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Prevention and management of rebound pain after resolution of regional block: a systematic review

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Background: An extreme pain known as rebound pain develops after regional blockage wears off. Patient, surgical, and anesthesia-related factors influence the occurrence and intensity of rebound pain. Prior to the peripheral nerve block (PNB) being resolved, multimodal therapy should use. The objective of this review was to explore rebound pain prevention and management following PNB resolution.

Methods: We conducted a thorough search across Pub Med, Hinari, Google Scholar, and Cochrane review databases, utilizing relevant keywords and search parameters to identify studies meeting our inclusion criteria. These studies aimed to provide sufficient evidence regarding the prevention and management of rebound pain following the resolution of regional blocks. Duplicate entries were removed using Endnote software. Screening of the literature was performed using a rigorous appraisal checklist. The findings of this review are reported in compliance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 statement.

Results: Using an electronic search, 3526 items were found from databases and websites. After removing duplicates ($n = 500$), 3026 articles remained. Of these, 2813 were excluded after going through their titles and abstracts. Of the 213 articles screened, 126 were removed for such reasons as ineligibility or similarity in objectives. Of the remaining 87 studies, 37 were excluded for such reasons as the inaccessibility of free full texts. Finally, 50 studies were included for review.

Conclusions and recommendation: Proper patient education about rebound pain, combined with the utilization of multimodal systemic analgesia before the resolution of PNBs, perineural dexamethasone, and employing a combination of nerve blocks, has been demonstrated to decrease the incidence of rebound pain. Therefore, clinicians should aim to prevent and manage rebound pain by implementing perioperative multimodal strategies before the resolution of regional blocks.

Keywords: prevention and management of rebound pain, rebound pain, Risk factors

Introduction

Patients undergoing surgery usually receive perioperative anesthesia and pain relief from anesthesiology, often through regional blocks[1]. It plays a significant role in enhancing the quality of postoperative pain management, decreasing the requirement for opioids, shortening hospital stays, reducing costs, and enhancing postoperative patient outcomes[2,3]. Many patients experience pain after the effects of regional block wear off, which could be attributed to the pro-inflammatory characteristics of local anesthetics. This may contribute to post-PNB hyperalgesia and neuropathic pain associated with nerve block injury[4].

HIGHLIGHTS

- Extreme pain, known as rebound pain, is experienced when a localized anesthetic's effects have worn off.
- Rebound pain occurrence and intensity are influenced by patient, surgical, and anesthesia-related factors.
- Prior to the resolution of the peripheral nerve block (PNB), multimodal therapy must be use.

Rebound pain refers to surgical pain of a mechanical nature that intensifies after the resolution of PNB, due to unimpeded nociceptive signals[3]. After the resolution of PNB, rebound pain can affect up to approximately 40% of patients. This occurrence may result from situations where there is abnormal hyperactivity of C-fibers and heightened excitability of nociceptors, even in the absence of mechanical nerve damage[3]. It is characterized by unexpected and significant pain that arises after the natural resolution of the PNB[5]. It refers to the contrast between well-managed pain [measured by a numerical rating scale (NRS) of 3 or lower] during the effectiveness of the nerve block and the onset of severe pain (NRS of 7 or higher) within 24 h after the block is administered[6]. The independent risk factors associated with the occurrence of rebound pain include the use of intravenous dexamethasone, preexisting preoperative pain, undergoing bone surgery, and insufficient postoperative analgesia[5,7–9]. Rebound pain has a significant impact on health-related concerns.

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However, it can be effectively prevented and managed through preoperative education and counseling regarding rebound pain, the utilization of continuous catheter techniques, the incorporation of anesthetic adjuvants, and the implementation of multimodal anesthesia approaches[2,10,11]. Rebound pain is defined as a short-lived, intense postoperative pain that arises 12–24 h after the PNB has dissipated. The rebound pain score is calculated by subtracting the pain score recorded within the first 12 h after the PNB wears off from the lowest pain score reported within the initial 12 h at the time the block was administered[3,6]. The occurrence of rebound pain might outweigh the benefits of PNBs. Poorly managed postoperative pain can lead to adverse outcomes, such as impaired quality of recovery, dependency on opioids, persistent postsurgical pain, and elevated medical expenses[2].

