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Authors
Schreiber, Kristin L
Belfer, Inna
Miaskowski, Christine
et al.

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AAAPT Diagnostic Criteria for Acute Pain Following Breast Surgery

Kristin L. Schreiber[*], **Inna Belfer**[†], **Christine Miaskowski**[‡], **Mark Schumacher**[§], **Brett R. Stacey**[¶], **Thomas Van De Ven**[‖]

[*]Department of Anesthesiology, Perioperative and Pain Medicine, Brigham and Women's Hospital, Harvard Medical School, Boston, Massachusetts [†]National Center for Complementary and Integrative Health, NIH, Bethesda, Maryland [‡]Department of Physiological Nursing, University of California San Francisco, San Francisco, California [§]Department of Anesthesia and Perioperative Care, Division of Pain Medicine, University of California, San Francisco, San Francisco, California [¶]Department of Anesthesiology and Pain Medicine, University of Washington, Seattle, Washington [‖]Duke University Department of Anesthesiology, Division of Pain Medicine, Durham, North Carolina

Abstract

Acute pain after breast surgery decreases the quality of life of cancer survivors. Previous studies using a variety of definitions and methods report prevalence rates between 10% and 80%, which suggests the need for a comprehensive framework that can be used to guide assessment of acute pain and pain-related outcomes after breast surgery. A multidisciplinary task force with clinical and research expertise performed a focused review and synthesis and applied the 5 dimensional framework of the AAAPT (Analgesic, Anesthetic, and Addiction Clinical Trial Translations, Innovations, Opportunities, and Networks [ACTTION], American Academy of Pain Medicine [AAPM], American Pain Society [APS] Pain Taxonomy) to acute pain after breast surgery. Application of the AAAPT taxonomy yielded the following: 1) Core Criteria: Location, timing, severity, and impact of breast surgery pain were defined; 2) Common Features: Character and expected trajectories were established in relevant surgical subgroups, and common pain assessment tools for acute breast surgery pain identified; 3) Modulating Factors: Biological, psychological, and social factors that modulate interindividual variability were delineated; 4) Impact/Functional Consequences: Domains of impact were outlined and defined; 5) Neurobiologic Mechanisms: Putative mechanisms were specified ranging from nerve injury, inflammation, peripheral and central sensitization, to affective and social processing of pain.

Perspective: The AAAPT provides a framework to define and guide improved assessment of acute pain after breast surgery, which will enhance generalizability of results across studies and facilitate meta-analyses and studies of interindividual variation, and underlying mechanism. It will

Address reprint requests to Kristin L. Schreiber, MD, PhD, Brigham and Women's Hospital, 75 Francis St, Boston, MA 02115. klschreiber@bwh.harvard.edu.

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allow researchers and clinicians to better compare between treatments, across institutions, and with other types of acute pain.

Keywords

Acute pain; mastectomy; postsurgical pain; psychosocial; taxonomy; pain assessment

Is Acute Pain After Breast Surgery Really a Problem?

Previously identified risk factors for greater *acute* postsurgical pain across a variety of surgical procedures include younger age, female gender, preoperative pain, surgical extent, and higher anxiety.[38,52,94] Therefore, more than 200,000 women who are diagnosed with breast cancer (BC) each year in the United States, most of whom will have at least one surgical procedure,[32] may be at higher risk of pain generally, and deserve more focused research efforts. Despite increasing interest and investigations into treating both acute[70] and chronic[56] postsurgical pain, it remains a significant problem for many individuals.[1] Roughly 28% of patients experience moderate to severe acute pain following surgery,[38] leading to increased exposure to opioids months after surgery.[17] Perhaps most concerning is the problem of persistent (or chronic) postsurgical pain (ie, pain lasting >3 months after surgery), which occurs in 20% to 30% of patients undergoing mastectomy or lumpectomy.[11,34,87] Since emergence of persistent pain is strongly associated with greater acute postoperative pain,[6,66,67] the perioperative period may be a critical time for surveillance and potential intervention.

Who Experiences Acute Pain After Breast Surgery?

