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Perioperative analgesia outcomes and strategies

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Despite an appreciation for many unwanted physiological effects from inadequate pain postoperative relief, moderate to severe postoperative pain remains commonplace. Though treatment options have evolved in recent years, including improvement in medications, multimodal regimens, and regional anesthetic techniques, including ultrasound and continuous catheters, outcomes data indicate that many of these strategies are associated with varying degrees of morbidity and mortality. This review focuses on the importance of effective postoperative analgesia and both short- and long-term effects associated with inadequate management. A careful literature review of emphasizing treatment options and potential pathogenesis associated with these strategies is emphasized in this review.

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Introduction

Over 51 million inpatient surgical procedures were performed in 2010 within the United States alone, according to the Centers for Disease Control and Prevention [1]. Despite recent progress, reports continue to demonstrate that postoperative pain among this population is largely found to be undermanaged. A survey polling US adults who had undergone a recent surgical procedure found that 80% of patients experienced pain after surgery. Of these patients, 86% had pain described as moderate, severe, or extreme. In addition, experiencing postoperative pain was listed as the most common concern (59%) among surgical patients [2]. Aggressive perioperative pain prevention can yield both short-term and long-term benefits as unrelieved pain affects patient recovery, prolongs hospital stays, increases hospital morbidity, and adds to the burden of growing health-care costs [3–5]. In total, there are many important reasons for aggressive acute pain management. This review article examines the results of poorly managed pain and outcomes related to various strategies in postsurgical analgesia. The results suggest that poorly controlled pain has many untoward systemic effects; however, treatment strategies currently utilized have the potential for both morbidity and mortality.

Consequences of undermanaged acute pain

Postoperative pain is considered a form of acute pain secondary to surgical trauma and is associated with an inflammatory reaction and subsequent pathway of afferent neuronal signals. Acute postoperative pain is associated with autonomic, endocrine-metabolic, physiological, and behavioral responses summarized in Table 1 [6]. Undermanagement of postoperative pain can have many consequences involving multiple organ systems, including local, systemic, and reactive effects which are summarized in Tables 2 and 3 [6,7]. Untreated pain can also cause psychological symptoms which can play a role in the development of chronic pain syndromes [6].

1. *Neuroendocrine and metabolic stress responses*

The stress response caused by surgical injury can be characterized by a cascade of endocrine, metabolic, and inflammatory mediators. Local and systemic inflammatory responses to surgery include an increase in proinflammatory cytokines including interleukin 1 (IL-1), IL-6, and tumor necrosis factor (TNF). It also causes a decrease in anti-inflammatory cytokines such as IL-10 [6,8]. The clinical consequences of these changes include immunosuppression, hypothermia, and thromboembolic complications among others [6]. In addition to an inflammatory response, acute postoperative pain can also induce endocrine metabolic changes. These changes include an increase in catabolic hormones like cortisol, catecholamines, and glucagon as well as a decrease in the anabolic hormones testosterone and insulin. These changes induce a catabolic response with clinical consequences including loss of muscle

Table 1
Adverse effects of undertreated acute pain, modified from Ref. [10].

Cardiovascular	Tachycardia, hypertension, increased peripheral vascular resistance, increased myocardial oxygen consumption, myocardial ischemia and/or infarction, altered regional blood flow, deep vein thrombosis, pulmonary embolism
Respiratory	Reduced lung volumes, atelectasis, decreased cough, sputum retention, infection, hypoxemia
Gastrointestinal	Decreased gastric and bowel motility, increased risk of bacterial transgression of bowel wall
Genitourinary	Urinary retention
Neuroendocrince/ metabolic	Increased catabolic hormones: glucagon, growth hormone, vasopressin, aldosterone, renin and angiotensin Reduced anabolic hormones: insulin, testosterone Catabolic state leading to hyperglycemia, increased protein breakdown, negative nitrogen balance leading to impaired wound healing and muscle wasting
Musculoskeletal	Muscle spasm, immobility with increased risk of deep vein thrombosis, muscle wasting leading to prolonged recovery of function
Psychological	Anxiety, fear, helplessness, sleep deprivation, leading to increased pain
Central nervous	Chronic pain state related to central sensitization