronic fistula, stable	Res/EEA	healed	
69	Chronic fistula, stable	Sut.Cl.	healed	Cholecystectomy
28	Uncontrolled fistula	Res/EEA	healed	
53	Uncontrolled fistula	Hartmann	healed	
64	Uncontrolled fistula	Res/Ext	healed	
65	Uncontrolled fistula	Res/EEA	healed	
30	Uncontrolled sepsis	Sut.Cl.	rec.F.	Died (sepsis)

Res/EEA = Resection/End-to-End-Anastomosis; Res/Ext = Resection/Exteriorization;
Sut.Cl. = Suture Closure.

2.5 DISCUSSION

Over the period of 10 year 114 patients with 138 external and internal fistulas of the gastrointestinal tract were treated. The fistulas ranged from simple fistulas to complicated fistulas in abdominal wall dehiscence. This retrospective study compressed all fistula locations, causes and primary diseases as well as patients with end-stage malignancy. Therefore, this patient population represents an unselected group of fistula patients. Most fistulas were located in the small bowel and were caused by postoperative complications.

Treatment was successful in 83 patients (73%), with spontaneous closure in 35 patients (31%) and closure after delayed definitive surgery in 48 patients (42%). Treatment failed in 31 patients: 10 patients were discharged with an open fistula and 21 patients died. The high failure rate (27%) is partly related to the fact, that patients discharged with an open fistula are also considered as a failure and to the fact that patients with endstage disease were included.

Comparing results of fistula treatment with that from the literature is difficult for several reasons. Over the last 2 decades both the improved supportive and parasurgical care and a more aggressive treatment of benign and malignant disease, resulted in a more complicated fistula population (Soeters, 1985).

Moreover, the composition of a fistula population depends on the local incidence of diseases and whether the hospital is a specialized centre. Although most patient groups mainly concern postoperative fistulas, the percentage of spontaneous fistulas ranges from 5 to 40% which can be expected to influence the end results of treatment (Aguirre, 1974; Athanassiakes, 1975; Reber, 1978; Soeters, 1979; Rose, 1986).

The results of fistula treatment of representative groups reported in the literature between 1960 and 1988 are summarized in Table 2.13.

It is striking that over the years there has been a wide range in spontaneous closure (10-90%), total closure (57-92%) and mortality (5-45%).

Only three authors (MacFadyen, 1973; Graham, 1977; McIntyre, 1984) reported far better results with a high closure rate (90-92%) and a low mortality

TABLE 2.13 Present results compared to reported groups of patients with fistulas, in relation to spontaneous closure, total closure, alive with open fistula and mortality

Author	Patient (n)	Spontaneous closure (%)	Total closure (%)	Total failure	
				Alive + fistula (%)	Mortality (%)
Edmunds (1960)	157	25	54	4	43
Chapman (1964)	56	32	53	0	45
Sheldon (1971)	51	35	82	6	12
Ali (1972)	20	30	70	0	30
MacFadyen (1973)	62	70	92	0	6
Rocchio (1974)	37	65	81	3	16
Aguirre (1974)	38	29	79	0	21
Athanassiakes (1975)	81	46	69	0	31
Soeters 60-70 (1977)	119	10	78	7	15
Graham (1977)	39	90	92	0	8
Reber (1978)	186	32	80	0	20
Soeters 70-75 (1979)	128	16	67	16	21
Sitges-Serra (1982)	75	62	79	0	21
Zera (1982)	50	16	72	9	19
McIntyre (1984)	117	24	90	5	5
Rose (1986)	108	61	86	0	15
Present study 77-87	114	31	73	9	18

(5-8%). The only explanation can be the composition of the patient group with a selection towards more benign fistulous disease. MacFadyen (1973) described 62 patients with 78 gastrointestinal fistulas, including 17 internal fistulas, and only 40% developed as a postoperative complication. Graham (1977) considered patients with wide-spread malignant disease unsuitable for fistula treatment. McIntyre (1984) described 56 patients with inflammatory bowel disease (49.1%) and did not specifically mention the location of the fistulas. If these three groups are excluded, the results of fistula treatment since 1970 have not fundamentally changed.

In general, considering the variable factors discussed before, our results are comparable. Therefore we have to conclude that over the years in centres concentrating on fistula treatment the expected improvement of results of fistula treatment did not occur, despite an improved supportive, diagnostic and therapeutic care. This is probably related to the development of a more complicated fistula population (Soeters, 1985).

Retrospective evaluation of our patients revealed several interesting aspects of fistula treatment which are worth considering:

Since 1960 primary conservative treatment of fistulas is considered the method of choice (Edmunds, 1960; Chapman, 1964). However, sometimes circumstances are so favourable that immediate operative treatment is possible, or so unfavourable that no treatment is possible. This is reflected in our patient groups, but is only seldom mentioned in the literature (Zera, 1982). Immediate operative treatment is indicated if the patient is in a stable general condition and spontaneous closure or improvement of the local and general condition cannot be expected, or if adequate control of the effluent is impossible (vaginal fistula). Therefore these patients represent a most favourable part of the fistula population, which explains the high rate of success (91%). Sometimes it is justified to refrain from treatment in case the circumstances are extremely unfavourable and are related to advanced untreatable malignant or infectious disease, or if circumstances are so favourable that no specific measurements of any kind are necessary.

Primary conservative treatment was instituted in the majority of our patients (96 patients with 116 fistulas) and conservative treatment failed in 28 patients (29%): 9 patients were discharged with an open fistula and 19 patients died during primary conservative treatment (20%). Mortality was related to uncontrolled sepsis in 11 of these 19 patients (58%), a similar percentage as mentioned by Reber (1978), Fazio (1983) and Hollender (1983). Therefore uncontrolled sepsis remains the major cause of death for patients with gastrointestinal fistulas (Soeters, 1979). It must be possible to prevent sepsis-related death by a more

aggressive diagnostic approach (CT-scan), non-definitive therapeutic intervention (abscess drainage, diverting stoma) or, under exceptional conditions, by early definitive surgery.

In our treatment policy parenteral nutrition was used as first choice method of nutritional support, providing optimal nutrition from the start of conservative treatment and simplifying nutritional management (Soeters, 1979; Reber, 1978). Most patients with proximal, postoperative and high output fistulas were treated with parenteral nutrition, and most patients with distal, spontaneous fistulas were treated with enteral nutrition. Therefore, no specific conclusions can be made in relation with the results of treatment (spontaneous closure) to the kind of nutritional support.

Although the rate of spontaneous closure was significantly higher in the subgroup of patients with low-output fistulas compared with those with high-output fistulas, after succesful definitive surgery the total closure rate was not different. These results are similar to the results in the more recent literature (Fazio, 1983; Hollender, 1983), indicating that modern supportive management of patients with high output fistula has resulted in a decrease in mortality.

A similar effect is found for patients with multiple fistulas: although, in theory the presence of multiple fistulas increases the morbidity and mortality, this could not be confirmed in our group of patients. Others had the same experience (Fazio, 1983).

Although our results are in accordance with the literature, it is difficult to use these overall data for a discussion on the quality of treatment or on the method of treatment. It is more useful to define subgroups, for instance by location, cause, etc., as already suggested by Edmunds in 1960, and by Sitges Serra in 1982. We therefore classified the fistulas of our patients by cause, number and output and will specifically discuss the methods and results of treatment in Chapter 3. Specific locations of the fistula in our patients will be discussed in Chapter 4.

CHAPTER 3

Management of fistulas according to cause, multiplicity and output

3.1 POSTOPERATIVE FISTULAS

Introduction

A postoperative fistula is related to suture line failure or unrecognized operative injury and generally develops within 14 days after operation. The percentage of postoperative fistulas in all series has gradually increased during the last decades and nowadays 70 to 95 per cent of fistulas develop postoperatively. More extended surgery in more deteriorated patients not only results in an increase of postoperative fistulas, but also initiates the development of these fistulas in more complicated situations, frequently associated with evisceration, cancer (radiation, chemotherapy, metastases), or inflammatory bowel disease (Crohn's disease, colitis ulcerosa). Improvement of the management of postoperative complications in general has also greatly contributed to decrease early postoperative mortality allowing fistulas to develop. In the past these complications generally led to considerable mortality before a fistula had developed and treatment could be considered. This also explains in part the increase of postoperative fistulas at present.

Patients and results of treatment

During the study period, 66 patients with 73 postoperative fistulas were treated. The fistula was in 27 patients related to suture line failure and in 39 patients to inadvertent surgical damage of the bowel. Six patients had multiple fistulas.

Nearly all patients were initially treated conservatively. Only 1 patient was operated immediately, the result was unsuccessful, and in 2 patients no specific treatment was necessary. These 3 patients will not be considered in this context further. Conservative treatment was started in 63 patients (Table 3.1).

TABLE 3.1 Primary conservative treatment (PCT) of 63 patients with 70 postoperative fistulas: location, primary disease, result of treatment

Location:	
Stomach	6
Duodenum	7
Jejunum/ileum	38
Colon	9
Vagina	2
Others	8
Primary Disease:	
Crohn's disease	7
Cancer	26
Ulcer disease	8
Pancreatitis	1
Diverticulitis	4
Appendicitis	1
Arterial disease	4
Others	12
Result of conservative treatment:	
<i>Success:</i>	44 (70%)
Spontaneous closure	27* (43%)
Surgical closure	18* (29%)
<i>Failure:</i>	19 (30%)
Alive, open fistula	3
Died:	
- sepsis	11
- primary disease	2
- unrelated	3

* One patient had both spontaneous and surgical closure

Most patients suffered from a prolonged period of sepsis starting 4-10 days after operation necessitating several diagnostic (CT-scan, fistulography, sonography) and therapeutic (non-definitive surgery) procedures. Parenteral nutrition was used in 56 patients, and was partly or completely changed to enteral nutrition (TEN) in 11 patients. The remaining 7 patients had TEN alone. The effluent of the fistula was collected by sump drainage in 38 patients and in 13 of them (34%) the fistula closed spontaneously. Non definitive surgery was performed in 31 patients, which most frequently (23/31) involved drainage of one or more abscesses.

The fistula closed spontaneously in 27 patients (43%) after an average period of 36 days (Table 3.1). One of these patients had a delayed definitive operation for resection of a stenotic and diseased bowel segment. The fistula persisted in 36 patients (Fig. 3.1). One of them was discharged with an open fistula, and 13 patients died without delayed definitive surgery after a mean period of conservative treatment of 48 days (range 10-89 days). A delayed definitive operation, most frequently resection with anastomosis, was performed in the remaining 22 patients. Delayed surgery was successful in 16 patients. Six patients had a recurrent fistula, in 4 of the 6 related to iatrogenic laceration of the bowel during laparotomy. In the remaining 2 patients failure was related to an error in management (suture closure in infected area) or timing (too early surgery). The treatment of the recurrent fistulas was successful in only 1 patient, the mortality was high (3/6).

The overall mortality after primary conservative treatment was 25% (16 patients), 11 patients died of uncontrolled sepsis. Only 5 patients died of other causes: metastatic cancer (2 patients) and cardiovascular disease (3 patients). Control of sepsis was most difficult if the anastomotic dehiscence with secondary abscesses was localized in the thorax or in the subphrenic area. The case histories of these patients are described in the Addendum (page 46).

Discussion

The treatment of 66 patients with external postoperative fistulas resulted in a total closure of 70% and a mortality of 26%.

Table 3.2 shows the reports of patients with postoperative fistulas from the literature (1966-1983): mortality ranges from 20% to 50%. Both our results and those from the literature confirm that, despite improvements in diagnostics, supportive care and operative techniques, the results of management of these postoperative fistulas did not improve in that period.

Most of the patients had primarily conservative treatment (63/66), according to the strategy outlined in Chapter 1. Further evaluation of the death of the

FIGURE 3.1. Result and method of treatment in 63 patients with postoperative fistulas

patient showed that mortality was most often (12/16) related to uncontrolled sepsis, which must be considered to be preventable. This is in accordance with the results of others (Soeters, 1979; Reber, 1978; Sitges Serrra, 1982; Fazio, 1983; Hollender, 1983). Failure can further be decreased if we learn to diagnose and treat sepsis more adequately. All the patients with sepsis had in common that the fistula was located proximal in the digestive tract, often above or just below the diaphragm. Proximal postoperative fistulas are more 'aggressive' than distal fistulas, resulting in a more rapid deterioration of the general condition with sepsis, multiple organ failure and death of the patient.

Conservative treatment in proximal fistulas can only be successful if treatment is started early, preferably before the fistula track with local inflammatory

TABLE 3.2 Postoperative fistulas, results of reported studies (1966-1983) compared with the present results (1977-1987)

Authors	Pnt. (n)	Cause (%)			Closure (%)		Failure (%)	
		postop.	IBD	other	spont.	total	alive, open fistula	died
Miller (1966)	28	100	0	0	7	50	0	50
Nemhauser (1967)	19	95	0	5	16	63	0	37
Ali (1972)	20	90	0	10	30	70	0	30
Roback (1972)	55	98	2	0	40	70	0	30
Himal (1974)	91	95	3	2	35	68	5	26
Blackett (1978)	25	100	0	0	60	72	8	20
Reber (1978)	186	95	0	5	32	80	0	20
Couftsoftides (1979)	174	98	0	2	29	78	0	22
Benhamou (1979)	183	100	0	0	28	52	0	48
Sitges Serra (1982)	75	100	0	0	71*	85*	0	21
Hollender (1983)	54	100	0	0	11	52	0	48
Present study	66	100	0	0	42	70	5	26

* fistulas; IBD = inflammatory bowel disease

reaction is established. Therefore, especially for the proximal fistulas, an aggressive conservative approach according to a standard protocol, including resuscitation, early diagnostics and optimal supportive care is a prerequisite. Several new developments in diagnostic techniques and supportive drugs not only give opportunity to detect the extent and location of a fluid collection (CT-scan), but also allow percutaneous drainage (CT-scan), and radically decrease the output of the leak by medical support (Somatostatin analogue). Therefore, the surgeon should be familiar with the standard principles and modern developments of supportive techniques. For nutritional support we prefer parenteral nutrition (TPN) in nearly every postoperative fistula, providing an optimal bowel rest and adequate nutritional support after 2 or 3 days. When the circumstances are controlled and stabilized, it is sometimes possible to change to enteral nutrition. In distal colon fistulas it is beneficial to construct a diverting colostomy, which simplifies nutritional support but does not guarantee spontaneous closure. Nowadays Sandostatin®, an analogue of Somato-

statin® is frequently used as adjuvant to optimal conservative treatment with TPN. Sandostatin® further decreases the already suppressed volume and enzymatic content of the bowel contents, resulting in less contamination of the surrounding tissues and a higher spontaneous closure rate. Although some results are promising, others are less spectacular. Probably this is related to an inadequate dosage, non-responders, etc. Further prospective studies have to be performed. Especially in proximal postoperative fistulas we have to realize that conservative management also includes non-definitive surgery. In proximal fistulas adequate drainage and rinsing is so important that sometimes, for instance in postoperative duodenal fistulas, extended non-definitive operative procedures may be advisable. But drainage of an abscess should generally not be combined with a definitive operation, for instance suture closure of the leak, since the results are bad. After surgical or CT-directed drainage clinical and laboratory parameters have to improve within 48 hours, otherwise repeated search for collections or inadequate drainage has to be done. When the infection is controlled, the fistula managed, and an adequate nutrition regimen started, rapid deterioration of the patient's condition is not likely. Although extensive diagnostic procedures are repeatedly recommended, these diagnostic methods cannot entirely be trusted. The clinical condition of the patient should still to a large extent guide our therapeutic approach. Here we are faced with the dilemma which degree of metabolic instability we should accept and what exactly should convince us to renew our efforts to achieve better drainage. If local and general conditions are optimal and sepsis is controlled, the circumstances are favourable for spontaneous closure. About 80% of the fistulas close within 6 weeks after control of sepsis. Fistulas draining through a disrupted laparotomy wound never close spontaneously and conservative management is very difficult and is associated with a high mortality. Postoperative fistulas originating from the distal bowel have a more benign course, the derangement will be less acute and less dramatic for the patient. However, early diagnostic evaluation and drainage is also important to achieve a controlled situation as soon as possible. In this way we can overcome deterioration of the general condition and save the life of the patient.

Conclusion and treatment protocol for postoperative fistulas (Fig. 3.2)

Failure in treatment of postoperative fistulas is particularly related to failure in controlling sepsis. Therefore, during conservative treatment repeated clinical and radiologic evaluation is indicated to decide whether or not drainage is adequate and the situation is under control. Sometimes, an extended exploration is needed to achieve adequate drainage of the intra-abdominal collections and

FIGURE 3.2. Treatment protocol for postoperative fistula

control of a leaking anastomosis. However, under these circumstances an early definitive operation is frequently unsuccessful and should therefore be avoided. If the general condition of the patient is stable and the fistula persists for more than 6 weeks, after extended diagnostic procedures, a definitive operation can

be performed under optimal conditions and with a high rate of success. The treatment approach can not be uniform in all types of external postoperative fistulas.

ADDENDUM

A short description of primary disease, operation, postoperative course, autopsy and conclusion of 16 patients with postoperative fistulas, who died during conservative treatment.

- 3: 75-years old man, low anterior resection for rectal carcinoma.
Day 9: Re-operation for wound dehiscence;
Day 24: uncontrolled small bowel fistulas;
Day 31: died of MOF and sepsis, no autopsy
Conclusion: insufficient diagnostics and drainage.
- 5: 77-years old man, Billroth II resection for bleeding gastric ulcer (emergency).
Day 7: Biliary leakage in the wound, drainage with sump;
Day 17: no leakage on X-ray stomach (gastrograffin);
Day 60: exploration abdominal wall for recurrent abscesses, no connection with the bowel;
Day 75: died of MOF (pulmonary insufficiency, renal failure).
Autopsy: Fistula from duodenal stump, bronchopneumonia.
Conclusion: insufficient diagnostics and drainage.
- 20: 85-years old man, suture closure of perforated duodenal ulcer (emergency).
Day 4: Re-operation for wound dehiscence;
Day 9: Re-operation for wound dehiscence, Marlex;
Day 30: colon-cutaneous fistula;
Day 45: died of sepsis and MOF.
Autopsy: gallbladder empyema, pericarditis, recurrent perforation duodenum.
Conclusion: insufficient diagnostics and therapy.
- 32: 64-years old man, resection of the oesophagus (carcinoma), stomach interposition.
Day 4: fever, leakage from proximal anastomosis;
Day 5: re-operation for drainage;
Day 10: died of sepsis.
Autopsy: leakage proximal anastomosis.
Conclusion: insufficient primary treatment of leakage.

- 34: 59-years old man, resection oesophageal diverticulum with suture closure.
 Day 3: sepsis, anastomotic leakage confirmed on day 6;
 Day 8: operative drainage of empyema;
 Day 38: surgical closure of the leaking anastomosis;
 Day 68: recurrent empyema, re-thoracotomy for drainage;
 Day 146: recurrent fistula, septic, re-operation for drainage;
 Day 234: died of sepsis and MOF, recurrent fistula.
 Autopsy: MOF (liver, spleen, kidney, lung), no specific septic focus, fistula closed ?
 Conclusion: protracted course, error in method of delayed definitive surgery (suture closure in infected area).
- 74: 16-years old woman, laparotomy for peritonitis, subtotal necrosis of the stomach, resection of the stomach, no reconstruction. Unknown primary disease.
 Day 3: acute abdomen, laparotomy: spontaneous perforation of the distal ileum, no specific cause. Resection, stoma;
 Day 11: leakage duodenal stump, necrosis sigmoid. Hartmann procedure and drainage;
 Day 15: splenectomy (autolytic), tracheostomy;
 Day 19: wound dehiscence, not closed. Thoracic drainage for pneumothorax.
 Day 31: small bowel fistula, sump drainage. Continuous sepsis;
 Day 45: Laparotomy for sepsis: no abscesses;
 Day 60: Died of MOF and sepsis. No autopsy.
 Conclusion: spontaneous intra-abdominal necrosis, unknown cause (vasculitis?), untreatable sepsis.
- 75: 40-years old woman, laparotomy in Spain for ileus: coecostomy.
 Day 3: Referred to our hospital, sepsis;
 Day 5: acute abdomen, perforation close to coecostomy: right hemicolectomy and stomata;
 Day 45: Drainage intra-abdominal abscess by extraperitoneal route;
 Day 64: bleeding duodenal ulcer. Left subcostal incision: closure omental flap;
 Day 65: small bowel fistula, sepsis. Sump drainage and reinfusion;
 Day 76: died of MOF and sepsis. No autopsy.
 Conclusion: protracted course with complications and failure to control sepsis.
- 89: 70-years old man, pancreaticoduodenectomy (Whipple) for carcinoma of the papilla of Vater.
 Day 11: enterocutaneous fistula, abscess-drainage;
 Day 14: dehiscence of pancreaticojejunostomy, sump drainage;
 Day 28: spontaneous improvement after septic episode;
 Day 31: bleeding duodenal ulcer, conservative treatment;
 Day 40: rapid deterioration with sepsis;
 Day 45: died of MOF.
 Autopsy: bronchopneumonia, septic spleen, fistula open.
 Conclusion: Diagnostic and therapeutic approach of septic focus insufficiently aggressive. Eventually an irreversible situation.

- 95: 42-years old man, colitis ulcerosa. Subtotal colectomy for toxic megacolon with perforation.
 Day 5: fistula from the wound;
 Day 11: Wound dehiscence. Closure with Vicryl-mesh, and 'Vorlagerung' of small bowel with fistula;
 Day 21: recurrent fistula. Suture closure;
 Day 24: recurrent fistula. Sump drainage;
 Day 41: septic. Thoracic empyema: drainage by sump; bronchopleural fistula?
 Day 47: stays septic. Laparotomy, disclosed no specific phocus;
 Day 48: died of sepsis.
 Autopsy: pulmonary abscesses, abdominal abscesses (between enteric loops), bronchopleural fistula.
 Conclusion: insufficient treatment of leakage (Vorlagerung), continuing sepsis, deterioration.
- 99: 72-years old man, total gastrectomy for carcinoma.
 Day 11: leakage anastomosis (oesophago-jejunostomy); expectative treatment (no drainage);
 Day 18: fever, sonography confirmed subphrenic abscess: tube drainage;
 Day 21: insufficient drainage, new drain inserted;
 Day 26: CT scan: large subphrenic abscess. CT directed drainage;
 Day 28: CT scan: pleura empyema. Sump drainage;
 Day 35: Fistula open. CT scan shows no abscess, however the patient remains septic.
 Day 51: Died of sepsis.
 Autopsy: anastomotic disruption, bronchopneumonia, small interenteric intra-abdominal abscesses.
 Conclusion: Insufficient drainage of the subphrenic abscess cavity.
- 104: 64-years old woman, ileorectal anastomosis, 2 year after subtotal colectomy for toxic megacolon.
 Day 9: Fistula ?, started with TPN;
 Day 18: Fistula !, conservative treatment;
 Day 38: Stable, low output fistula. Start enteral nutrition;
 Day 57: Rectal bleeding and from fistula;
 Day 66: Fistula output increases: TPN started again;
 Day 76: Laparotomy: several fistulas from the anastomosis: anastomosis disconnected, stomata. Closure abdomen with Vicryl mesh;
 Day 80: multiple fistulas, conservative treatment.
 Day 90: progressive deterioration, high output fistulas;
 Day 109: died of sepsis. No autopsy.
 Conclusion: insufficient diagnostics in the early period, recurrent fistulization by inadvertent lacerations during the second operation (day 76).

- 66: 71-years old man, aneurysm of abdominal aorta: prosthetic replacement.
 Day 10: wound absces, small bowel fistula; TPN;
 Day 20: stable. No diagnostics performed;
 Day 30: deterioration with sepsis;
 Day 38: died.
 Autopsy: small bowel fistula open, no abscesses, cardiac failure with decompensation and bronchopneumonia.
 Conclusion: No specific error. Patient died of cardiac failure and pneumonia.
- 23: 64-years old man, subtotal gastric resection for carcinoma.
 Day 8: peritonitis! No leakage detectable by gastrograffin passage;
 Day 9: Subcostal incision: leakage duodenal stump; drainage;
 Day 78: Start Somatostatine;
 Day 89: sudden death.
 Autopsy: Myocardial infarction, fistula open.
 Conclusion: adequate conservative treatment. Ultimately definitive surgery would have been indicated.
- 22: 70-years old man, hemicolectomy and antrectomy for colon carcinoma.
 Day 11: peritonitis upper abdomen (local). Leakage Roux-Y anastomosis. Percutaneous drainage of abscess;
 Day 14: sudden death, neurological symptoms.
 Autopsy: adequately drained cavity, cerebro-vascular accident.
 Conclusion: adequate conservative treatment. No error.
- 85: 56-years old man, Grawitz carcinoma: nephrectomy and sigmoid resection, end-to-end anastomosis.
 Day 3: leaking anastomosis: conservative treatment (drainage and enteral nutrition);
 Day 20: insufficient drainage, laparotomy: colostomy;
 Day 30: deteriorating, pleura-exsudate with malignant cells, lung-metastasis. No further aggressive therapy;
 Day 41: died of cardiac failure.
 Autopsy: dehiscent anastomosis, intrathoracic and intra-abdominal metastasis
 Conclusion: insufficient primary treatment to control sepsis, death related to metastatic disease.

100: 61-years old man, malignant Schwannoma of the duodenum, duodeno-pancreatic resection (Whipple), no signs of liver metastasis.
 Day 17: leakage pancreatico-jejunostomy: resection remaining part pancreas and spleen, new Roux-Y anastomosis;
 Day 22: wound dehiscence;
 Day 26: multiple fistulas. Conservative treatment;
 Day 56: Fever. Laparotomy: no abscess, closure of the abdominal wall with Marlex-mesh;
 Day 141: Definitive operation (DDS-1): closure of fistulas, Marlex-mesh;
 Day 151: recurrent fistula;
 Day 180: DDS-2: closure of bowel and fistula;
 Day 182: recurrent fistula;
 Day 199: DDS-3: closure of bowel and fistula;
 Day 203: recurrent fistula;
 Day 290: 4 fistulas of the abdominal wall;
 Day 340: liver metastasis with icterus;
 Day 355: died.
 Autopsy: liver metastasis, peritonitis carcinomatosa, 3 small bowel fistulas (handling).
 Conclusion: error in timing: 3 attempts to close the fistulas by definitive surgery in 58 days.