The most consistent surgical variables associated with postoperative pain include axillary dissection and reconstruction,[4,5,13,35,61,85,96,97] with one study showing an 3- to 4-fold increased risk of moderate-severe pain and opioid use at 2 weeks after surgery.[88] Although the perioperative management of acute pain after breast surgery has relied on opioids as the standard of care, opioid-sparing approaches such as regional anesthesia, (paravertebral, proximal intercostal, and pectoral and serratus anterior plane blocks) may reduce pain and decrease opioid use.[7,100]

However, even given relatively standard surgery and anesthetic approaches, interindividual variability exists in patients' experience of pain. Psychosocial characteristics such as enhanced negative affect, anxiety, depression, sleep disturbance, and maladaptive coping (catastrophizing) are associated with higher levels of acute pain after mastectomy,[53,55,61,73,81] as well as with the transition to a more persistent pain state, making them important considerations in breast surgery patients.[27,86] More generally, current abuse of ethanol or opioids may be an important risk factor for more severe postsurgical pain and prolonged opioid use.[17]

What Underlies Acute Postmastectomy Pain? Hints From the Preclinical Literature

Preclinical research has focused on understanding the mechanisms that underlie postsurgical pain.[12] As a result of damage to and microdevascularization of tissues, a cascade of inflammatory cells, growth factors, and other mediators are released into the surgical site in the hours, days, and even weeks after surgery. These mediators change the sensitivity of nociceptors.[8,30] Changes in gene expression in the dorsal root ganglion (DRG), as well as in neurons and glia in the dorsal horn of the spinal cord, also occur in response to tissue injury like that occurring routinely in surgical procedures.[39,101] In addition, exposure to high doses of opioids in the perioperative period may induce acute opioid tolerance and possible opioid-induced hyperalgesia, and alter the balance of descending inhibition and facilitation from higher brain centers.[62]

Why do We Need a Taxonomy?

The lack of a consistent classification system (taxonomy) for acute pain leads to several important problems that limit our ability to study and treat it more effectively. First, we cannot determine the *degree* to which acute postsurgical pain is a problem (ie, what is the incidence and scope of the problem). Second, meaningful comparisons and meta-analyses cannot be performed across studies carried out in different health care systems or across surgical types. Third, postsurgical pain cannot be *contrasted with* other types of acute pain (eg, trauma, sickle cell, neuropathic pain). Fourth, trials to develop and evaluate new preventive therapies are less definitive without a taxonomy. For example, while novel regional anesthetic approaches have shown promise in some centers and in some patients, results are often inconsistent, possibly owing to differences in how pain outcomes are defined, surgical procedures, or patient classifications, as well as to individual differences in response to treatment. Having a common language and taxonomy, agreement on valid and reliable pain measures, and a list of important sources of interindividual variation that warrant further evaluation will facilitate meaningful comparison across studies, and more definitive conclusions about the value and personalized targeting of preventive therapies.

In order to accomplish a coordinated creation of a common language and taxonomy, the AAAPT (Analgesic, Anesthetic, and Addiction Clinical Trial Translations, Innovations, Opportunities, and Networks [ACTTION]-American Pain Society [APS]-American Academy of Pain Medicine [AAPM] Acute Pain Taxonomy) effort was begun in 2016. The resulting AAAPT is a multidimensional acute pain classification system.[57] Identified sub-categories of acute pain included acute pain after breast surgery, to which this multidimensional classification system was applied.

Working Group Methods

A working group (WG) of 6 individuals with expertise in research and clinical management of acute pain after breast surgery met in Washington, D.C, in November 2017. This meeting was jointly sponsored by the ACTTION, AAPM, and the APS. The WG was formed to specifically address issues around the assessment, study, and treatment of pain following

breast surgery. Before the meeting, WG members were provided with templates and background articles. Each member of the WG conducted her/his focused narrative literature review, with special attention to their particular area of expertise (ie, preclinical research, regional anesthesia, perioperative care, postoperative care, biopsychosocial modulators of pain). The WG discussed topical areas of importance through conference calls and e-mail exchanges and a consensus was reached. At the meeting, WG members summarized data and discussed their application with respect to the 5 AAAPT dimensions for acute pain: 1) core criteria, 2) common features, 3) modulating factors, 4) impact/functional consequences, and 5) neurobiologic mechanisms (Table 1). An initial presentation of findings was made to other acute pain WGs to align definitions and categories among the dimensions and across acute pain types. Feedback regarding alignment with other types of acute pain conditions was applied based on the other WGs' presentations. Knowledge gaps were identified and strategies to translate findings into research and clinical practice were formulated.

Dimensions

Using the AAAPT framework for acute pain, the 5 dimensions for acute pain after breast surgery were defined (Table 1).

Dimension 1: Core Criteria

The WG formulated the following definition of acute pain after breast surgery:

> Pain in patients during the time of normal healing after a breast surgery.

This short definition is expanded to 4 simple diagnostic criteria (Table 2), which include the proximity to the surgical event, the presence of pain, in the surgical area, during a timeframe consistent with a normal healing process (2 weeks to as long as 3 months).

Surgical breast procedures, primarily those surgeries done for cancer, include partial mastectomy (lumpectomy), total mastectomy, radical mastectomy, ± axillary procedures, and ± reconstruction procedures (Fig 1). By definition, acute pain is distinguished from more persistent pain by the fact that it does NOT extend beyond the expected time of healing (approximately 2–3 weeks to as long as 3 months). However, it should be noted that the time window for acute (vs chronic) pain may vary considerably depending on the degree of tissue damage, occurrence of postsurgical complications, and other modulating factors.

