Can perioperative psychological interventions reduce chronic pain after surgery?

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Abstract

Chronic post-surgical pain is a relatively common adverse effect following surgery. Several prognostic factors for chronic post-surgical pain have been identified, including psychological states and traits. Psychological factors are modifiable, and perioperative psychological interventions may reduce the incidence of chronic post-surgical pain. A meta-analysis showed preliminary evidence for the benefits of such interventions for the prevention of chronic post-surgical pain. Further research must be conducted to better understand the specific type, intensity, duration and timing of interventions that are most effective. The number of studies in this area has recently increased, with additional randomised controlled trials currently being carried out, which may allow for the development of more robust conclusions in the coming years. In order to implement perioperative psychological care alongside routine surgical interventions, efficient and accessible interventions should be available. In addition, demonstration of cost-effectiveness may be a prerequisite for wider adoption of perioperative psychological interventions in regular healthcare. Offering psychological interventions selectively to patients at risk of chronic post-surgical pain could be a means to increase cost-effectiveness. Stepped-care approaches should also be considered, where the intensity of psychological support is adapted to the needs of the patient.

Key words: Chronic postoperative pain; Perioperative psychological intervention; Predictors; Prevention

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Introduction

Pain is one of the most common adverse effects of surgery, and is usually resolved within days or weeks, depending on the type of operation and the amount of tissue damage. However, some patients experience persistent pain after surgery, which may develop into long-term chronic pain. The International Classification of Diseases - 11th Revision (World Health Organization, 2022) defines chronic post-surgical pain as pain that develops or increases in intensity after a surgical procedure and persists beyond the healing process, which is usually considered to be 3 months post-surgery (Schug et al, 2019). Prevalence estimates of chronic post-surgical pain vary widely, and may depend on the type of surgery (Schug and Bruce, 2017). A survey across 21 European hospitals indicated a 35% incidence rate of chronic post-surgical pain for patients experiencing any pain and 12% of moderate to severe pain 12 months after different types of surgical interventions (Fletcher et al, 2015). Considering the number of surgeries performed each year, chronic post-surgical pain can be considered a prevalent condition that is in urgent need of attention. Given that pain is particularly difficult to treat once it becomes chronic, preventive approaches should be explored to decrease the burden of chronic post-surgical pain.

Psychological factors are prognostic for chronic post-surgical pain

In the last decade, multiple studies have explored the factors that increase the risk of developing chronic post-surgical pain. Several prognostic factors have been identified, the most robust of these being pre-existing pain, acute postoperative pain, younger age, female sex and negative psychological states (Schug and Bruce, 2017). Regarding the latter, meta-analyses indicated that, in particular, pain catastrophising, fear of surgery and

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state and trait anxiety may be prospectively associated with the development of chronic post-surgical pain (Theunissen et al, 2012; Jackson et al, 2016; Giusti et al, 2021). This has been found across various surgical procedures and after controlling for other risk factors, such as pre-existing pain and extent of the surgical lesion.

There are multiple underlying mechanisms that contribute to the relationship between psychological stress and adverse surgical outcomes. Based on the fear-avoidance model of chronic pain (Vlaeyen et al, 2016), patients with high levels of pain catastrophising and fearful appraisals of the impact of surgery may be inclined to protect themselves from the projected harm by limiting their physical activity. This inactivity may be counterproductive for the rehabilitation process, especially in conditions where regaining muscular strength and flexibility is recommended (eg after joint arthroplasty or spinal operations).

Additionally, a psychobiological explanation has been proposed, suggesting that psychological states can influence the surgical stress response, leading to increased levels of stress hormones and sustained inflammatory responses (Munk et al, 2021). Animal studies showed that pre- and post-surgical stress exposure leads to prolonged hyperalgesia in rodents, which appears to be mediated by activation of glucocorticoid receptors (Cao et al, 2015). Moreover, pro-inflammatory cytokines are linked to pain hypersensitivity, since they act on several levels of the pain neuraxis, including peripheral nociceptors and spinal and supraspinal areas (Goncalves dos Santos et al, 2020).

A prolonged stress response can also result in changes in the corticolimbic circuit, which has a direct impact on nociceptive transmission and pain awareness (Munk et al, 2021). Other negative emotional and cognitive states and traits, such as pain-related fear and pain catastrophising, have also been associated with the dysregulation of endogenous pain modulation by changing the balance of facilitatory and inhibitory central descending mechanisms (Chapman and Vierck, 2017).