3.2 SPONTANEOUS FISTULAS

Introduction

A spontaneous fistula develops spontaneously and originates from a diseased hollow viscus, and communicates with skin or vagina or with an adjacent hollow viscus. A fistula that develops after drainage of a spontaneous abscess related to a diseased hollow viscus is also considered as a spontaneous fistula (Hill, 1988). Before 1945, most fistulas were spontaneous. Nowadays, the number of spontaneous fistulas has relatively decreased. Most frequently a spontaneous fistula develops in patients with Crohn's disease. Less frequently, spontaneous fistulas are related to diverticulitis, extended malignancy or radiation therapy.

Patients and results of treatment

During the study period we treated 48 patients with 65 spontaneous fistulas (33 external fistulas and 32 internal fistulas). Fifteen patients had multiple fistulas. Primary disease, method and result of treatment are summarized in Table 3.3.

TABLE 3.3 Spontaneous fistulas: primary disease, method and results of treatment (48 patients)

Primary disease (n)	Treatment method			Success		Failure	
	PCT	IOT	NT	Spont. closure	Total closure	Alive F+	Died
Crohn's disease (15)	14	—	1	5	15	—	—
Cancer (14)	9	3	2	—	5	6	3
Diverticular disease (13)	7	6	—	1	13	—	—
Appendicitis (2)	2	—	—	1	2	—	—
Cholecystitis (1)	—	1	—	—	1	—	—
Arterial disease (1)	1	—	—	—	—	1	—
Unknown (2)	—	—	2	—	1	—	1
TOTAL (48)	33	10	5	7	37	7	4

PCT = primary conservative treatment; IOT = immediate operative treatment; NT = no treatment; F+ = fistula open

Most patients were conservatively treated. The construction of a diverting stoma was also considered to be conservative treatment.

Treatment was successful in 37 patients (77%), treatment failed in 11 patients. Four patients died of cancer (8%) and 7 patients were discharged with an open fistula, in 3 patients related to cancer and in 3 patients to radiation damage.

Crohn's disease. Conservative treatment improved the local and general conditions in 14 of 15 patients with Crohn's disease, 5 of them had spontaneous closure of the external fistula. A delayed definitive operation to remove the diseased bowel segment was always considered necessary and successful. In one patient the fistula persisted for more than one year without specific nutritional or drug treatment, and subsequent surgical treatment was successful (Figure 3.3). Most frequently Crohn's disease was located in the ileocecal region; one patient had Crohn's disease of the transverse colon and a skip lesion of the ileum, and another patient had a severe diseased rectum with stenosis, a rectovaginal fistula and perianal fistulization. Eight patients had an external fistula or a combination of external and internal fistulas. Seven patients with more internal fistulas did not sufficiently react to drug treatment alone. The condition stabilized during treatment with TPN and bowel rest, and resection with primary anastomosis was successful.

FIGURE 3.3. Spontaneous fistulas: 15 patients with Crohn's disease, methods and results of treatment.

NT = no treatment; PCT = primary conservative treatment

In 10 patients the internal fistula was communicating between small bowel and colon. In one of these 10 patients secondary involvement of the colon was so extensive that resection with anastomosis of the colon was indicated as well. The other 9 patients had an uneventful suture closure of the colon.

Diverticular disease. Thirteen patients with 15 spontaneous fistulas related to diverticular disease of the sigmoid were treated, 8 colo-vesical fistulas, 2 colo-vaginal fistulas, 1 ureter-colon fistula, 1 colo-cutaneous fistula, 1 jejuno-cutaneous fistula, and 2 internal fistulas.

Spontaneous closure during conservative treatment occurred only in the patient with the colo-cutaneous fistula. In the other 12 patients, early or delayed surgery achieved closure of the fistula (Figure 3.4).

The colo-vesical fistula was treated by a three-staged procedure (diverting colostomy, resection with anastomosis, closure of the stoma) in 3 patients, by a two-staged procedure (resection with anastomosis and diverting stoma, closure of the stoma) in 4 patients, and by a one-stage procedure (resection with anastomosis) in 1 patient. The severity of local infectious disease, the general condition of the patient or preference of the surgeon was decisive for the type of procedure.

FIGURE 3.4. Spontaneous fistulas: treatment and results in 13 patients with diverticular disease
PCT = primary conservative treatment; IOT = Immediate operative treatment

Cancer. A total of 19 spontaneous fistulas occurred in 14 patients with cancer: 10 patients had a gynaecological malignancy and 4 patients had a malignancy of the digestive tract (Table 3.4).

Six patients with a gynaecological malignancy had the fistulas as a complication of radiation therapy, most frequently a recto- or colo-vaginal fistula (5 pts.). In only 1 of these patients an early definitive operation was possible and a Hartmann procedure was performed. Four patients had a spontaneous fistula directly or indirectly related to cancer of the digestive tract. In only one of them complete radical resection was possible. One patient died without surgery in the hospital, 2 patients could be discharged with an open fistula and died at home.

Appendicitis. Two patients with an abscess related to appendicitis had an external fistula, originating from the appendix after drainage of the abscess. The fistula in one patient closed after 39 days and in the other the fistula persisted for 36 days. Both patients had a delayed appendectomy with good result.

TABLE 3.4 Spontaneous fistulas: treatment and results in 14 patients with cancer

Nr.	Location fistula	Primary treatment	Definitive surgery	End-result
Gynecological malignancy				
12	rectum-vagina	PCT	laparotomy, no resection	died
27	colon-bladder	diverting stoma (PCT)	—	open fistula
28	jejunum-vagina jejunum-colon	IOT (resection, anastomosis)	—	closed fistula
53	colon-vagina	IOT (Hartmann)	—	closed fistula
Radiation therapy for gynaecological malignancy				
2	colon-bladder	PCT	—	died after 48 days
13	bladder-vagina rectum-vagina	diverting stoma (PCT)	Bricker	open fistula vaginal fistula
40	colon-vagina	diverting stoma (PCT)	—	open fistula
64	rectum-vagina	IOT (resection, stoma's)	—	closed fistula
79	colon-vagina ileum-vagina	diverting stoma (PCT)	resection	closed fistula
88	bladder-vagina rectum-vagina	diverting stoma (PCT)	Bricker	open fistula vaginal fistula
Digestive tract malignancy				
42	colon-skin colon-skin	NT	—	open fistula
68	colon-vagina	diverting stoma (PCT)	—	open fistula
71	jejunum-skin	PCT	—	died after 45 days
98	colon-skin	NT	delayed resection	closed fistula

PCT = Primary Conservative Treatment; IOT = Immediate Operative Treatment; NT = No Treatment

Discussion

Patients with inflammatory disease (Crohn's disease, diverticulitis, appendicitis) and spontaneous fistulas respond well to treatment. Treatment was often unsuccessful in patients with cancer. Mortality was most often related to cancer and not to uncontrolled sepsis, the latter being the cause of death in 12 patients with postoperative fistulas (12/17).

Apparently, success or failure of treatment in spontaneous fistulas is related to the primary disease: the fistula is a symptom of progressive disease, and treatment can only be successful if the underlying disease is treated (Hawker, 1983).

In case of postoperative fistulas the fistula itself causes the secondary septic problem, which has to be controlled to make the patient survive and the fistula close. The question is whether there is a place for conservative treatment in spontaneous fistulas. Spontaneous closure is unlikely and if this happens, delayed resection is nearly always *necessary* as illustrated by our patients. However, resection is not always *possible* in cancer or radiation disease. In these patients the therapeutic priorities and possibilities are dictated by the extent of the malignancy, the extent of radiation damage and the involvement of adjacent structures, which are frequently not resectable. Therefore, at first sight, conservative treatment has no place in the treatment of spontaneous fistulas. However, especially in inflammatory disease, improvement of local and general conditions is of value, and makes delayed definitive surgery successful (Ostro, 1985). If anaemia and hypoalbuminaemia are corrected and the patient has no sepsis, the definitive operation is nearly 100% successful without major complications and with a limited resection (Gouma, 1983; Irving, 1983). Sometimes control of the fistula, especially in radiation-induced vaginal fistulas, can only be achieved by construction of a temporary stoma.

For that reason, the first treatment of spontaneous fistulas has to be conservative, not with the intention to close the fistula but to improve the local and general condition, to perform diagnostic tests, etc. If improvement is not necessary or not possible, or if the fistula cannot be controlled, an immediate operation with resection is advised.

In case the fistula is directly related to malignant disease, the patient will only survive for a prolonged period of time if the malignant process is resectable. The resectability can only be determined by laparotomy. Therefore, the delay should be as short as possible. After diagnostic procedures, early laparotomy (within one or 2 weeks) should be performed with 'the intention to resect'. If resection is not possible, a diverting stoma or bypass may provide symptomatic relief and

palliation. Even an extensive procedure, for instance a Bricker deviation is sometimes palliation. These conclusions are summarized in the protocol (Fig. 3.5).

FIGURE 3.5. Treatment protocol for spontaneous fistula
IOT = immediate operative treatment; NT = no treatment

3.3 MULTIPLE FISTULAS

Introduction

At first sight patients with multiple fistulas would be expected to have a more protracted clinical course with a higher morbidity and mortality. However, literature specifically comparing results of treatment of multiple fistulas and single fistulas can hardly be found. Therefore, in this context, a specific description and discussion of these patients is certainly of interest.

Patients and results of treatment

During the study-period 21 patients with multiple fistulas were treated, compared to 93 patients with single fistulas. These 21 patients had 45 fistulas, 10 patients with external fistulas, 5 patients with internal fistulas, and 6 patients with both external and internal fistulas. Further characteristics (age, sex, primary disease, cause) and results of treatment are summarized in the table, and compared with single fistulas (Table 3.5).

Methods and results of treatment of patients with multiple fistulas are shown in Figure 3.6. Most patients were treated conservatively which resulted in spontaneous fistula closure in 4 patients (4/17) after a mean period of 34 days (range 14-65), but delayed definitive surgery was necessary to resect the stenotic bowel segment. Two patients died with an open fistula of advanced malignant disease. A delayed definitive operation was successful in 9 patients and unsuccessful in 2 patients. These 2 patients had a vesico-vaginal fistula after radiation therapy, the fistula was closed by surgery (Bricker deviation), but they had also a rectovaginal fistula which persisted without complaints (alive, open fistula) (Fig. 3.6). Two patients were immediately operated upon, one patient had an uncontrollable vaginal fistula, and one had internal fistulas resulting from diverticulitis.

No treatment was needed in 2 patients: one patient was discharged with a cutaneous fistula originating from an irresectable carcinoma of the colon, a second patient with Crohn's disease and a low-output cutaneous fistula did not receive specific nutritional and drug treatment for more than one year. Finally this patient was operated upon with good result.

Frequently single fistulas developed as a postoperative complication (65%), multiple fistulas were in 48% of cases related to inflammatory disease. There was no difference in the overall results of treatment, more in particular, there was not a significant difference in mortality.

TABLE 3.5 Results of treatment of 93 patients with single fistulas and 21 patients with multiple fistulas

	Single fistulas n = 93 (%)	Multiple fistulas n = 21 (%)
Cause		
postoperative	60 (65)	6 (29)
inflammatory disease	21 (22)	10 (48)
other	12 (13)	5 (24)
Primary disease		
IBD	11 (12)	11 (52)
cancer	35 (37)	7 (33)
diverticulitis	15 (16)	2 (10)
other	32 (35)	1 (5)
Treatment Method		
Conservative (PCT)	79 (85)	17 (81)
Operative (IOT)	9 (10)	2 (9.5)
No treatment (NT)	5 (5)	2 (9.5)
Nutritional Method		
TPN	50 (63)	11 (64)
TEN	19 (24)	5 (30)
TPN → TEN	10 (12)	1 (6)
Spontaneous Closure	31 (40)	4* (23)
Result of treatment		
Alive, fistula closed	68 (73)	15 (71)
Alive, fistula open	7 (7)	3 (14)
Death	18 (20)	3 (14)
sepsis	10 (11)	2 (10)
primary disease	5 (5)	1 (5)
unrelated	3 (3)	—

* these four patients also had a successful definitive operation for resection of the diseased bowel segment (Crohn's disease).

FIGURE 3.6. Treatment and result of 21 patients with multiple fistulas

PCT = primary conservative treatment; IOT = immediate operative treatment; NT = no treatment; Alive F+ = alive, open fistula.

Discussion

There is no specific literature with regard to patients with multiple fistulas. Even an extensive review by Webster and Caley (1976), discussing every possible location and cause, does not mention morbidity and mortality of multiple fistulas. Fazio et al state that multiple fistulas sometimes implicate multiple resections and anastomoses during definitive surgery, and therefore they expect a higher mortality (Fazio et al, 1983). However, in this study the mortality of patients with multiple fistulas (25.9%) and single fistulas (19.3%) is statistically not different. Further evaluation of their figures is not possible

because primary disease and cause of the fistulas are not specifically reported. The overall results in our patients are similar: mortality in multiple fistulas 14% and in single fistulas 20%. The low mortality in patients with multiple fistulas is probably related to the fact that in most patients (10/21) the fistulas were caused by Crohn's disease (low mortality). When comparing patients with single postoperative fistulas (60 patients) and multiple postoperative fistulas (6 patients), the mortality is 23% and 50% respectively. However, this subgroup is too small for statistical evaluation.

Conclusion: the presence of multiple fistulas does in general not influence the result of treatment. If the fistulas are related to inflammatory bowel disease the prognosis is good and is not different from that of single fistulas. The presence of multiple fistulas postoperatively indicates a complicated abdominal problem, necessitating an aggressive conservative approach, with early diagnostics for abscesses and an optimal bowel rest. With this extended regimen, the morbidity and mortality associated with postoperative multiple fistulas can be similar to the results obtained in postoperative single fistulas.

The treatment protocol for multiple fistulas depends on the cause of the fistulas and is similar to the protocol for postoperative or spontaneous fistulas.

3.4 HIGH-OUTPUT FISTULAS

Introduction

Over the years the definition of high output fistulas has changed. Before the 1970's every external fistula producing more than 100 ml (Edmunds, 1960; Nemhauser, 1967) or 200 ml (Chapman, 1964) of effluent in 24 hours was classified as a high-output fistula. Since the 1980's it is generally accepted to classify fistulas with a production of more than 500 ml of effluent in 24 hours as high output. Until 1972, most high output small bowel fistulas were considered to be uncontrollable with conservative measures. Therefore it was generally accepted that they should be operated early to overcome rapid deterioration and early mortality (Nemhauser, 1967; Lorenzo, 1969; Nassos, 1971; Ali, 1972). Nowadays, we have the impression that these fistulas are also amenable to conservative treatment.

Patients and results of treatment

A total of 96 patients were managed conservatively: 32 patients had a high output fistula (HOF), 41 patients a low output fistula (LOF) and 23 patients a

Table 3.6 Output of external fistulas and result of conservative treatment (PCT)

Output	High output n = 32 (%)	Low output n = 41 (%)	Unspecified n = 23 (%)
Spontaneous closure	9 (28)	21 (51)	4 (17)
Persisting	23	20	19
Died	8	6	2
Discharged	—	1	4
Delayed definitive surgery	15 (47)	13 (32)	13 (57)
Alive, without fistula	22 (69)	31 (76)	15 (65)
Alive, with fistula	1 (3)	2 (5)	6 (26)
Died	9 (28)	8 (19)	2 (9)

fistula with an output that could not be measured ('unspecified'), because of internal fistulization and/or vaginal fistulas (Table 3.6).

Nine patients with high-output fistulas had spontaneous closure after a mean period of 42 days (range 14-135 days), in 21 patients with low-output fistulas the fistula spontaneously closed after a mean period of 32 days (range 8-70 days). Spontaneous closure during optimal conservative treatment occurred in 28% of the patients with high-output fistulas and in 51% of the patients with low output fistulas ($p < 0.05$). However, after delayed definitive surgery successful closure was achieved in 69% of patients with high-output fistulas versus 76% of patients with low-output fistulas the mortality between high-output and low output fistulas was not significantly different (28 versus 19%).

Discussion

Our results are in accordance with those from the literature and indicate that the output of a fistula is no longer an adverse prognostic sign (Hollender, 1983; Soeters, 1985). Modern techniques of conservative management and support allow us to achieve adequate nutrition and bowel rest at the same time, resulting in a substantial reduction of fistula discharge. The use of parenteral nutrition in the management of external fistulas has been reported to decrease the output of the fistula with 50 to 85% per cent (Wolfe, 1972; MacFadyen, 1973; Aguirre, 1974). Further reduction can be achieved by the combination of TPN and

Somatostatin analogue, which results in a high rate of spontaneous and total closure (Pederzoli, 1986; Geerdsen, 1986; Nubiola, 1987; diCostanzo, 1987).

CHAPTER 4

Management of fistulas according to location

4.1 STOMACH

Introduction

The stomach produces about 3000 ml of gastric juice, which contains enzymes, hydrochloric acid and mucus, secreted every day by the cells and the glands of the mucous membrane. Mucus plays an important role in the protection of the mucous membrane against the potent digestive properties of the enzymes (pepsin, lipase). Postoperative gastric fistulas are nearly always external and develop after a gastric operation, an operation of an adjacent structure or upon removal of a gastrostomy catheter (Aguirre, 1974; Pearlstein, 1977). Gastric juice causes erosion of the skin with secondary infection, malnutrition and metabolic disturbances, for instance hypochloraemic alkalosis. Spontaneous fistulas are rare and usually communicate between the stomach and the colon, causing contamination and bacterial overgrowth of the proximal digestive tract with malabsorption and diarrhoea.

Patients and results of treatment

During the study period 6 patients (5 men and 1 woman) with external postoperative gastric fistulas were treated. The mean age of the patients was 60 years (range 28-76 years). One patient developed a fistula after a splenectomy. Four fistulas were directly related to suture-line failure of a gastro-enterostomy (Table 4.1).

TABLE 4.1 Results of treatment in 6 patients with postoperative gastro-cutaneous fistulas

Emergency operation	Primary diagnosis	Surgical procedure	Fistula days postop.	GJC/GCU	Closure/Persist. (days)
No	Leiomyoma	Subtotal gastric resection	9	GJC	Closure (28)
Yes	Duodenic ulcer	Antrectomy, Roux-Y	11	GJC	Closure (15)
No	Obesity	Gastric Bypass	8	GJC	Closure (23)
No	Blunt trauma	Roux-en-Y choledochus	6	GCU	Persistent (29)
No	CA ductus choledochus	Whipple	10	GJC	Closure (31)
No	CA rectum	Low anterior + splenectomy	16	GCU	Closure (53)

GCU = gastro-cutaneous; GJC = gastro-jejuno-cutaneous; CA = carcinoma

No patients with spontaneous fistulas were treated during the study period. Conservative treatment was started in every patient with parenteral nutrition. This was ultimately changed in one patient to enteral nutrition. In one patient Cimetidin® was used as soon as the fistula was discovered. Abscess drainage was performed in 3 patients, once by CT-directed puncture. Spontaneous closure was achieved after a mean period of 30 days (range 15-53 days) in 5 patients. One fistula persisted and a late definitive operation (debridement and suture closure) was performed with good results. None of the patients died.

Discussion

Our results of conservative treatment of **external postoperative gastric fistulas** are good and consistent with the results reported in the literature (Table 4.2). These data support that conservative treatment according to the principles described in chapter 5 is the therapy of choice. Early definitive surgery has been performed previously but failed (Carter, 1957; Edmunds, 1960).

The factors responsible for postoperative gastric fistulas are identical to those for anastomotic disruption elsewhere in the abdomen: technical failure, steroids, malnutrition, local contamination.

One of the fistulas developed after a splenectomy for a iatrogenic laceration of the spleen during low anterior resection. A gastric fistula after an 'uncomplicated' splenectomy has been suggested to be related to local ischaemic

TABLE 4.2 Results of conservative treatment (PCT) of postoperative gastric fistulas, reported in the literature

Author	Patients (n)	Spontaneous closure	Total closure	Mortality
Bowlin (1962)	13	7	11	2 (15%)
Chapman (1964)	7	4	5	2 (29%)
Graves (1970)	3	3	3	0
Aguirre (1974)	4	1	3	1 (25%)
Pearlstein (1977)	13	9	11	2 (15%)
Tarazi (1983)	18	8	12	4 (22%)
Present study	6	5	6	0

gastric necrosis after sequential ligation of the arterial blood supply of the stomach (Graves, 1970; Kilgore, 1950). We, and also others, consider this unlikely, because the stomach has an abundant arterial circulation which allows nearly complete ligation (Pearlstein, 1977). We consider damage to the wall of the stomach by incorrect clamps placement during splenectomy a more likely explanation. The symptoms of gastric leakage may become obvious more than 3 weeks after the primary operation (Edmunds, 1960; Pearlstein, 1977). Most common clinical findings associated with the onset of the fistula are fever, pleural effusion or pulmonary infiltrate, increased wound drainage and left upper abdominal pain. Contrast radiography of the upper gastrointestinal tract or fistulography should be performed to confirm the leakage. All conservative measures are started as soon as the fistula is suspected to prevent erosion of the surrounding structures and skin. Generally tube drainage of the left subphrenic space is necessary. At present, we prefer percutaneous placement of the drainage tube by a puncture guided by CT-scan (DeCosse, 1974; Gerzof, 1981). When the fistula output decreases, the nasogastric tube can often be removed and enteral nutrition can be started before the fistula is completely dry with a fine bore tube selectively placed in duodenum or jejunum. Delayed definitive surgery has to be considered if the fistula persists for more than 6 weeks. Prior to surgery the gastrointestinal tract has to be visualized to exclude distal obstruction. Several methods have been described for surgical closure, for instance the 'serosal patch technique' (Wolfman, 1964; Pelliccia, 1973), a Roux-Y procedure (Ujihi, 1981), or diversion of a Billroth-I procedure into a Billroth-II. Only under exceptional circumstances, for instance in case of per-

sistent drainage after a gastrostomy catheter, suture closure may be successful (Tarazi, 1983).

Spontaneous internal fistulas are caused by advanced benign or malignant disease of the stomach or adjacent structures (pancreas, colon, right kidney, aorta), and mainly concern *benign gastrojejunal colic fistulas* and *malignant gastrocolic fistulas*. Seldom benign gastrocolic fistulas and other gastric fistulas, for instance gastro-pleural fistulas are found (Rotstein, 1985) (Table 4.3).

Benign gastrojejunal colic fistulas generally develop when a peptic ulceration of a gastroenterostomy perforates spontaneously into the colon (Marshall, 1957). The first patient was described by Czerny in 1903 (Thomas, 1940). Before 1940 a gastroenterostomy was complicated by a peptic jejunal ulcer and a fistula in 1 per cent of cases (Thoeny, 1960). When Dragstedt (1946) introduced truncal vagotomy supplementary to gastroenterostomy, the incidence of gastrojejunal colic fistulas decreased dramatically and, as from that time, these fistulas became very rare.

The classic symptoms of gastrocolic fistulization are diarrhoea, weight loss and faecal vomiting. Barium enema visualizes the fistula in 90-100% of cases (Thoeny, 1960; Lowdon, 1953; Marshall, 1957), and barium meal is conclusive in only 26-30% of cases (Wilson, 1970). Before the 1930's a one-stage resection was the recommended operation. This procedure had a high mortality (over 40%), related to the debilitating condition of the patient (Wilkie, 1934). Afterwards Pfeiffer (1939) and Marshall (1945) published improved results by using a two-stage technique: diversion of the faecal stream by colostomy (Pfeiffer) or ileosigmoid anastomosis (Marshall) abolished the symptoms and allowed time for recovery of the severely debilitated patient before definitive surgery. Advances in pre- and postoperative care, progress in antibiotic therapy, replacement of blood and electrolytes, made one-stage procedures after appropriate pre-treatment again possible with a low mortality (2.6%) and a low recurrence (4.3%) (Barber, 1962). This one-stage procedure includes suture closure of the transverse colon, a reconstruction of the gastro-jejunal anastomosis and a truncal vagotomy. When no vagotomy is performed recurrent fistulization occurs in more than 50% of cases (Wilson, 1973).

Malignant gastro-colic fistulas are generally caused by locally advanced gastric or colonic carcinoma. Ingrowing pancreatic carcinoma with fistulization is rare (Wilson, 1973). Symptoms are related to advanced intra-abdominal malignant disease (weight loss, nausea, pain, anaemia) and to the fistula (faecal vomiting). Frequently a large palpable mass is found in the upper abdomen. The passage through the fistula is often one way from colon to stomach and therefore both a barium enema and barium meal are necessary for a correct diagnosis.

TABLE 4.3 Spontaneous internal gastric fistulas: gastrojejunocolic fistula (GJC-F), gastrocolic fistula (GC-F)

Location	Author (year)	Patients (n)	Primary disease
GJC-Fistula (benign)	Pfeiffer (39)	3	Ulcus pepticum jejunum
	Lowdon (53)	41	Ulcus pepticum jejunum
	Marshall (57)	49	Ulcus pepticum jejunum
	Thoeny (60)	41	Ulcus pepticum jejunum
		1	Colitis ulcerosa
	Amlicke (64)	7	Ulcus pepticum jejunum
	Wilson (70)	1	Ulcus pepticum jejunum
	Cody (75)	3	Ulcus pepticum jejunum
		1	Colon carcinoma
		1	Crohn's disease
	Schein (87)	1	Ulcus pepticum jejunum
GC-Fistula (malignant)	Lynch (55)	1	Malignant carcinoid
	Marshall (57)	10	Colon carcinoma
		1	Stomach carcinoma
	Clay (57)	2	Colon carcinoma
	Ponka (61)	1	Stomach carcinoma
	Thoeny (60)	12	Colon carcinoma
		6	Stomach carcinoma
	MacMahon (63)	3	Colon or stomach carcinoma ?
	Smith (72)	12	Stomach carcinoma
		17	Colon carcinoma
GC-Fistula (benign)	Altchek (57)	1	Colitis ulcerosa
	Ganji (67)	1	Gastric ulcer
	Hitchens (72)	1	Gastric ulcer
	Ghahremani (74)	1	Diverticulitis coli
	Saha (74)	1	Pancreatic abscess
	Cody (75)	3	Gastric ulcer
		1	Pancreatic abscess
		1	Appendicitis
		1	Diverticulitis coli
		1	Unknown
	McDaniel (82)	1	Crohn's disease
	Logio (87)	1	Crohn's disease
	Schein (87)	1	Gastric ulcer

Survival after palliative surgery is less than 2 months. However, in selected cases of advanced local malignant disease without metastases an extended resection has been reported with an acceptable five year survival (Smith, 1972; Amlicke, 1964; Ponka, 1961). Therefore, after appropriate preparation, a laparotomy should be performed to evaluate the resectability.