Dimension 2: Common Features

Surgical Type—Breast surgery includes a variety of procedures, with frequent evidence-based updates of recommendations for specific surgeries (eg, lumpectomy vs total mastectomy vs modified radical mastectomy), as well as ongoing advances in surgical reconstructive techniques (implant vs autologous flap) (Fig 1). Depending on the indication and approach to management, multiple surgeries may be required, which are separated in time and constitute repeated instances of acute pain. Furthermore, because surgical techniques are evolving, older studies with less frequently used approaches (radical mastectomy) are of uncertain relevance. Breast reconstruction has become more standard and more frequently combined with the initial surgery for BC, often with 2 surgical teams

working together. Although much of the previous literature regarding surgical risk factors has focused on an evaluation of *chronic* pain following BC surgery, some information is available on surgical characteristics that are associated with greater acute postoperative breast pain.

1. *Axillary dissection, with and without preservation of the intercostal brachial nerve.* Axillary surgery (lymph node dissection or single node biopsy) is associated with higher levels of acute pain.[88] Evidence suggests that more sensory deficit is associated with increased pain. However, it is not clear if a specific axillary approach is consistently associated with increased pain.[4,5,13] Of note, in a large study of patients who underwent breast reconstruction, neither sentinel node biopsy nor axillary dissection was associated with a significant increase in postoperative pain.[61]

2. *Breast reconstruction.* Numerous techniques are used to reconstruct the breast, from creating flaps from autologous tissue to the placement of a prosthesis. While some procedures are staged, others are done at the time of the mastectomy. The source of the material (eg, autologous muscle/fat from remote or local site such as a transverse rectus abdominis myocutaneous (TRAM) flap, implant), the location of the reconstruction (eg, under the pectoralis), treatment of the flap (muscle, vasculature, fascia), and the associated treatment of the nipple and skin are important characteristics that can influence the severity of acute pain. In some studies that examined implants versus autologous tissue flaps, implants were associated with more acute pain than autologous techniques. Specifically, deep inferior epigastric perforator flap (DIEP), superficial inferior epigastric perforator flap (SIEA), and pedicle transverse rectus abdominis musculocutaneous flap (PTRAM) were associated with less pain at one week compared to tissue expanders (TE) and implants.[61,36] Avoiding the placement of an implant below the pectoralis appears to be associated with less pain.[104] Use of a TE as an intermediate step to make space for implants is common (69% of 2667 patients in one study) and necessitates a 2-stage procedure.[61] In several studies, the use of tissue expanders was associated with increased pain.[35,61,85,97] Of note, larger volume tissue expanders were associated with higher opioid use in the postoperative period.[35]

3. *Surgical extent.* In general, the more extensive the surgery, the more severe the postoperative pain.[88] Bilateral procedures are more painful than unilateral procedures and are associated with lower levels of physical well-being in the week following surgery.[36,61] This is an important consideration with regards to the choice for reconstruction, which invariable involves a greater extent of surgery, and often multiple surgeries.

4. *Surgical drains.* An increased number of drains is associated with higher pain scores and a longer hospital stay.[84] The impact of newer techniques that minimize the use of drains on acute postsurgical pain warrants investigation.

Pain Measures—Several measures have been used to assess acute pain after breast surgery, including: a simple 0–10 numerical rating scale (NRS; with 0 = “no pain” and 10 = “the worst possible pain”), which is commonly used in clinical practice; composite scores, such as the breast cancer pain questionnaire[34] that take into account several dimensions of the pain experience (eg, severity, frequency, location); pain at rest (spontaneous) versus with movement (evoked); all pain scores averaged over a defined period of time; and pain trajectory (resolving vs not) (Table 3). Many studies use multiple measures, most commonly an assessment of pain severity and a measure of analgesic utilization, which obviously can be interrelated and potentially confounded. One important conclusion of the WG regarding the assessment or measurement of pain was that a comprehensive approach to the assessment of pain is optimal (eg, cognitive, emotional, functional impact, opioid analgesic use) and comparisons between measures is important to future research. From a clinical standpoint, understanding the severity, timing, and impact of acute pain may facilitate matching of an analgesic approach to a specific mechanism, and allow for early detection of a transition from acute to chronic pain. Additionally, a careful examination of interindividual differences in the trajectories of acute pain and characteristics associated with postbreast surgical pain between 2 weeks and 3 months (depending on the procedure) is critical to determine risk factors and to develop more effective preventive interventions. From a research perspective, more comprehensive assessments will allow for comparisons across studies and different types of acute pain, as well as improve generalizability of findings across interventional studies.

