Haemodynamics in deep venous obstruction

Valorisation addendum

Socioeconomic relevance of the scientific results in this thesis

Chronic deep venous obstruction is a frequently occurring problem. Although the number of patients suffering from a significant iliac vein compression syndrome is unclear, post-thrombotic obstruction appears to be present in 25-56% of patients who suffered from a deep vein thrombosis (DVT).[1-5] Considering that 1-2 per 1,000 people in Western society develop a DVT, this number is vast.[6,7] When the iliofemoral tract is affected by such an obstruction, complaints can be more severe and the obstruction could be treated by stenting.[8-10] About a quarter of patients affected by DVT suffer from an iliofemoral DVT.[1] This means that, annually, approximately 40,000 people in the Netherlands develop severe PTS caused by iliofemoral obstruction. This results in more than 1.5 million patients for the whole of Europe. Studies have shown that PTS can have a detrimental effect on quality of life and leads to increased absence from work.[1,11] On top of that, healthcare costs due to chronic venous obstruction is estimated at 1-2% of the national healthcare budget in developed countries.[12] Thus, post-thrombotic obstruction has a significant negative effect on the economy.

The results of this thesis lead to a better understanding of the pathophysiologic effects of such an obstruction. Moreover, these results are the first step in identifying patients who are in need of further examination and will benefit from interventional treatment options. However, the current evidence on stenting of such an obstruction is of limited quality and lacks proper randomised controlled trials. This thesis has shown that stenting of post-thrombotic venous obstruction has a direct positive effect on venous haemodynamics and is associated with significant improvement in quality of life, which provides substantiation for its use on a haemodynamic level. Therefore, this thesis provides better evidence to justify the associated health care costs of this intervention.

Target population

Results of this thesis may be interesting for various target groups outside the scientific community. First and foremost, physicians in contact with patients who suffer from venous obstruction and who are not involved in scientific research should take heed of the results in this thesis. Physicians who examine patients with lower limbs complaints that could be of venous origin should routinely inspect the abdominal wall and pubic area. This thesis establishes that the presence of a collateral vein in these areas is highly predictive for chronic deep venous obstruction proximal to the femoral confluence. Such a collateral vein should therefore be considered as a red flag and symptomatic patients should be referred to a dedicated specialised centre.

Other chapters contain valuable information for those physicians who consider treating an obstruction by stenting. The results presented in this thesis demonstrate that patients with iliofemoral obstruction can suffer from a significant ambulatory venous hypertension and that this can be markedly reduced by stenting the obstructed tract, which is associated with improvement in quality of life. The beneficial effects of stenting that have been identified in this thesis should ensure that the treating physician considers referral to or consultation with a venous expert in patients with severe post-thrombotic disease. A dedicated specialist can better establish whether interventional therapy may be beneficial, as opposed to conservative therapy alone.

Furthermore, this thesis also identified post-thrombotic obstruction of the femoral and deep femoral vein as predictors for stenosis or occlusion of the treated tract. This is of particular importance for vascular surgeons and interventional radiologists who perform stent placements for deep venous obstruction. Before intervention, they should take this information into consideration and adequately investigate the quality of inflow to avoid complications or an unsuccessful procedure.

Medical technology companies are another very important target group. In several chapters of this thesis the need for development of innovative techniques was discussed. Techniques that can quantify flow in the lower extremity and those that can quantify collateral circulation are warranted to be able to identify which patients will benefit from interventional treatment. Also, easier to use, non-invasive techniques for measuring venous pressure should be developed. Support from medical technology companies is paramount to achieve this goal as soon as possible.

Knowledge utilisation, innovation and future perspectives

The results of this thesis have led to the development of a system that can monitor intravenous pressure while the patient is mobile. At this moment the project is in its design phase. A guidewire with the ability to measure intravenous pressure is attached to a device that records, transmits and stores data obtained from this pressure guidewire. The guidewire will be percutaneously placed inside the common femoral vein and the recording device will facilitate more optimal mobilisation than the techniques used in this thesis. Restrictions will be less as a result from the superior mobile nature of the device. The ability of the device to transmit data real time will ensure that the researcher can monitor measured pressures directly on a portable electronic device. This real time connection enables the researcher to respond to changes in pressure.

The results in this thesis are already innovative of itself: no studies have aimed to investigate the haemodynamic effects of a chronic deep venous obstruction during actual ambulation. The method of wireless transmission of the invasive pressure measurements will surpass that. Using this device, we will be able to gain more insight into pressure changes throughout the day in various positions and during different activities. This could prove particularly helpful in patients with partial obstruction or non-thrombotic iliac vein compression. The aim of the next study will be to investigate whether these pressure measurements will be able to predict clinical success of treatment, as measured by improvement in quality of life. After in vitro tests have been successfully performed, we will start a pilot study to test the feasibility of its use in patients. If this pilot study proves successful, it will be extended with more patients to investigate whether the hypothesised predictive value is true. Those data would result in a more profound understanding of deep venous obstruction and well-defined indications for invasive treatment of obstruction, leading to a reduction in unnecessary procedures and complications.

Two other aspects this thesis highlights are the importance of flow and collateralisation in the presence of deep venous obstruction. Developments of new techniques that can quantify these aspects are of the utmost importance in predicting which patients will benefit from interventional treatment and which will not. Furthermore, quantification of flow and collateralisation might also be important in understanding obstruction caused by non-thrombotic compression of certain vein segments. Innovation in this area would ultimately lead to improved quality of care.

Risks of developing such techniques are very low since development of devices can be based on innovation of existing techniques through observational studies. When embarking on such

a path financial costs are difficult to predict, though market opportunities will likely be ideal since such techniques could be amended to facilitate their use in other areas of medicine as well. Moreover, it could have a great societal impact if such innovations will lead to a tailored treatment approach. Improved quality of care can lead to a reduction in overall health care costs and have a beneficial effect on the economy through reintegration of people affected by this condition into the workforce.

References

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