Spontaneous benign gastro-colic fistulas are very rare, only case-reports are described in the literature (see Table 4.3). Symptoms are related to the fistula and the primary disease. The therapy of choice is operation after appropriate diagnostics and pretreatment.

Conclusion and treatment protocol (Fig. 4.1)

External gastric fistulas generally develop after suture-line failure. Conservative treatment is started as soon as possible and consists of adequate sump drainage, skin and fistula care, parenteral nutrition and supportive medication. The results are excellent with a high spontaneous closure rate, probably because drainage by sumpsuction and nasogastric tube is relatively easy. The therapy of choice in spontaneous internal gastric fistulas (benign or malignant) is operative treatment if technically applicable and after careful evaluation. Sometimes, a diverting stoma and/or a period of adequate support and nutrition can improve circumstances and make a definitive operation more successful.

4.2 DUODENUM

Introduction

The duodenum is clearly differentiated from the rest of the small bowel by the retroperitoneal position and fixation, and because the secretory ducts of the liver and pancreas are connected with the duodenum. This implies that surgical treatment of fistulas is more difficult and more liable to complications.

The passage of food stimulates the mucosal cells of the duodenal wall to produce secretin and cholecystokinin. These intestinal hormones activate the release of bile and pancreatic juice. Every 24 hours up to 7 litres of saliva, gastric juice, bile and pancreatic juice are secreted and mixed with food. A duodenal fistula disorganizes the digestion and absorption and therefore has important consequences for the patient. Most frequently, duodenal fistulas are **external postoperative fistulas**. An end-fistula of the duodenum generally results from a leaking duodenal stump or a diverticulized duodenum (Donovan, 1966). In lateral duodenal fistulas there is passage of food, saliva and gastric

FIGURE 4.1. Treatment protocol for gastric fistula

secretions through the duodenum and therefore these fistulas have a bad prognosis (Malangoni, 1981; West, 1961). Other duodenal fistulas are **spontaneous duodenal fistulas** and **posttraumatic duodenal fistulas**.

Patients and results of treatment

During the study period, 8 patients with duodenal fistulas were treated, all fistulas were postoperative and external (7 end-fistulas and one lateral fistula). There were 5 men and 3 women, with a mean age of 63 years (range 42-81 years). The fistulas developed after an emergency operation in 5 patients (4 x bleeding ulcer, 1 x toxic megacolon), and after an elective operation in 3 patients. In one patient a fistula was deliberately constructed by closing a duodenal stump over a Foley catheter (Table 4.4).

TABLE 4.4 Results in 8 patients with postoperative duodeno-cutaneous fistulas

Emergency operation	Primary diagnosis	Surgical procedure	Fistula in situ (days)	PCT/ IOT	Result (days)
Yes	Duodenic ulcer	BII (Hand)	7	PCT	Died of pneumonia (63)
No	Ventricular ulcer	BII (TA)	8	PCT	Died of myoc. infarction (86)
No	Ventricular ulcer	BII (TA)	10	PCT	Closure (16)
Yes	Duodenic ulcer	BII	3	IOT	Died of sepsis (31)
Yes	Ventricular ulcer	BI→BII	?	PCT	Closure (32)
No	Ventricular ulcer	BII (Foley)	-	PCT	Closure (34)
Yes	Duodenic ulcer	BII (GIA)	6	PCT	Closure (52)
Yes	Toxic colon	Colectomy	30	PCT	Died of sepsis (56)

+ = bleeding; BI = Billroth I; BII = Billroth II;

Seven patients were treated by conservative measures and one patient (nr. 30) by immediate operative treatment: three days after BII resection the Winslow drain produced enteral effluent and re-operation followed. At operation the duodenal stump was leaking and was closed again with an omental patch. After this operation the patient remained septic and died after 2 weeks with persistent drainage from the fistula. Nutritional support was provided by TPN in six patients and only in one patient with a leaking duodenal stump after a BII resection total enteral nutrition was instituted.

All fistulas were initially classified as low-output fistulas. In 2 patients the production increased during treatment and led to high-output fistulas. Drugs were used in 3 patients, H₂-blockers in 2 patients and one patient received Somatostatin®. In the latter patient fistula production decreased immediately but after a few days the patient died of acute myocardial infarction. Abscess drainage was performed in 3 patients and in 2 patients an abdominal dehiscence was closed. The fistula closed spontaneously in 4 patients after 16 to 52 days of conservative treatment (mean 33 days). Four patients died after prolonged conservative treatment (mean 59 days) with open fistulas, 3 had persistent sepsis and 1 a myocardial infarction. Definitive surgery was not performed, because these patients were not in a condition to have an operation.

Discussion

Our results reflect the bad reputation of the postoperative external duodenal fistula, with a high sepsis-related mortality (3/8). Therefore, adequate detection and drainage of abscesses is important and even extended non-definitive operations may be necessary.

Postoperative duodenal fistulas are nearly always external, but an internal postoperative duodenal fistula (duodenal-colic) has been described (Kerstein, 1973). External fistulas of the duodenum are usually caused by an anastomotic disruption after a gastric resection or a duodenotomy, although the incidence of this complication is only 1 to 3% (Edmunds, 1960; Moody, 1984). Risk factors are local circumstances during an emergency operation or the use of steroids (Rossi, 1986; Garden, 1988; DeBacker, 1985). Five duodenal fistulas in our patients developed after an acute operation. After difficult stump closure and in *patients at high risk it is generally advised to perform a guided drainage of the duodenal stump*. This recommendation was neglected in one of our patients, who died. The fistula may also develop after a iatrogenic laceration of the duodenum during surgery of a neighbouring structure.

If there are no signs of general peritonitis and circumstances are controllable, the patient should be treated conservatively as soon as leakage is suspected. During the resuscitation period (24-48 hrs), the patient is regularly re-evaluated to decide whether drainage is adequate. Immediate operation is indicated in these patients if signs of local peritonitis are progressing to general peritonitis or drainage is insufficient. The operation is directed to adequate drainage of the effluent by placing a drain through or close to the leaking anastomosis. Direct decompression of the duodenum by catheter duodenostomy, or indirect decompression by gastrostomy or jejunostomy catheters, may be useful. Levy et

al (1984) advocate the use of a compound drain set, suitable for rinsing and draining.

Depending on the local circumstances and the preference of the surgeon a more extended non-definitive operation may be performed, such as diverticularization or pyloric occlusion with gastro-enterostomy (Berne, 1968; Vaughan, 1977). Both techniques have in common that a lateral fistula is changed in an end fistula (duodenal stump). Diverticularization was first described by Berne in 1968, and includes primary duodenal repair and drainage, antrectomy, gastro-jejunosomy and tube duodenostomy. Pyloric exclusion, first described by Vaughan in 1977, consists of suturing of the pylorus and a gastrojejunosomy. The pyloric occlusion is performed through the gastrotomy with resorbable suture material or with a TA stapler (DeSantis, 1987; Eckhauser, 1988). Early definitive surgery cannot be recommended, because of the high mortality (West, 1961). More recent studies show that during conservative treatment, spontaneous closure occurs in more than 50% of patients and that a mortality of less than 16% is possible (Table 4.5). Essential for adequate conservative treatment is a repeated evaluation by CT-scan to detect and if indicated drain fluid collections. Further diagnostics are performed if the fistula does not close spontaneously after 4 to 6 weeks of conservative treatment and delayed defini-

TABLE 4.5 Spontaneous closure and mortality of postoperative duodenal fistulas reported in the literature

Author	Patients (n)	Spontaneous Closure (%)	Mortality (%)
Bartlett (1938)	128	?	38
Avola (1954)	11	?	81
Edmunds (1960)	37	?	54
West (1961)	19	63	31
Bowlin (1962)	19	63	37
Chapman (1964)	7	?	57
Blackett (1978)	6	84	16
Reber (1978)	19	37	10
Sandler (1981)	27	92	7
Malangoni (1981)	14	29	7
DeBacker (1985)	23	78	9
Rossi (1986)	14	50	14

tive surgery is considered. Several procedures can be performed, ranging from primary closure to pancreato-duodenectomy, depending on the local situation and circumstances. Primary closure includes excision of necrotic tissue with suture closure of the remaining defect, if necessary combined with penrose drains and decompression. Primary closure is only feasible if the circumstances are optimal, the duodenal wall is healthy and without risk for stenosis. These circumstances are exceptional for a persistent fistula. Local resection and anastomosis includes primary resection of part of the duodenum and primary anastomosis. This is only suitable under optimal local conditions and great care should be taken to avoid a stenosis. The serosal patch technique and the Roux-Y procedure have in common that a proximal part of the jejunum is used for closure of the defect. The serosal patch technique was first tested in dog experiments (Kobold, 1963; Jones, 1964). A perforated duodenal stump or a lateral duodenal defect was closed by suturing an intact segment of jejunum over the open duodenum. For closure any tension had to be avoided. All duodenal closures healed without evidence of leakage or peritonitis. Microscopic studies showed that the jejunal serosa was soon covered with duodenal mucosa. The first clinical cases were reported by McKittrick (1965) and Elliott (1967). Jones and Joergenson (1964) and Ujiki (1981) described the use of a Roux-Y limb as the ultimate, safe and reliable technique for closure in patients with a defect of the duodenal wall. An advantage of the serosal patch procedure might be that disruption of the jejunal continuity can be avoided.

Pancreatico-duodenectomy (Whipple procedure) can only be considered under exceptional circumstances, if all other possibilities have failed or are technically impossible (Donovan, 1966).

The prognosis of an external postoperative duodenal fistula depends on the success of controlling the local situation. Sepsis has to be treated vigorously. When a stable situation is reached, the fistula frequently closes within 5 weeks of conservative treatment. When the fistula persists, after about 8 weeks, circumstances are suitable for a delayed definitive operation with a high rate of success. Prevention is important in external postoperative duodenal fistulas and the use of a catheter duodenostomy under unfavourable conditions has considerably decreased the incidence of these fistulas (Jones, 1964).

Posttraumatic duodenal fistulas are rare and develop after an emergency operation for blunt or penetrating duodenal trauma (2-14%, Malangoni, 1981). An collective review of the literature of 1563 patients with duodenal injury, included only 90 patients with a duodenal fistula (Martin, 1983). The principles of conservative and operative treatment of posttraumatic duodenal fistulas are not different from those described for postoperative duodenal fistulas. Spon-

taneous closure happens in about 50% of patients. If the fistula persists an extended non-definitive operation (pyloric exclusion or diverticularization), or a delayed definitive operation (suture closure, serosal patch, Roux-y) can be performed under optimal conditions. The prognosis of patients with post-traumatic duodenal damage is not only related to duodenal damage, but is also determined by the time interval between blunt or penetrating injury and subsequent therapy, as well as to the severity of associated damage to the pancreas, major blood vessels, liver, spleen, etc. (Table 4.6).

TABLE 4.6 Posttraumatic duodenal fistulas, reported in the literature in relation to type of trauma, overall mortality (%), number of fistulas, spontaneous closure and fistula related mortality

Authors	Pnt (n)	Type of trauma		Overall mortality (%)	Duodenal fistula	Spontaneous closure	Fistula mortality
		Penetr.	Blunt				
Donovan (1966)	29	18	11	14	3	2	1
Snyder (1980)	228	180	48	10	16	2	7
Martin (1983)	313	?	?	18	7	3	1
Levison (1984)	93	74	19	18	5	?	?
Hasson (1984)	10	10	—	10	2	2	—
Ivatury (1985)	100	100	—	25	4	2	2
Shorr (1987)	115	?	?	12	4	1	2

Spontaneous duodenal fistulas are rare and are caused by benign or malignant disease of the duodenum or adjacent structures (pancreas, gallbladder, colon, right kidney, aorta) (Table 4.7). *Internal malignant* fistulas are generally secondary to advanced colonic cancer (Medhurst, 1956; Raffensperger, 1957; Chang, 1982; Cawthorn, 1985). *Spontaneous external fistulas* are extremely rare and are caused by Crohn's disease, duodenal ulcer or pancreatic cancer (Fitzgibbons, 1980; Rossi, 1986).

Only exceptionally in benign disease such as Crohn's disease the fistula may close with conservative treatment. In duodenocolic fistulas the passage through the fistula is mainly one-way, from the colon to the duodenum, and the diarrhoea is caused by proliferation of colonic flora (chronic enteritis) in the small intestine. Similar as in malignant gastro-colic fistulas, both a barium meal and a barium enema are necessary to visualize the fistula. Preoperative evaluation by CT-scan or angiography may be useful. In general, immediate operative treatment is feasible. Sometimes it is necessary to improve the general condi-

TABLE 4.7 Spontaneous internal duodenal fistulas, reported in the literature (benign)

Location	Author(s)	Primary Disease
Aorto-duodenal	Starzl (1959)	Duodenal Ulcer
Graft-duodenal	Paaske (1985)	Aneurysm or occlusive arterial disease (aorta)
Duodeno-biliary	Craighead (1954)	Duodenal Ulcer
	Constant (1968)	Duodenal Ulcer
Duodeno-colic	Medhurst (1956)	Ulcerative colitis
	Medhurst (1956)	Appendicitis
	Grayson (1960)	Duodenal Ulcer, Crohn's disease
	Rhodes (1964)	Duodenal Diverticulum
	Ferguson (1985)	Diverticulosis Coli
	Jacobson (1985)	Crohn's disease
	Klein (1987)	Crohn's disease
Ileo-duodenal	Wilk (1977)	Crohn's disease
	Jacobson (1985)	Crohn's disease
	Klein (1987)	Crohn's disease

tion of the patient with parenteral nutrition. A simple suture closure can be performed in some patients with benign disease (duodenal diverticulum). A defect in the duodenal wall can be closed by a serosal-patch (Wolfman, 1964) or a Roux-Y procedure (Ujiki, 1981). If the underlying disease has to be treated a more extensive procedure can be advocated, for instance an antrectomy-vagotomy and a partial resection of the colon. In more extended malignant disease of the colon radical resection is sometimes advocated (Cawthorn, 1985). More often, radical resection is technically impossible and only a palliative operation can be performed (gastro-enterostomy, colostomy).

Conclusion and treatment protocol (Fig. 4.2)

The prognosis of an external postoperative duodenal fistula mainly depends on the success of control of the local situation. If a stable situation is reached the fistula frequently closes spontaneously within 5 weeks of conservative treatment. When the fistula persists, after about 8 weeks, circumstances are suitable to perform a delayed definitive operation with a high success rate. Prevention of external postoperative duodenal fistulas is important and the use of a catheter duodenostomy in unfavourable circumstances has decreased the amount of

FIGURE 4.2. Treatment protocol for duodenal fistula

these fistulas considerably (Jones, 1964). The therapy of choice in spontaneous internal duodenal fistulas is operative treatment if technically applicable and after careful evaluation. Sometimes a diverting stoma and/or a period of adequate support and nutrition can improve local and general conditions and make definitive surgery more successful.

4.3 EXTERNAL FISTULAS OF THE JEJUNUM OR ILEUM*

Introduction

Most studies on gastrointestinal fistulas published between 1970 and 1980 focussed on risk factors, supportive therapy, parenteral nutrition, closure rate and mortality (Athanassiades, 1975; Blackett, 1978; Halasz, 1978; MacFadyen, 1973; Reber, 1978; Roback, 1972; Soeters 1979).

Primary conservative treatment was concluded to be more advantageous than early definitive surgery and there was optimism that results of treatment would further improve. In high-output external fistulas of the jejunum and ileum, early operation was customarily performed, because conservative management was extremely difficult and associated with a high mortality. But improvements in supportive treatment, intensive care facilities and diagnostic and interventional techniques have made primary conservative management possible also for these external fistulas (Blackett, 1978; Dudrick, 1969; Fazio, 1983; Hollender, 1983).

The purpose of this study was to assess the results of primary conservative treatment of external fistulas of the jejunum and ileum. The influence of an increasing proportion of complicated fistulas on the rate of spontaneous closure, total closure and mortality was assessed by defining simple and complicated fistulas.

Material and methods

In the period 1977 to 1987, 114 patients with a total of 138 postoperative or spontaneous gastrointestinal fistulas were treated in our hospital. Only few patients had been referred from other hospitals. There were 45 consecutive cases of external fistula of the jejunum or ileum, 42 of which were conservatively treated. The other three, with chronic (2) or uncontrolled (1) fistula, were operated on immediately.

The 42 initially conservatively treated patients (27 men, 15 women) are now presented. Their mean age was 55 (range 16-76) years. They had a total of 45 fistulas, 16 originating from the jejunum, 14 from the ileum and 15 from midway in the small bowel. The 24-hour fistula output was ≥ 500 ml in 27 patients and < 500 ml in 15. In addition to the 45 small-bowel fistulas, seven

* Published in The Acta Chirurgica Scandinavica 156: 457-462, 1990
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TABLE 4.8 Primary disease and cause of external fistulas of the jejunum or ileum (42 patients with 45 fistulas)

Primary disease	(n)	Cause of fistulas	
Inflammatory bowel disease	12	Postoperative complications	35
Cancer	17	Operative injury	29
Diverticulitis of colon	1	Suture-line failure	6
Appendicitis	1	Spontaneous fistulas	7
Arterial disease	4	Crohn's disease	5
Other	7	Cancer	1
		Radiation	1
Total	42		

simultaneous fistulas (1 internal, 6 external) were found in various parts of the gastrointestinal tract. The etiology of the fistulas and the primary diseases are summarized in Table 4.8. The commonest cause of fistula was postoperative complication (35/42) and the commonest primary diseases were cancer (17/42) and inflammatory bowel conditions (12/42).

The conservative approach included early stabilization, adequate nutritional support, skin and fistula care, diagnostic evaluation (fistulography), non-definitive surgery and re-infusion of secretions (Fischer, 1975; Soeters, 1979).

Parenteral nutrition started as early as possible. Enteral nutrition was added if appropriate and when the proximal fistula secretion could be safely collected without exposing the skin to such secretions. Whenever possible, proximal secretion was re-infused in the distal part of the bowel (Gouma, 1986). Repeated search for abscess by CT-scan or sonography was the most important diagnostic procedure, and such abscesses were preferably drained percutaneously, by CT-guided puncture (Gerzof, 1981).

Non-definitive surgery was not intended to explore the fistula per se, but was performed for e.g. surgical drainage of abscess or construction of a dividing stoma. When the fistula did not close spontaneously, further diagnostic procedures were performed to provide information on its location and on the distal bowel, especially concerning the presence of a distal obstruction. Delayed definitive surgery was generally performed if the fistula persisted after 6-8 weeks of conservative treatment, the abdomen appeared quiescent and the patient was well nourished and had no sepsis. Resection of the fistula-bearing segment with end-to-end anastomosis was performed in about all instances. Suture closure was exceptional.

The influence of more complicated fistulas on the rates of spontaneous closure and mortality was studied by distinguishing simple from complicated fistulas. Simple fistulas communicated with the skin directly or via a long fistula tract. Complicated fistulas included multiple fistulas or fistulas associated with a serious problem of the abdominal wall, e.g. when a fistula drained via an open wound or was located in abdominal dehiscence.

For statistical analysis we used the chi-square test with one degree of freedom.

Results

Conservative treatment was initiated in all patients and included sump suction in 24, total parenteral nutrition in 40 and total enteral nutrition in two patients. In 6 patients TPN could be changed to TEN. Nondefinitive surgical procedures were performed in 18 patients. An intra-abdominal abscess was found in eight patients and was treated with CT-guided puncture in 3 and surgical drainage in 5 patients.

The fistula closed spontaneously in 10 patients (24%) after a mean period of 44 days (range 7-135 days) (Fig. 4.3).

Spontaneous closure did not occur more often in high-output than in low-output fistula or in jejunal compared to ileal fistula (Table 4.9).

Conservative treatment failed to close the fistula in 32 patients, after a mean of 51 days (range 7-150 days). Eight of these 32 patients died without definitive surgery, one was discharged with an uncomplicated open low-output fistula after 24 days of conservative treatment, and 23 underwent delayed definitive operation (resection with end-to-end anastomosis in 20 and various other procedures in 3). In five of these 23 patients the fistula recurred and was eventually successfully closed in only one case (Fig. 4.3).

The fistulas were classified as simple in 19 patients and as complicated in 23 (Table 4.10). In the complicated group there were 12 patients with abdominal dehiscence and eight with multiple fistulas. The cause and primary disease were comparable in both groups. Uncontrolled sepsis, however, occurred two times in the simple fistula group, but 11 times in the complicated fistula group ($p < 0.01$). Three of 19 patients with simple fistula were treated in the intensive care unit for a mean of 10 days, whereas 14 of the 23 with a complicated fistula required intensive care for a mean of 35 days (range 3-100 days) ($p < 0.01$). Seven of the 19 simple fistulas and only 3 of the 23 complicated fistulas closed spontaneously (n.s.).

Ten of the 42 patients died (24%). Three had simple and seven complicated fistulas. The deaths in the simple fistula group were due to disseminated cancer

FIGURE 4.3. End result of treatment in 42 patients with 45 external fistulas of the jejunum and ileum, treated by a primary conservative approach

(1 pt.) or unrelated disease (2 pts.). All patients who died of sepsis had complicated fistula. Spontaneous fistula closure never occurred when there was abdominal dehiscence, and five of these 12 patients died, four of sepsis and one of disseminated cancer.

TABLE 4.9 Spontaneous fistula closure and mortality in relation to fistula output, location and cause, and to primary disease (42 patients, 45 fistulas)

	Patients (n)	Spontaneous closure (%)	Mortality (%)
Output			
≥ 500	27	6/27 (22)	7/27 (26)
< 500	15	4/15 (27)	3/15 (20)
Location fistula			
Jejunum	16	2/16 (12)	3/16 (19)
Ileum	14	3/14 (21)	1/14 (7)
Small bowel	15	5/15 (33)	6/15 (40)
Cause			
Surgical complications	35	9/35 (26)	9/35 (26)
Spontaneous	7	1/7 (14)	1/7 (14)
Primary disease			
Cancer	17	4/17 (24)	5/17 (29)
Inflammatory bowel disease	12	3/12 (25)	2/12 (16)
Other	13	3/13 (23)	3/13 (23)

Discussion

Initially, conservative treatment was considered to be inadequate for control of high-output fistulas of the small bowel. Early definitive surgery (two-staged resection or exteriorization) was frequently advised in these uncontrolled circumstances (Keyes, 1941; MacNaughton, 1941; Harbison, 1950; Welch, 1962; Miller, 1966; Nemhauser, 1967; Lorenzo, 1969; Goligher, 1971; Nassos, 1971; Roback, 1972). Since 1975, further improvement of supportive care has brought general acceptance that such fistulas should preferably be managed conservatively (Fischer, 1975; Gerzof, 1981; McIntyre, 1984).

In the present study, treatment was successful in 69% of the patients (10 fistulas closed spontaneously and 19 after delayed definitive surgery) and failed in 31% (3 patients were discharged with open fistula and 10 patients died).

TABLE 4.10 Results of treatment in simple versus complicated external fistulas of the jejunum or ileum

	Simple fistula n=19 (%)	Complicated fistula n=23 (%)	
Cause			
Postoperative	14 (74)	21 (91)	n.s.
Spontaneous	5 (26)	2 (9)	n.s.
Primary disease			
Cancer	9 (48)	8 (35)	n.s.
I.B.D.	5 (26)	7 (30)	n.s.
Other	5 (26)	8 (35)	n.s.
Sepsis			
Controlled	4 (21)	9 (39)	n.s.
Uncontrolled	2 (10)	11 (48)	p<0.01
Intensive care	3 (16)	14 (61)	p<0.01
Spontaneous closure	7 (37)	3 (13)	n.s.
Total closure	14 (74)	15 (65)	n.s.
Death	3 (16)	7 (30)	n.s.
Sepsis	0	6	
Primary disease	1	1	
Unrelated disease	2	0	

These results are comparable with reports in the available literature (Table 4.11) and support the value of primary conservative treatment. The advantages of such management are obvious. An abdominal catastrophe generally becomes manifest more than 7 days after the operation, when suppuration and abscess formation have already occurred. Definitive fistula surgery at that time has a very low success rate and high mortality (Blackett, 1978; Fazio, 1983; Hollender, 1983). Consequently definitive fistula surgery must be postponed for about 2 months. Thereafter the abdominal cavity and intestinal adhesions are accessible for relatively easy dissection with a substantially less risk of recurrent iatrogenic lesions. Another advantage of postponing definitive surgery is that metabolic balance and a non-infected granulating wound surface are achieved. During conservative management there is still the possibility of spontaneous closure.

