Persistent Postsurgical and Posttrauma Pain

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It is estimated that as many as 50% of patients who have undergone surgery experience persistent pain long after the expected postoperative recovery period, and in 2% to 10% of these individuals, the intensity of the pain is severe (see Table 1 for incidence associated with various surgical procedures). This type of pain is common in chronic pain centers, where as many as 20% of individuals seeking help report surgery as the origin of their pain. The incidence of persistent postoperative pain varies according to the type of surgical procedure performed, but it seems that nearly every surgery has the potential to produce this complication. One study found that 18% of women suffered continued surgical site pain at one year after cesarean section delivery, the most common surgery in the world. A study of 90 women who underwent abdominal hysterectomy for noncancer conditions found that 16.7% experienced persistent postoperative pain. A prospective study reported an incidence of 15% in men after radical prostatectomy. Studies that evaluated patients after inguinal hernia repair found an incidence of 19% to as high as 30% after this procedure. A cross-sectional study (N = 736) revealed that 23% of patients who underwent cardiac surgery (coronary artery bypass graft [CABG], valve replacement, or both) experienced ongoing pain and more than half of these experienced pain of moderate to severe intensity. A cohort study of 1,348 patients after CABG found a higher prevalence of approximately 40% for the presence of chronic chest and leg pain. Even higher percentages have been reported for mastectomy (65%), thoracotomy (67%), and amputation (85%).

Pain after traumatic injury is common as well. Similar to persistent postsurgical pain, approximately 19% of individuals seeking help at chronic pain centers have posttrauma pain. A multicenter study conducted in 69 hospitals in 14 states in the United States found that 62.7% of the patients (N = 3047) reported injury-related pain at 12 months after a traumatic injury. A quarter of the patients in an earlier study (N = 397) described pain that interfered with daily activity seven years after limb-threatening lower extremity trauma; 40% reported high pain intensities.

As with other types of chronic pain, comorbidities and poor quality of life as a result of the continued pain are common with both persistent postsurgical and posttrauma pain. Many of these individuals suffer from depression and in the case of trauma, posttraumatic stress disorder. Postsurgical pain is also similar to other types of chronic pain in its resistance to treatment.

Definition and Criteria

As noted before, the incidence of persistent postsurgical pain is highly variable. This is in large part because there is no consensus on a definition for postsurgical pain. Macrae provides the following criteria: (1) pain that develops after surgery, (2) pain of at least two months’ duration, and (3) other causes of pain have been excluded. Others have defined it more simply as postoperative pain that persists for three to six months after surgery.

Etiology

Kehlet and colleagues suggest that persistent postsurgical pain is the result either of ongoing nociception and inflammation or, more commonly, neuropathic pain from surgical injury to major
peripheral nerves. Nociceptive pain results from the normal processing of noxious stimuli that is capable of damaging tissue, such as pain from a scalpel cutting the skin. Inflammation occurs normally in response to surgical tissue injury and produces a reduction in the threshold of nociceptors (free nerve endings that respond to painful stimuli) that innervate the inflamed tissue, enhancing the pain experience. Under normal circumstances, nociceptive and inflammatory pain diminish with healing. Neuropathic pain is believed to be sustained by a set of mechanisms that are driven by damage to (or dysfunction of) the peripheral or central nervous system or both. Major nerves "trespass" the surgical field of most surgical procedures, and although not solely responsible, damage to these nerves is a prerequisite for the establishment of the neuropathic component of persistent postsurgical pain. Most patients respond well to traditional treatment in the immediate postoperative period, and the pain and nerve injury from surgery resolve with healing; however, in some patients, this pain persists in the absence of any peripheral noxious stimulus.

### Predictors and Contributing Factors

Further research is needed to identify all of the predictors of postsurgical pain, but multiple factors contribute to its occurrence. Researchers note that the significant inter-individual differences in sensitivity to nociception and clinical pain suggest that genetic susceptibility may have a role. Several have found that moderate to severe preoperative or immediate postoperative pain predicted incidence. For example, severe pre-amputation pain has long been associated with a higher incidence of phantom limb pain. A two-year study of 57 patients who underwent lower extremity amputation revealed that high levels of both pre-amputation pain and acute pain after amputation predicted persistent postamputation pain. Greater analgesic requirements during the immediate postoperative period after cardiac surgery predicted persistent pain in one study. Patients with pain 48 weeks after thoracotomy were more likely to report that analgesic therapy during the immediate postoperative period was less effective than those without persistent pain.

Older patients tend to have a lower risk of developing persistent postsurgical pain than younger patients. Studies have shown that females are more likely than males to have persistent postsurgical pain. Other contributing factors include high body mass index ($\geq 25$), higher incidence of postoperative complications, and the presence of chronic pain in other sites in the body. Although further research is needed, psychological factors, such as thinking that surgical recovery will be "troublesome," have been associated with the existence of persistent postsurgical pain.

Predictors of persistent posttrauma pain differ in some ways from those of persistent postsurgical pain. The presence of pain at three months after injury was a predictive factor for both the presence and the high severity of persistent pain after major trauma. Although the presence of persistent pain varied with age, it was more common in women and in those who had untreated depression before the traumatic injury in this study. Another study found that multiple factors influenced the likelihood of persistent pain seven years after major lower extremity trauma. These included having less than a college education, low self-efficacy for return to usual major activities, a high level of alcohol consumption in the month before injury in addition to high pain intensity, high levels of sleep and rest dysfunction, and elevated levels of depression and anxiety at three months after hospital discharge. Interestingly, those who were treated with opioid analgesics during the first three months after discharge in this study had lower levels of persistent pain at seven years, underscoring the importance of early initiation of aggressive pain management approaches.

