International Journal of
Science Inventions Today
www.ijsit.com
ISSN 2319-5436
Review Article

POST-OPERATIVE PAIN MANAGEMENT

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ABSTRACT

Post-operative pain is a major problem, with both undertreatment and overtreatment leading to serious consequences, including increased risk of persistent post-operative pain, impaired rehabilitation, increased length of stay and/or hospital readmission, and adverse events related to excessive analgesic use, such as oversedation.. To manage the post-operative pain effectively, one should start management initially from the preoperative period. New analgesic medications and techniques have been introduced that target the preoperative, intraoperative and post-operative pain to better manage acute post-operative pain, with improvements in analgesic efficacy and safety.

INTRODUCTION

Effective post-operative pain control is an essential component of care of the surgical patients. Inadequate pain control may increase morbidity or mortality [1, 2]. There is evidence that surgery suppresses the immune system which is proportionate to surgical invasiveness [3, 4]. Proper analgesia is recommended to reduce deleterious effect of surgery. According to data available, afferent neural blockade with LA is the most effective analgesic technique. Next in order of effectiveness are high dose opioids, epidural opioids and clonidine, Patient Controlled Opioid therapy and NSAIDS[5]. The advantages of effective post-operative pain management are early mobilization, patient comfort, less cardio-pulmonary complications, decrease risk of deep vein thrombosis, early recovery with less likelihood of development of neuropathic pain and reduced cost of care. Insufficient education, fear of complications associated with analgesic drugs, poor pain assessment and inadequate staffing are the major causes of the failure to provide good post-operative analgesia.

Pathophysiology of Post-Operative Pain:

Surgery provokes changes in CNS and PNS that must be dealt therapeutically for effective care and positive outcome [6-8]. The process of incision, traction and cutting of tissue stimulate free nerve endings and specific nociceptors [6-8]. The threshold for activation and activity of these receptors is modified by local release of chemical mediators of inflammation and sympathetic amines released within the surgical stress response. Bradykinin, serotonin and histamine sensitize and stimulate the receptors, whereas Arachidonic acid derivatives only sensitize them. The influence of Sympathetic Nervous System is appreciated, though the exact mechanism of its interaction are not well defined.

In the post-operative period, peripheral sensitization leads to pain without an obvious stimulus, exaggerated response to a given stimulus. A-delta and c-fibers transmit nociceptive information from periphery to the CNS [6-8].A-delta fibers transmit sharp, localized pain (these are myelinated fibers) whereas c fibers transmit dull aching, throbbing, diffuse pain(unmyelinated fibers).

A-alpha and A-beta fibers also carries nociceptive input to the CNS when peripheral sensitization occurs. These fibers terminates in the dorsal horn but not at the same level as does A-delta and c-fibers. Thus, the input from these fibers does not necessarily undergo the usual inhibition in the dorsal horn. Therefore, CNS gets bombardment of noxious input which overwhelms the CNS's innate capability to filter painful input and fuels undergoing plasticity in the CNS response. Surgical stress response peaks in the post-operative period and has major effects on the cardiac, coagulation and immune system of the body [9].

Although Regional anesthesia and analgesia do not inhibit the local release of stress mediators into bloodstream, Brodner et al[10] have shown that blocking surgical stress response results in earlier tracheal

extubation and ambulation, thus augmenting recovery and decreasing cost.

The primary excitatory neurotransmitter are glutamate and aspartate. The intensity, consistency or both of the noxious inputs recruits N-methyl d-aspartate(NMDA) receptor activation.

Pathophysiologic Consequences of Pain

Cardiovascular	tachycardia, hypertension, increased SVR, increased cardiac work
Pulmonary	hypoxia, hypercarbia, atelectasis; decreased cough, VC, FRC; ventilation perfusion mismatch
Gastrointestinal	nausea, vomiting, ileus, NPO
Renal	oliguria, urinary retention
Extremities	skeletal muscle pain, limited mobility, thromboembolism
Endocrine	vagal inhibition; increased adrenergic activity, metabolism, oxygen consumption
Central nervous system	anxiety, fear, sedation, fatigue
Immunologic	impairment

Assessment:

Proper assessment of pain is necessary for proper management of pain. Visual Analogue Scale(VAS), score from 1-10 is the subjective method of assessment of pain. Here, 1 means no pain and 10 refers to severe pain. Only this method is not adequate for assessing pain. It also requires a careful visualization by a pain therapist. The purpose of assessment of pain is not to keep the VAS score low, its aim is to optimize the pain of the patient, to avoid unpleasant side effects of therapy such as sedation, nausea or pruritus.