TABLE 4.11 Present results and literature concerning closure of external fistula of the jejunum or ileum versus failure

Author(s)	Patient (n)	Closure (%)		Failure (%)	
		Spontaneous	Total	Fistula open	Mortality
Sheldon (1971)	29	13	76	10	14
Nassos (1971)	15	40	73	0	27
MacFadyen (1973)	26	69	88	4	8
Athanassiakes (75)	26	42	84	0	15
Halasz (76)	47	60	89	2	8
Blackett (78)	19	53	68	11	21
Reber (78)	120	33	71	0	29
Sternquist (78)	18	22	77	5	18
Benhamou (79)	124	29	49	0	51
Allerdyce (83)	52	43	62	0	38
Hollender (83)	54	11	52	0	48
Fazio (83)	174	10	72	6	22
Hill (88)	85	42	82	2	16
Present study	42	24	69	7	24

The type of fistula that may close spontaneously has certain characteristics: the fistula is lateral, there is no distal obstruction, the bowel wall is healthy and there is no adjacent abscess (Irving, 1977; Webster, 1976). However, conditions often are less favourable, therefore reported spontaneous closure rates range from 10 to 69%. Spontaneous closure appears to be determined by many factors that cannot be influenced by optimal conservative treatment, e.g. by cause and location of the fistula, primary disease or distal obstruction (Athanassiades, 1975; Fazio, 1983; Hollender, 1983; MacFadyen, 1973; Reber, 1978; Sheldon, 1971). Hence spontaneous closure should not be the principal aim of conservative management. The present study and a review of the literature showed that the results of treatment of external fistulas of the jejunum or ileum have not improved despite modern techniques of supportive and intensive care (Table 4.11). The overall closure is still less than 82% and the mortality as high as 16% (Hill, 1988). In a chronologic review of fistula treatment, there was even an increase in mortality, from 15% to 21% (Soeters, 1979). This change was

suggested to be related to a change in the fistula population. Patients with more advanced disease survived the early complications in the postoperative phase because of better supportive therapy, but incurred more complicated problems of the abdominal wall with fistulization. Other aggravating factors were intraperitoneal septic foci, disease of the fistulated intestine, exposure of fistula in evisceration, complex fistula and advanced age of the patient (Fazio, 1983; Hollender, 1983; McIntyre, 1984; Sitges Serra, 1982). The proportion of complicated fistulas in the present series (55%) was remarkably high. Cause and primary disease did not differ between the group with simple and those with complicated fistula, but the latter were more seriously ill, had more sepsis, e.g. intra-abdominal abscesses, and therefore were more often treated in the intensive care unit ($p < 0.01$).

These data support the relevance of our definition of simple and complicated fistulas. Mortality was higher in the complicated fistula group, while rates of spontaneous and total closure were higher in the simple fistula group, although due to group size the differences did not reach statistical significance. These figures are in accordance with our view that current series of fistula are of an increasingly complicated nature. In cases of simple fistula mortality is related to the primary disease (e.g. cancer) or to unrelated disease, and consequently further improvement is not to be expected. Mortality in complicated fistula is still related to sepsis, and hence the results of treatment, especially total closure and mortality rates, should improve with more adequate preventive measures. Especially in patients who survive an abdominal catastrophe, the search for intra-abdominal abscesses and septic foci should be more intensive.

Conclusion and treatment protocol (Fig. 4.4)

External fistulas of the jejunum and ileum are preferably managed conservatively. Our results are comparable with those from the literature and show that results of treatment have not improved despite all advanced techniques of supportive and intensive care. We defined simple and complicated fistulas, and analysis reveals that current series of fistulas are of an increasingly complicated nature. In patients with simple fistulas the mortality is related to the primary disease (e.g. cancer) or to an unrelated disease, and consequently further improvement is not to be expected. Mortality in complicated fistulas is still related to sepsis and hence the results of treatment should improve with more adequate treatment of intra-abdominal abscesses and septic foci and better nutritional and metabolic support.

FIGURE 4.4. Treatment protocol for external fistulas of jejunum or ileum

4.4 EXTERNAL FISTULAS OF COLON OR APPENDIX

Introduction

The function of the colon is to absorb the major part of the 1.5 L/day ileocecal flow, and this results in a faecal loss of about 0.1 L water per day. Colonic fistulas are most frequently lateral low output fistulas and, compared with fistulization of more proximal parts of the bowel, fistulization of part of the colon has less serious consequences (Soeters, 1985).

External fistulization of the appendix is also considered in this subgroup of external colonic fistulas, because the metabolic and septic consequences of an external appendicular fistula are difficult to distinguish from fistulas arising from the caecum. Fistulas between the colon and the vagina will be discussed in Chapter 4.5 (vaginal fistulas). Generally, external colonic fistulas are a postoperative complication, after suture line failure or surgical damage (Edmunds, 1960). Spontaneous external colonic fistulas are caused by advanced inflammatory or malignant disease or develop after drainage of a spontaneous intraabdominal abscess or are related to radiation damage.

Patients and results of treatment

During the study period 15 patients with external colonic fistulas and 3 patients with external fistulas from the appendicular region were treated, with a total number of 26 fistulas, 22 external fistulas and 4 internal fistulas. There were 11 men and 7 women with a mean age of 55 years (range 12-85 years) (Table 4.12).

In 9 patients the fistula was as a postoperative complication and in 9 patients the fistula developed spontaneously, related to Crohn's disease, diverticulitis, appendicitis or malignancy. Seventeen colonic fistulas were classified as low output fistulas, and one patient had a high output fistula (nr. 20).

Conservative treatment was started in 15 patients, 9 patients with postoperative fistulas and 6 patients with spontaneous fistulas (Fig. 4.5). Nine patients received TPN, 6 patients TEN and nutritional support was changed from TPN to TEN in 1 patient. Fistula closure occurred spontaneously in 8 patients (5 postoperative and 3 spontaneous) after a mean period of 30 days (range 14-70 days). The colonic fistula persisted in 7 patients, treated during a mean period of 89 days (range 16-200 days). In 2 patients a definitive operation was not performed and both died respectively after 38 days of cancer and after 16 days of sepsis. Successful delayed definitive surgery was performed in 4 patients and surgery failed in one patient, subsequently dying of metastatic cancer. A proximal diverting stoma was constructed in 3 patients, but never resulted in spon-

TABLE 4.12 Characteristics of 18 patients with external colonic fistulas

Nr.	Age	Sex	Primary disease	Cause fistula	Location fistula
16	59	F	Diverticulitis	P: *suture line	colon-skin
78	75	M	AdenoCa. colon	P: *suture line	colon-skin
82	72	M	Diverticulitis	P: *suture line	colon-skin
85	56	M	Grawitz	P: suture line	colon-skin
20	85	M	Duodenal ulcer	P: damage	colon-skin
36	84	F	Duodenal ulcer	P: damage	colon-skin
84	38	M	Seminoma testis	P: damage	colon-skin
92	45	M	Pancreatitis	P: damage	colon-skin
100	61	M	Duodenal Ca.	P: damage	SB-skin 2x colon-skin
17	16	M	Crohn's disease	S: Crohn's disease	colon-skin stomach-colon
73	47	M	Crohn's disease	S: Crohn's disease	colon-skin jejuno-jejuno jejuno-colon
94	22	F	Crohn's disease	S: abscess	appendix-skin ileum-skin ileum-colon
42	48	F	AdenoCa. coecum	S: cancer	colon-skin 2x
98	59	F	AdenoCa. colon	S: cancer	colon-skin
51	12	F	Appendicitis	S: abscess	coecum-skin
90	73	F	Appendicitis	S: abscess	coecum-skin
97	69	M	Diverticulitis	S: abscess	colon-skin
102	76	M	Ca. stomach	S: unknown	colon-skin

SB = small bowel; * closure stoma; P = postoperative; S = spontaneous

taneous fistula closure, despite the fact that two of these fistulas developed as a postoperative complication.

In 3 patients no specific treatment (NT) was installed: one patient was discharged with an irresectable fistulating malignancy (Dukes D) and in 2 patients the fistula persisted without consequences for 114 and 350 days respectively and was closed by delayed definitive surgery. Where the fistula originated in the appendicular region, delayed definitive surgery was always necessary to

remove the appendix or the stenotic bowel segment, despite the fact that one fistula closed spontaneously (Fig. 4.5).

FIGURE 4.5. Method and results of treatment of 18 patients with external colonic fistulas
PCT = Primary conservative treatment; NT = No treatment; DDS = Delayed definitive surgery

Discussion

Patients with external colonic fistulas are only described in the literature as a subgroup of a larger fistula population (Table 4.13). Apparently these fistulas are less frequent and have a less dramatic and troublesome course. Comparison of our results with the literature is difficult, because these series are frequently not consecutive and do not mention results of treatment related to etiology, primary disease and treatment method. In general, spontaneous closure is high (more than 50%), and mortality is rather low (7 to 18%). Our failure rate of 23% is high, but two of our patients died of advanced malignant disease and one patient was discharged with an open fistula, also related to a malignancy. Failure in these 3 patients is inevitable and is a consequence of the inclusion in the series of end stage malignant disease.

Conservative treatment was started in 15 of our colonic fistula patients and spontaneous closure occurred in 8 patients, 5 postoperative and 3 spontaneous fistulas. Similar results are found in the literature and therefore, especially in postoperative fistulas, most authors advise to start with TPN, diagnostic procedures and abscess drainage (Edmunds, 1960; Ali, 1972; MacFadyen, 1973).

TABLE 4.13 Present results on external colonic fistulas compared to the literature: spontaneous closure, total closure, alive open fistula, mortality

Authors	Pnt. (n)	Spontaneous Closure (%)	Total Closure (%)	Alive, open fistula (%)	Mortality (%)	Remarks
Edmunds (1960)	55	15 (27)	43 (80)	3 (5)	9 (16)	Both*
West (1961)	18	5 (28)	15 (83)	1 (6)	2 (11)	Postop.
Chapman (1964)	19	?	12 (63)	3 (16)	4 (21)	
Miller (1968)	13	?	11 (85)	—	2 (15)	Postop.
Sheldon (1971)	13	11 (85)	13 (100)	—	—	Both
Ali (1972)	7	3 (43)	6 (86)	—	1 (14)	
MacFadyen (1973)	24	19 (79)	22 (93)	—	2 (7)	Both
Sternquist (1978)	15	4 (27)	14 (93)	—	1 (7)	
Sitges-Serra (1982)	12	11 (92)	12 (100)	—	—	Postop.
Rose (1986)	17	10 (59)	14 (82)	—	3 (18)	
Present study	18	8 (53)	14 (77)	1 (6)	3 (17)	Both

*Both = spontaneous and postoperative

In general the postoperative fistula becomes manifest after a period of sepsis, local peritonitis and persisting ileus. Frequently these fistulas are lateral and related to partial suture line failure. Spontaneous closure can be expected under optimal conditions. If the suture line is nearly completely disrupted, or in the presence of a distal obstruction, spontaneous closure is unlikely. A delayed definitive operation can generally be performed after 6 weeks under optimal conditions (Sitges Serra, 1982).

Spontaneous external colonic fistulas can be subdivided according to the cause in two subgroups both with a different behaviour and prognosis. If the spontaneous fistula is related to inflammatory disease (Crohn's disease, diverticulitis, appendicitis) conservative treatment is the method of choice. Spontaneous closure is possible, but has nearly always to be followed by a definitive operation to resect the diseased bowel segment. Therefore, conservative treatment is not started with the intention to close the fistula, but to improve the general condition of the patient and perform adequate diagnostics. If the spontaneous fistula is related to malignant disease the therapy depends on the extent

of the local disease, the resectability, involvement of adjacent structures and metastatic disease. Curative resection is often not possible and only a palliative procedure (diverting stoma, palliative resection) can be performed, or no treatment of any kind is possible, as was also demonstrated in our patients.

Both in postoperative and spontaneous colonic fistulas the decision to construct a diverting stoma has to be taken individually, related to primary disease, cause, local conditions and the possibility of nutritional support. If the fistula originates from the descending colon or sigmoid a diverting stoma on the transverse colon has a low output, can be handled easily, simplifies fistula treatment and allows enteral nutrition. A fistula from the ascending colon has the slight disadvantage that an ileostomy has to be constructed, with a high(er) output, which further increases upon enteral nutrition. A proximal diversion does not guarantee spontaneous closure of the fistula, as was also shown in our patients. Optimal conservative fistula treatment with TPN and without a diverting stoma has also a high spontaneous closure rate (8/12) and might therefore be preferred if TPN is available and local conditions are appropriate. Otherwise, a diverting stoma is frequently a good alternative, allowing early discharge of the patient.

Several methods of definitive surgical treatment can be considered. Both one stage and multistage procedures have their place in the management of these fistulas (Amin, 1985; Bacon, 1971). A one stage procedure with optimal bowel preparation and perioperative antibiotics is safe and effective in a well nourished patient without sepsis. Otherwise, a resection without primary anastomosis, for instance a Hartmann procedure, has to be performed (Smits, 1985). A disadvantage of the Hartmann procedure is that the second operation is also a major procedure. In our study 2 of the 3 colonic fistulas related to suture line failure developed after the reanastomosis of a Hartmann operation.

Conclusion and treatment protocol (Fig. 4.6)

Postoperative external colonic fistulas are most frequently related to suture line failure and are preferably treated conservatively with TPN, diagnostic evaluation and drainage. The construction of a diverting stoma may be beneficial.

Spontaneous external colonic fistulas can be distinguished in fistulas related to inflammatory disease and fistulas related to malignancy. A fistula related to inflammatory disease is preferably first treated conservatively to improve the local and general condition of the patient in order to make delayed definitive surgery successful. In case of malignancy, rapid evaluation and early laparotomy is necessary to determine the extent and resectability of the disease. If resection is not possible a palliative procedure can be performed.

FIGURE 4.6. Treatment protocol for external colonic fistulas

4.5 ENTERO-VAGINAL FISTULAS

Introduction

Fistulization between the intestine and the vagina or uterus has important social, psychological and local implications for the patient. Early diagnostic evaluation and therapy is mandatory to prevent further extension and to devise causal treatment of the underlying disease. Low rectovaginal fistulas as well as vesico-vaginal or entero-vesico-uterine fistulas are beyond the scope of this thesis, and will therefore not be discussed in more detail (Bacon, 1971). High entero-vaginal fistulas can be classified in subgroups according to primary disease:

(recurrent) malignant disease, radiation disease, inflammatory disease (Crohn's disease, diverticular disease) and a rest group of other disorders (traumatic, postoperative and obstetric) (Hudson, 1970). Rarely the enterovaginal fistula is the first manifestation of a primary disease, as for instance in Crohn's disease.

Patients and results of treatment

From 1977 to 1987 16 patients with enterovaginal fistulas were treated (Table 4.14). The age ranged from 34 to 86 years (mean 63 years). In 9 patients the

TABLE 4.14 Characteristics of 16 patients with entero-vaginal fistulas

Nr.	Fistula	Primary disease	Pathogenesis
13	Recto-vaginal	Cervix carcinoma	Radiation
	Vesico-vaginal		
40	Recto-vaginal	Cervix carcinoma	Radiation
64	Sigmoido-vaginal	Cervix carcinoma	Radiation
79	Sigmoido-vaginal	Cervix carcinoma	Radiation
	Jejuno-vaginal		
88	Recto-vaginal	Cervix carcinoma	Radiation
	Vesico-vaginal		
12	Recto-vaginal	Cervix carcinoma	Recurr. Carcinoma
53	Sigmoido-vaginal	Cervix carcinoma	Recurr. Carcinoma
28	Small bowel-vaginal	Ovarian carcinoma	Recurr. Carcinoma
	Small bowel-gut		
54	Recto-vaginal	Ovarian carcinoma	Unknown
63	Recto-vaginal	Rectal carcinoma	Postoperative
68	Sigmoido-vaginal	Sigmoidal carcinoma	Carcinoma
67	Recto-vaginal	Diverticulitis*	Postoperative
14	Sigmoido-vaginal	Diverticulitis	Diverticulitis
	Colon-colon		
65	Sigmoido-vaginal	Diverticulitis*	Diverticulitis
41	Recto-vaginal	Crohn's disease	Crohn's disease
15	Recto-vaginal	Aneurysma AAA	Ischaemia

* previous hysterectomy

fistula communicated with the rectum and the vagina, in 5 patients with the sigmoid and the vagina, and in one patient with the ileum and the vagina. One patient had an entero-uterine fistula after radiation therapy communicating with both the distal ileum and the sigmoid and uterus.

In 15 patients the output was minimal or could not be measured. Only one patient had a high output vaginal fistula. Every patient presented with a history of vaginal discharge of faeces or flatus and the diagnosis could be established by vaginal examination. Further evaluation was performed by barium enema in 9 patients, visualizing the fistula in 6 patients. Sigmoidoscopy confirmed the fistula in 3 out of 6 patients. Cystoscopy was only performed in the 2 patients with a concomitant vesical fistula.

Method and result of treatment is summarized in Figure 4.7. Conservative treatment was started in 11 patients resulting in spontaneous closure in only one

FIGURE 4.7. Method and result of treatment in 16 patients with entero-vaginal fistulas
PCT = primary conservative treatment; IOT = immediate operative treatment; NT = no treatment

patient after 36 days (nr. 54). A primary diverting stoma was constructed in 4 patients and never resulted in spontaneous closure of the vaginal fistula.

A laparotomy was performed in 9 patients after 14 to 115 days of conservative treatment (mean 48 days), and in 4 patients the diseased bowel could be resected and the fistula closed (Table 4.15): in the remaining 5 patients a curative resection was not possible. Four patients had an early definitive operation for uncontrolled vaginal fistulation. In patient nr. 63, a postoperative rectovaginal

TABLE 4.15 Method and result of treatment in 16 patients with entero-vaginal fistulas

Nr.	Age	Method; result
Primary conservative treatment		
54	59	Spontaneous closure after 36 days; discharged.
12	54	Laparotomy after 39 days: irresectable carcinoma, diverting stoma; died.
13	58	Laparotomy after 61 days: frozen pelvis, Bricker deviation, diverting stoma; discharged with open fistula.
14	56	Laparotomy after 14 days, successful two-stage resection; discharged
15	59	Laparotomy after 18 days, diverting stoma; fistula persisted; discharged with open fistula
41	34	Laparotomy after 61 days, proctocolectomy; discharged.
79	60	Laparotomy after 14 days, small bowel resection, Hartmann; discharged.
40	84	Diverting stoma (recurrent malignancy, vaginal fistula); discharged with open fistula.
67	62	Diverting stoma; after 118 days laparotomy: resection; discharged.
68	83	Diverting stoma; after 32 days laparotomy: no resection possible; discharged with open fistula
88	56	Diverting stoma sigmoid, after 75 days Bricker deviation; discharged with open fistula
Immediate operative treatment		
64	60	Hartmann, ileo-coecal resection; discharged.
53	73	Hartmann procedure; discharged.
28	63	Laparotomy: resection small bowel; discharged.
65	64	One-stage resection: fistula closed; discharged.
No treatment		
63	86	Spontaneous closure; discharged.

fistula developed after a Hartmann procedure for rectal carcinoma. The fistula was without consequences, requiring no specific treatment, and closed spontaneously after 14 days.

Discussion

Treatment resulted in successful fistula closure in 10 patients and failed in 6 patients, 5 were discharged with an open fistula and 1 patient died. Mortality was low, but 2 of the 5 patients with an open fistula had recurrent malignancy confirmed by laparotomy. They died shortly after discharge. The other 3 patients had a laparotomy and resection was not possible for various reasons. They were discharged with a diverting colostomy. Comparison of these results with those of the literature is difficult because most authors describe vaginal fistulas with one specific cause, for instance radiation damage or diverticulitis (Palmer, 1976; Smith, 1984; Piver, 1976; Al-Humadi, 1974; Bacon, 1971). Others describe totally different patient populations from Africa, with a large proportion of obstetric fistulas (Hudson, 1970). When primary disease and cause of our patients are considered, our results are acceptable. The optimal management of vaginal fistulas is related to the cause of the fistula, the primary disease and local or general condition. Often conservative treatment is started, not with the intention to close the fistula, but to improve the circumstances and perform adequate diagnostic evaluation, which, especially in inflammatory disease, allows a more successful and limited delayed definitive operation (Smith, 1984; Colonna, 1990). If the fistula effluent is uncontrolled, or the fistula is related to advanced malignant or radiation disease, an early laparotomy is performed because prolonged conservative treatment does not improve circumstances or survival. After laparotomy, the extent of disease is established and, if possible, resection is performed. Otherwise, a palliative procedure (total bypass or diverting stoma) should be undertaken.

Enterovaginal fistulas most frequently develop after radiation therapy. The Cobalt-60 teletherapy for cervical carcinoma in combination with intracavitary irradiation resulted in a rectovaginal fistula in 1-3% of patients (Cooke, 1981). At least two of our patients with the combination of a rectovaginal fistula and a vesicovaginal fistula had this type of radiation treatment. Nowadays, the modern radiotherapy techniques using linear accelerators with high energy photons, CT and simulator-based treatment set-up and computerized multibeam dose calculation, have substantially diminished the number of vaginal fistulas. A radiation fistula generally develops 6 to 18 months after the completion of radiation therapy, but shorter and longer intervals (up to 30 years) have been reported (Boronow, 1971; Parks, 1978). Immediately after the recognition of the

fistula by vaginal flatus and faeces, a rectal and vaginal investigation has to be performed under general anaesthesia with biopsy for histology to exclude the existence of local recurrent malignancy. Furthermore, a gastrointestinal series with small intestinal follow through and a barium enema should be performed to establish the fistula tract and localize segments of radiation enteritis. Cystoscopy is of value if there is clinical suspicion for a vesical fistula. Thereafter, a laparotomy should be performed, unless there are important reasons to continue conservative treatment (depletion, sepsis, etc.). Fistulas between the vagina and the recto-sigmoid or sigmoid can frequently be managed with an anterior resection. For rectovaginal fistulas a rectal extirpation is the ultimate solution. Several operations have been described to preserve the anal sphincter. These procedures have all in common that vital tissue is brought into the defect, for instance "reverse colon graft" (Bricker, 1979), "pull through procedure" (Parks, 1978), "Gracilis muscle" and "omental patch" or a combination of these procedures (Boronow, 1971). If the fistula originates from the small bowel, a resection has to be performed. If this is technically not feasible an exclusion operation with mucous fistula is considered to be the method of choice (Piver, 1976).

Conclusion and treatment protocol (Fig. 4.8)

Optional management of vaginal fistulas is related to the cause of the fistula, the primary disease, and local or general conditions. Conservative management is directed to improve the circumstances and perform adequate diagnostic evaluation. Early laparotomy has to be performed if the fistula is related to advanced malignant or radiation disease.

4.6 ENTERO-VESICAL FISTULAS

Introduction

An entero-vesical fistula communicates between the intestine and the bladder and frequently originates from the sigmoid (diverticulitis) or the ileo-coecal region (Crohn's disease). Appendico-vesical fistulas (Haas, 1984) and appendico-vesico-colonic fistulas are rare (Dalessandri, 1983). Most entero-vesical fistulas are spontaneous. Rarely they develop as a postoperative complication or after trauma (Slade, 1972; Suits, 1985). The spontaneous entero-vesical fistulas can be classified according to the primary disease: infectious disease (diverticulitis, Crohn's disease, appendicitis), malignancy and other disease, for instance radiation or trauma. Malignancy can be distinguished in cancer origi-

ENTERO-VAGINAL FISTULA

Resuscitation

Diagnostic work-up

- * Local examination (general anaesthesia) with rectoscopy, colposcopy, histology
- * barium enema
- * optional: - small bowel follow through
 - cystoscopy
 - CT-scan

DIAGNOSIS

- * Inflammatory disease
- * Radiation disease
- * Malignancy
- * Other disease: treatment depends on primary disease

PRIMARY CONSERVATIVE TREATMENT (PCT)

- * Non-definitive surgery
 - diverting colostomy
 - abscess drainage
- * Nutritional support (TPN)

- Unless:**
- * Local or general conditions cannot be further improved → IOT
 - * Uncontrolled fistula → IOT
 - * End-stage disease → NT

Persistent fistula !

ALIVE, FISTULA OPEN

(no spontaneous closure in radiation and malignancy;
often closure in inflammatory disease)

Delayed definitive surgery

After 10-14 days for malignancy

After 2 to 4 weeks for radiation disease

After 2 to 6 weeks for inflammatory disease, also when fistula is closed

FIGURE 4.8. Treatment protocol for entero-vaginal fistula

IOT = immediate operative treatment; NT = no treatment

nating from the recto-sigmoid or coecum, the cervix or ovaries, the bladder or prostate.

Patients and results of treatment

Between 1977 and 1987 thirteen patients with spontaneous entero-vesical fistulas were treated, 6 men and 7 women, with a mean age of 62 years (range

20-82 years). The primary disease was diverticulitis of the sigmoid in 8 patients, Crohn's disease of the ileum in 2 patients, and a gynaecological malignancy in 2 patients. In one patient, repeatedly treated for recurrent urinary tract infection, the fistula was diagnosed in an end-stage uncontrolled sepsis, the primary disease could not be discovered.

The most common symptom was recurrent infection of the urinary tract in 5 patients, pneumaturia in 6 patients, and faecaluria in 1 patient.

Cystoscopy was employed in 10 patients, the fistula was visualized in 9 patients and suspected in one patient. A barium enema revealed a fistula in 4 of the 11 patients (36%), colonoscopy in 1 of 5 patients (20%). Small bowel series, used in both patients with Crohn's disease, delineated the fistula one time.

In 8 patients conservative treatment was started, 4 patients were immediately operated upon and one patient was not treated. The choice whether to operate or not was mainly related to the primary disease, but was also influenced by the local situation and the general condition of the patient. Treatment was successful in 10 patients, 1 patient was discharged with an open fistula and 2 patients died (Fig. 4.9).

FIGURE 4.9. Management and result of treatment in 13 patients with entero-vesical fistulas
PCT = primary conservative treatment; IOT = immediate operative treatment; DDS = delayed definitive surgery

Discussion

Entero-vesical fistulas are rare and are generally related to diverticulitis (50-60%), cancer (15-35%) or to Crohn's disease (3-15%) (Table 4.16). Series in the literature are relatively small and have focussed on symptoms, diagnostic methods and method of treatment. Most frequently, the presenting symptoms are related to the urinary tract: dysuria, pneumaturia, faecaluria, haematuria, recurrent infection, urine loss per rectum (Table 4.17).