Rebound pain, a common yet poorly understood phenomenon, involves a sudden escalation in pain intensity, occurring typically within 12–24 h after the resolution of a PNB. Despite financial constraints and the established initial benefits of PNBs, rebound pain presents a new challenge in perioperative care. Hence, the objective of this systematic review was to investigate various strategies aimed at preventing and managing rebound pain subsequent to the resolution of PNBs.

The rationale of the review

Despite limited clinical and experimental research, rebound pain remains a prevalent occurrence following the resolution of regional analgesia. Despite advancements in pain assessment and management, the incidence of rebound pain after the resolution of regional blocks continues to pose a significant public health concern.

It has been reported that the incidence of rebound pain could increase up to 61.7%, potentially exerting a substantial impact on patients' postoperative outcomes. Prevention and management of rebound pain are crucial aspects of perioperative care. This review of recent evidence provides additional insights into strategies for preventing and managing rebound pain, aiming to achieve a consistent standard of care across perioperative settings.

Methodology

Search strategy

The Pub Med, Hinari Google Scholar, and Cochrane review databases were systematically searched using relevant keywords and search parameters to identify studies meeting the inclusion criteria. The primary focus was on gathering sufficient evidence related to the prevention and management of rebound pain following the resolution of regional blocks. Duplicate entries were removed using EndNote software. Literature screening was conducted using a proper appraisal checklist. The review adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 statement guidelines. Additionally, any duplications across all materials were eliminated using EndNote, version X8 software.

Ultimately, the final review comprised 50 articles. A thorough screening of the literature was carried out using an appropriate appraisal checklist. Following a comprehensive evaluation, the WHO guidelines from 2011 and good clinical practice were utilized to assess the level and caliber of evidence, as well as to formulate recommendations. 1a: meta-analysis, systematic review of randomized controlled trials; 1b: randomized controlled trial; 2a: systematic review of cohort and case–control studies; and 3a: case reports and case series (Table 1). This work has been reported in line with AMSTAR (assessing the methodological quality of systematic reviews) guidelines[12]. This work has been reported in line with the PRISMA criteria[13](Fig. 1). This review was registered in a research registry.

Eligibility criteria

The review encompassed all studies focusing on the prevention and management of rebound pain, conducted in the English language and with full-text availability. Duplicate articles, unrelated studies, case reports, and articles lacking full text were excluded from the review.

Data extraction

Two independent authors were responsible for selecting articles for review and importing them into EndNote manager software to eliminate duplicates, as well as screen titles and abstracts. Any discrepancies were resolved through discussions involving a third author.

Study quality assessment

The authors utilized an AMSTAR 2 methodological quality appraisal checklist to assess the articles. The authors discussed and resolved any discrepancies. The critical analysis checklist comprised 16 parameters[12]. The quality of this review after critical appraisal of its method was reported as a moderate quality review.

Operational definition

Rebound pain

The transition from well-controlled pain (NRS ≤ 3) while the block is working to severe pain (NRS ≥ 7) within 24 h of block performance[6].

Results

Study selection

Using an electronic search, 3526 items were found from databases and websites. After removing duplicates ($n = 500$), 3026 articles remained. Of these, 2813 articles were excluded after going through their titles and abstracts. Of the 213 articles screened, 126 articles were removed for such reasons as ineligibility or similarity in objectives. Of the remaining 87 studies, 37 articles were excluded for such reasons as inaccessibility of free full texts. Finally, 50 articles were included for review.

Description of included studies

Fifty studies were included in this systematic review after meeting the eligibility requirements. Out of all articles included, eight were systematic reviews, two were meta-analysis, 19 were cross-sectional studies, 10 were cohort studies, five were comparative studies, and six were controlled trials (Fig. 1).

Table 1

Good clinical practice, good clinical practice, WHO, 2011 and www.gradeworkinggroup.org.

Levels	Type of evidence	Degree of recommendation
1a	Meta-analysis, evidence based guideline, systematic reviews of RCTs	Strongly recommended/directly applicable
1b	Systematic review	Highly recommended/directly applicable
1c	Randomized clinical trials/RCTs	Recommended/applicable
2a	Systematic reviews of case–control or cohort studies	Extrapolated evidence from other studies
3a	Nonanalytic studies, e.g., case reports, case series, clinical audits, commentaries, and expert opinions	Extrapolated evidence from other studies

