

Chronic Pediatric Pain

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A 16-year-old girl arrives for follow-up after undergoing placement of a Nuss Bar via a minimally invasive approach. Her postoperative pain management course included: A T6 thoracic epidural placed intraoperatively with continuous ropivacaine infusion until postoperative day two (POD). On POD 2, she was transitioned to intravenous opioids and by POD 3, her pain was well-controlled with transition to PO pain medication. She was discharged on POD 5 and discharged with a two-week supply of oxycodeone to be used PRN and instructed to take acetaminophen and ibuprofen PRN. On her two-week office visit, she was improving with pain well-controlled with PO medication. At her subsequent two-month appointment, she complained of some intermittent retrosternal pain that was enough to lead to some distress. Her mother is concerned about persistent pain after surgery. She has read that many patients have pain long after surgery and wants to know if her daughter is at risk. What will you tell her?

How Common Is Chronic Pain in Children?

Pediatric chronic pain, particularly when it develops after surgery, only recently entered the public consciousness as one of the factors contributing to the over-prescribing of opioids. The emerging understanding of the impact of pain on a young person's functional ability and quality of life reveals a physical, psychological, and social decline mirroring that of adult patients. The incidence of pediatric chronic pain is alarmingly high, with 20% of patients developing post-surgical chronic pain. As our appreciation of the multiplicity of pain presentations matures, we may reveal this to be an underestimation.

What Issue Should Be Considered Given the Preoperative Chronic Opioid Use?

Patients with chronic opioid dependence pose a unique perioperative challenge. Patients on chronic opioid therapy are at risk of suboptimal pain control due to increased opioid requirements, opioid tolerance, and iatrogenic under-dosing.

What Are the Implications of Poorly Controlled Postoperative Pain?

Patients with poorly controlled postoperative pain can have longer recovery times, increased risk of infection, unplanned readmissions, and development of chronic postsurgical pain. Additionally, poor pain control can leave a significant psychological footprint in the patient and family that can color future healthcare transactions. Whenever possible, effective treatment of these patients should include a combination of non-pharmacologic pain strategies (acupuncture, distraction, virtual reality, diaphragmatic breathing), neuraxial/regional anesthesia, multimodal analgesia, and maintenance and optimization of chronic opioid medication delivery during their hospital admission.

Would Your Discussion Be Different if You Learned that the Child Has Chronic Pain from Headaches or Abdominal Pain?

The underlying pathophysiology of pain can range from nociceptive pain or neuropathic pain to "functional pain" which is thought to be a result of an abnormal processing by both central and peripheral

components of the nervous system. The International Association for the Study of Pain (IASP) defines pain as “an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage,” and can result from a combination of any of the aforementioned sources of pain. A primary pain disorder (often called “functional pain”) is a term that is given to patient-reported pain which may or may not have an identifiable clear organic disease or to pain that is thought to have become its own separate disease or syndrome even when accompanied by a primary pathophysiology. Functional abdominal pain and chronic daily headaches are among the most commonly recognized of these pain disorders, and the perioperative clinician should pay special attention to these issues. Secondary pain disorders include pain states that clearly arise from and accompany an organic process. Examples of secondary pain disorders include polyneuropathy from type 2 diabetes mellitus and chemotherapy-induced neuropathy in blood cancers. The treatment of pediatric chronic pain disorders regardless of classification is anchored in the biopsychosocial model and necessitates an interdisciplinary or multidisciplinary care model that includes a medical, psychological, and functional evaluation. Parental education, cognitive behavioral therapy (CBT), behavior modification, improved coping, and avoidance of triggers have been shown to produce positive treatment responses in multiple pain conditions.

If the clinical environment allows for a preoperative visit and patients with known or suspected chronic pain can be identified, the clinician should obtain a pain consultation, and one preferably in conjunction with the chronic pain team. Given that chronic pain is a disease of the central nervous system which acts to alter and amplify pain messaging, especially in the context of stressful incidents, effective management of pain should also include cataloguing and addressing any mood disturbances, sleep disorders, functional state, family pain history, and stressors. Both pharmacologic and non-pharmacologic recommendations, including the importance of committing to physical therapy and biobehavioral treatment before and after surgery, should be candidly discussed with chronic pain patients and their families.