Less specific symptoms are findings at physical evaluation (abdominal mass, abdominal tenderness, fever) and signs related to the primary disease in the intestine (changed bowel habits, obstipation, diarrhoea) (Morrison, 1983; Carson, 1978). Pneumaturia in combination with faecaluria or passage of urine via the rectum can be considered pathognomonic for entero-vesical fistulization (Suits, 1985). The location and extent of the intestinal disease and visualization of the fistula tract can most successfully be performed by a combination of diagnostic techniques: cystoscopy followed by upper gastrointestinal series and/or barium enema, and the Bourne test (radiological examination of urine following barium enema). Intravenous pyelography and plain abdominal X-ray are of little value. Despite the use of all diagnostic tests, it is not always possible to visualize the fistula track (Naucler, 1981). However, if the medical history is

TABLE 4.16 Patients with entero-vesical fistulization related to primary disease, compared to the literature

Author(s)	Patients (n)	Diverticulitis (%)	Cancer (%)	Crohn's disease (%)	Other (%)
Moisey (1972)	68	58	19	11	10
Slade (1972)	74	48	30	10	14
Morse III (1974)	39	60	18	15	17
Kovalcik (1976)	55	55	15	15	16
Carson (1978)	100	51	21	12	16
Morrison (1983)	32	66	24	3	6
Suits (1985)	16	50	19	13	18
Goldman (1985)	20	45	35	15	5
Present study	13	61	15	15	7

TABLE 4.17 Symptoms related to entero-vesical fistulization compared to the literature

Author(s)	Patients (n)	Urinary tract infection (%)	Pneumaturia (%)	Faecaluria (%)	Bowel sympt. (%)	Remarks
Moisey (1972)	61	60	64	39	31	
Morse III (1974)	39	44	54	51	unsp.	
Kovalcik (1976)	55	69	unsp.	unsp.	22	
Carson (1978)	100	95	67	38	70	
Morrison (1983)	32	unsp.	59	28	34	
Schraut (1984)	29	80	50	52	66	Crohn
Greenstein (1984)	38	74	76	21	100	Crohn
Dongen v. (1984)	14	79	43	7	50	Crohn
Suits (1985)	16	37	25	69	unsp.	
Present study	13	38	46	8	0	

reliable (pneumaturia and faecaluria) and the barium enema shows diverticular disease of the sigmoid, a fistula must be present (Morrison, 1983; Goldman, 1985).

According to the literature, the preferred method of treatment for entero-vesical fistulization depends on the primary disease, the local situation and the general condition of the patient. Treatment varies from medical treatment (antibiotics, analgetics, catheter drainage of the bladder) to diverting colostomy or resection in one or more stages. This is especially true for diverticular disease, as was also reflected by our patients: 4 patients were immediately operated upon and 4 patients had initially conservative treatment, which did not result in spontaneous closure of the fistula. However, the local and general condition of the patients improved and delayed definitive surgery was successful in all 4 patients.

In general, a one-stage procedure is safe and effective in patients without active inflammation whereas a multi-stage procedure is indicated in case of abscesses or obstruction and adequate bowel preparation is impossible (Amin, 1985). When staged procedures are necessary, primary resection with proximal colostomy can be performed either with a Hartmann mucous fistula or a Hartmann pouch, followed by reanastomosis in a second session. Nowadays, a three-stage procedure is rarely indicated (Suits, 1985; Moss, 1990). The benefit

of prolonged or repeated antibiotic treatment as only therapy is questionable. Carson (1978) and Amin (1985) suggested antibiotic treatment if a patient had serious contra-indications for operation (cardiovascular disease) or refused operation (Carson, 1978; Amin, 1985).

In Crohn's disease an entero-vesical fistula is a rare but serious complication and is always a sign of active disease. Therefore we and others advocate primary conservative treatment with delayed definitive surgery (resection with primary anastomosis) (Gouma, 1983; van Dongen, 1984; Schraut, 1984). The lesion in the bladder can be safely sutured and protected with an indwelling catheter for about one week. However, successful medical treatment alone has also been reported (Glass, 1985). Medical treatment should always be followed by surgery because of the high incidence of recurrence. The entero-vesical fistula originates in the majority of cases from the ileo-coecal region, and rarely from the sigmoid colon (Schraut, 1984).

In primary or recurrent malignant disease a neoplastic entero-vesical fistula is a sign of advanced local disease with involvement of adjacent structures. A radical resection offers the only chance of cure but is rarely possible due to the extent of disease. Laparotomy is necessary not only to evaluate the extent of the disease but if resection is impossible, also to construct a diverting stoma as palliative treatment (Carson, 1978; Suits, 1985).

Conclusion and treatment protocol (Fig. 4.10)

The preferred method of treatment in entero-vesical fistulas depends on the primary disease, local situation and the general condition of the patient. In inflammatory disease conservative management may be initiated to improve the circumstances. Thereafter a one-stage procedure is safe and effective in patients without active inflammation, whereas a multi-stage procedure is indicated in case of abscesses or obstruction. In primary or recurrent malignant disease a radical resection offers the only chance of cure, but is rarely possible due to the extent of disease. Laparotomy is not only necessary to evaluate the extent of disease but also to construct a diverting stoma as palliative treatment.

4.7 OTHER FISTULAS

4.7.1 Internal fistulas of the jejunum, ileum or colon (Fig. 4.11)

Only internal fistulas communicating between jejunum, ileum or colon will be considered and will be classified according to primary disease.

ENTERO-VESICAL FISTULA
(Predominantly spontaneous)

Resuscitation

Diagnostic work-up

- * Cystoscopy
- * barium enema with Bourne test
- * optional: - Rectoscopy
 - small bowel follow through
 - CT-scan

DIAGNOSIS

- * Inflammatory disease
- * Radiation disease
- * Malignancy
- * Other disease: treatment depends on primary disease

PRIMARY CONSERVATIVE TREATMENT (PCT)

- * Non-definitive surgery
 - diverting colostomy
 - abscess drainage
- * Nutritional support (TPN)

Unless: * Local or general conditions can not be improved further → IOT
* End-stage disease → NT

Persistent fistula !

ALIVE, FISTULA OPEN

(no spontaneous closure in radiation and malignancy;
often closure in inflammatory disease)

Delayed definitive surgery

After 10-14 days for malignancy

After 2 to 4 weeks for radiation disease

After 2 to 6 weeks for inflammatory disease, also when fistula is closed

FIGURE 4.10. Treatment protocol for entero-vesical fistulas

IOT = immediate operative treatment; NT = no treatment

During the study period 12 patients (5 men and 7 women) with 16 internal fistulas were treated. The mean age of the patient was 40 years (range 19-77 years). In 12 patients the internal fistula communicated between small bowel and colon, in 3 patients between small bowel and small bowel, and in 1 patient between colon and colon. Ten patients had multiple fistulas including 2 fistulas between small bowel and bladder, and 6 were concomitant external fistulas.

No surgery, unless

- * the fistula has specific symptoms (short-circuiting)
- * complicated primary disease is present, necessitating operation
e.g. Crohn's disease with stenosed bowel segments and obstruction

FIGURE 4.11. Treatment protocol for internal fistulas of the bowel

In all 12 patients the internal fistula developed spontaneously, in 9 patients the fistula was related to Crohn's disease, in 2 patients to diverticular disease of the sigmoid, and in one patient to a gynaecological malignancy.

Nine patients (8 Crohn's disease, 1 diverticular disease) were treated conservatively, determined by the extent and activity of the primary disease. After a mean period of 53 days (range 25-150 days) a delayed definitive operation was performed for a persistent internal or external fistula (6 patients) and a diseased and stenotic bowel segment with a closed fistula (3 patients). The postoperative course was uneventful.

Two patients were immediately operated upon, but the presence of the internal fistula was not the indication for operation: the patient with the gynaecological malignancy had an uncontrolled vaginal fistula, and one patient with diverticular disease of the sigmoid was operated upon for complicated chole-docholithiasis. One patient with Crohn's disease had uncomplicated internal and external fistulas for more than one year without any specific therapy. Ultimately, elective resection was performed with good result.

Discussion: The abnormal communication (short circuiting) of an internal fistula between jejunum, ileum or colon is seldom symptomatic. Frequently the abnormal communication is an accidental finding during radiological examination or operative treatment of a patient with inflammatory bowel disease or with a malignancy (Givel, 1983; Glass, 1985). Therefore, the presence of such a fistula is rarely an indication for operation. In advanced inflammatory disease conservative treatment is started to improve the local and general condition of the patient and ultimately, a delayed definitive operation is performed to resect the diseased and stenotic bowel segment. The secondary involved bowel can often be treated by suture closure or wedge resection. A resection is seldom

indicated (Givel, 1983; Glass, 1985). If the fistula is secondary to malignant disease, immediate operative treatment is mandatory.

The conclusions are summarized in the protocol (Fig. 4.11).

4.7.2 Biliary fistulas (Fig. 4.12)

Biliary fistulas are often internal and develop spontaneously in patients with chronic cholecystolithiasis or choledocholithiasis. In about 50% of patients the presenting symptom is intestinal obstruction (gallstone ileus). An external fistula may develop after biliary surgery or after trauma (Clavien, 1990).

FIGURE 4.12. Treatment protocol for biliary fistulas

Case Reports

A 76-years old female patient presented with aspecific complaints in the right upper abdomen. Further examination revealed a cholecystoduodenal fistula. Cholecystectomy was performed with suture closure of the duodenum.

A 49-years old male patient had multiple thrusts with a knife in the upper abdomen. At laparotomy multiple lacerations of the liver, stomach and pancreas were oversewn and drained. Postoperatively he developed a persistent external biliary fistula, originating from the gallbladder. Finally, cholecystectomy was performed.

Discussion: Internal biliary fistulas generally communicate between gall-bladder or common bile duct and duodenum (70%) or colon (15%). The

symptoms are aspecific and related to chronic cholecystolithiasis or choledocholithiasis, intestinal obstruction (gallstone ileus), short circuiting (diarrhoea) or cholangitis (Safaie-Shirazi, 1973; Haffner, 1972). The diagnosis can be established by plain abdominal X-ray (gas in the bile duct, aberrant biliary stone, gallstone ileus), roentgen contrast studies (stomach, colon), CT-scan, HIDA scan (Haffner, 1969; White, 1983) or ERCP. Preoperative evaluation should also include diagnostics to visualize the presence or absence of common bile duct obstruction (stones or tumour). The preferred therapy in uncomplicated biliary fistulas depends on the primary disease, but frequently a cholecystectomy is performed with suture closure of the duodenum or colon (LeBlanc, 1983; Piedad, 1972). In case the fistula presents acutely with a gallstone ileus the therapy should consist of enterotomy with removal of the stone. A second stone large enough to obstruct the bowel is found in 14% of the patients. Therefore, a careful palpation of the bowel has to be performed. Most stones pass without obstruction (Piedad, 1972). A one-stage cholecystectomy can be performed if circumstances are favourable. However, this approach is controversial. The postoperative mortality after simple enterotomy is high in debilitated patients with ileus or sepsis (12%) and, therefore, a secondary cholecystectomy is to be preferred.

External biliary fistulas frequently develop after external drainage of a postoperative collection of bile, and will close spontaneously if the bile flow to the duodenum is not obstructed by a stone or tumour. Conservative treatment consists of diagnostic evaluation, preferably by ERCP with the insertion of an endoprosthesis, and adequate drainage. If the fistula persists, delayed definitive surgery is performed.

The conclusions are summarized in the protocol (Fig. 4.12)

4.7.3 Oesophageal fistulas (Fig. 4.13)

Oesophageal fistulas most commonly occur after endo-oesophageal instrumentation or as a complication of oesophageal, neck, or pulmonary surgery. Treatment may be conservative or operative.

Case Reports

Two patients (nr. 32, 34) developed leakage and fistula after esophagus surgery: resection for carcinoma with stomach interposition and resection of an oesophageal diverticulum respectively. Both had a rethoracotomy for drainage and were treated conservatively. Ultimately both patients died, probably due to inadequate primary drainage and diversion (Addendum, page 46).

Three patients had an external fistula after total gastrectomy for carcinoma with a leaking oesophago-jejunostomy. In 2 of them the fistulas spontaneously closed after 16 and 29 days.

FIGURE 4.13. Treatment protocol postoperative for esophageal fistulas

The third patient (nr. 99) had a subphrenic abscess which was not adequately drained. He died of sepsis after 32 days (Addendum, page 46).

Discussion: In patients with a *spontaneous rupture* or a *iatrogenic perforation* during endoscopy or dilatation, the leak is often immediately diagnosed or within 6 to 24 hours after the incident. Surgical treatment is nearly always indicated. Conservative management is possible in minor leakage confined to

the mediastinum (intact parietal pleura), and consists of naso-oesophageal and gastric suction, antibiotics and parenteral nutrition (Cameron, 1979). If there is major leakage or the parietal pleura is perforated, conservative treatment has a very high mortality (Dooling, 1967; Hendren, 1968; Wilson, 1970; Wolloch, 1974; Sawyers, 1975; Grillo, 1975). The surgical method of choice depends on the local condition of the oesophagus. Generally the oesophagus is diseased and under these circumstances resection of the oesophagus with secondary reconstruction is indicated (Tilanus, 1991). Rarely, a healthy oesophagus is involved, which makes direct repair with adequate drainage hardly ever possible.

In *postoperative oesophageal* fistulas the delay is in most cases more than 48 hours. The leakage presents with deterioration, fever, purulent production from the drain or wound, progressive pleural effusion on the X-ray, and can be confirmed by oral methylene blue or by oesophagography with a water-soluble contrast medium (Ginsberg, 1983). If the anastomotic leakage presents early (within 5 days after surgery) or is associated with excessive intrathoracic fluid collections and sepsis, the only acceptable treatment seems to be rethoracotomy with disconnection of the anastomosis (cervical oesophagostomy and gastrotomy) and drainage (Urschel, 1974). Otherwise, rapid diagnostic evaluation, frequently a combination of fistulography, oesophagography and CT-scan is initiated. If the local situation is favourable (small size leak, healthy oesophagus, no distal obstruction, no fluid collection) adequate conservative treatment is started (Fig. 4.13). The CT-scan gives information about the location of intrathoracic and subphrenic collections and about the expansion of the lung. Failure to achieve continuous expansion of the lung results in chronic empyema with a collapsed lung encapsulated in fibrous tissue. If the leakage is minimal, rethoracotomy is not necessary and sump drainage of the pleura and mediastinum, in combination with TPN and naso-oesophagogastric drainage must be sufficient. Sometimes a posterior rib resection is needed for adequate drainage. Repeated CT-scan may give information about the expansion of the lung and undrained collections.

A cervical fistula has a more benign course upon adequate external drainage, especially after transhiatal oesophagectomy. These fistulas frequently close spontaneously, and re-operation with re-anastomosis is only needed in case of an extended disruption of the anastomosis or if pathological tissue is present in the anastomosis.

Leakage of an oesophago-jejunostomy after total gastric resection is regarded as an abdominal problem, and behaves like a postoperative gastric fistula. Spontaneous closure is often possible if the drainage is adequate and the sepsis is under control.

4.7.4 External pancreatic fistulas (Fig. 4.14)

External pancreatic fistulas may develop after a pancreatic or peripancreatic surgery, blunt or penetrating trauma to the abdomen, or pancreatitis complicated by abscess or pseudocyst formation. Mortality ranges between 6 and 11% and about 80% of pancreatic fistulas will close spontaneously, but fistula drainage frequently persists for many months, especially if the fistula is secondarily infected. Serious complications may develop, including infection, haemorrhage, erosion of adjacent viscera, fluid and electrolyte imbalance, and malnutrition.

FIGURE 4.14. Treatment protocol for external pancreatic fistula

Case Reports

A 69-years old female patient developed an external pancreatic fistula after a pancreaticoduodenectomy (Whipple) related to leakage of the pancreaticojejunostomy. A relaparotomy was performed for adequate drainage and conservative treatment including Somatostatin® was started. The Somatostatin did not reduce the fistula output and was discontinued after 9 days. The fistula closed spontaneously after 46 days.

A 70-years old male patient also developed an external pancreatic fistula related to a leaking pancreaticojejunostomy. Conservative treatment was started and 2 operations were performed for adequate drainage. He stabilized eventually but after 40 days a rapid deterioration with sepsis resulted in MOF and death. The autopsy revealed an open fistula, a bilateral bronchopneumonia, a septic spleen and an open fistula.

A 61-years old male developed a leakage of the pancreatico-jejunosomy, which was treated on day 17 by resection of the remaining part of the pancreas and the spleen ('salvage pancreatectomy'). This patient is described extensively in the Addendum (nr. 100).

Discussion: External fistulas of the pancreas should primarily be treated conservatively. This results in a high spontaneous closure rate if circumstances are favourable and the patient is not septic. Adequate drainage is important to overcome ramification of the fistula with secondary involvement of surrounding structures. Diagnostic evaluation is performed to detect adjacent collections and abscesses (CT-scan or sonography), and to visualize the fistula tract and its relation with the pancreatic duct: a stenotic or disrupted pancreatic duct indicates that spontaneous closure is unlikely or impossible.

For adequate drainage it is frequently necessary to perform an operation and position sump drains and drains for rinsing (diCostanzo, 1987). Rinsing has the advantage that the aggressive pancreatic excretions are diluted, and that skin care is easier. If the postoperative pancreatic fistula originates from a leaking pancreatico-jejunosomy after a pancreaticoduodenectomy (Whipple) an acute 'salvage pancreatectomy' (resection of the pancreatic remnant) has to be considered to solve the uncontrolled problem. The use of Somatostatin analogue as adjunct to optimal conservative treatment seems promising (Pederzoli, 1986; Prinz, 1987; Myrèn, 1986): parenteral nutrition and bowel rest already decrease the amount of effluent from the pancreas with 30 to 50%, which is further decreased by a Somatostatin analogue, if properly administered. Sometimes delayed definitive surgery (distal pancreatectomy, Roux-Y-procedure) is indicated.

4.7.5 Uretero-ental fistulas

A fistula between the urinary tract and the bowel most frequently originates from the bladder (see chapter 4.6).

A fistula between the ureter and the gastrointestinal tract is rare, the fistula may develop secondary to urological disease (impacted ureter stone, malignancy) intestinal disease (carcinoma, inflammatory disease) or retroperitoneal disease (Winter, 1973; Sankaran, 1974; Nieh, 1983; Heney, 1985; Sumiya, 1985; Ferrie, 1985).

Case Report

A 75-years old female patient presented with a one-month history of weakness, nausea, abdominal pain and intermittent fever. Urine culture revealed a urinary-tract infection with *Escherichia Coli*. The excretory urogram (IVP) showed complete obstruction of the right ureter and then retrograde pyelogram showed a fistula between the distal right ureter and the sigmoid. Specific fistula-related complaints (pneumaturia, faecaluria) were absent. A barium enema showed diverticular disease of the sigmoid, but a fistula was not visualized.

A diverting colostomy was constructed and an ureteral stent placed. The patient was discharged and after three months a sigmoid resection was performed with good result.

Discussion: An uretero-ental fistula may be secondary to a wide variety of diseases, for instance infectious disease (pyelonephritis, urosepsis), urinary tract disease (calculi, malignancy), disease of the digestive tract (diverticulitis, obstruction), or a combination. The cause of the fistula is not always clear and the complaints are frequently not specific, this was also the case in our patient. Diagnostic evaluation by antegrade and/or retrograde ureterography frequently delineates the fistula tract (Ferrie, 1985).

If the fistula is secondary to advanced infectious or non-infectious disease of the ureter or bowel, the therapy of choice is resection of the diseased kidney or bowel. Only exceptionally conservative treatment by antibiotics or stenting of the stenotic ureter is successful (Nieh, 1983).

CHAPTER 5

Supportive care

5.1 NUTRITION:

Enteral nutrition (TEN) or parenteral nutrition (TPN) ?

Introduction

The majority of patients with enteric fistulas suffer from malnutrition and hypoalbuminaemia (Coutsoftides, 1979; Reber, 1978; Soeters, 1979). Weight loss results from inadequate food intake, excessive loss of gastrointestinal contents, and increased energy expenditure due to sepsis. Hypoproteinaemia can be due to decreased intake, malabsorption, and excessive protein losses from pancreatic or proximal jejunal fistulas. Finally, especially in the acute phase, albumin synthesis is diminished.

Both Edmunds (1960) and Chapman (1964) demonstrated that malnutrition in patients with fistulas resulted in an increased morbidity and mortality. In the 1970's it was generally accepted that adequate nutrition should be an essential part of conservative and operative fistula treatment. Enteral and parenteral nutrition rapidly improved and were successfully used in these complicated patients (MacFadyen, 1973; Aguirre, 1974; Reber, 1978; Bury, 1971; Rocchio, 1975; Kaminsky, 1975; Voitek, 1973). The overall mortality of more than 40% decreased to 20%.

The main goal of enteral and parenteral nutrition in fistula treatment is to provide adequate quantities of nutrients to maintain or to regain the normal nutritional status. The second goal is to allow bowel rest which evokes a decrease in fistula production, reduces the peri-fistular reaction and prevents skin damage. Both goals can be achieved by TPN, and therefore some surgeons administer TPN to every patient with a fistula, accepting the potential complications, mainly related to the use of a central venous catheter (pneumothorax, sepsis). Enteral nutrition can only be adequately used if there is sufficient bowel

with normal absorptive capacity proximal or distal to the fistula. Further, enteral nutrition has the disadvantage that bowel rest is not complete (Wolfe, 1972). Both circumstances diminish the application of TEN in fistula patients. On the other hand, enteral nutrition has the advantage that the physiological function of the bowel is maintained, and that it is not expensive.

In the early phase of fistula treatment we generally prefer to start parenteral nutrition. This has the advantage that within a few days after recognition of the fistula optimal nutrition and bowel rest is achieved. If the local conditions are stabilized and circumstances are favourable, a partial or complete change towards enteral nutrition is frequently possible, but not always necessary (MacFadyen, 1973; Rocchio, 1974).

ENTERAL NUTRITION (TEN)

Enteral nutrition involves the delivery of nutrients to the alimentary tract, followed by transport, digestion and absorption. In this chapter we only consider those commercially available formulas, that can be delivered by oral route or by tube. These formulas can be subdivided in complete (monomeric or polymeric), modular and specialized formulas.

Complete formulas contain all essential nutrients (carbohydrate, protein, fat, vitamins, trace-elements, minerals) and can be subdivided in monomeric and polymeric formulas. Monomeric formulas, in the past named 'elemental diets', contain these nutrients in a 'predigested' form, that does not require intact digestive capabilities for breakdown: mono-, di- and oligo-saccharides, polysaccharides (maltodextrin), a mixture of oligopeptides and aminoacids, essential fatty acids (linoleic acid) and medium chain triglycerides. Polymeric formulas require an intact ability to digest protein, (complex) carbohydrates and fat. Modular formulas are composed of nutritional components (carbohydrates or proteins or fat) and are used as individual supplement to the usual dietary intake. Specialized (monomeric or polymeric) formulas are especially designed for hepatic, renal or pulmonary failure. Their electrolyte content is generally limited. Formulas for hepatic encephalopathy may contain high quantities of branched-chain aminoacids (BCAA) and low quantities of aromatic aminoacids. Formulas for renal failure contain only essential aminoacids and formulas for pulmonary failure contain an increased proportion of calories from fat and less from carbohydrate to decrease the respiratory quotient (RQ).

Many commercial formulas are available with specific qualities for different indications. To facilitate a rational choice between standard and specialized formulas, Heimburger (1985) distinguished major criteria, minor criteria and

inconsequential criteria. Major criteria relate to major nutritional requirements or warrant consideration in every patient. Minor criteria are not related to nutritional requirements or are only indicated for patients with specialized gastrointestinal or metabolic problems. Inconsequential criteria are those which virtually never require a decision.

According to these criteria the formulas, commercially available in the Netherlands, can be classified as follows: Polymeric (Standard), Polymeric (Specialized), Monomeric and Modular (Table 5.1).

The total amount of calories for an individual patient is calculated according to the Harris-Benedict formula with a correction factor for activity, stress and specific dynamic action of food. The daily amount of fluid administered generally equals the amount of calories (1 ml/kcal). Extra water is necessary during the period of adaptation especially when hyperosmolar formulas are directly introduced in the duodenum or jejunum.

Access-route and method: Tube feedings can be provided through a cervical oesophagostomy, gastrostomy, duodenostomy, jejunostomy or a nasogastric, nasoduodenal or nasojejunal tube (Torosian, 1980; Levenson, 1986; Randall, 1984). The introduction of new tube material (polyurethane, silastic) and techniques (jejunostomy according to Delaney, endoscopic gastrostomy) as well as a better understanding of the complications have contributed to more successful enteral nutrition. Bolus feeding through large tubes has now been replaced by continuous feeding via a fine-bore nasogastric or naso-enteric tube. However, fine-bore tubes also have drawbacks and some of these have proved to be quite dangerous for the patient: malpositioning or displacement, aspiration, blockage, perforation (Bohnker, 1987). These complications are rare if the fine-bore catheter is specifically positioned into the duodenum or jejunum, instead of in the naso-gastric position. The optimal access route in patients with a fistula and fit for TEN largely depends on the location of the fistula. The most frequent locations are discussed separately.

If laparotomy is performed in a patient with an oesophageal, gastric or duodenal fistula, a needle jejunostomy according to Delaney offers an adequate route for TEN, and a polymeric formula can be started with a 1:4 dilution. Otherwise, a naso-jejunal or naso-duodenal catheter has to be positioned. In a patient with multiple small-bowel fistulas it is sometimes possible to re-infuse the effluent of the proximal fistula in the distal fistula, which makes enteral nutrition possible. Generally TPN is required for jejunal fistulas. In patients with a low-output ileal fistula TPN can sometimes be changed to TEN, when a monomeric formula is used. In high output fistulas the use of TPN is mandatory.

TABLE 5.1 Enteral formulas, commercially available in the Netherlands: Polymeric standard, Polymeric specialized, Monomeric, Modular.