Table. Ramsay Sedation Scale

1	Anxious, agitated or restless, or both
2	Cooperative, oriented, and tranquil
3	Responds to commands only
4	Brisk response to a light glabellar (forehead) tap or auditory stimulus
5	Sluggish response to a light glabellar (forehead) tap or loud auditory stimulus
6	No response

Therapeutic Modalities:

Systemic opioids: Opioids acts as an agonist on central and peripheral opioid receptors. Routes of opioids administration are oral, rectal, sublingual, transdermal, subcutaneous, intramuscular, intravenous or neuroaxial. The drugs commonly used are morphine, meperidine, fentanyl and hydromorphone. PCA is widely used for management of post-operative pain. The advantages of this modality are that the patient can obtain pain relief without waiting for caregiver, no painful injections are required and the patient retains a certain amount of control[11].Safety of this system depends on the proper functioning of the pump and its proper use. In this mode, patients should be reassessed with a sedation score.

1) **NSAIDs:** An intravenous acetaminophen is used for management of fever, mild to moderate pain or moderate to severe pain with adjunctive opioids [12]. A meta-analysis has shown that preoperative use of iv acetaminophen has reduced upto 50% of pain during post-operative period and less post-operative use of opioid [13]. Intravenous ibuprofen is also used for management of mild to moderate pain or moderate to severe pain with adjunctive opioids[12].
2) **Anxiolytics:** Anxiety is common prior to surgery, and is associated with poor outcomes, including severe post-operative pain[14]. Anxiolytics such as midazolam is used to reduce preoperative anxtiety and improve post-operative outcomes[15].
3) **Hypnotic drug:** Ketamine is hypnotic drug, used for induction of anesthesia, especially in pediatric patient. It acts by antagonizing N-methyl D-aspartate receptor [16]. A clinical trial has evaluated the effect of iv or subcutaneous infiltration of ketamine administered 15 minutes before incision in patients undergoing appendectomy under general anesthesia[16]. Result showed that the use of ketamine by either route of administration significantly lowered pain score in PACU[16].
4) **Regional techniques:** Epidural and spinal analgesia has improved surgical outcomes by decreasing intra-operative blood loss, post-operative catabolism and incidence of thromboembolic events, improved vascular graft blood flow and post-operative pulmonary function[17]. Epidural and spinal opioids provide better analgesia than systemic opioids, but the side effects are still present and therefore monitoring protocols are necessary. The neuroaxial narcotics may cause insidious delayed respiratory depression.

   LA may cause hypotension and muscle weakness that may slow down mobilization. To reduce the narcotics side effect, low concentration of LA such as ropivacaine 0.2% may be added to the infusion. This concentration is weak enough to avoid motor weakness. One of the most dangerous complications in the placement of epidural catheter is development of spinal hematoma and the risk increase in patients receiving anticoagulation therapy [18].

5) **Paravertebral block:** First described in 1905 by Hugo Sellheim of Leipzig (1871-1936), it has only recently become popular [19]. Paravertebral space is a wedge-shaped area between the heads and necks of the rib. Contents of paravertebral space are spinal nerve, its dorsal ramus, rami communicantes and the sympathetic chain. This block is particularly effective for unilateral surgical procedures such as thoracotomy, breast surgery, cholecystectomy and renal surgery. It has low incidence of adverse effect and patient require no additional nursing care. It can be safely performed in patient on anticoagulation therapy. It has benefit of early post-operative mobilization.
6) **TAP Block:** Transverse Abdominis Plane block involves the injection of local anesthetics into neurovascular plane of the abdominal wall. Use of TAP block for acute pain management is growing. Use of TAP block has reduced the post-operative use of morphine and a meta-analysis has confirmed the opioid sparing effect of TAP block[20]
7) **Non-pharmacological techniques:** Opioid and non-opioid analgesics have potential side effects. Therefore, alternative therapies has been explored with varying success. Electrical stimulation of peripheral nerves may influence pain inhibitory pathways, inhibit substance-P release and cause release of endogenous opiate substance[21]. Their efficacy in reducing requirement for conventional pain medications is still controversial.

Pediatric Pain Management:

Children experiences pain differently than adults do. They are not malingerers. Nevertheless, it may not be easy to differentiate between pain and distress. NSAIDS can be used for mild pain. Oral, iv or rectal routes are preferred methods of administration of analgesics in children. Iv fentanyl, morphine and meperidine are the most popular opiates. PCA has been successfully used among them. Regional analgesia performed while the patient is under general anesthesia can provide excellent early post-operative pain relief.

Preemptive Analgesia:

Analgesia administered before the painful stimulus occurs may prevent or substantially reduce subsequent pain or analgesic requirements. A recent study examined the administration of epidural fentanyl or bupivacaine prior to surgical incision in patients undergoing radical prostatectomy. The study group experienced less post-operative pain and at follow up 9 weeks later were more active sooner compared with the control group[22].

CONCLUSION

Advances in pharmacology, techniques and education have been developed that target the preoperative, intraoperative and post-operative periods to reduce post-operative pain. The quality of

analgesia with epidural techniques exceed that of systemic opioid in many cases. The use of epidural local anesthetic, opioid or both is consistently superior to routine IM analgesia or PCA.

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