What Is Your Approach to a Chronic Pain History and Physical in the Perioperative Period?

Prompt recognition of chronic pain is the most important step in the management of chronic pain during the perioperative period. The clinician should begin this process by obtaining a focused history and physical examination that includes a detailed neurologic exam. Pain-related disturbances in sleep onset and maintenance, school functioning (school attendance, grades), physical activity (sports, physical education), mood disturbances (anxiety, depression), and social functioning should also be assessed. Additional high-yield questions are provided below:

1. Determine timing and goals of surgery
 - Is this a new or a repeat procedure?
 - Is the timing of the surgical procedure fixed or flexible?
 - Is the goal of surgery to decrease pain (important for preexisting pain)?
 - Is the goal of surgery to increase function?
 - What type of surgery is to occur?
 - Different types of surgeries result in varying levels of pain/chronic pain. Different anatomical approaches may impact the perioperative pain plan.
2. Inquire about pain. If pain is present, assess its location, radiation pattern, duration, character, intensity, exacerbation factors, and alleviating factors. If pain started as a result of an injury, it is important to learn about the mechanism of injury and any ongoing rehabilitation (“pre-hab”) efforts.
3. Inquire about previous surgeries and in particular ask about any ongoing pain issues, previous regional anesthetics, and existing nerve damage.
4. Ask about previous and current pain therapies. This includes complementary and alternative medicine therapies (CAM) (e.g., acupuncture, massage), psychological support, pharmacologic therapies.
5. A complete past medical history should be collected to identify any comorbidities that may potentially contribute to pain. Some relevant

comorbidities include mood disorders, neurodevelopmental disorders, addiction, hepatic disease, renal disease, pulmonary disease, and gastrointestinal diagnoses.

6. A family history of chronic pain, mood disorders, psychiatric disorders, and addiction should be gathered.
7. Elicit family and patient goals of care for hospitalization. Set expectations for the surgical procedure and post-operative period.

What Is Chronic Postsurgical Pain?

Chronic postsurgical pain (CPSP) is an issue that has been gaining increasing recognition due to its impact on long-term disability. Patients undergoing surgery can have ongoing pain that does not improve within the usual time it takes to recover from surgery. The definition for CPSP as established by the International Association for the Study of Pain (IASP) is as follows:

- Pain must develop after surgical procedure
- Must be at least two months in duration
- Other causes must be excluded
- The possibility of pain from a preexisting condition is excluded

CPSP is a well-documented issue in adults with up to 40% of patients complaining about pain several months after surgery. Significantly, 5% of all patients undergoing surgery report severe debilitating pain after surgery. According to the IASP, one in every ten adult surgical patients experiences CPSP, and in one of every one hundred operations, this pain is intolerable. CPSP has known substantial economic effects (functional, days off, medical burden) in adult patients, but it has not been well studied in the pediatric population. Formerly, it was thought to be a much less prevalent issue in children; however, several studies have shown that the incidence of CPSP in the pediatric population may mirror that in the adult population, and a recent meta-analysis of 12 studies and 628 participants showed an incidence of 20% across all studies.

What Are the Risk Factors for CPSP in the Pediatric Population?

While studies looking at the risk factors associated with CPSP have been conducted in the adult

population, little is known about which risk factors are significant within the pediatric population. The contributions of risk factors like gender, thoracotomy surgical subtype, breast surgery, and depression, which have been clearly delineated in the adult population, continue to be unknown in children. Recently, several studies have suggested that the presence of childhood anxiety, baseline level of pain before surgery, catastrophizing, and parental anxiety are significant risk factors for CPSP, over surgical type or pain cause. In adults, the type of surgery or the severity of a patient's disease process are thought to contribute to the severity and duration of pain after surgery. However, in the pediatric population, only the presence of preoperative pain has consistently been shown to be a risk factor for the development of CPSP.