Polymeric standard:	<ul style="list-style-type: none"> * Nutrison Standaard (Nutricia) * Osmolite (Abbott) * Nutrodrip (Wander) * Nutrison poeder (Nutricia) * Humana poeder (Humana)
Polymeric specialized:	<ul style="list-style-type: none"> * Pre-Nutrison (Nutricia) * Nutrison Energie Plus (Nutricia) * Ensure Plus (Abbott) * Nutrodrip Energie (Wander) * Pulmocare (Abbott) * Nutrison Fibre Enriched (Nutricia) * Osmolite Fibre (Abbott) * Nutrodrip Fibre (Wander) * Nutrison Soja (Nutricia) * Nutrison Sodium Restricted (Nutricia) * Nutrison Protein and Electrolytes Restricted (Nutricia) * Renilon powder (Nutricia) * Survimed renal powder (Fresenius)
Monomeric:	<ul style="list-style-type: none"> * Peptison (Nutricia) * Pepti 2000 variant powder (Nutricia) * Pepti 2000 powder (Nutricia) * Reabilan (Roussel) * Reabilan HN (Roussel) * Nutri 2000 powder (Nutricia) * Vivonex powder (Norwich Eaton)
Modular:	<ul style="list-style-type: none"> * Nutrical (Nutricia) * Fantomalt powder (Nutricia) * Polycose (Abbott) * Cal 400 (Roussel) * Protifar powder (Nutricia) * Proteine 88 (Wander)

A patient with a colonic fistula can have enteral nutrition by a naso-gastric or naso-duodenal catheter with a polymeric formula, dilution 1:1.

A naso-jejunal catheter or needle-jejunostomy provides optimal bowel rest and adequate nutrition in patients with pancreatic fistulas. A polymeric formula can be started with a 1:4 dilution.

Oral nutrition with a polymeric formula is frequently possible if a vaginal fistula communicates with the colon or rectum. Alternatives are a monomeric formula, or a diverting colostoma. A fistula between small bowel and vagina can only be treated by TPN.

Introduction of the fine-bore catheter: Several techniques are known to facilitate positioning of fine-bore naso-enteric catheters. Nowadays, most of these are considered to be superfluous, invasive and expensive. However, the use of 20 mg Metoclopramide[®] i.v. prior to insertion has been described to be beneficial. A tube can be successfully positioned by placing the patient in the sitting position with the neck slightly flexed. A naso-enteric tube is used with a stylet. The tube is further stiffened by cooling in ice water, and passed over a length of 85 cm while the patient is swallowing water through a straw. The position of the tube should be controlled by aspiration and radiography. When the catheter is positioned in the stomach it can be tested with air insufflation. A duodenal or jejunal catheter should be controlled with contrast fluid. If there is doubt about gastric emptying, gastric retention should be controlled every 4 or 6 hours. Retention should not exceed 150 ml of fluid. Feeding should be started with the patient in the right lateral position. Spontaneous duodenal intubation occurs frequently, generally within 48 hours (Levenson, 1986). Especially, feeding in the duodenum or jejunum should be started slowly to compensate for the hyperosmolality of the solution. If the formula has an osmolality of more than 550 mosm/L and is administered into the duodenum or jejunum, it is advisable to dilute the formula to one-fourth of the normal concentration. Thereafter, the volume and the concentration are step-by-step increased. Six to 8 days are necessary to reach the full caloric requirements. If the patient does not complain of cramps, diarrhoea or other discomfort, the speed of infusion can be increased every 12 or 24 hours with 25 ml/hour. When an adequate volume is reached, the concentration can be gradually increased.

Treatment of complications: Complications related to osmolality (diarrhoea, nausea, vomiting, cramps) can adequately be treated by decreasing the infusion rate or discontinuing the enteral nutrition for a short period (12 hours). If the diarrhoea persists the use of Loperamide[®] is beneficial sometimes, although other causes of diarrhoea have to be excluded, for instance reaction to

antibiotics, choleric colitis, villous atrophy after prolonged TPN or starvation. Delayed gastric emptying can be treated with Motilium[®] or a naso-duodenal or naso-jejunal catheter. Aspiration is a most serious complication that has to be treated by immediate bronchoscopic cleaning of the bronchial tree. It is clear that TEN should be discontinued and TPN initiated.

PARENTERAL NUTRITION (TPN)

Parenteral nutrition allows complete bowel rest and adequate nutrition and is therefore initiated early in the development of a fistula. Sometimes the TPN regimen can be changed partly or completely to enteral nutrition.

The hyperosmolar parenteral nutrition solutions rapidly cause phlebitis and thrombosis in a peripheral vein so that central venous cannulation is indicated. The technique of percutaneous infraclavicular cannulation of the subclavian vein is to be preferred. The advantage of this technique is that the catheter can be safely fixed and that the puncture site in the skin can be properly cleaned according to a standard protocol. Both circumstances considerably decrease the risk of late complications (sepsis, thrombosis) (less than 5%). Cannulation is performed in the operating theatre under strict aseptic conditions and with an ordinary PVC catheter. In a prospective trial we did not find a decrease in infection rate upon tunneling of the catheter. Alternative methods are percutaneous cannulation of the internal jugular vein and cannulation of the cephalic vein after venotomy. If the patient is not septic and prolonged TPN is necessary the use of a Hickman or Broviac catheter with a subcutaneous tunnel may be advantageous. The most common early complications after infraclavicular cannulation are pneumothorax and haemothorax.

Before TPN is started, the position of the catheter has to be assessed by a chest radiograph, which also shows a possible pneumothorax. The chest X-ray should be repeated after 24 hours because pneumothorax becomes often evident at a later stage.

TPN is composed according to standard formulation with individual adaptations and daily corrections. The standard formulation includes the caloric amount according to the calculated energy expenditure and the amount of carbohydrates, fat, aminoacids, electrolytes, trace elements and vitamins (Dudrick, 1969; Hill, 1984; Shanbogue, 1987). These will be discussed more specifically.

Caloric amount: In contradistinction to recommendations from the beginning of the TPN era, a general agreement has been reached that patients should not receive more calories than their actual energy expenditure. Few hospitals

have easy access to an indirect calorimeter, but the actual energy expenditure can be reliably estimated with the formula of Harris and Benedict (1919).

The basal energy expenditure (BEE) is:

for men:

$$66 + (13.7 \times \text{weight in kg}) + (5 \times \text{length in cm}) - (6.8 \times \text{age in years});$$

for women:

$$655 + (9.6 \times \text{weight in kg}) + (1.7 \times \text{length in cm}) - (4.7 \times \text{age in years}).$$

To estimate the actual energy BEE should be augmented with 10% for specific dynamic action of food and with a stress factor varying between 10 and 50% of BEE.

Carbohydrates: The body cannot oxidize more than 6 g glucose per kg body weight per 24 hours (Phillips, 1985). When more glucose is given, the carbon skeleton of glucose is utilized for lipogenesis or glycogen synthesis. As a consequence the respiratory quotient (CO_2 produced / O_2 uptake) rises due to a substantial increase of CO_2 production. Simultaneously O_2 consumption rises moderately. Therefore, patients come in a moderately hypermetabolic state and have problems with expiration CO_2 , especially when they suffer from chronic obstructive lung disease or acute respiratory insufficiency ($60 \text{ kg} \rightarrow 360 \text{ g} / 24 \text{ uur} = 1440 \text{ KCal}$).

Nitrogen: In metabolically stable patients 1 g of crystalline aminoacids / kg body weight / 24 hr should achieve optimal nitrogen sparing. Many of the available crystalline amino-acid solutions have a good biological value. Experimental work from Larsson suggests that in severely ill hypermetabolic patients an augmentation of aminoacid intake to 1.5 g / kg / 24 hrs diminishes nitrogen losses. Several investigators have found that extra amino acids administered to severely ill patients does not diminish nitrogen loss by inhibiting protein degradation but by stimulating protein synthesis.

Fat: As a result of the limitation of carbohydrate administration more fat should be administered than is advocated in the past. Many, predominantly European, publications have revealed that fat (e.g. Intralipid) can safely be used in almost all clinical situations in amounts ranging between 1 and 2 g / kg body weight / 24 hr without any side effects. The essential fatty acids requirements are about 4% of the total amount of calories per day. To minimize potential hyperlipaemia, fat should be distributed over a larger part of the day or even 24

hr. Only hyperlipaemias may be a contra-indication for the use of fat as a caloric source. Carpentier et al demonstrated that Intralipid 20% should be preferred over the 10% solution. The highly concentrated solution is relatively cheaper, contains less fospholipids and the clearance is better.

Electrolytes: It is important to add electrolytes to TPN solutions that are tailored to the need of the individual patient. Table 5.2 lists three possible mixtures, which can be added to 1 L of TPN mixture (22% glucose, 4.25% aminoacid; 1 Cal/ml). With these mixtures almost every patient can meet his individual requirements. The high sodium mixture is suitable for patients with excessive sodium losses (fistulization). The low potassium mixture is appropriate for patients with renal insufficiency. It should be realized that anabolism can only be achieved when the nutritional regimen contains sufficient quantities of these electrolytes. In this respect the electrolytes are as essential as nitrogen and calories.

TABLE 5.2 Electrolytes (mmol) per liter amino-acid glucose mixture (25% glucose, 4% amino-acids)

Electrolyte mixtures	Standard (mmol)	High (mmol)	Low (mmol)
Sodium	20	50	20
Potassium	40	40	12
Magnesium	3	3	3
Calcium	2.25	2.25	2.25
Chloride	26.5	41	18.5
Acetate	30	45	16
Phosphate	11	13	6

Vitamins: Many multi-vitamin preparations are available of which the one listed in Table 5.3 is one of the better ones. It is however far from clear to what measure requirements change in severe illness. Nor is it elucidated how vitamin status should be determined during disease.

Trace elements: Zinc, copper, manganese, iodine, chromium and selenium are all essential for an optimal biological function. A possible preparation as daily dosage is listed in Table 5.4. It is not yet certain if requirements are

TABLE 5.3 Daily vitamin requirements for adults

Vitamin C	100 mg
Vitamin A (retinol)	3.300 IU
Vitamin D (ergocalciferol 5ug)	299 IU
Thiamin (B1)	3.0 mg
Riboflavin (B2) (5'-phosphaat)	3.6 mg
Pyridoxin (B6) (HCl)	4.0 mg
Niacin (niacinamide)	40.0 mg
Pantothenic acid (dexpanthenol)	15.0 mg
Vitamin E (dl-alpha-tocopheryl acetate) (7.4 alpha tocopherol equivalent)	10 IU
Biotin	60 µg
Folic acid	400 µg
Vitamin B12	5 µg

increased during disease and if trace element status can be established in the same manner as in healthy subjects.

In the recommendations mentioned above Fe and vitamine K are not mentioned. Both should be supplemented in the long run when patients are totally devoid of oral intake.

Fluid: Especially in patients with fistulas an adequate fluid balance is extremely important. The losses through the fistula may exceed 3 litres per day. Complete supplementation of these losses, augmented with daily insensible losses and urine production is necessary.

TABLE 5.4 Daily dosage for adults

Trace elements	
Zinc	3 mg
Copper	1 mg
Manganese	0.8 mg
Iodine	120 µg
Chromium	10 µg
Selenium	40 µg

Administration: It is advocated in the past, initially in France, that all constituents, except vitamin K and Fe can safely be mixed in any well-equipped hospital pharmacy. Recently more and more European countries have adopted this technique. A complete mixture facilitates safe and easy handling in the wards, a stable and continuous infusion rate and therefore less metabolic disturbances, and a better nitrogen sparing.

5.2 SKIN AND FISTULA CARE

Introduction

Control of the effluent and protection of the skin are essential for successful conservative treatment of an external fistula. An uncontrolled fistula rapidly leads to excoriation of the surrounding skin with pain, itching, infection, and physical and emotional deterioration of the patient. The continuous soiling is depressing for the patient and the nursing staff. However, the problem is not only located at skin level. The prognosis of the patient is also influenced negatively by adjacent intra-abdominal collections. Control of the effluent diminishes these complications and after the development of a fibrous canal, spontaneous healing may occur, depending on the local situation of the fistula and functional integrity of the distal bowel. If spontaneous closure does not occur within eight weeks, circumstances are generally favourable for delayed definitive surgery.

Historical aspects

In the past various methods and materials were used to control the effluent. Adhesive or neutralizing substances were used for skin protection: tannic acid (Dixon, 1938), beef extract (Potter, 1929), kaolin paste (CoTui, 1930). Still in 1971 Sheldon mentioned the appliance of 'fresh placenta as a dressing'. The fistulous opening was blocked with a wooden button, a button of leather, chewing gum, a double metallic button (Dowd, 1917). Absorbable dressings had the disadvantage that they were insufficient and had to be changed regularly. Therefore, a suction device was used to protect the skin and collect the effluent (Cameron, 1923; Tenopyr, 1937). Several sophisticated suction devices were developed, for instance the famous 'Goldsmith Cup' (Goldsmith, 1961; Goldsmith, 1967). Another method used in these desolate cases was nursing of the patient in the prone position, supported by a frame, for instance by the 'Bradford frame' (Potter, 1932), the 'Stryker frame' (Patey, 1946).

Nature of the effluent

The nature of the effluent depends on the location of the fistula. The effluent of proximal fistulas consists of activated gastric, biliary or pancreatic juice. Therefore a rapid digestion of the skin may occur with pain and infection, progressing to extensive erosion of deeper layers. Neutralization with lactic acid, chloric acid or beef extract has been reported to be successful (Potter, 1929; Tremolieres, 1961). Nowadays these serious derangements are less frequently observed. This is mainly due to the improvement of skin protective material. Another explanation may be that these skin lesions were also related to deficiency of essential fatty acid or zinc, which is nowadays prevented by supplementation. Colonic fistulas have a less aggressive effluent and have only a slow excoriation, that can easily be treated.

General aspects of skin/fistula care

Modern stoma care provides a wide choice of material specifically useful for collection of the effluent and protection of the skin. Therefore, nowadays problems related to external high output fistulas can be treated much easier. A professional stoma therapist can be helpful to select the optimal treatment and to anticipate on the local situation.

The material can be divided in: barrier sheets, filler pastes and material for special situations. Barrier sheets are used to protect the skin against the effluent of the fistula and are available in different sizes, with flange and without flange (Table 5.5).

Filler pastes with alcohol are used, frequently in combination with a thin layer of Orahesive powder, to fill-up crevices and hollows around the fistula before the barrier sheet is applied. The filler paste without alcohol can be used when the skin is irritated (Table 5.6).

The use of continuous low pressure suction has to be reconsidered. A few decades ago suction was the only reliable method to collect the effluent and protect the skin. Therefore, suction was used in nearly every patient with external fistulization. Nowadays, the wide range of Stomahesive wafers with flange and bag make it far easier to collect the effluent and protect the skin against digestion and maceration. Therefore, the use of a sump with suction is only indicated in the more complicated fistulas and can frequently be discontinued after a few weeks when fistulography shows no adjacent collections. The sump can be withdrawn step by step and a collection bag can be applied. Until a few years ago, the problems related to dehiscence with fistulization of the

TABLE 5.5 Barrier sheets for skin protection, with or without flange

Firm	Name	Flange
Hollister / Abbott	Karaya Sheet	+ or -
	Hollihesive	-
	Premiun	-
	Hollihesive / Premium	+
ConvaTec / Squibb	Stomahesive	-
	Combihesive	+
	Combihesive Flexible	+
	Varihesive	-
	Durahesive	+
	Combihesive extra plus	+
	SurFit	+
	DuoDERM ET	-
	DuoDERM E	-
	DuoDERM E Border	-
	Dress Collection	-
Coloplast	Comfeel	+ or -
	Comfeel MC 2002	+
Dansac	Supersquare	+
Simcare	Seel a Peel	-
	Seel a Peel plus	+
Biotrol / Laprola	Biotrol S	+ or -
United	Soft and Secure	+
van Heek	Marlen	-

abdominal wall could only be solved by suction in combination with Op-Site. Nowadays the so-called Wound Manager is available, which combines protection of the skin with adequate collection of the effluent and access for cleaning.

Meticulous application of the protective and collective material in a patient with a fistula is essential to overcome leakage. Application should not be performed in a hurry or in the middle of the night. After careful assessment of the local situation, the method is considered step by step and all the material is selected in advance.

TABLE 5.6 Filler paste (with and without alcohol) and special material

Firm	Name
Filler paste with alcohol	
ConvaTec / Squibb	Stomahesive Paste
Hollister / Abbott	Premium Paste
	Karaya Paste
United	"S and S" Paste
Beyersdorf	Stominal Paste
Filler paste without alcohol	
ConvaTec / Squibb	Orabase Paste
	DuoDERM Paste
Coloplast	Comfeel Paste
United	Unisalve
Material for special situations	
ConvaTec / Squibb	Orahesive Powder
	Stomahesive Irrigation Device
	Surgicare Loop Ostomy Starter
	DuoDERM ET
	DuoDERM E
	DuoDERM E Border
	Durahesive
	Little Ones System (special locations)
	Wound Manager
3 M	Tegaderm
Smith-Nephew	Op-Site
Coloplast	Comfeel Ulcer Plate
	Comfeel Powder
Biotrol	Biofilm
	Biofilm Powder

A suction apparatus is mandatory. After careful cleaning of the surrounding skin with Cetrimide and shaving, the skin barrier is applied and the bag is connected. Sometimes, in high-output fistulas, it is necessary to block the effluent temporarily with a balloon catheter to facilitate dry cleaning.

FIGURE 5.1 Category 1

Specific aspects of skin and fistula care

The local situation and skin condition determine the optimal method for protection of the skin which surrounds the external fistula orifice and for collection of the effluent. Irving classified the skin condition in four categories, considering the location of the orifice in relation to wounds or bony structures, neighbouring scars and the integrity of the abdominal wall (intact, small dehiscence, large dehiscence) (Irving, 1982).

Category 1. The fistula is a single orifice passing through an intact abdominal wall or otherwise healed scar, surrounded by flat skin in a reasonably good condition (Fig. 5.1).

After cleaning and drying of the skin surrounding the orifice, a barrier plate with flange, for instance Combihesive is applied. With Stomahesive paste the hole in the plate is fitted as closely as possible to the margin of the fistula. In high-output fistulas it may be advantageous to use an open system or a close-end system with a tap.

FIGURE 5.2 Category 2

FIGURE 5.3 Category 3

14

Filler pastes, for instance Stomahesive paste in combination with Orahesive powder (ConvaTec/Squibb), can be used to support the edges and give extra protection of the skin.

Category 2. The fistula has single or multiple orifices, passing through the abdominal wall close to bony prominences, surgical scars, other stomas or the umbilicus (Fig. 5.2).

In these patients adequate protection of the skin against the effluent and overcome leakage is difficult. After cleaning and drying, a flat surface is created by filling the grooves and gullies with a filler paste, for instance Stomahesive paste. Thereafter, a large barrier plate for example Durahesive with flange, are cut to fit and pressed in position.

Category 3. The fistula has an orifice situated in a small dehiscence of the abdominal wound (Fig. 5.3).

The surrounding skin is cleaned and large plates of skin barrier are applied. The edges of the wound defect are protected with filler paste, for instance Stomahesive paste. In larger wound defects it may temporarily be advantageous to use a Wound Manager or irrigate the wound continuously with a special irrigation device, for instance Stomahesive irrigation device.

Category 4. The fistula has an orifice situated in a large dehiscence of the abdominal wall or at the bottom of a gaping wound.

Adequate protection of the surrounding tissues and collection of effluent is extremely difficult and quite some ingenuity is needed. The most adequate technique is to use a Wound Manager, with or without sump suction: the wound edges are cleaned and protected with filler pastes, Stomahesive paste and Orahesive powder, and a large Wound Manager is meticulously positioned (Fig. 5.5).

FIGURE 5.4 Category 4.

FIGURE 5.5 Wound Manager on wound

5.3 REINFUSION OF SECRETIONS FROM HIGH-OUTPUT PROXIMAL STOMAS OR FISTULAS*

Introduction

High-output stomas or fistulas, often the result of resection of the small intestine for abdominal catastrophes, are associated with a high morbidity and mortality (Soeters, 1979; Roback, 1972). The management of these patients is difficult because they frequently suffer from sepsis, malnutrition, loss of body fluids, electrolyte disturbances, trace element deficiencies and hepatic enzyme abnormalities. The introduction of total parenteral nutrition (TPN) has most favourably improved the prognosis of these patients (Blackett, 1978). However, hepatic enzyme abnormalities and hyperbilirubinaemia persist, and may even increase during TPN (Lindor, 1979; Bower, 1983). These liver function abnormalities are probably related to loss of bile salts, to a certain extent, a disruption of the enterohepatic cycle or bacterial overgrowth, or both, in the defunctionalized intestine (Baker, 1987). Reinfusion of the excretions, already suggested in 1964 (Welch), should re-establish the function in the small intestine, restore the enterohepatic cycle and normalize the bacterial flora.

This study was performed to evaluate the influence of reinfusion of excretions on the serum levels of bilirubin, hepatic enzymes, renal function, plasma sodium, prealbumin and albumin.

Patients and methods

From 1982 to 1986, reinfusion was performed in eight patients who either underwent acute resection of the intestine resulting in a proximal stoma of the small intestine and a distal mucosal fistula or who had a proximal fistula of the small intestine. Most patients suffered from generalized peritonitis caused by radiation enteritis with perforation, volvulus, postoperative anastomotic disruption and such (Table 5.7). In all patients, TPN was started one day after the primary operation. A central venous line was inserted under aseptic conditions into the superior vena cava by an infraclavicular approach. The amount of calories was calculated according to the Harris-Benedict equation augmented with 10% specific dynamic action of food and a correction factor of 1.3 to 1.5

* This paper has been published in *Surg. Gynecol. Obstet* 167: 372-376, 1988.
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Table 5.7 Data from eight patients with reinfusion of intestinal secretions

Pnt. nr.	Sex	Age	Diagnosis	Proximal stoma	Distal stoma	Method
1	M	57	Diverticulitis	Jejunum	Jejunum	IVAC
2	M	63	Adhesions	jejunum	Ileum	Roller
3	F	60	Mesenteric thrombosis	Jejunum	Ileum	IVAC
4	M	56	Adenocarcinoma of the sigmoid	Ileum	Ileum	IVAC
5	F	52	Radiation enteritis	Jejunum	Ascending colon	Roller
6	F	62	Adhesions, intestinal necrosis	Ileum	Ileum	Roller
7	M	47	Adenocarcinoma of the rectum	Jejunum	Jejunum	IVAC
8	F	30	Mesenteric thrombosis	Jejunum Ileum	Jejunum Ileum	Roller Roller

for stress. A standard solution of 25.0% glucose and 4.2% amino acids (Synthamin® 14%) and containing balanced electrolytes, trace elements and vitamins, was used and prepared under strictly aseptic conditions in the hospital pharmacy.

All 8 patients received 500 ml of fat emulsion (Intralipid® 10%) at least twice a week for suppletion of essential fatty acids, this could be increased to a maximum of 500 ml of Intralipid 20% per day, depending on individual energy requirements. The mean daily intake was 2500 kilocalories (range of 1645-3100 kilocalories), with a nitrogen to kilocalorie ratio of 1 : 142. Individual suppletion of fluid and electrolytes was performed according to fluid balance and serum electrolyte levels. Reinfusion of proximal intestinal secretions was only started to overcome metabolic disturbances. In the course of this study reinfusion was started at an earlier stage to prevent rather than to treat metabolic complications. During reinfusion, most patients used clear fluids.

Technique

A collection bag is applied to the proximal enterostomy. The bag is connected to an infusion set, which is then connected to a urinary bladder catheter, which is inserted into the distal stoma. A roller pump is used to transfer the fluid. The pumping rate can easily be adjusted to the fluid level in the collection bag. If a turbid solution is excreted, the fluid is filtered and then reinfused using an

FIGURE 5.6 Serum bilirubin level of each patient, before and after reinfusion of gastrointestinal secretions. Bar represents standard deviation ($p < 0.05$)

FIGURE 5.7 Serum alkaline phosphatase level for each patient, before and after reinfusion. Bar represents standard deviation ($p < 0.05$).

IVAC® intravenous fluid pump. In this instance, secretions have to be collected every four hours to avoid severe bacterial contamination.

Both roller pump and IVAC intravenous fluid pump were used in four patients. One patient had a proximal and distal jejunostomy, as well as a proximal and distal ileostomy. In this patient two separate roller pumps were used. Most of the patients were able to move around the ward with the pumping device in situ, while recovering and waiting for the definitive reanastomosing procedure to be performed.

Results

During the first four weeks, four patients were re-operated upon for drainage of an intra-abdominal abscess or an abdominal dehiscence, or both. Reinfusion was started after 13 to 60 days (mean 36 days) after the first procedure and was performed for a mean period of 32 days (range 27 to 54 days). No complications were observed during the reinfusion period. During the period of reinfusion, the serum prealbumin, albumin and total lymphocyte count were measured.

Serum prealbumin level (n=4) was 0.23 gram per litre and improved to 0.31 gram per litre. Serum albumin level (n=8) was 31 grams per litre and increased to 36 grams per litre; the total lymphocyte count (n=4) was 1700 and increased to 2200. At the start of reinfusion, all patients had one or more hepatic enzyme abnormalities. The serum alkaline phosphatase (AP) level was increased up to four times in seven patients, gamma-glutamyl transpeptidase (gamma-GT) value was increased in all patients and serum bilirubin was increased in five patients. The serum AP, gamma-GT and bilirubin levels were simultaneously elevated in five patients. These liver function values decreased significantly during the period of reinfusion, as illustrated in Figures 5.6, 5.7 and 5.8. Plasma alanine transaminase (ALAT) and aspartate transaminase (ASAT) levels did not decrease significantly. Mean plasma sodium levels, slightly decreased before reinfusion (131.0 ± 4.6 mm/L), despite daily suppletion, normalized during reinfusion (137.0 ± 4.0 mm/L) (Fig. 5.9). Serum creatinin and urea levels did not change significantly during reinfusion. After recovery of the patients, reanastomosing procedures were performed without postoperative complications.