Dimension 3: Modulating Factors

While the surgical technique may impact acute pain, interindividual differences in pain are also evident within the same surgical procedure.[33] The biopsychosocial model of pain[37] outlines the contribution of pain modulation from several dimensions: 1) *bio*logical differences between procedures or individuals (including genetics); 2) *psycho*logical reactions to and processing of injury and pain; and 3) *social* contexts and factors that relate to the procedure and the pain associated with it (Table 4).

Biological: Biological factors related to the surgery include the surgical extent (how much and what type of tissue is damaged), location (how highly innervated are the areas involved), and postsurgical complications (hematoma, seroma, infection, which may be associated with increased inflammation). Differences in genetic risk may cause variations in responses to a given injury, pre-disposing some patients to more severe acute pain and/or more chronic pain.[54] Anesthetic and analgesic treatments may modify the expression of genes, proteins, and signaling cascades in important ways. For example, volatile anesthetics may sensitize peripheral sensory neurons to noxious stimuli,[29] potentially leading to epigenetic changes such as increased DNA methylation that modifies gene expression in the skin, muscle, and sensory ganglia.[90,92] Regional anesthetic techniques including paravertebral block, proximal intercostal block, and pectoral and serratus plane blocks (PECS) may decrease acute pain after breast surgery[100] and also reduce opioid use in the acute postoperative period.[7,100] There is also evidence that the efficacy of opioids[14–16] and regional anesthestics[105] may also vary among individuals.

Pre-existing pain is the most consistently reported risk factor for more severe acute pain after breast surgery. This consistent relationship between chronic and acute pain may reflect a biological state of generally heightened pain sensitivity which occurs in some individuals, and which can be assessed using quantitative sensory testing (QST).[46,99] The predictive power of preoperative QST is variable and dependent on the testing modality used.[82,83,88] In particular, temporal summation of pain (TSP) is associated with more severe acute pain after surgery.[2,74,88,98] Similarly, younger age is associated with greater pain, seemingly independent of the stage of the BC and more extensive surgical procedures. While usually separated from the time of surgery, chemotherapy, and radiation therapy may activate biologic processes that cause new episodes of acute pain.

Psychological: Pain after breast surgery is influenced by psychological traits and factors, including emotional distress,[49,69] preoperative levels of acute and trait anxiety or depression (assessed with self-report and clinician-rated measures) at the preoperative assessment,[95] pain catastrophizing,[3,11,28] sleep disturbance (including the night after surgery[43]), coping strategies,[80] and expectations.[68] Psychological factors such as anxiety constitute an independent source of risk for pain at 2 days,[77] 3 months,[63] and even later[93] after surgery. Conversely, increased psychological "robustness," a composite variable representing positive affect and dispositional optimism, was associated with decreased acute pain at rest and movement after surgery for BC.[13] Importantly, psychological predictors of acute pain after breast surgery may differ in patients with and without pre-existing chronic pain. For example, in one study of patients with pre-existing pain, higher presurgical Pain Catastrophizing Scale scores were associated with higher levels of postmastectomy pain, while this relationship was not seen amongst those without preexisting pain.[82] Higher levels of preoperative anxiety and depression (measured with State-Trait Anxiety Inventory and the Beck Depression Inventory, and PROMIS short forms) were also associated with higher levels of postmastectomy pain and analgesic requirements and increased functional impairment after surgery.[49,53,75,81,88] Along with anxiety and depression, negative body image was associated with more severe acute pain.[10] Pre-existing ethanol or opioid abuse is also associated with more severe postsurgical pain and prolonged opioid use.[17]

In addition to these psychological factors, the BC diagnosis itself can have a profound influence on a woman's physical, psychological, social, and spiritual well-being. Anxiety, depression, anger, fatigue, and fear of recurrence are common responses to a diagnosis of BC and its treatment, which may impact a patient's pain experience. On the other hand, protective factors like resilience and positive affect may decrease acute pain after breast surgery.

Social: Less education and lower social economic status (SES) may impact access to care. While not as stigmatizing and isolating as it once was, a cancer diagnosis may worsen patients' pain and suffering. Social isolation, in the context of a BC diagnosis, is associated with higher mortality.[60] While less well studied, certain aspects of social functioning appear to impact the experience of pain. Several studies suggest that a more insecure attachment style is associated with greater distress,[19] lower self-efficacy to decrease pain,[65] greater pain catastrophizing,[59] more disability due to pain,[23] and greater pain sensitivity.[64] Naturally

occurring social networks do seem to be protective[40] and interventions to increase social connection have had some success in decreasing pain severity.[40]

Psychological and social influences may interact in important ways to affect patients' pain experiences. In several studies, women with higher attachment anxiety exhibited hypervigilance toward medical diagnoses and pain, expressed greater negative thoughts and feelings about pain (ie, pain-catastrophizing),[19,59,65] and at the same time had more severe or exaggerated pain-related behaviors,[59] possibly to acquire attention and social support. In addition, these individuals tended to seek more support from healthcare providers.[20] Other social issues, including societal impact on body image and sexuality, may modulate pain. This reaction is varied amongst individuals, more likely to be relevant in the longer term, and far from straightforward.

