

Rebound Pain After Nerve Block- Is it Inevitable, or Can it be Tackled?

Abhijit S. Nair¹

¹Department of Anaesthesiology, Ibra Hospital, Sultanate of Oman.

Postoperative rebound pain occurs when patients experience a marked increase in pain intensity after the effects of a peripheral nerve block (PNB) wear off. In addition to long-term problems like chronic postoperative pain, opioid use disorder, and higher medical expenses, poorly managed postoperative pain may contribute to respiratory and cardiovascular adverse events.

PNBs and other regional anaesthesia techniques, like the fascial plane blocks, are frequently used to offer superior intraoperative and early postoperative analgesia. In addition to revolutionizing postoperative pain management, the use of PNBs as part of an anaesthetic and analgesic strategy has been associated with a decrease in patient exposure to opioids and their adverse effects. However, after the sensory block is resolved, a clinical phenomenon known as "rebound pain" (RP) can arise [1]. This is characterized by an abrupt, frequently severe resurgence of pain. Optimizing patient outcomes requires proactive management and awareness of RP.

Patients undergoing orthopaedic surgeries have a greater propensity to encounter RP than patients undergoing soft tissue surgery [2]. RP presents as a state of hyperalgesia with an onset between 8 and 24 h after block administration, depending on the block characteristics (volume, concentration, and success). The various consequences of rebound pain are patient dissatisfaction, functional impairment, increased opioid consumption, and increased healthcare utilisation.

Based on a retrospective study published by Williams et al, they mentioned that RP is the 'quantifiable difference in pain scores when the block is working versus the increase in acute pain encountered during the first few

hours after the effects of peri-neural single-injection or continuous infusion local anaesthetics resolve' [3]. Dada et al. published a narrative review that investigated whether rebound pain had any influence on postoperative analgesia and opioid consumption [4]. In this paper, they defined RP as a state of hyperalgesia with an onset between 8 and 24 h after block administration. Lavand'homme defined RP as a very severe pain when PNB wears off, which is a clinically relevant problem and a cause of increased healthcare resource utilization after ambulatory surgery [5].

Sunderland et al compared the incidence of severe postoperative pain in patients undergoing wrist fracture surgery under general anaesthesia with brachial plexus block versus general anaesthesia only [6]. They found that the incidence of postoperative pain was 40% in the block group versus 10% in the no block group. The authors emphasized using adjuvants in the blocks, prescribing multimodal analgesia, and educating patients on using regular analgesics, and also the possibility of rebound pain if the advice on analgesic use is not adhered to.

The pathophysiology of RP is not fully understood. It is considered a multifactorial entity. Increased nociceptors' excitability and the spontaneous hyperactivity of C-fibers may be contributing factors to neuropathic pain. Even after the PNB obtunds the transduction and conduction, the surgical stimulus nevertheless produces pain signals. This results in central sensitization that causes hyperalgesia and allodynia [8]. Pain becomes more severe as the effects of PNB wear off, leading to excruciating pain. One more contributing factor is the reversible neurotoxicity of local anaesthetics (LA) [8]. RP may also be a side effect

Address of Correspondence

Dr. Abhijit S. Nair,

Department of Anaesthesiology, Ibra Hospital, Sultanate of Oman.

Email: abhijitnair95@gmail.com

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of injury to nerves from intra-fascicular injections and extended tourniquet use. The list of adjuvants that can be used in PNBs includes several medications like clonidine, dexmedetomidine, dexamethasone, buprenorphine, midazolam, epinephrine, ketamine, tramadol, magnesium, morphine, nalbuphine, and sodium bicarbonate. These adjuvants help in prolonging the duration of PNBs, provide better satisfaction, reduce opioid consumption and adverse events like nausea/vomiting, and possibly facilitate early recovery. However, there is a concern about the neurotoxicity of most of these adjuvants used in PNB [9-12]. Perineural dexamethasone is probably the most commonly used adjuvant in PNB. However, several studies and review articles have concluded that both perineural and intravenous dexamethasone can reduce rebound pain after a PNB performed for perioperative analgesia [13, 14]. Perineural ketamine in varying doses has been found quite effective in prolonging analgesia and reducing rebound pain in several studies [15]. Based on the results of a systematic review and meta-analysis involving 20 randomised-controlled trials, Xiang et al concluded that perineural ketamine could be an ideal adjuvant to local anaesthetics irrespective of the types of anaesthesia employed [16]. However, the quality of the evidence was low. A similar efficacy in reducing rebound pain was not demonstrated when ketamine was used intravenously [17, 18]. Theoretically, liposomal local anaesthetics could prolong the duration of analgesia when used in a PNB. However, the current evidence is insufficient to support its use to prevent RP, as the level of evidence is moderate [19].

Another modality of reducing rebound pain following a PNB is using continuous analgesia with indwelling catheters. The issue with this modality is the catheter migration or dislodgement, the additional cost incurred, and the expertise needed to effectively secure or tunnel the catheters at the desired site [20].

Factors responsible for RP could be patient-related, surgical, or regional anaesthesia technique-related. In the patient's category, the younger age group patients undergoing surgery, patients having preoperative pain (trauma, peri-arthritis) are the ones susceptible to RP. In the surgical category, orthopaedic surgery could predispose to RP. In the regional anaesthesia category, use of PNB that leads to dense sensory block (brachial plexus block, popliteal sciatic block, lumbosacral block) has a higher propensity of RP than fascial plane blocks.

Pre-emptive analgesia before the block wearing off, intra-articular or intravenous anti-inflammatory drugs like dexamethasone, use of catheters for continuous analgesia, and the use of adjuvants in nerve blocks along with use of other analgesics like acetaminophen, non-steroidal anti-inflammatory drugs, if not contraindicated, are examples of multimodal strategies that could mitigate the severity of RP. Furthermore, it is crucial to inform patients about the potential for RP to guarantee the proper administration of pre-emptive analgesic prescriptions and set realistic expectations for reduced postoperative opioid requirements. To effectively use regional anaesthesia and lessen the negative effects of chronic opioid use, it is essential to understand the effects of RP and measures to avoid them.

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Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given his/her consent for his/her images and other clinical information to be reported in the Journal. The patient understands that his/her name and initials will not be published, and due efforts will be made to conceal his/her identity, but anonymity cannot be guaranteed.

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