While considering pediatric risk factors for CPSP, it is important to look at what risk factors have been identified in the adult population. Risk factors in the pre-, intra-, and postoperative phase have been more clearly identified in adults. Consistent with pediatric risk factors, the existence and severity of preoperative pain is a significant risk factor for the development of CPSP. In addition, the type of surgery tends to be important, with thoracotomy, amputation, hernia repair, and mastectomy resulting in the highest incidences of CPSP. Intraoperative factors such as longer and repeat surgeries tend to have higher rates of CPSP, and postoperative factors such as high levels of pain and adjuvant therapies such as chemoradiation lead to increased risk for CPSP. While psychosocial factors are thought to play a role in the development of CPSP, very few studies have been conducted looking at this effect in adults.

The patient is a quiet and shy-appearing girl who frequently tracks the expressions of her mother and father. Her mother talks most during the conversation and appears very concerned about the procedure. When the anesthetic risks are discussed with the patient, the patient's mother bursts into tears and the patient also begins to cry.

What Is Pain Catastrophizing?

Pain catastrophizing is described as a maladaptive cognitive response to an actual or anticipated pain stimulus. The response itself is usually psychological

or emotional in nature, and is often exaggerated in comparison to the usual response to the said pain stimulus. Pain catastrophizing is a significant issue due to the way it affects pain-related outcomes, and has been associated with increased pain sensitivity, pain severity, disability, and depression in both pain-free patients and patients with chronic pain. Significantly, pain catastrophizing has been shown to cause significant variance in patients during the postoperative period, often affecting pain severity, opioid usage, and willingness to undergo rehabilitation.

What Is Parental Catastrophizing?

While pain catastrophizing is an important issue in patient-related pain outcomes, parental catastrophizing may be a more significant contributor to pain outcomes in the pediatric population. Parental catastrophizing is, put simply, catastrophizing that is enacted by the parent in response to present or anticipated pain that the patient may experience. Catastrophizing is a maladaptive response, and can lead to potential worsening of the patient's pain. Firstly, children's thoughts and beliefs about pain are initially dictated by their interactions with parents. Different parents have differing perspectives about pain, how to react to pain, how to express pain, and how to alleviate pain, and such responses do not go unnoticed by children. High levels of parental anxiety in turn lead to high levels of child anxiety in the perioperative period. Pagé et al. showed that high levels of both parental and child anxiety lead to higher pain intensity, pain unpleasantness, and functional disability in the acute postsurgical phase. In addition, initial levels of parental catastrophizing correlated with the development of CPSP in children. Parental behavior is likely to reinforce the child's behavior and disposition towards pain.

What Is the Pediatric Fear-Avoidance Model?

The pediatric fear-avoidance model (p-FA model) for pain has become an increasingly salient explanatory model for how acute pain may transition to chronic pain. The FA model allows us to conceptualize how a patient could develop chronic pain as a result of pain-related fear. Take for example the patient who is experiencing acute back pain and

diminishes that pain with a certain avoidant behavior (sitting, lying in bed); this avoidant behavior becomes positively enforced by a reduction in pain and anxiety. While this behavior may have initially been protective, as a way to prevent further damage to an injury or surgical site, after time the avoidant behavior becomes a maladaptive response that could potentially result in improper healing to the site of injury and decreased function even after the resolution of the acute pain.

Why Is the Psychosocial Model of Pain so Important?

The development of CPSP in the pediatric population has to be understood within the context of the biopsychosocial model. Historically, surgical pain was thought to be coupled with an identifiable and organic pathophysiology, where tissue injury or organic disease are prerequisite to the pain experience. However, we know that chronic pain is decoupled from tissue injury and can exist in the absence of nociceptive stimuli. It is easy to overlook this fundamental point when faced with a patient whose acute postoperative pain course appears to deviate from normal or when a patient's chronic pain state and attendant disability cannot be explained by a negative extensive medical workup. The most current definition of pain states that the pain experience is "an unpleasant sensory *and* emotional experience," and one that should never be purely segregated as medical vs. psychological or organic vs. non-organic or "supratentorial". Anxiety, depression, and catastrophizing are significant risk factors for CPSP in adults, though no definitive data on the incidence of CPSP in patients with anxiety or catastrophizing have been clearly delineated. Theunissen et al. showed that in a meta-analysis of 29 studies, there was a statistically significant association between anxiety or pain catastrophizing and CPSP in 67% of studies involving musculoskeletal surgery and 36% in all other types of surgery.