Dimension 4: Impact/Functional Consequences

Acute pain after breast surgery serves an important function: namely, the protection of healing tissue. In this context, pain's "functional impact" can be viewed both positively and negatively. While acute pain is most commonly measured as pain severity, its impact and consequences also depend on its frequency, as well its effect on normal movement and activity (see Table 3). Importantly, any assessment of functional impact should take into consideration the timing of normal healing. Pain beyond this time may be considered as having outlasted its protective function. Sensory disturbances in the surgical area, most commonly numbness, as well as allodynia and spontaneous symptoms of neuropathic pain such as shooting or tingling, may impact normal function.

Psychological and other factors may modulate pain (see Dimension 3). However, the reciprocal is true: acute pain may have a negative impact on physical, emotional, and cognitive function. Pain, especially when more severe or prolonged, may lead to higher levels of anxiety, depression, and sleep disturbance. Combining various pain characteristics (severity, frequency, number of body areas)[34] into an overall pain burden score may allow for a better estimation of the overall impact of pain.[11,88] Another aspect that warrants further evaluation is identifying factors that predict continued use of opioids in the later post-operative period,[88] which may be associated with increased later risk of misuse and addiction. In addition, the extent to which pain interferes with patients' ability to interact with others in work and social situations is an important part of pain impact.

Dimension 5: Putative Pain Mechanisms

Understanding the mechanistic pathways that contribute to postsurgical breast pain may help guide clinicians in a rational, multimodal approach to analgesia that will dampen sources of sensitization and prevent the transition to chronic pain. Surgery on the breast may involve a number of tissue types, including skin, breast, adipose, connective, vascular structures, nerve, muscle, and even bone. Depending on the surgical subtype, different subsets of these tissues may be involved (Fig 2). Nerve injury, particularly in the case of axillary clearance, appears to be an important mechanistic contributor, with a positive correlation observed between sensory disturbance and pain severity.[5] The intercostobrachial nerve (ICBN) is the most common larger nerve injured, although smaller nerve branches from the intercostal

nerves may be injured in the course of surgery. This nerve injury is implicated in both persistent pain after breast surgery and permanent loss of sensory function in the region supplied.[44,78,89,104] In preclinical models, damaged nerves begin to spontaneously and repetitively fire without the presence of distal sensory input within the first hours to days after injury.[24,91] Tissue damage from surgical manipulation and the associated healing response leads to release of mediators including prostaglandins, bradykinins, cytokines (IL-1B and TNF), hydrogen ions, bacterial peptides, and miR-NAs,[30] many of which activate nociceptors directly and/or enhance sensitivity. Release of substance P and CGRP act to increase the epithelial permeability of local capillaries, allowing movement of immune cells into the area of tissue injury (ie neurogenic inflammation). These newly arrived neutrophils, macrophages, and T-cells release more inflammatory mediators that sustain nociceptor sensitization.[39,47,51] Similarly, release of mediators from local glial cells in DRG, [50,103] provides an inflammatory and signaling environment to create and maintain peripheral sensitization. Moreover, peripheral signaling may help initiate a similar activation of spinal microglia and astrocytes.[41,50] These processes contribute to the central inflammatory and signaling events underlying central sensitization and maintenance of pain in the days to weeks after a surgical injury.[48]

Psychological modifiers (eg, depression, anxiety) likely interact with functional connectivity in pain-relevant higher brain centers that could magnify incoming nociceptive signals. In addition, stress-related hormones may increase and impact inflammatory processes in the periphery. While the mechanisms of social influence on pain are more speculative, they likely involve supratentorial pain processing. In addition, emerging evidence suggests that oxytocin, which is released by social interaction, and is decreased in chronic pain patients, may inhibit nociceptive processing,[79] including after surgery.[31]