### Table 1. Incidence of Persistent Postsurgical Pain and Associated Disability

<table>
<thead>
<tr>
<th>Surgery</th>
<th>Incidence</th>
<th>Severe Disability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amputation</td>
<td>30-85%</td>
<td>5-10%</td>
</tr>
<tr>
<td>Thoracotomy</td>
<td>5-67%</td>
<td>10%</td>
</tr>
<tr>
<td>Inguinal hernia</td>
<td>10-30%</td>
<td>2-4%</td>
</tr>
<tr>
<td>Breast surgery</td>
<td>11-65%</td>
<td>5-10%</td>
</tr>
<tr>
<td>Coronary artery bypass graft</td>
<td>30-50%</td>
<td>5-10%</td>
</tr>
<tr>
<td>Cesarean section</td>
<td>10-18%</td>
<td>4%</td>
</tr>
</tbody>
</table>

Based on data from references 1, 3, 4, 9, 20.
injury is the extent of nerve damage. For example, the degree of intercostal nerve injury is thought to be the primary determinant of persistent post-thoracotomy pain. Further research is needed to evaluate the impact of the more noninvasive surgical techniques, such as video-assisted thoracic surgery; however, an early study found a lower incidence of persistent pain after thoracoscopy compared with lateral thoracotomy. Rivara et al found that 59% of the patients who experienced posttrauma pain had multiple pain sites (higher likelihood of extensive nerve damage).

Clinical Presentation

In addition to the presence of pain beyond the expected time of resolution, the clinical presentation of persistent postsurgical or posttrauma pain is primarily the patient’s report of the features characteristic of neuropathic pain, such as continuous burning, stabbing, sharp pain, and shooting pain. Many report numbness and tingling or the presence of allodynia, whereby pain occurs from a non-noxious stimulus such as touch or pressure. For individuals with allodynia, the mere weight of clothing or bed sheets on the skin can be excruciatingly painful. One study used the short-form McGill Pain Questionnaire to survey patients with persistent post-hernia pain and revealed that patients used a range of terms to describe their pain. Most of the patients (73.9%) used descriptors typical of nociceptive pain, such as “aching,” “cramping,” and “sore”; 6.5% used those typical of neuropathic pain, and 19.6% used both types. A later study by these researchers yielded similar results.

Prevention and Treatment

Strategies for preventing persistent postsurgical pain states are being investigated, but careful dissection of tissue and the use of the least invasive surgical approach possible in addition to sustained multimodal pharmacological methods that target the underlying mechanisms of neuropathic pain are recommended. Suppression of pain at the time of surgery or trauma is thought to be inadequate to prevent the occurrence; adequate and sustained afferent blockade is required in most cases. The use of nonsteroidal antiinflammatory drugs (NSAIDs) and opioids during the perioperative period is indicated for treatment of inflammatory pain. The role of anticonvulsants in the prevention of persistent postoperative pain is the subject of ongoing research. A randomized, controlled trial of patients undergoing thyroidectomy found that preoperative gabapentin was associated with a significant reduction in the incidence of persistent neuropathic pain at 6-month evaluation. An interesting study randomized 50 patients undergoing breast cancer surgery to receive placebo formulations or a preoperative and postoperative multimodal treatment plan that included oral gabapentin, a eutectic mixture of local anesthetic creams applied to the surgical area, and intraoperative irrigations of ropivacaine to the brachial plexus and adjacent intercostal spaces. Those who received the multimodal treatment had better postoperative pain control, consumed less supplemental analgesia, and had a significant reduction in persistent pain. Whereas 82% and 57% of those in the control group reported pain at three and six months, respectively, 45% and 30% of those in the treatment group reported persistent pain at three and six months. A later study found similar results in women undergoing abdominal hysterectomy.

Ketamine has also been studied for the prevention of postsurgical pain. An interesting placebo-controlled study compared preoperative gabapentin with ketamine and found that gabapentin, but not ketamine, prevented persistent pain in the first six months after abdominal hysterectomy. Timing in addition to method of analgesic administration may be important. A randomized, controlled trial of 85 patients undergoing colon resection administered various combinations of intravenous (IV) ketamine plus IV or epidural local anesthetic, clonidine, and opioid initiated preoperatively and administered intraoperatively, or initiated postoperatively. At one year, persistent pain was found in 28% of those who received IV analgesics only, 11% of those who received IV and epidural analgesia postoperatively only, and 0% of those who received epidural analgesia intraoperatively and IV and epidural analgesia postoperatively. When three analgesic methods were compared in another study, patients who received thoracic epidural bupivacaine and morphone initiated preoperatively experienced a lower incidence of persistent post-thoracotomy pain than those who received the same epidural analgesia postoperatively only or IV patient-controlled analgesia morphine.
As demonstrated in the previously discussed study, clonidine may have a role in prevention as well. A randomized, controlled study found that an intraoperative intrathecal injection of clonidine produced a lower incidence of persistent pain at six and 12 months after colonic surgery compared with those who received an intraoperative intrathecal injection of bupivacaine or placebo.

**Conclusion**

Further research is needed to gain a better understanding of persistent postsurgical and posttrauma pain. Studies are under way to better identify which surgical procedures and types of trauma carry the highest risk, which patients are most susceptible, and how this type of pain can be prevented. If persistent postsurgical or posttrauma pain is suspected, early referral to a pain specialist with access to multiple disciplines for evaluation and treatment of both the pain and common comorbidities is recommended. If present, the pain should be treated the same as other types of persistent pain. Pharmacologic approaches include anticonvulsants, antidepressants, and local anesthetics. NSAIDs and opioids may be indicated for continuous inflammatory pain.

**References**