Perioperative psychological interventions

Knowing that maladaptive psychological factors are prognostically associated with chronic post-surgical pain allows for the development of preventive approaches. Psychological states are modifiable, and targeting these states through psychological interventions, such as cognitive behavioural therapy, may mitigate the risk of chronic post-surgical pain. Burns and Moric (2011) argued that cognitive behavioural therapy might be able to reduce the incidence of chronic post-surgical pain by half in at-risk patients (ie those who display high levels of pain catastrophising). They calculated the theoretical reduction in risk by mapping the effect size of cognitive behavioural therapy for reducing maladaptive pain cognitions on to the effect size of the association between pain catastrophising and chronic post-surgical pain. However, a limitation of their work is that it is based on a theoretical exercise. Empirical testing of the influence of cognitive behavioural therapy in clinical trials is necessary to establish whether, and to what degree, such interventions can actually reduce the incidence of post-surgical pain.

Further studies have examined whether perioperative psychological interventions can mitigate the risk of chronic post-surgical pain (for example, Monticone et al, 2014; Rolving et al, 2015; Dindo et al, 2018; Darnall et al, 2019; Hadlandsmyth et al, 2019; Lotzke et al, 2019; Riddle et al, 2019). These used different types and lengths of interventions and examined patients undergoing various types of surgical procedures. Results are inconsistent, with some studies showing benefits of perioperative psychological interventions for long-term pain and/or disability, while others showed no effect. A meta-analysis aimed to synthesise the current evidence by aggregating the results of randomised controlled trials which examined the effects of psychological interventions on chronic post-surgical pain and/or persistent disability (Nadinda et al, 2022). In addition, effect moderators were examined to elucidate which factors may determine efficacy. The meta-analysis included studies that examined pain and/or disability at 3 months or longer after surgery, and administered a psychological intervention before surgery, shortly after surgery or both. When a study used more than one long-term follow-up assessment (eg at 6 and 12 months), the mean of the effects across these time points was used. A total of 18 studies were included: two studies looked only at the outcome of pain, one study looked only at the outcome of disability

and 15 studies looked at both pain and disability. Of the included studies, 12 examined the effects of cognitive behavioural therapy-based interventions, three studies used acceptance and commitment therapy and three looked at other forms of psychological intervention. There was significant variance in the length of the interventions, ranging from a single 90-minute session to an 8-week programme consisting of seven 2.5-hour sessions with an additional full-day session. The mode of delivery also varied, with some interventions occurring face-to-face and others online or by telephone. Half of the studies directed the interventions towards patients who were identified preoperatively as being at increased risk for chronic post-surgical pain (ie they showed signs of high levels of fear, anxiety or pain catastrophising), whereas the other half directed the interventions to unselected patients.

Two separate meta-analyses were performed for pain and disability outcomes respectively. The results indicated that perioperative interventions significantly reduced chronic post-surgical pain and persistent disability. However, the effect size was small for chronic post-surgical pain, and small to moderate for disability. The data showed a high level of heterogeneity, which may be related to the difference in the type and intensity of interventions. Moderator analyses were used to explain some of this variance and draw preliminary conclusions about the most effective components of perioperative interventions. Several potential moderators were examined: whether interventions targeted at-risk patients, type of psychological intervention (cognitive behavioural therapy vs other forms of therapy), the person providing the intervention (psychologist or other), timing and length of the intervention, type of surgery and presence of pre-existing pain. Only timing of the intervention was found to influence the effectiveness. Interventions occurring after surgery, or both before and after surgery reduced chronic post-surgical pain and disability more than interventions that were delivered preoperative only. This may be in part related to the fact that preoperative interventions were usually shorter and less intensive. There was no significant evidence to support the a priori expectation that interventions specifically targeting at-risk patients would be more effective than interventions delivered to all patients. However, the number of studies was too low to allow for high-powered analyses of moderator effects. Additional studies are needed for more reliable examination of the factors that make interventions more or less effective and to identify which patients may benefit most from them.

A randomised controlled trial, appearing after finalisation of the meta-analysis by Nadinda et al (2022), confirmed the overall finding of a protective effect of perioperative psychological intervention for chronic post-surgical pain (Ziadni et al, 2022). This study examined the effects of a brief digital intervention on reductions of pain-related outcomes up to 3 months after orthopaedic trauma surgery. The intervention studied was called ‘my surgical success’ and aimed to help patients to develop a personalised management plan for their post-surgical pain by presenting them a 45-minute online psychoeducation video and worksheets. The video explained how cognitive and emotional processes affect pain and how one can downregulate physiological arousal. Patients could incorporate the treatment information in downloadable worksheets. They were also given access to a relaxation app that they could use whenever they wished. Although the main purpose of the study was to assess the feasibility and acceptability of the intervention, the results showed that the programme led to a greater reduction in pain intensity at 1, 2 and 3 months after surgery compared to a health education programme. This study shows that even brief, completely online interventions may be effective in mitigating the risk of chronic postoperative pain.