Discussion

Implications for Perioperative Care

Because no standard of care for the management of acute pain following breast surgery exists, practice appears to be driven by the location of care, type of institution, and/or extent of operation. Historically, opioids were the foundation of perioperative analgesia. However, because of the opioid crisis, the use of an opioid-free anesthetic protocol[21,76] is increasingly a goal. Enhanced Recovery After Surgery (ERAS) programs are popularizing the standard administration of multimodal analgesia to all patients. Multiple studies have suggested an analgesic benefit to gabapentinoids up to 48 hours after surgery,[25,42,58] while studies of infiltration with local anesthetics or the use “sustained release” formulations of local anesthetics, NSAIDS, ketamine, or systemic lidocaine are less abundant or conclusive.[18] It is clear that regional interventions such as thoracic epidural analgesia provide a significant reduction in acute postoperative pain in the initial 48 hours postmastectomy, although this is rarely practiced due to the interference that epidural placement imposes on timely discharge from the hospital.[22,26] On the other hand, paravertebral nerve blocks can be used to improve post-operative pain for up to 72 hours with a reduction in opioid consumption, and does not require the placement of a catheter for continuous infusion (ie, single shot blocks).[71,72,102] Newer interfascial plane blocks, such as “Pecs-1 and Pecs-2”, show promise for reducing

postmastectomy acute pain.[9] While efficacious, PECS-1 alone may be less effective than the paravertebral approach.[45]

The ideal management of acute pain after breast surgery includes the following considerations: 1) How best to balance the goals of decreasing opioid consumption and length of stay, while insuring adequate analgesia, 2) How to account for interindividual differences and treat patients according to their individual needs (personalized medicine) in the context of a “one size fits all” ERAS-based approach, and 3) How to evaluate novel therapies for their independent efficacy in the context of variability in multimodal approaches (varying by institution or surgeon), variable and changing surgical approaches, and a diverse patient population. A summary of considerations for acute pain management by surgical type, applying the AAAPT taxonomy, is forwarded in Table 5.

Conclusions/Recommendations

Adoption of this systematic approach to classifying acute pain following breast surgery will allow for more precise and meaningful assessment and result in more rational and personalized treatment of patients having surgery for BC. Since these patients are cared for in different settings, countries, and health systems, it is important to use a common taxonomy to report study findings. This approach will allow study findings to be generalized and adapted, more robust conclusions reached, improvements in care realized, and transition to persistent pain prevented. While commonalities exist between acute pain after breast surgery and other types of postsurgical pain, unique attributes, related to its occurrence primarily in women and in the context of cancer and survivorship, warrant unique consideration. Unlike other types of acute pain (eg, sickle crisis, accidental injury), it does not require a formal diagnostic test. Luckily, it also occurs in a controlled, scheduled setting, with ample time for preoperative assessment and identification of high risk patients, who may benefit from preventive perioperative management.

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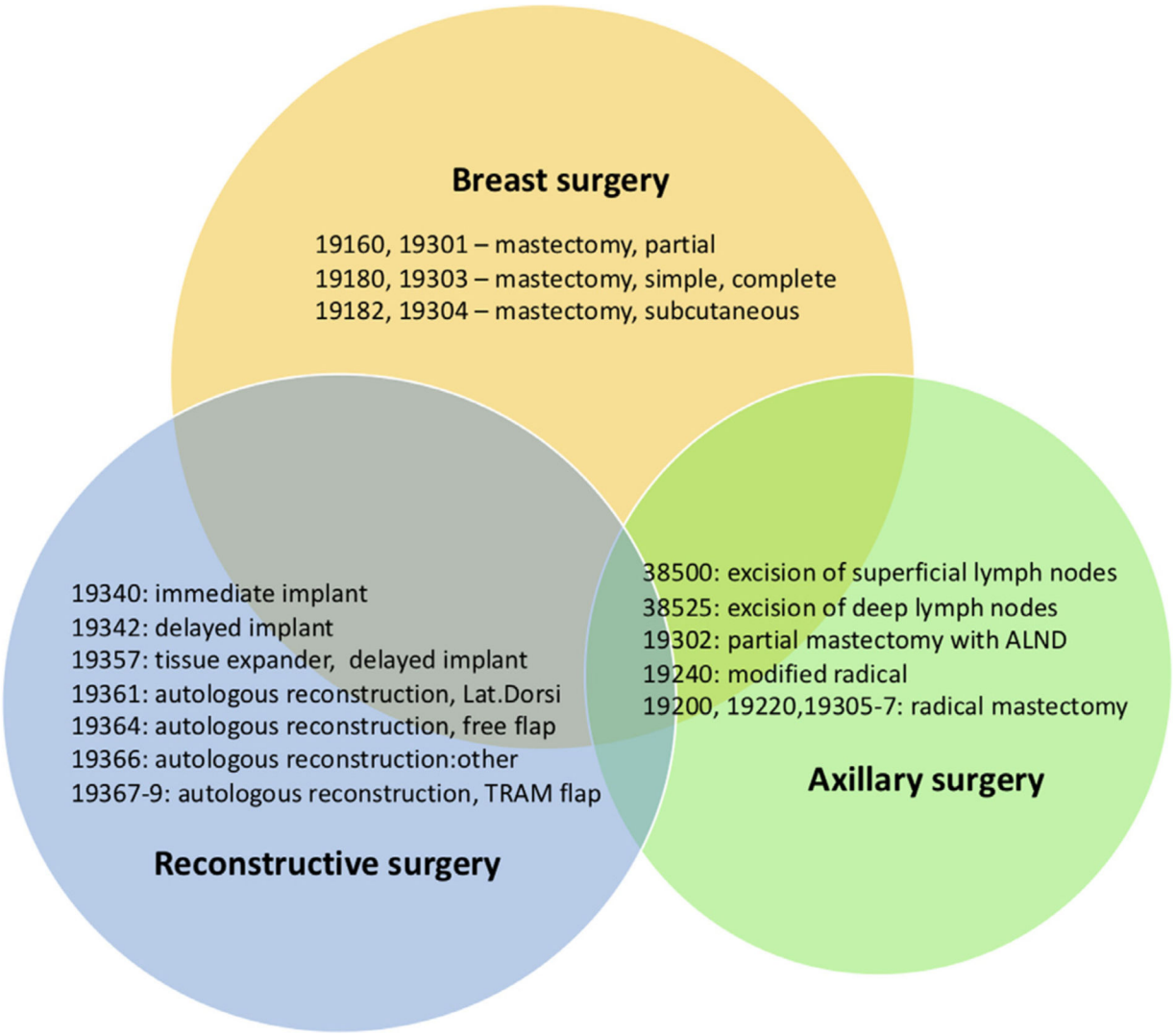

