

Can We Predict Postoperative Pain Prior to Patients' Undergoing Surgery?

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Perioperative pain is the most common concern for patients undergoing surgery, and many patients experience unpleasant side effects related to pain medications [1,2]. Despite increased emphasis on pain management and creation of new standards for controlling postoperative pain, many patients continue to experience moderate to severe pain after surgery [2]. If we can identify preoperative factors which reliably predict patients at risk of developing severe postoperative pain, we may be able to significantly improve postoperative pain management by: 1) creating individualized rather than standardized treatment plans, 2) properly allocating resources, and 3) intervening early to improve patients' postoperative care. Current standardized pain management protocols may lead to undertreatment of some patients and overtreatment (increased side effects from analgesics) of others, whereas individual plans specify stratified or targeted treatments. For example, practitioners could utilize larger drug doses (e.g., 200 mcg versus 100 mcg intrathecal morphine) and might add adjunct medications (e.g., ketamine, clonidine) with narrow therapeutic indexes and adverse side-effect profiles only in patients "at risk" of severe, postoperative pain.

Demographic, Psychological and Surgical Pain Predictive Factors

Investigators have identified the following demographic, psychological and surgical factors associated with increased postoperative pain: (1) Age (younger patients); (2) psychological factors (anxiety, depressed mood, personality, pain catastrophizing and coping styles); (3) patients' preoperative pain levels; (4) type of surgery (e.g., abdominal, orthopedics, thoracic); (5) surgical setting (e.g., emergency surgery); (6) surgical indication (e.g., cancer diagnosis); and (7) duration of surgery [3]. Some studies show that women are more likely to develop postoperative pain; however, gender is an inconsistent predictor of surgical pain [3]. Although the psychological factors associated with increased postoperative pain require time consuming, validated questionnaires to identify, demographic and surgical factors are readily available at the time of surgery and should be considered for pain prediction in all patients undergoing surgery.

Experimental Pain Tests

A number of studies have examined whether experimental pain tests (or quantitative sensory tests) of patient's basal pain perception prior to surgery can accurately predict the magnitude of pain and analgesic requirements after surgery. A number of sensory modalities to induce noxious stimuli have been used for experimental pain tests including heat, cold, pressure and electrical [4,5]. Pain rating of suprathreshold heat stimulus may be the best technique for pain prediction [4-6], however, the ideal sensory modality and technique has not been established. Data from studies suggests that patient's preoperative responses to "static" experimental pain tests is variable with 4-54% of postoperative pain variance predicted [7]. The predictive strength of experimental pain tests are however higher than reported for demographic and psychological factors mentioned above.

Most studies of postoperative pain prediction have focused on acute pain. Chronic pain (persistent incisional pain > 3 months after surgery) is reported to occur in approximately 10% of patients undergoing surgery [8,9]. A consistent finding in postoperative pain studies is an association between severe, acute, postoperative pain and the likelihood of ongoing persistent incisional pain [9,10]. "Dynamic" experimental pain tests attempt to show the strength of an individual's endogenous inhibitory nociceptive pathways (diffuse noxious inhibitory controls), and the propensity for nociceptive excitation or sensitization (temporal summation) [5,11]. These "dynamic" tests may better predict an individual propensity to develop persistent postoperative pain than "static" experimental pain tests which are better suited for acute pain prediction.

Genetics of Human Pain Sensitivity

Genetics studies of human pain sensitivity have revealed potential to predict post-operative pain; however, investigators' enthusiasm for expecting genetics to account for most of the variability in individuals' postoperative pain have not been borne out by current research. Because the phenotype (pain perception and analgesic requirements) is complex, multifactorial and subjective, and the genotypic susceptibility is polygenic and complex, it has been very difficult to evaluate the association between genotype and phenotype [12]. Studies have concentrated on the role of single nucleotide polymorphisms (in particular, μ -opioid receptor gene and COMT Val158Met genotype) to explain postoperative pain responses [12]. In the future, candidate gene studies and genome-wide association studies may improve our understanding of the genetic component of postoperative pain.

In conclusion, investigators have not adequately elucidated robust, quick-to-perform, "point-of-care" clinical tests that accurately and comprehensively predict postoperative pain and analgesic use. Experimental pain tests techniques and methodologies need to be better refined and then optimally combined with psycho-social and genetic tests. Predicting individual's postoperative pain experience prior to surgery will facilitate the creation of individualized pain treatment protocols that may significantly improve postoperative pain management for all patients undergoing surgery in the future.

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