In addition to these published studies, there are multiple ongoing trials looking at the effectiveness of various interventions on reducing chronic post-surgical pain (Scarone et al, 2020; Lindberg et al, 2021; Rabbitts et al, 2021; Hadlandsmyth et al, 2022; Lukas et al, 2022; Moorthy et al, 2022; Reme et al, 2022). These trials are targeting patients undergoing breast cancer surgery (Lukas et al, 2022; Moorthy et al, 2022; Reme et al, 2022), total joint arthroplasty (Lindberg et al, 2021; Hadlandsmyth et al, 2022) and spinal surgery (Scarone et al, 2020; Rabbitts et al, 2021). The perioperative psychological interventions being used are mostly cognitive behavioural therapy-based, with one study combining hypnosis and acceptance and commitment therapy (Reme et al, 2022). Three of the studies are targeted trials, examining patients with high levels of pain catastrophising or fear before surgery (Scarone et al, 2020; Lukas et al, 2022; Moorthy et al, 2022), four studies are untargeted

trials (Lindberg et al, 2021; Rabbitts et al, 2021; Hadlandsmyth et al, 2022; Reme et al, 2022). Most of these ongoing trials offer treatment of moderate intensity, varying from four to ten session, with one study using an online platform that can be accessed continuously for up to 12 months after surgery (Reme et al, 2022). In addition, with the exception of one study that is only using postoperative sessions (Lindberg et al, 2021), most studies are using a combination of pre- and postoperative sessions. Four studies are using an online intervention (Lindberg et al, 2021; Rabbitts et al, 2021; Reme et al, 2022), one study is delivering the intervention in person (Moorthy et al, 2022) and the other two by phone (Hadlandsmyth et al, 2022) or video conferencing (Scarone et al, 2020). These new studies will add to the existing evidence base, allowing more robust conclusions to be made regarding the most efficient intervention strategies in chronic post-surgical pain.

Two of the ongoing trials are also looking into the underlying mechanisms of the effect of psychological intervention. Lukas et al (2022) are not only measuring pain and disability as outcomes of their trial, but also the sensitivity of the nociceptive system by quantitative sensory testing and the efficiency of endogenous pain modulation assessed by conditioned pain modulation. Assessments are being conducted before, shortly after and 6 months following surgery, both in the psychological intervention condition and an active control condition. Reme et al (2022) are using biomarkers to assess whether preoperative hypnosis affects stress reactivity. Before and 3–4 weeks after surgery, high-sensitive C-reactive protein in the blood is being assessed as a marker of low-grade inflammation. A meta-analysis conducted by Lanini et al (2022) found that perioperative psychological interventions can have an effect on the metabolic surgical stress response, which is associated with reduced pain. Studies like these go beyond merely examining the efficacy of a certain intervention and may provide evidence for the assumed mechanisms by which psychological factors lead to altered pain sensitivity.

Integrating psychological care in routine clinical practice

A major issue for perioperative psychological interventions is the implication for having a real-world impact, essentially taking the interventions beyond a research context and realising their feasibility in clinical practice. Factors that influence feasibility include adoption of the intervention by patients, support by healthcare providers and staff, integration in the organisation and reimbursement by health insurance.

An important condition for implementing an intervention in routine clinical practice is efficiency of intervention delivery. Many past and ongoing studies have tried to reduce the time investment of healthcare providers and improve accessibility for patients by delivering the intervention online, through an app or over the phone (eg Riddle et al, 2019; Rabbitts et al, 2021; Hadlandsmyth et al, 2022; Lukas et al, 2022). Cost-effectiveness is another important step towards the implementation of interventions. Only a few studies have incorporated an economic evaluation of perioperative psychological interventions compared to usual care in their design (Rolving et al, 2016; Lotzke et al, 2019; Lindberg et al, 2021; Reme et al, 2022). Rolving et al (2016) performed a cost-effectiveness and cost-utility evaluation of a six-session perioperative cognitive behavioural therapy intervention for patients undergoing lumbar spinal fusion. No clear cost benefits were found, but the sample size was small and there was poor compliance with filling in the cost diary. Future studies should further investigate the economic costs and benefits of perioperative psychological interventions.

