

## Rebound pain: Undesired, yet unexplored

Rebound pain is defined as “transient acute increase in postoperative pain which occurs following resolution of a peripheral nerve block (PNB)” or as a phenomenon where quantifiable difference is seen in the pain scores when the PNB is working compared to when its effect is resolved.<sup>[1]</sup> The intensity of such pain is frequently disproportionate to the degree of noxious stimulus secondary to surgical incision and the pain score patient would have had in the absence of a PNB. Patients often describe it as a burning or dull aching pain typically occurring 12–24 h after the performance of a PNB, but at times, it becomes difficult to predict the precise time when the block effect is going to disappear.<sup>[2]</sup> Rebound pain often lasts for a limited duration of 3–6 h, and the subsequent pain severity is proportional to the balance between inflammatory and healing process from the surgical insult. Hence, rebound pain is a transient phenomenon, but understandably, it is a distressing condition which significantly impacts total analgesic consumption, overall patient satisfaction, and recovery. It may also negatively affect patient outcome by resulting in cardiovascular and pulmonary complications.

The incidence of rebound pain varies widely and is reported to be highest in patients undergoing surgery on an outpatient basis (up to 40%).<sup>[3]</sup> Seeking medical attention for postoperative pain following resolution of PNB is reported to be highest in ambulatory surgeries performed on day care basis. Few of the randomized controlled trials (RCTs) have specifically looked into the risk factors and found that the incidence of rebound pain is greater in young age, female gender, and orthopedic (particularly upper limb) surgeries.<sup>[4]</sup> Patients undergoing bone surgery are at 6.5 times higher risk of developing rebound pain compared to those who undergo soft tissue surgery.<sup>[5]</sup> Patient’s cognitive status and expectation on postoperative pain have also been implicated as independent risk factors.<sup>[6]</sup> In a recent study by Admassie *et al.*,<sup>[7]</sup> presence of pain in the preoperative period has also been implicated as one of the risk factors for the development of rebound pain.<sup>[7]</sup>

The pathophysiology behind this complex phenomenon is not fully understood. There is possibly an element of neuropathic pain occurring due to increased excitability of nociceptors and spontaneous hyperactivity of C-fibers.<sup>[8]</sup> Surgical stimulus continues to fire pain signals even when the transduction and conduction are blunted by the PNB. This leads to central sensitization that results in hyperalgesia and allodynia, a phenomenon called as “pain memory.”<sup>[6]</sup> When the effect of PNB subsides, the sensation of pain becomes amplified, resulting

in severe pain. Reversible neurotoxicity of local anesthetics (LA) is also attributed as a contributing factor.<sup>[9]</sup> Occurrence of rebound pain can also be secondary to nerve injury caused by intrafascicular injection and prolonged tourniquet application.

Though performing PNB offers excellent pain control in the acute perioperative period and has become a standard of care, its advantages may get offset by the occurrence of rebound pain, and therefore does not necessarily translate to an overall patient satisfaction and better outcome. Many of the patients often experience difficulty in predicting their analgesic needs following dissipation of PNB and how to effectively prevent or manage rebound pain, as they may develop a falsely low pain tolerance.<sup>[10]</sup> Hence, preoperative education of patients and caregivers about the probable duration of analgesia with PNB, the possibility of moderate to severe pain after the block effect wears off, and the need to stay ahead of the pain by taking long-acting analgesics earlier while the block is still working is important. Majority of the patients will experience severe pain during night time when the block effect wears off or with active movements. Therefore, formulating a perioperative care plan on an individual basis and administering analgesics round the clock in the first 24 h even if the patient is not in pain is crucial. This is particularly important in patients undergoing surgery on day care basis.<sup>[11]</sup> Subsequent analgesic requirement can then be tapered to individual need.

There are a few studies which compared the use of continuous catheter technique and found that the insertion of perineural catheters is an effective means to prevent rebound pain by allowing more time for the inflammatory response to diminish. In a study by Salviz *et al.*,<sup>[12]</sup> the authors randomized patients undergoing arthroscopic rotator cuff repair surgery into three groups receiving general anesthesia (GA) alone, GA combined with single-shot interscalene block, and GA combined with perineural interscalene catheter. The authors found significantly lower pain scores in the catheter group compared to the other two groups at all time intervals and also a lower incidence of rebound pain. Similarly, combining PNB with central neuraxial blockade helps in reducing the severity of rebound pain compared to when surgery is done under PNB alone. Use of adjuvants, in particular, dexamethasone, enhances the efficacy of PNB and may play a role in prevention of rebound pain by virtue of its anti-inflammatory action. In a prospective study by Woo *et al.*,<sup>[13]</sup> the authors assessed whether perineural administration of dexamethasone as an adjuvant reduces the intensity and incidence of rebound pain in patients undergoing arthroscopic shoulder surgery compared to the injection of LA alone and found that the incidence of rebound pain was significantly lower in the dexamethasone group compared to the control group (37.1% and 82.9%, respectively,  $P < 0.001$ ). However, the effects of type and site of nerve

blockade, choice of LA and its concentration, use of adjuvants, and insertion of perineural catheters on rebound pain are not fully explored. In the near future, we need more prospective RCTs which objectively explore the role of the above measures as well as the effect of longer-acting LAs like liposomal bupivacaine and repeating the PNB on rebound pain. It will also be interesting to know whether rebound pain, if left untreated, progresses to chronic pain or not. We are also in need of a standardized scoring system to evaluate rebound pain. Though there is enough evidence to support the use of multimodal protocols in curtailing rebound pain, a comprehensive and effective regimen is not yet available for clinical use.

Rebound pain has emerged as a potential challenging complication of regional anesthesia with many unanswered questions related to its etiology, risk factors, and management. However, the question is not whether occurrence of rebound pain should be considered as a complication related to performing a PNB or not; what is of paramount importance is to discuss this issue with the patient during the risk–benefit discussion preoperatively, until we get to know more effective means of managing this unique problem. Hence, the use of multimodal analgesia (combination of paracetamol, nonsteroidal anti-inflammatory drugs, opioids, and a gabapentinoid), administering pain killers before the effect of PNB disappears with the intent of achieving a steady-state plasma concentration, and patient education (realistic outcome and what to expect) are the most useful short-term management strategies available for the time being to address this distressing problem.<sup>[14]</sup>

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	DOI: 10.4103/joacp.joacp_435_22

**How to cite this article:** Bhatia P, Metta R. Rebound pain: Undesired, yet unexplored. *J Anaesthesiol Clin Pharmacol* 2022;38:527-8.

Submitted: 15-Feb-2022

Accepted: 15-Feb-2022

Published: 26-Dec-2022