Figure 1.

Surgical subtypes and current procedural terminology (CPT) codes. Breast surgery may include several aspects, including the operation on the breast itself, procedure in the axillary to gather diagnostic tissue from nodes, and reconstruction of the breast using a variety of techniques. Listed are several of the common procedural codes related to these aspects of the surgical procedure, and a representation of how they may overlap.

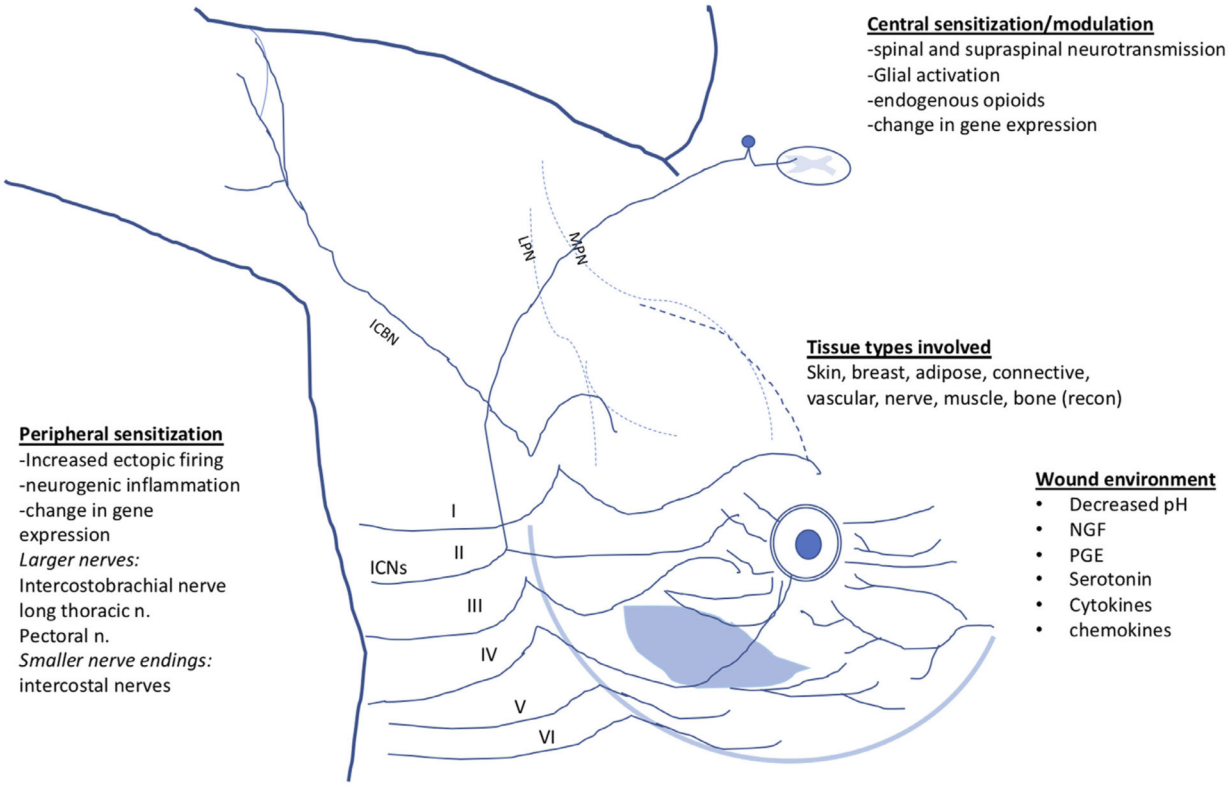

Figure 2.