Discussion

A method to reinfuse the secretions from high-output proximal stomas or fistulas was described, thereby allowing postponement of definitive surgical treatment until patients had recovered metabolically, sepsis had subsided and

FIGURE 5.8 Serum gamma-glutamyl transpeptidase level of each patient, before and after reinfusion. Bar represents standard deviation ($p < 0.05$).

FIGURE 5.9 Serum sodium level of each patient, before and after reinfusion ($p < 0.05$).

open wounds were covered with healthy granulating tissue or were epithelialized. After a reinfusion period of a mean of 32 days, the definitive operation was performed without complications in all patients. Hyperbilirubinaemia in these patients must have been the result of intrahepatic cholestasis because the hyperbilirubinemia was largely conjugated, AP and gamma-GT levels were elevated in most patients and signs of extrahepatic obstruction were absent.

Intrahepatic cholestasis with jaundice is well known after more than three weeks of TPN (Bower, 1983; Baker, 1987; Welch, 1964; MacFadyen, 1979; Lowry, 1979). Multiple causes have been proposed, including the amount of carbohydrate administered, the composition of amino acid solutions, the ratio of fat and carbohydrate calories in the TPN mixture, metabolites of tryptophan and such (Bower, 1983; Baker, 1987; MacFadyen, 1979). The TPN regimen we used met the recommendations made in the literature (Baker, 1987).

During reinfusion and despite ongoing TPN, serum bilirubin, alkaline phosphatase and gamma-GT levels showed a significant decrease, which proved that TPN by itself did not cause intrahepatic cholestasis observed in these patients. Theoretically, drugs could have caused intrahepatic cholestasis, but this would not explain the improvement achieved after reinfusion.

The marked improvement we observed after the reinfusion in the distal intestine suggests that defunctionalization of the distal intestine or interruption of the enterohepatic cycle, or both, caused the intrahepatic cholestasis. This is a similar situation as the hyperbilirubinaemia, steatosis and hepatic failure observed in patients after jejuno-ileal bypass (Powell-Jackson, 1979; Drenick, 1982). Bacterial overgrowth could develop in the defunctionalized intestinal segment because of the disrupted enterohepatic cycle and absence of bile acids in the intestine (Powell-Jackson, 1979) and, of course, because of the absence of normal passage of food. It was demonstrated that bacterial growth by way of a, as yet unknown, mechanism may cause intrahepatic cholestasis and that treatment with metronidazole overcomes the cholestasis in patients with Crohn's disease receiving TPN. The following potential mechanisms, acting separately or in concert, can be suggested to explain the cholestasis in coherence with bacterial overgrowth:

- 1) production and absorption of endotoxins is increased in absence of bile acids in the intestine (Nolan, 1975; Cahill, 1983);
- 2) endotoxins or other products of the interaction between host and bacteria are hepatotoxic (Nolan, 1975);
- 3) the liver is more susceptible to harmful effects of endotoxins in the presence of a small bile acid pool (Richards, 1985); and

4) increased bacterial dehydroxylation of primary bile acids yields an increased amount of secondary bile acids of which, for instance, lithocholic acid has a strong cholestatic effect (Fouin-Fourtunet, 1982).

The latter explanation was not applicable to the results in our patients because primary bile acids did not reach this distal intestinal segment. The other 3 explanations remain; restoration of the distal intestinal function by reinfusion may have had a beneficial influence on each of these possibilities. Endotoxaemia has also been described in obstructive jaundice and is probably related to absence of bile salts. A beneficial influence by the bile salt sodium desoxycholate and lactulose has been reported (Cahill, 1983; Gouma, 1986; Pain, 1986). Further studies are needed to elucidate the exact mechanism and therapeutic possibilities.

Electrolyte disturbances are common under the circumstances. The plasma sodium level reached, at best, the low normal range despite administration of enormous quantities of sodium salt through peripheral infusion sites. After reinfusion of proximal secretions, plasma sodium levels returned to normal values even without the administration of sodium by peripheral infusions. Renal failure did not occur in our patients and renal function did not change significantly during the reinfusions.

5.4 MEDICATION: SOMATOSTATIN, H₂-BLOCKERS, ANTIBIOTICS

Medical treatment during conservative fistula treatment can be divided in medication directed to decrease the fistula production (Somatostatin, H₂-blocker), and medication directed to septic complications.

Somatostatin

In 1972 Guillemin and co-workers isolated a substance from the ovine hypothalamus with a cyclic tetradecapeptide structure, which they called 'somatostatin' in the belief that it was the neuro-hormone inhibiting release of growth hormone. Further analysis showed that Somatostatin had a wide range of gastrointestinal and endocrine activities. These activities were mainly inhibitory in nature and could be subdivided in two large subgroups: endocrine and non-endocrine.

Examples of the endocrine activities are inhibition of secretion of gastrin, secretin, pancreatic polypeptide, motilin, glucagon and insulin. Examples of the non-endocrine activities are inhibition or diminution of gastric acid secretion and gastric emptying, gallbladder contraction, splanchnic blood flow and plate-

let aggregation (Gerich, 1978; Reichlin, 1983). A disadvantage of Somatostatin is its short half-life time of about 2 minutes (1.1 - 3.0 min.), which necessitates continuous intravenous administration. Several analogues have been developed with a half-life of about 90 minutes, which can be administered subcutaneously.

Since 1980 an increasing number of publications mentions the use of Somatostatin or its analogue Octreotide as an adjuvant in the conservative treatment of external gastro-intestinal fistulas (Hild, 1980; diCostanzo, 1982; Hild, 1982; Lewis, 1986; Hild, 1986; Kingsnorth, 1986; Geerdson, 1986; Nubiola-Calonge, 1987; Rosenberg, 1987; diCostanzo, 1987). These authors report a high spontaneous closure rate after a short period of treatment and a low mortality (Table 5.8). The conclusion in most reports is that Somatostatin or Octreotide, if used as adjuvant medication to optimal conservative treatment including TPN, induces a substantial decrease of fistula output in external gastrointestinal fistulas. The rate of spontaneous closure is very high and occurs after a shorter period of conservative treatment. If the fistula output does not decrease with more than 50% percent during the first 24 hours of Somatostatin or Octreotide infusion ('non-responder'), closure of the fistula after prolonged treatment is not likely, and Somatostatin or Octreotide treatment can be discontinued (diCostanzo, 1987). Hild et al published the largest group of patients in the literature (Hild 1986), and recommend the use of Somatostatin if surgery is not advisable, if fistula production is life-threatening, or if the fistulas persist despite long-term TPN.

Table 5.8 Review of spontaneous closure and mortality in the literature concerning patients with fistulas treated with Somatostatin or the analogue Octreotide

Author	Patients (n)	Spontaneous closure (%)	Days (mean)	Mortality (%)	Remarks
diCostanzo (1982)	6	5 (83)	7	1 (16)	
Hild (1982)	10	8 (80)	?	?	
Jost (1984)	39	29 (80)	?	?	
Hild (1986)	50	40 (80)	11	?	
Pederzoli (1986)	8	7 (87)	6.5	0P	
Geerdson (1986)	6	4 (66)	16	0B	
Rich (1986)	3	1 (33)	10	1	
Nubiola-C. (1987)	14	11 (78)	4.5	2 (14)	Octreotide
diConstanzo (1987)	37	30 (82)	5.4	5 (14)	
Prinz (1987)	5	4 (80)	?	0	Octreotide

Somatostatin is very expensive and has to be administered continuously by intravenous infusion, with a maximum dose of 3.0-3.5 µg/kg body weight/hour. For the analogue Octreotide (Sandostatin®), which is far cheaper and can be administered subcutaneously, the recommended daily dose is 200-300 µg, divided over two or three gifts. To avoid a rebound effect the dosage should be continued for at least 2 days after fistula closure and reduced gradually (Reasbeck, 1984). Allergic reactions are rare. Especially in patients with diabetes, serum glucose levels tend to increase and have to be assessed at regular intervals.

In conclusion: Somatostatin or Sandostatin® has to be considered as adjuvant treatment to TPN for the conservative treatment of external fistulas in case the loss of effluent is uncontrolled and life-threatening and if surgical fistula closure is not advisable, or if the fistula persists despite TPN.

H2-blockers

H2-blockers are frequently used for the treatment of proximal external gastrointestinal fistulas, especially gastric, duodenal and pancreatic fistulas (Reber, 1978; Fournier, 1983). H2 blockers inhibit, by competition, the stimulation of the H2-receptors in the stomach by histamine and, therefore, decrease the basic and stimulated gastric acid secretion, and diminish the pepsin production of the stomach. This results in a decrease of the daily production of gastric juice from 2.5 L to 0.8 L.

Antibiotics

Morbidity and mortality in fistulas of the digestive tract is to a large extent related to septic complications. Between 1945 and 1960, antibiotics (sulfonamides, penicillin, streptomycin) were liberally used in fistula treatment (Dixon, 1946; Edmunds, 1960). However, the results did not improve (Edmunds, 1960). In 1964, Chapman et al advised against routine use of antibiotics: in a septic and progressively deteriorating patient operation had to be performed and potential sites of intra-abdominal infection explored. Nowadays, this strategy is generally accepted (Fischer, 1975; Graham, 1977; Soeters, 1979). Antibiotic prophylaxis is instituted during an operative procedure to decrease the risk of local bacterial infection or septicaemia, and is discontinued after 24 hours unless there are specific reasons for continuation (positive blood cultures, prosthesis). Preferably, the antibiotic regimen should include antibiotic agents with a spectrum of activity against colonic aerobes and anaerobes, including *Bacteroides fragilis*

(Nichols, 1979; Weinstein, 1975). There is still disagreement about the optimal antibiotic regimen in intra-abdominal sepsis about the duration of antibiotic treatment (Kager, 1985; Birolini, 1985; Nichols, 1986; Rowlands, 1984). We prefer the adjuvant use of a combination of gentamicin and metronidazole, perioperatively during 24 hours. Only if uncontrolled sepsis develops and no intraperitoneal collections (CT-scan) or other drainable collections can be detected, the prolonged use of antibiotics is advocated, although it is not yet clear that prolonged antibiotics are of benefit. Important side effects of antibiotics are colonization with resistant bacterial flora, nosocomial super infections and allergic reactions.

5.5 DIAGNOSTICS, ABSCESS DRAINAGE

Introduction

One of the main denominators of mortality in fistula treatment is uncontrolled sepsis (Edmunds, 1960; Chapman, 1964; Reber, 1978; Soeters, 1979). In patients with fistulas, uncontrolled sepsis is especially related to the insufficient detection and drainage of intra-abdominal abscesses, leading to persistent malnutrition, deterioration, organ failure and death of the patient.

Abdominal abscesses frequently develop as a postoperative complication (70%) and are less frequently related to trauma, spontaneous perforation or infection (Connell, 1980; Gerzof, 1979; Gerzof, 1981). Abdominal abscesses contain a combination of aerobic (*Escherichia coli*, Klebsiella, Proteus, Pseudomonas) and anaerobic (*Bacteroides fragilis*, Clostridium) bacterial species. The clinical features of an abdominal abscess are related to its site and primary disease. However, there are no specific symptoms to diagnose an intra-abdominal abscess: abdominal pain, fever and leucocytosis are aspecific symptoms and only helpful to stimulate the search for a septic focus (DeCosse, 1974; Deck, 1979). Several methods, all with a varying accuracy, sensitivity and specificity, are available (Norton, 1978).

Abscess diagnostics

A chest radiogram and plain abdominal x-ray are simple, non-invasive techniques and, therefore, have to be performed first. An ipsilateral pleural effusion or pulmonary infiltrate on a chest radiogram may, in combination with abdominal and systemic signs, raise suspicion with regard to the presence of a subphrenic abscess, but will rarely be conclusive as solitary symptom (De-

Cosse, 1974; Deck, 1979). A chest fluoroscopy to observe the movement of the diaphragms may be a useful adjunct to chest X-rays after profound expiration and inspiration. A plain abdominal x-ray is an insensitive and aspecific method to confirm the diagnosis intra-abdominal abscess. However, it is easy to make and gives in 70% of cases positive but not always conclusive findings (Connell, 1980; Halber, 1979). Diagnostic criteria suggesting an abscess on a plain abdominal X-ray are: 1) abdominal gas or fluid levels, not corresponding with the normal bowel architecture, 2) a mass or a mass effect on normal intra-abdominal, intrapelvic or retroperitoneal structures (Halber, 1979), and 3) elevated diaphragm and pleural effusion (Connell, 1980). Additional contrast studies may be helpful to show displacement of a viscus, anastomotic leakage or an abscess adjacent to an external fistula.

An intra-abdominal focus of infection can be detected with radioisotope scanning. The most frequently used isotopes are Gallium 67 and Indium 111, labelled to leucocytes. Gallium 67 requires 48 hours for maximum resolution and has the disadvantage that it is not specific for infection. Gallium 67 can also accumulate in healing wounds and within the bowel wall (Ascher, 1980). Another disadvantage is that the nucleide is excreted by the liver and biliary tract, and therefore infections at this site are difficult to differentiate from normal accumulations. Indium-111 labeled with polymorphonuclear leucocytes is more specific and has a resolution of only 4 hours. Ascher et al found an accuracy of 90% with a specificity of 92% (Ascher et al, 1980).

Ultrasound (US) can distinguish between solid tissue and fluid-filled structures, and is, therefore, used in the detection of abscess cavities. Ultrasound has the advantage to be a bedside, noninvasive and safe technique with only minimal inconvenience for the patient. A disadvantage is that ultrasound is difficult to use in a disrupted abdominal wall or open wounds, in the presence of stomas, sumps and abdominal dressings, also abdominal tenderness may prevent an optimal examination (Halber, 1979). A good US examination requires considerable technical expertise, even in experienced hands, a conclusive ultrasonic examination is often not possible because of bowel gas (ileus) and other deranging factors (Ascher, 1980). A sensitivity ranging from 75% (Dobrin, 1986) to 93% (Taylor, 1978) and a specificity of more than 90% (Dobrin, 1986; Taylor, 1978) is reported, but these figures cannot be reproduced in most hospitals.

Computed tomography (CT) is not impeded by abdominal wall disturbances or ileus. A CT-scan with enteral and intravenous contrast is the optimal diagnostic

procedure for intra-abdominal abscesses (Ascher, 1980) and gives reproducible images of the abscess and neighbouring structures with a sensitivity that ranges from 84% (Glick, 1983) to 96% (Halber, 1979) and a specificity of about 90%. Criteria for the diagnosis of intra-abdominal abscess by CT are: 1) the presence of a low density mass different from bowel that enhances after intravenous injection of iodinated contrast material; 2) extra-luminal gas (Daffner, 1979). An important advantage of a CT-scan is accurate assessment of a safe route for percutaneous puncture (Haaga, 1980; Sones, 1984). The actual puncture can be performed guided by US or CT. A disadvantage is that the accuracy depends on the ability to fill the gut lumen with contrast, which is sometimes difficult in the presence of abscesses due to paralytic ileus.

Dobrin (1986) evaluated the charts of 94 patients who were examined with US, CT, Gallium scan and plain X-ray to rule out the diagnosis intra-abdominal abscess. Review of radiological data showed that plain X-ray had an accuracy rate of only 57%, and that CT was superior with an accuracy of 91%. The accuracy for US and Gallium were 87% and 78% respectively. The authors concluded that CT is usually the only specific radiologic test that should be performed to localize the abscess.

In conclusion: a CT-scan with enteral and intravenous contrast is the method of choice to detect an intra-abdominal abscess in case of clinical suspicion. The adjuvant use of other techniques (US, Indium, plain X-ray) may be beneficial under special conditions or for special locations or follow-up.

Abscess drainage: method, indications and complications

Before 1975, before the general application of CT, two different approaches were available for surgical abscess drainage: the extraserosal route or the laparotomy. The extraserosal route was introduced by Ochsner and Debakey (1938) before the antibiotic era and was intended to prevent contamination of the general peritoneal cavity. In 1970, Halasz mentioned as disadvantages of the extraperitoneal approach: the high frequency of synchronous abscesses (25%), the difficulty in diagnosing multiple abscesses preoperatively and the high mortality in patients with a non-diagnosed intra-abdominal abscess (30%). Therefore, the use of an exploratory laparotomy for drainage of an intra-abdominal abscess was recommended (Halasz, 1970). In 1974 DeCosse et al analysed the high mortality related to the diagnosis and treatment of the subphrenic abscess. The authors concluded that a subphrenic abscess can and should be promptly recognized by appropriate diagnostic manoeuvres, that clinical findings can reliably sort out solitary and multiple abscesses, and that a

lateral approach has replaced exposure through the bed of the 12th rib for the purpose of drainage of the subdiaphragmatic abscess (DeCosse et al, 1974).

After 1975, the wide introduction of more specific diagnostic tools, especially CT-scan and ultrasound, made accurate preoperative evaluation feasible. CT and US were not only used to detect single or multiple abscesses but were also employed for percutaneous puncture and drainage (Gerzof, 1979; Haaga, 1980). Extended studies were published on puncture methods, selection of access route, indications, relative indications, contra-indications, complications and aftercare (Gerzof, 1981; van Sonnenberg, 1982; van Sonnenberg, 1984; Ercoli, 1988). Successful treatment of abscesses was achieved in more than 80% of cases, resulting in a decrease of the mortality below 15% (Saini, 1983).

This improvement was related to an earlier diagnosis and to drainage of abscesses, wider use of extraserous drainage because of more refined imaging techniques, and antibiotics effective against both aerobic and anaerobic micro-organisms. If percutaneous drainage was not possible or unsuccessful, a direct surgical access route could be detected and a laparotomy was not necessary (Stone, 1984). Exploratory laparotomy was indicated if the localization could not be assessed preoperatively, if sepsis had not resolved after another method of drainage, or if a concomitant abdominal condition had to be treated surgically (Glick, 1982).

Levison et al (1991) had the impression that the mortality of patients with intra-abdominal abscesses was mainly correlated with the degree of physiological derangement (APACHE II-score) and less related to the method used for drainage. The authors retrospectively reviewed a group of 91 patients with intra-abdominal abscesses treated between 1980 and 1987, and demonstrated that survival depended on the severity of illness. Percutaneous drainage appeared equal in efficacy to surgical drainage and should be tried first in most instances. However in this group of 91 patients were more survivors in the most critically ill patients who had surgical treatment. Therefore, these patients should not have been excluded as candidates for operative intervention because they were too ill (Levison, 1991).

Percutaneous drainage

The first results of percutaneous abscess drainage of 24 patients was published by Gerzof in 1979. Others had similar methods and results in the following years, and more sophisticated catheters for puncture and drainage were developed (Haaga, 1980; v.Sonnenberg, 1982; Mueller, 1984).

After detection of an intra-abdominal collection by US or CT a diagnostic aspiration is performed with a 22-gauge needle via the safest and most ap-

appropriate access route. The fluid is sent for immediate Gram stain, and chemical and haematological evaluation. If pus is aspirated, intravenous antibiotics are instituted directed against aerobic and anaerobic micro-organisms. Once the abscess has been defined, the angiocatheter and the Trocar Catheter techniques are available for catheter placement. The angiocatheter technique is used to drain intraparenchymal abscesses, smaller abscesses and those in close proximity to the bowel. A guide wire is inserted through a teflon sleeve, followed by a dilator and a 8-French multiple side-hole pigtail catheter. The trocar catheter technique is used to drain the larger abscesses with a wide and safe access window. After planning the access route and after diagnostic aspiration, a 12-16 French trocar catheter is inserted, along the same route. Some prefer to perform the detection and drainage procedure with US instead of with a CT-scan (Reuvers, 1983; Lameris, 1987; Gronvall, 1982). The same results have been claimed and the authors mentioned as advantage that the 'bedside procedure' is also feasible in the intensive care unit.

Access route planning: the optimal drainage route should be as direct and short as possible, but must be absolutely free of any intervening organ or vital anatomic structures. Route planning includes meticulous consideration of the cutaneous entry site, angle and depth. Gerzof et al consider CT superior for abscess diagnosis and route planning, but find US superior for guidance during the catheter introduction (Gerzof et al, 1981).

Indications for percutaneous drainage: Optimal indications for percutaneous drainage are abscess locations that can be drained with a high success rate and a low failure rate: a defined unilocular abscess cavity with a safe drainage route (Gerzof et al, 1981; Sones, 1984).

Relative indications for percutaneous drainage: With the growing success of and confidence in percutaneous abscess drainage, an increasing amount of relative indications, related to abscess location, access route and condition of the patient, were recognized. In general, it was estimated that, if percutaneous drainage failed, operative drainage was still possible without delay or increase in morbidity or mortality. Incomplete drainage still facilitated improvement of the general condition of the seriously ill patient with successful surgical drainage via a direct, localized approach. Relative indications are: multiloculated abscesses, multiple abscesses, thick viscous content of the abscess (blood/necrosis), fistulous communication with the skin, abnormal clotting, interloop abscesses, abscess in the pelvis adjacent to the rectum (Beltran, 1984; Sones, 1984; Gerzof, 1985).

Contra-indications for percutaneous drainage: An ecchinococcal cyst is a contra-indication for puncture, because of the risk of fatal anaphylaxis (van Sonnenberg, 1982). Pancreatic abscesses are not likely to respond well to simple

catheter drainage for they contain large amounts of necrotic material (Welch, 1981; Sones, 1984).

Complications of percutaneous drainage: Van Sonnenberg (1984) mentioned a complication rate of 10% (26/250), 7 major complications and 19 minor complications. Major complications were haemorrhage, septicaemia, superinfection and bowel perforation. Minor complications were bacteraemia, catheter back-bleeding, a traversed pleura, bowel puncture and superficial skin infection. In only one patient the major complication was fatal (hemorrhage). Others have a similar experience (Gerzof, 1982). Inadvertent perforation of a bowel or another hollow viscus should be treated with prolonged catheter drainage to allow evolution of a fibrous tract and gradual withdrawal of the catheter, frequently resulting in spontaneous closure (Mueller, 1985).

After care of drainage: The catheter is secured with sutures. Initially the catheter is irrigated every 3 hours. Gradually, depending on the nature and quantity of the effluent, careful irrigation with a 10% saline solution 2 or 3 times a day is performed to avoid bacteraemia. The catheter is removed when the clinical response, cessation of drainage, and follow-up scans indicate complete resolution of the abscess.

Discussion

Untreated intraabdominal abscesses have a mortality of nearly 100% (Altemeir, 1973) and if abscesses are only treated with antibiotics, the mortality is still over 50% (Brolin, 1984). After surgical drainage the mortality declines to 30% (Fry, 1980), which is still a high figure and is related to late detection of the abscess and the morbidity associated with the surgical technique (DeCosse, 1974). The invention of CT made early detection possible and offered an advanced method for adequate drainage with a low morbidity and mortality (Gerzof, 1981; Haaga, 1980; Martin, 1982; vanSonnenberg, 1982). Therefore, it was necessary to reconsider the indications and methods of surgical drainage. Early and more accurate detection of an intra-abdominal abscess frequently allows successful percutaneous drainage instead of an operation and, if percutaneous drainage is insufficient or impossible, local surgical drainage can be performed instead of drainage via a median laparotomy (Saini, 1983; Deck 1979). Especially for the relative indications of percutaneous drainage a thorough clinical evaluation by surgeon and radiologist is indicated (Welch, 1981). The surgeon has to decide whether there is an indication (peritonitis) or a contra-indication ('obliterative peritonitis') for surgical drainage and the radiologist has to conclude if there is a safe or relatively safe access route to solve the problem. Advantages and disadvantages have to be balanced against another to decide which technique is

suitable for the patient in a particular situation (Walters, 1985). At first an abscess communicating with a fistula was considered a contraindication for percutaneous drainage (Welch, 1981). At present, several studies showed patients with successful drainage followed by spontaneous closure or delayed definitive operation. This emphasizes that, especially in these fistula patients, during their phase of 'obliterative peritonitis', a surgical procedure is very dangerous and that percutaneous drainage is the method of choice (Ercoli, 1988; Beltran, 1984; Papanicolaou, 1984).

CHAPTER 6

General discussion

Over the past 40 years the population of gastrointestinal fistulas has changed from predominantly spontaneous fistulas to postoperative fistulas. Postoperative fistulas are frequently secondary to technical errors or errors in timing, indication and preparation. Therefore, prevention remains an important factor. The development of these fistulas can be diminished by recognition of high-risk factors (age over 70 years, emergency operation, malnutrition), and by appropriate preoperative measures (nutrition, diagnostics, bowel preparation) as well as planning and execution of the procedure. During the past decade, the fistula population has further changed from predominantly simple postoperative fistulas towards more complicated postoperative fistulas presenting after abdominal catastrophes with abdominal wall defects. The skills and techniques which allow us to perform more extensive and complicated surgery and to manage adequately serious postoperative complications, allow severely ill patients to survive and develop complicated fistulas. Successful management of these fistulas is only possible if the duration of sepsis is shortened by early and aggressive conservative management (TPN, Somatostatin, CT-scan, non-definitive surgery). As a result the fistula will be more controlled and optimal circumstances for spontaneous closure can rapidly be established in most instances. Improved techniques of skin and fistula care (Wound Manager) are available for conservative treatment of complicated abdominal situations and to perform definitive surgery, if necessary, after 6 or 8 weeks. Safe access to the abdomen is then possible and the patient in a stable metabolic condition, so that he or she can generate adequate host defence. During follow-up repeated evaluation by CT scan offers information on the local situation and distant abscesses or fluid collections, that can be adequately treated.