Transitional pain services are currently in place to fill the gap between acute and chronic pain management and provide ongoing care after discharge from hospital. The first and most well-known transitional pain service was implemented in Toronto General Hospital (Katz et al, 2015). The goal of this service is to provide comprehensive pain management to patients at high risk of chronic post-surgical pain and persistent disability after various surgical procedures, and to prevent persistent opioid use. Multidisciplinary specialised care, consisting of pharmacological and non-pharmacological pain management, is provided to patients pre- and postoperatively in the hospital and on an outpatient basis for up to 6 months following the intervention. Non-pharmacological pain management includes

psychological intervention, consisting of pain education, mindfulness exercises, hypnosis and acceptance and commitment therapy. Patients are screened for risk factors during the pre-admission visit to the clinic, including pre-existing chronic pain and chronic opioid use, a history of anxiety or depression and high levels of pain catastrophising. Patients can also be referred to the transitional pain service after surgery if they report intense postoperative pain, have high postoperative opioid consumption or show emotional distress. Currently, only preliminary results on the efficacy of the Toronto General Hospital transitional pain services from non-randomised trials are available (Azam et al, 2017; Clarke et al, 2018). These results suggest that treatment by the transitional pain service team can reduce pain intensity and pain interference as well as opioid use (Katz et al, 2019).

Directing interventions towards at-risk patients

Targeting interventions towards patients at-risk for chronic post-surgical pain could be most cost-effective, because resources are being used for the patients who need them most. However, the meta-analysis did not provide conclusive evidence that interventions specifically targeting patients with identified risk factors were more effective than generic interventions. A possible explanation could be that there are no clear criteria for the identification of patients who would benefit most from perioperative psychological intervention. A targeted approach requires sensitive risk-assessment tools to reliably identify at-risk patients. Although there is robust evidence that factors such as pain catastrophising, trait anxiety and fear of surgery are prognostically related to chronic post-surgical pain, clinically relevant cut-off values for most instruments assessing these constructs have not been determined. Moreover, prediction models for chronic post-surgical pain based on psychological factors only (Lötsch et al, 2018a) or on a combination of demographic, somatic and psychological factors have shown only modest predictive value, with suboptimal sensitivity and specificity (Dereu, et al, 2018; Lötsch et al, 2018b; Montes et al, 2020).

Another issue around targeted interventions is uncertainty around when to best assess these potential risk factors. Most studies have used preoperative assessment of prognostic factors to identify patients at-risk for chronic post-surgical pain. However, pain catastrophising in the early postoperative phase has also been found to be predictive of chronic post-surgical pain (Coronado et al, 2015). A study looking at patients who had undergone spine surgery reported that postoperative pain-related fears may have more predictive value than preoperative assessment (Archer et al, 2014). Postoperative assessment may be more feasible for procedures where the time between diagnosis and surgery is limited (eg emergency surgery or surgery for cancer). Another approach would be to assess the trajectory of prognostic factors with multiple assessments, starting preoperatively and continuing postoperatively. Giordano et al (2020) assessed pain catastrophising before, and at 1, 3 and 6 months after the operation in patients undergoing several different surgical procedures. Unremitting and worsening pain catastrophising trajectories, in particular, predicted long-term pain.

Despite the potentially higher efficacy of offering perioperative psychological interventions specifically to at-risk patients, there could still be benefits in offering some form of psychological guidance to all patients. A stepped-care approach could be used, where all patients are offered a brief psychological preparation before surgery, consisting of education and/or relaxation, in an efficient manner such as through an app or website. Patients that still report pain-related or surgery-related fears, pain catastrophising or general anxiety after this initial intervention, either pre- or postoperatively, can then be referred to more intensive psychological treatment. Ideally, the duration and type of intervention could be adapted to the patient's needs and preferences.

Conclusions

Several perioperative psychological states are associated with the development of chronic post-surgical pain and long-term disability. Psychological interventions can potentially mitigate the risk of these adverse outcomes by reducing the identified psychological risk factors. Although several studies have found perioperative interventions to be effective,

Key points

- Negative psychological states and traits may increase the risk of chronic post-surgical pain.
- Perioperative psychological interventions can decrease the incidence of chronic post-surgical pain.
- Future studies should identify which interventions are most effectiveness in mitigating the risk of post-surgical pain.
- Cost-effectiveness of perioperative may be increased by specifically targeting patients at heightened risk of post-surgical pain and/or using a stepped-care approach.

questions remain as to how the interventions can be most effective, when they should be delivered and at what intensity (ie number and length of sessions). In addition, future studies should be directed at how to best select patients who should be offered an intervention. Implementation of perioperative psychological interventions in routine clinical care should be considered when more evidence around efficacy becomes available.

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Conflicts of interest

The author declares that there are no conflicts of interest.

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