Proposed mechanisms of acute pain after breast surgery. Several putative mechanisms, involving a wide variety of tissues types within the surgical area, as well as along the pain transduction pathway, may contribute to acute pain after breast surgery. ICBN, intercostobrachial nerve; ICNs I-VI, intercostal nerves 1–6; LPN, lateral pectoral nerve; MPN, medial pectoral nerve.

Table 1.

Dimensions of Acute Pain After Breast Cancer Surgery

Dimension	Description	Unique Considerations
Core criteria	*Who?*	Linked to surgical event; identifiable in advance (Table 2)
Common features	*What?*	Surgical and anesthetic technique (Fig 1, Table 5)
Modifying factors	*Why variable?*	Biopsychosocial contributors (Table 4)
Functional impact	*So what?*	Impact and links (Table 3)
Putative mechanisms	*How?*	Rational targets for prevention (Fig 2)

Table 2.

Core Criteria for Acute Pain After Breast Surgery

Core (Diagnostic) Criteria:	
1	The patient has undergone breast, lymph node, or breast-related reconstructive surgery.
2	Pain of some severity (>0/10) is present
3	The pain is primarily in the area of the surgery (typically breast, axilla, upper arm, chest, or flap site for autologous reconstruction)
4	Onset of the pain is immediately following surgery and duration extends to the point of normal healing (2 weeks to as long as 3 months).

Table 3.

Measurement of Acute Pain After Breast Surgery

Pain Characteristic	Example of Measures	Example References
Pain at rest (spontaneous)	Numerical rating scale (NRS)	Majority of studies
Pain with movement (evoked)	Numerical rating scale (NRS) with movement, time to mobilization	Kim, 2011[58]
Averaged over time or across specific pain characteristics (by patient or investigator)	Brief Pain Inventory, McGill Pain Questionnaire	Kulkarni AR, 2017[61]
Trajectory (resolving, increasing, fluctuating, constant)	Multiple NRS	
	Pain diaries	Tighe et al, 2015[94]
Location	Map, checklist, separate questions and pain rating scales per body area	Gartner R, 2009[34]
Burden/functional impact	Pain burden index cognitive/emotional impact	Belfer I, 2013[11]
		Schreiber KL, 2018[88]
Need for analgesia	Morphine equivalents in perioperative period; continued opioid use at home	Abdallah FW, 2017[1]
		Schreiber KL, 2018[88]

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Table 4.

Modulating Factors Associated with Acute Pain Following Breast Surgery

Biological	Psychological	Social
Surgical extent and location	Distress/anxiety	Education
Surgical complications (hematoma, seroma, infection)	Catastrophizing	Socioeconomic status
Anesthetic/analgesic treatment	Depression	Context (cancer)
Chemotherapy	Sleep disturbance	Uncertainty about care
Radiation	Coping behaviors	Access to care
Previous surgery	Expectations	Social connectedness vs isolation
Preexisting pain	Positive/negative affect	Reconstruction availability
Exercise		Group/team building
Body mass index	Body image	
Age	Sexuality	
Genetics		
General pain sensitivity (Quantitative Sensory Testing)		

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Table 5.

Common Features and Treatments of Acute Pain by Surgical Subtype

Surgery	Location	Severity	Duration	Character	Treatment implications
Breast conserving / Partial mastectomy ± sentinel node	Breast ± axilla	Mild-moderate	1–5 days	Inflammatory	Intraoperative sedation or GA; day surgery
				Nociceptive	
				Less NP	RA usually not used
Mastectomy (unilateral or bilateral) ± sentinel node	Breast ± axilla	Mild-severe	1–10 days	Inflammatory	Usually GA
				Nociceptive	RA
				Less NP	Adjuvant analgesics
Mastectomy with axillary dissection/clearance	Breast	Moderate-severe	3–14 days	Inflammatory	GA
	Axilla			Nociceptive	RA
	Arm			NP	Adjuvant analgesics
Mastectomy with reconstruction: Tissue expander	Breast	Moderate-severe	5–15 days	Inflammatory	GA
	Chest wall			Nociceptive	RA
	Muscle				Adjuvant analgesics
Mastectomy with reconstruction: Flap reconstruction	Breast	Moderate-severe	5–21 days	Inflammatory	GA
	Sternum			Nociceptive	RA
	Abdomen				Adjuvant analgesics
	Back				

GA, general anesthesia; RA, regional anesthesia; LA, local anesthetic; NP, neuropathic.