Where does this development end? Will we be able to eradicate the mortality in patients with a fistula? With an increase in age of the population and consequently more extensive operations in older patients with other co-existing

diseases or compromised organ functions, such operations are bound to lead to a certain rate of complications. If such complications cannot rapidly and adequately be treated, depletion and deterioration will occur leading to inadequate host defense. These elderly patients can regularly be observed in intensive care units, on the respirator with many organs failing but without a clear septic focus. The condition of these patients sometimes deteriorates despite seemingly adequate treatment and they ultimately die of superimposed opportunistic infection. In the future we should therefore first of all balance pre-existing risk factors against the magnitude of the trauma related to a planned operation. Furthermore we should try to find methods to interrupt the vicious circle described above. Nutritional repletion, maintenance of the mucosal barrier, prevention of nasocolonial infections, measures to limit the effects of endotoxin and tumor necrosis factor (TNF) are in part established as therapy and are in part still under investigation. We should have an open eye for these possibilities and apply them once there is proof for their efficacy. Their existence and eventual efficacy will however lead surgeons to embark on even more daring operations in high-risk patients which will make it therefore unlikely that the mortality of sepsis will be completely eradicated.

Data from the literature demonstrate that the overall mortality of patients with gastrointestinal fistulas varies from 10 to 15%. A further improvement (5-10%) may be possible, but it is utopian to believe that an overall mortality between 0 and 5% can be reached, unless patients with less complicated diseases are selected. Mortality cannot be prevented in patients with cancer or myocardial infarction. In theory the only mortality that can be prevented is the sepsis-related mortality. Patients with complicated fistulas and sepsis will only survive after aggressive treatment according to well-defined protocols and by experienced physicians. Patients with more complicated abdominal or thoracic fistulas are an intensive care problem, necessitating a large staff of experienced doctors (surgeon, intensive care doctor, radiologist), a high grade of structural organization (nursing staff, professional stoma therapist, CT scan) and consequently a large budget. Therefore it seems beneficial to concentrate these complicated fistula problems in experienced centres, which have the manpower, budget, equipment, experience and further facilities to support these patients and make them survive with a closed fistula.

Finally, this thesis is by necessity of a retrospective nature. Our hypothesis, that patients with newly developed gastrointestinal fistulas should, in most instances, primarily be treated conservatively can, therefore, by definition not be proven. We have demonstrated however that this approach has yielded results in a group of non-selected patients which can compete with the results of other

investigators, especially when we take into account that many other studies are at random and not consecutive. We have learnt from the present study that we still should diagnose septic foci in an earlier stage and that we should treat gastro-intestinal fistulas more aggressively. That policy will lower the mortality to around 10%.

Summary

Gastrointestinal fistulas have always been associated with a high morbidity and mortality. During the past decades results of treatment improved, but not as spectacularly as expected when the improvements in surgical, diagnostic and supportive techniques are taken into account.

The aim of this thesis is to analyse the management and results of unselected patients with fistulas treated in our institution over a 10-year period according to a consequently followed treatment strategy, and to develop new treatment protocols for the 1990's, specified according to different locations and causes.

In *Chapter 1* the literature is reviewed distinguishing four time-periods, representing significant alterations in etiology, method of treatment and results of treatment of gastrointestinal fistulas. Before 1945, most fistulas developed spontaneously, related to chronic infections or malignant disease and were initially treated conservatively, because immediate operative treatment had a very high mortality. Between 1945 and 1960 most fistulas were a postoperative complication. Conservative treatment was the method of choice, but supportive techniques, antibiotic drugs included, were inadequate. The mortality was high and was related to fluid- and electrolyte disturbances, malnutrition and sepsis. Between 1960 and 1970, the supportive techniques improved and patients were treated conservatively according to a standard protocol. The mortality decreased from 45 to 15% and there was optimism that results of fistula treatment would further improve. Between 1970 and 1980, this optimism could not completely be met. The results of treatment did not further improve despite the use of more advanced techniques of intensive patient care. Most probably this minor result was related to the development of a more complicated fistula population: more extended operative procedures were performed and frequently combined with chemotherapy, glucocorticoid therapy or radiation therapy, resulting in an increase of the proportion of fistulas, presenting under more complicated conditions.

Three specific strategies of fistula treatment are recognized (*Chapter 1.1*): primary conservative treatment (PCT), immediate operative treatment (IOT) and no treatment (NT).

Chapter 2 presents a retrospective evaluation of all 114 consecutive patients with a total of 138 external and internal fistulas of the gastrointestinal tract, ranging from simple to complicated fistulas, treated in our institution between 1977 and 1987. Management was successful in 83 patients and failed in 31 patients (27%); 10 patients were discharged with an open fistula and 21 patients died (18%). The high failure rate can partly be explained by the fact that patients discharged with an open fistula were also considered as a failure and moreover to the fact that the patients with end-stage disease were included as well. In Table 2.14 our results are compared with those from the literature, which reveals that our results are comparable. Mortality is largely related to uncontrolled sepsis, which must be considered to be preventable by more aggressive diagnostics (CT scan), non-definitive therapeutic intervention (abscess drainage, diverting stoma), or in exceptional cases by early definitive surgery. Patients with multiple fistulas and high-output fistulas did not have a significantly higher mortality, indicating that modern supportive management of these patients has resulted in a decrease in mortality. It is concluded that methods and results of treatment can only be adequately discussed if we distinguish subgroups, classified by location and cause of the fistula.

In *Chapter 3*, the subgroups of the patients are classified according to cause (postoperative and spontaneous) and according to other classifications (multiple fistulas and high-output fistulas). If a postoperative fistula becomes manifest within 5 days after the primary operation, or if a generalized peritonitis is present, in most instances a laparotomy should be performed. Otherwise postoperative fistulas are preferably managed conservatively with early diagnostic evaluation and early drainage of fluid collections. Supportive treatment consists of parenteral nutrition, skin- and fistula care, and sometimes Octreotide. Repeated clinical and laboratory evaluation is indicated to detect a septic focus as early as possible. If the fistula does not close spontaneously after 6 weeks without sepsis, a delayed definitive operation can be safely performed (Chapter 3.1). For spontaneous fistulas spontaneous closure is not to be expected. However, conservative management is to be preferred during the short period of diagnostic evaluation. If local or general circumstances can be substantially improved, conservative management is continued for more than 2 weeks, followed by definitive surgery. A chronic fistula under stable conditions can be operated upon immediately. Sometimes no therapy is possible (Chapter 3.2). In general the presence of multiple fistulas does not influence the result of treatment. In postoperative fistulas this indicates that a complicated abdominal problem exists, requiring an aggressive conservative approach with early diagnostics for abscesses and an optimal bowel rest. With an extended regimen of

conservative management morbidity and mortality may be similar as the results obtained in single fistulas (Chapter 3.3). The output of a fistula can be significantly decreased by conservative measures (parenteral nutrition, Octeotride) so that nowadays output is no longer an adverse prognostic sign (Chapter 3.4).

In *Chapter 4*, the subgroups of patients are classified according to location. External gastric fistulas most frequently develop as postoperative complication and should preferably be treated conservatively. The results of treatment are excellent if drainage is adequate. Internal gastric fistulas are rare and develop spontaneously in advanced malignant or benign disease. They should be operated upon in an early stage unless circumstances can be improved by conservative measures (Chapter 4.1).

External postoperative duodenal fistulas have a bad reputation, this can only be improved by successful control of the local situation with vigorous treatment of sepsis. Sometimes extended non-definitive surgery is indicated. Posttraumatic duodenal fistulas behave like postoperative fistulas. Spontaneous internal duodenal fistulas should be operated upon as early as possible unless circumstances can be improved by conservative management with delayed definitive surgery (Chapter 4.2). External fistulas of the jejunum and ileum are preferably managed conservatively. Our results are comparable with those from the literature and show that results of treatment have not improved despite all advanced techniques of supportive and intensive care. We defined simple and complicated fistulas, and analysis reveals that current series of fistulas are of an increasingly complicated nature. In patients with simple fistulas the mortality is related to the primary disease (e.g. cancer) or to an unrelated disease, and consequently further improvement is not to be expected. Mortality in complicated fistulas is still related to sepsis and hence the results of treatment should improve with more adequate treatment of intra-abdominal abscesses and septic foci and better nutritional and metabolic support (Chapter 4.3). Postoperative colonic fistulas or external colonic fistulas related to inflammatory disease are preferably managed conservatively. The construction of a diverting stoma facilitates local and nutritional care but does not always lead to spontaneous closure. In case of malignancy, rapid evaluation and early laparotomy should be performed to determine the extent and resectability of the disease. If resection is impossible, a palliative procedure can be performed (Chapter 4.4). Optimal management of vaginal fistulas is related to the cause of the fistula, the primary disease, and local or general conditions. Conservative management is directed to improve the circumstances and perform adequate diagnostic evaluation. Early laparotomy has to be performed if the fistula is related to advanced malignant or radiation disease (Chapter 4.5). The preferred method of treatment in entero-

vesical fistulization depends on the primary disease, local situation and the general condition of the patient. In inflammatory disease conservative management may be initiated to improve the circumstances. Thereafter, a one-stage procedure is safe and effective in patients without active inflammation, whereas a multi-stage procedure is indicated in case of abscesses or obstruction. In primary or recurrent malignant disease a radical resection offers the only chance of cure, but is rarely possible due to the extent of disease. Laparotomy is not only necessary to evaluate the extent of disease, but also to construct a diverting stoma as palliative treatment (Chapter 4.6). The presence of an internal fistula between jejunum, ileum or colon is rarely an indication for operation. Only if the fistula is secondary to advanced benign or malignant disease, surgery is indicated with resection of the diseased bowel. Several small subgroups of miscellaneous fistulas (biliary fistulas, oesophageal fistulas, pancreatic fistulas, uretero-enteral fistulas) are discussed and a management protocol is formulated (Chapter 4.7).

In Chapter 3 and Chapter 4 it is emphasized that preventable mortality in fistula treatment is nowadays largely related to uncontrolled sepsis, which can be decreased successfully by the adequate use of all modern techniques of supportive treatment. In *Chapter 5* these techniques are extensively highlighted. These include skin and fistula care, parenteral or enteral nutrition, reinfusion, medication and diagnostic evaluation. Therefore, the surgeon should be familiar with these supportive techniques and be aware of its possibilities and pitfalls.

In *Chapter 6* the general discussion is directed to the management aspects of complicated fistula care such as man-power, budget and know-how. The importance of prevention in postoperative fistulas is emphasized, and it is suggested to manage the patients with most troublesome fistulas i.e. duodenal, oesophageal, pancreatic and multiple postoperative fistulas in specialized centres.

Samenvatting

De behandeling van gastro-intestinale fistels verloopt vaak moeizaam en gaat gepaard met een hoge morbiditeit en mortaliteit. Gedurende de laatste decennia verbeterden de resultaten geleidelijk, maar minder spectaculair als werd verwacht gezien de verbeteringen in chirurgische mogelijkheden, diagnostische technieken en ondersteunende maatregelen.

Het doel van dit proefschrift is om de resultaten van behandeling te analyseren van een opeenvolgende groep fistelpatiënten die gedurende een periode van 10 jaar (1977-1987) in ons ziekenhuis volgens een bepaalde strategie werden behandeld, en om aan de hand van de eigen resultaten en die uit de literatuur nieuwe behandelstrategieën voor het komende decenium te formuleren, gespecificeerd naar fistellokatie en oorzaak.

In *Hoofdstuk 1* wordt de literatuur geanalyseerd en worden vier opeenvolgende periodes onderscheiden, elk gekenmerkt door specifieke veranderingen in oorzaak, behandelmethode en resultaat. Vóór 1945 ontstonden de meeste fistels spontaan als gevolg van chronische infecties of maligniteit en werden meestal conservatief behandeld, omdat onmiddellijke operatieve behandeling gepaard ging met een hoge mortaliteit (vaak meer dan 50%). In de periode 1945-1960 ontstonden de meeste fistels als postoperatieve complicatie. Conservatieve behandeling had de voorkeur, maar de ondersteunende technieken waren, ondanks het gebruik van antibiotica, onvoldoende om de fistels te behandelen. De mortaliteit was hoog en werd voornamelijk bepaald door stoornissen in vocht en elektrolytbalans, ondervoeding en sepsis. Tussen 1960 en 1970 verbeterden de ondersteunende technieken aanzienlijk en werden de patiënten conservatief behandeld volgens een gestandaardiseerd protocol. De mortaliteit daalde van 45 naar 15% en de verwachting bestond dat de resultaten van behandeling verder zouden verbeteren. In de periode 1970-1980 werden deze optimistische verwachtingen echter niet bewaarheid. Ondanks het gebruik van alle moderne intensive-care technieken verbeterden de resultaten van behandeling niet, waarschijnlijk samenhangend met het geleidelijk ontstaan van een meer gecompliceerde fistelpopulatie: steeds uitgebreidere operatieve ingrepen werden verricht die vaak werden gecombineerd met chemotherapie, corticosteroiden of bestraling. Dit resulteerde in een toename van het aantal fistels, en deze fistels manifesteerden zich vaak onder meer problematische omstandigheden. Drie

strategieën van fistelbehandeling worden gesignaleerd en specifiek geformuleerd (Hoofdstuk 1.1): primair conservatieve behandeling (PCT), onmiddellijk operatieve behandeling (IOT) en geen behandeling (NT).

In *Hoofdstuk 2* wordt een uitgebreide beschrijving gegeven van de resultaten van behandeling van 114 opeenvolgende patiënten met 138 externe en interne fistels van de tractus digestivus. Bij 83 patiënten was de behandeling succesvol en bij 31 patiënten faalde de behandeling: 21 patiënten overleden (18%) en 10 patiënten werden met een open fistel uit het ziekenhuis ontslagen. Dit relatief hoge percentage niet succesvolle behandeling hangt gedeeltelijk samen met het feit dat ook patiënten met een slechte prognose (bijvoorbeeld een uitgebreid gemetastaseerde maligniteit) in het onderzoek werden opgenomen, en met het feit dat ook patiënten die met een open fistel uit het ziekenhuis werden ontslagen als een mislukte behandeling werden beschouwd. Dit overwegende kan gesteld worden dat onze resultaten niet slechter zijn dan die van anderen (Tabel 2.13). De mortaliteit wordt voornamelijk bepaald door niet adequaat behandelde sepsis, hetgeen in principe voorkomen zou moeten kunnen worden door vroege en meer uitgebreide diagnostiek (CT-scan), niet definitieve operaties (abcesdrainage, ontlastend stoma), of in uitzonderingsgevallen door vroege definitieve chirurgie. De mortaliteit bij patiënten met multipale fistels en high-output fistels was niet significant hoger, hetgeen aangeeft dat deze problemen door middel van de moderne ondersteunende technieken beter in de hand te houden zijn. Tenslotte wordt geconcludeerd dat methodes en resultaten van behandeling alleen zinvol kunnen worden vergeleken als we deelgroepen van fistelpatiënten onderscheiden, gespecificeerd naar oorzaak en lokatie.

In *Hoofdstuk 3* wordt het patiëntenmateriaal besproken na onderverdeling op grond van oorzaak (postoperatief of spontaan) en op grond van andere factoren (multipale fistels, high-output fistels). Indien een postoperatieve fistel zich binnen 5 dagen na de eerste operatie manifesteert, of als sprake is van een gegeneraliseerde peritonitis, dient over het algemeen een laparotomie te worden verricht. Onder andere omstandigheden worden postoperatieve fistels bij voorkeur conservatief behandeld met vroege diagnostiek en met vroege drainage van eventuele abcessen of vochtcollecties. Ondersteunende behandeling bestaat uit parenterale voeding, huid- en fistelverzorging, en soms Octeotride. Teneinde een ontstekingshaard zo vroeg mogelijk op te sporen dient herhaald klinisch- en laboratoriumonderzoek plaats te vinden. Indien de fistel na een stabiele periode zonder sepsis niet spontaan sluit, kan een resectie met anastomose worden uitgevoerd met een grote kans van succes (Hoofdstuk 3.1). Bij spontane fistels valt spontaan sluiten van de fistel niet te verwachten. Desondanks heeft kortdu-

rende conservatieve behandeling gecombineerd met noodzakelijke diagnostiek de voorkeur. Indien de lokale of algehele omstandigheden daadwerkelijk kunnen worden verbeterd, dient langer dan 2 weken conservatief te worden behandeld, gevolgd door definitieve chirurgie. Bij een chronische fistel onder stabiele omstandigheden kan gekozen worden voor onmiddellijke chirurgie. Soms is geen enkele therapie mogelijk (Hoofdstuk 3.2).

Bij patiënten met multiële fistels is het resultaat van de behandeling over het algemeen niet verschillend van het resultaat bij patiënten met enkelvoudige fistels, mits de patiënt behandeld wordt volgens een meer uitgebreid conservatieve behandelingsstrategie, waardoor begeleidende abcessen vroeg worden gediagnostiseerd en er een optimale darmrust wordt gegarandeerd (Hoofdstuk 3.3). Doordat met de moderne ondersteunende technieken (parenterale voeding, Octeotride) de productie van een fistel aanzienlijk kan worden gereduceerd, zijn de resultaten van behandeling van patiënten met een hoge outputfistel heden ten dage niet slechter dan die van patiënten met een lage outputfistel (Hoofdstuk 3.4).

In *Hoofdstuk 4* wordt het patiëntenmateriaal besproken na onderverdeling op grond van de locatie van de fistel. Externe maagfistels ontwikkelen zich over het algemeen als een postoperatieve complicatie en worden bij voorkeur conservatief behandeld. Het resultaat van de behandeling is uitstekend mits de drainage voldoende is. Tegenwoordig zijn interne maagfistels zeldzaam, daar zij zich over het algemeen spontaan ontwikkelen in samenhang met een vergevorderd infectieus of maligne proces. Operatieve behandeling heeft de voorkeur, tenzij door conservatieve maatregelen de algehele toestand van de patiënt kan worden verbeterd (Hoofdstuk 4.1). Externe postoperatieve duodenumfistels hebben een slechte prognose, welke alleen kan worden verbeterd door de lokale situatie in een vroeg stadium onder controle te brengen en sepsis te voorkomen. Hiervoor is soms uitgebreide niet definitieve operatieve behandeling noodzakelijk. Post-traumatische duodenumfistels gedragen zich als postoperatieve fistels. Spontane interne duodenumfistels worden bij voorkeur in een vroeg stadium geopereerd, tenzij de omstandigheden door conservatieve maatregelen kunnen worden verbeterd (Hoofdstuk 4.2). Externe fistels van jejunum en ileum worden bij voorkeur conservatief behandeld. Onze resultaten zijn vergelijkbaar met die uit de literatuur en tonen opnieuw aan dat, ondanks het gebruik van alle moderne ondersteunende en intensive-care technieken, de resultaten van behandeling niet zijn verbeterd. Wanneer onderscheid wordt gemaakt tussen eenvoudige en meer ingewikkelde fistels, blijkt bij verdere analyse dat onze groep patiënten voor een relatief hoog percentage uit meer ingewikkelde fistels bestaat. Bij patiënten met eenvoudige fistels wordt de mortaliteit bepaald door het

onderliggend lijden (bijv. kanker) of door toevallig optredende problematiek (bv. hartinfarct of longembolie), en daarom valt verdere verbetering niet te verwachten. Bij patiënten met fistels onder meer problematische omstandigheden wordt de mortaliteit voornamelijk bepaald door sepsis, en mag verwacht worden dat de resultaten van behandeling verbeteren indien abdominale abscessen adequater worden behandeld en ondersteunende technieken consequenter worden toegepast (Hoofdstuk 4.3). Een postoperatieve fistel van het colon of een spontane colonfistel, samenhangend met een ontstekingsproces, wordt bij voorkeur primair conservatief behandeld. Het aanleggen van een ontlastend stoma maakt de lokale verzorging eenvoudiger en maakt enterale voeding mogelijk, maar leidt niet altijd tot spontaan sluiten van de fistel. In geval van een fistel op basis van maligniteit heeft snelle evaluatie gevolgd door laparotomie de voorkeur. Als resectie onmogelijk blijkt kan een palliatieve operatie worden verricht (Hoofdstuk 4.4). De optimale behandeling van vaginale fistels wordt bepaald door de oorzaak van de fistel, het onderliggend lijden en de lokale of algehele toestand. Over het algemeen wordt aanvankelijk conservatief behandeld ten einde de lokale omstandigheden te verbeteren en adequate diagnostiek mogelijk te maken. Indien de fistel veroorzaakt wordt door een gevorderde maligniteit of door bestralingsziekte heeft een vroege laparotomie de voorkeur (Hoofdstuk 4.5). Bij entero-vesicale fistels wordt behandeling bepaald door het onderliggend lijden, de lokale situatie en de algehele conditie van de patiënt. Indien de fistel samenhangt met een ontstekingsproces wordt bij voorkeur aanvankelijk conservatief behandeld teneinde de lokale omstandigheden te verbeteren. Daarna kan over het algemeen veilig in één tempo een resectie met anastomose worden verricht. Een operatie in meerdere tempi is noodzakelijk bij lokaal abcessen of bij een ernstige obstructie. In geval van een primaire of recidief maligniteit biedt radicale resectie de enige kans op genezing, maar vaak is de lokale doorgroei dusdanig dat dit niet mogelijk is. Bij deze patiënten is laparotomie niet alleen wenselijk om de uitgebreidheid van de ingroei vast te stellen, maar ook om ter palliatie een ontlastend stoma aan te leggen (Hoofdstuk 4.6). Bij een interne fistel tussen jejunum, ileum of colon bestaat alleen een operatie-indicatie indien de fistel het gevolg is van een uitgebreid infectieus of maligne proces. Hierbij dient resectie van de aangetaste darm plaats te vinden met end-to-end anastomose. Verder worden enkele kleine subgroepen van uiteenlopende fistels (galfistels, oesophagusfistels, pancreasfistels, ureterfistels) besproken en wordt een protocol voor behandeling geformuleerd (Hoofdstuk 4.7).

In Hoofdstuk 3 en 4 wordt benadrukt dat heden ten dage te voorkomen mortaliteit bij de behandeling van gastro-intestinale fistels voornamelijk bepaald wordt

door niet te beteugelen sepsis, welke door het gebruik van de moderne ondersteunende technieken succesvol kan worden beïnvloed. In *Hoofdstuk 5* worden deze technieken daarom uitgebreid toegelicht. Deze technieken omvatten onder andere de huid- en fistelverzorging, parenterale- en enterale voeding, reinfusie van darmsappen, medicamentueze ondersteuning en röntgendiagnostiek. Het is van belang dat de chirurg vertrouwd is met de moderne ontwikkelingen en op de hoogte is van de werkingen en de bijwerkingen.

In *Hoofdstuk 6* komen in de slotdiscussie voornamelijk de 'management' aspecten van de behandeling van meer problematische fistelpatiënten ter sprake (man-power, budget, know-how). Opnieuw wordt benadrukt dat bij postoperatieve fistels preventie heel belangrijk is, en wordt gesuggereerd om de patiënten met meer problematische fistels (duodenum, oesophagus, pancreas, multipel postoperatief) in daarvoor gespecialiseerde centra te behandelen.

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Acknowledgements

The publication of a thesis is a milestone and the end of a long period of learning, study and development, as well as the beginning of a new and exciting era. This occasion also gives me the opportunity to express my gratitude and thanks to my parents who have provided me with a solid start. Dr J. de Gruyl and Prof. dr J.M. Greep offered me the opportunity to start a career in surgery, and also aroused my interest for surgery as a science, which certainly attributed to my further development as a 'human being'. For all this I am very grateful. Also I would like to express my gratitude to all the members of the departments of Surgery of the Gemeenteziekenhuis Dordrecht and University Hospital Maastricht. I felt it as a privilege to work with them.

The management of patients with a fistula is teamwork. During the past fifteen years, many persons have directly or indirectly cooperated in the realization of this thesis. To all of you I am greatly indebted. Some of you were particularly important.

- Peter Soeters, your great interest in and knowledge of the basic concepts of diseases have always fascinated me. You taught me that it is not enough to be a good surgeon but that one has to be a good physician as well, and be able to stimulate the other members of the team in order to achieve a good result. You have guided me in the field of fistula treatment and specifically learned me how to write a paper and discuss a problem. Apart from this you are a good friend. My warmest thanks.

- Dirk Gouma, you already recognized that I was 'fistula minded' before I did myself. You encouraged me to do a retrospective study on patients with fistulas treated in the Maastricht Hospital. Your comments were critical and to the point, and improved the manuscript of this thesis considerably. I thank you for your support and friendship.

- Margriet Rouflart, you 'are' the nutritional team, and without the support of you and your colleagues the fistula study would not have been possible. My thanks for your loyal support.

- Marcia van Puijenbroek, the process of learning to write a paper implicates automatically that each step has its unavoidable corrections, and these were quite some! I am grateful for your patience and kind dedication.

- I like to thank Prof. dr J.M.A. van Engelshoven, Prof. dr Janknegt, Prof. dr H. Obertop, Prof. dr R.W. Stockbrügger and Prof. dr R.I.C. Westdorp for their critical comments and basic discussion.

- I thank my fellow surgeons and the other members of the medical staff of the Oosterscheldeziekenhuis for their continued interest and support during the last year.

- I thank Dini Kok-Noorman for her assistance in correcting the English and Joop Reparon for the cover design.

Last but not least, I owe great debt to my wife Ineke and our son Jelle for their love and patience during the preparation of this thesis. Without their support it would not have been possible.

Curriculum vitae

The author of this thesis was born in Rotterdam (The Netherlands) in 1954. He attended Dutch high school (HBS-B) in Rijswijk ZH and passed his final exam in 1971. He studied medicine at the Faculty of Medicine of the State University of Leiden where he graduated in 1978. After military service (medical officer), he worked as resident in the Department of Traumatology of the Wilhelmina Gasthuis (head at the time Prof. dr A.A. Holscher), University of Amsterdam (1979/1980). Surgical training started in the Department of Surgery of the Gemeenteziekenhuis Dordrecht (supervisor dr J. de Gruyl). In 1985 he continued the surgical training at the Department of Surgery of the University Hospital Maastricht (head Prof. dr J.M. Greep and Prof. dr G. Kootstra), and was registered as general surgeon on April 1, 1986. He remained in the University Hospital Maastricht and worked as chef-de-clinique. During this time, he initiated a retrospective study on gastrointestinal fistulas under the supervision of Prof. dr P.B. Soeters and dr D.J. Gouma.

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