What Role Does Regional Anesthesia Play in CPSP?

Regional and neuraxial techniques have been implicated in improving pain in the immediate post-operative period and for some surgeries, can improve

long-term surgical recovery. Both techniques involve the use of either local anesthetics or other adjunct analgesics perineurally to blunt the transmission, perception, and effects of pain (tachycardia, hypertension, nausea, infection, stress response, healing, etc.). Not only do patients report more comfort after both neuraxial and regional techniques, but several key benefits of these analgesic modalities have been well documented including antiinflammatory effects, faster recovery of bowel function, decreased systemic opioid use, and improved participation in physical therapy. The benefits of neuraxial analgesia are especially apparent in procedures that cause significant postoperative pain.

What Types of Chronic Medication Should the Patient Continue?

Pediatric patients may be on chronic opioid therapy (COT), antidepressants, or anticonvulsant medications. In terms of nonopioid adjunct medication such as NSAIDS or anticonvulsant medications like gabapentin, there are no formal pediatric guidelines on their use during the perioperative phase. However, because many of these drugs have been used in adult “multimodal analgesia” protocols, it is generally recommended that such medications are continued into the perioperative phase. Discontinuation or selective continuation of NSAIDS should be a mutual discussion with surgical colleagues given their impact on platelet function and potential threat to renal function.

Continuation of all chronic opioids is advised and higher perioperative opioid requirement in the perioperative phase should be anticipated. In a study conducted in 1995, Rapp et al. found that patients who were on chronic opioid therapy (with an average daily morphine equivalent of 13 mg IV morphine) required a three-fold greater dosage of opioids in the postoperative phase with worse pain scores than their nonchronic opioid counterparts.

There are several important considerations to optimize patients on chronic opioid therapy for the perioperative period. Management of opioids can be challenging because the patient’s outpatient baseline chronic opioid requirement must be met on the inpatient setting on top of titrating opioids for acute and

incident pain without increasing the baseline chronic, non-operative regimen. No data is currently available looking at the predicted postoperative opioid requirement based on preoperative daily opioid requirements, so the clinician must be vigilant about dosing during the perioperative period.

Which Adjuncts Should Be Considered Intraoperatively?

Intraoperative adjuncts such as ketamine, NSAIDs, α_2 -agonists, methadone, acetaminophen, ketorolac, and anticonvulsive agents have been used successfully to reduce opioid requirement both in the intraoperative and postoperative setting. The use of multimodal analgesia can allow the anesthesiologist to treat pain at receptors other than just opioid receptors, allowing for broader coverage of pain. In addition, regional anesthesia, neuraxial anesthesia, and even wound infiltration and lavage have been used to great effect in not only preventing the sensation of pain, but also the autonomic and inflammatory consequences of tissue damage, thereby preventing additional pain in the postoperative setting.

How to Prevent CPSP?

There is limited data on which modalities of anesthesia or chronic medication management prevent the development of CPSP. Overall, early and aggressive analgesic treatment after surgery has the potential to reduce the incidence of CPSP, but no specific pharmacologic agent or regional/neuraxial technique has yet been identified as a preventative therapy for the development of CPSP. Ketamine has shown some benefit in potentially preventing the development of CPSP, but no study has proven this effect. Gabapentin and pregabalin have been shown to be able to reduce the incidence of CPSP. A large systematic review showed that perioperative gabapentin decreased the incidence of chronic pain more than 2 months after surgery, and pregabalin similarly had a large decrease in the development of CPSP as well as a greater improvement in postsurgical patient function. Greater, more high-powered research will be required to properly determine how to best prevent the development of CPSP.

Suggested Reading

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