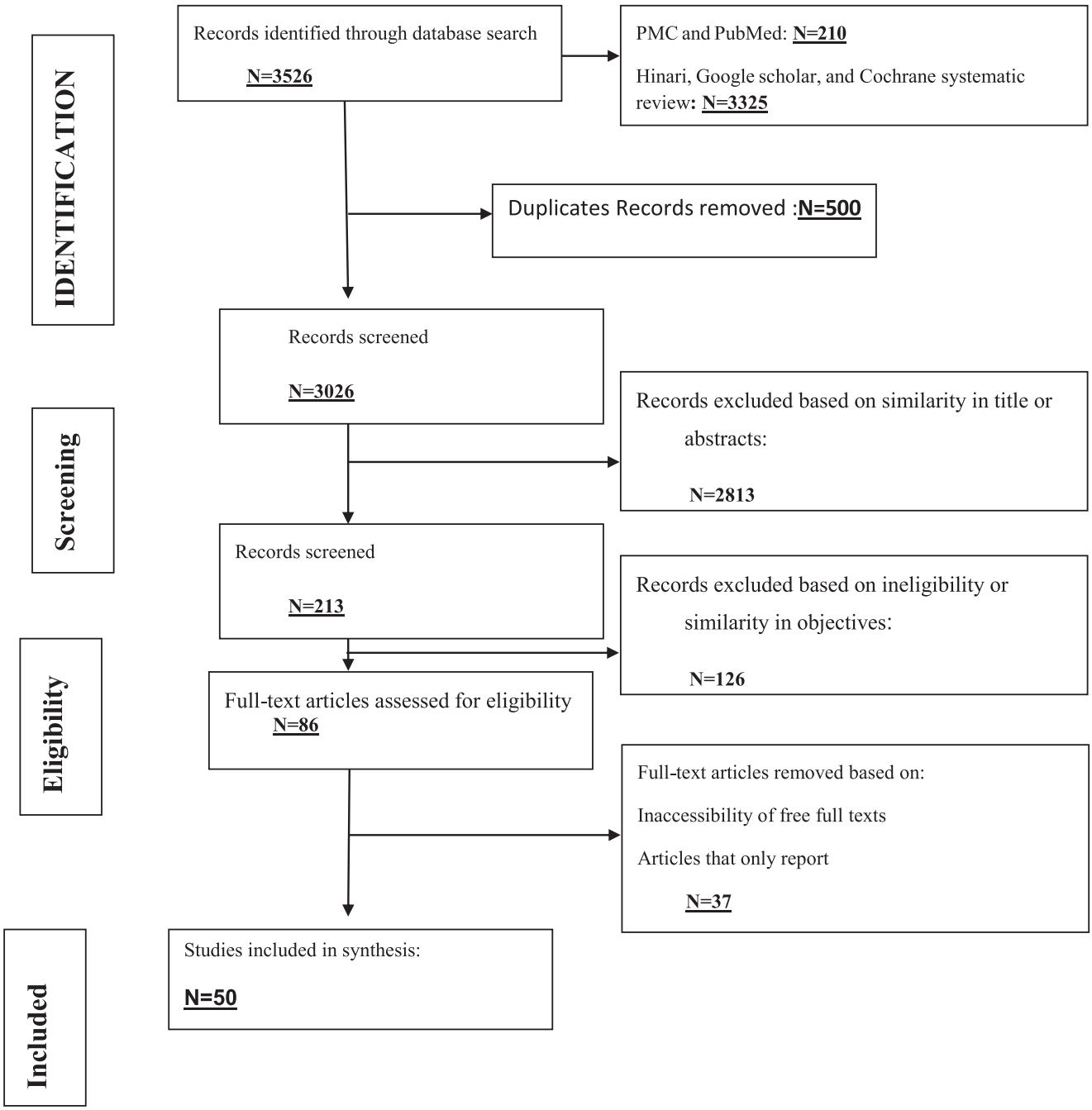

Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) 2020.

Discussion

Incidence of rebound pain

Rebound pain refers to a sudden escalation in pain intensity in the area where anesthesia was administered. Typically, this heightened pain occurs within 12–24 h after the anesthesia wears off. It can be notably severe, impacting the patient's comfort, quality of sleep, and overall postoperative recovery[14]. In Ethiopia, the overall incidence of rebound pain after PNB was resolved was 61.7% (95% CI: 56.5–66.7) with a mean rebound pain score of 4.19 ± 2 (95% CI: 3.94, 4.5), in Canada, 49.6% of people experienced rebound pain after PNB resolved, in Belgium, up to 40% of the patient experience rebound pain[3,6,15]. Additionally, in a previous study, 35 and 41% of patients experienced severe rebound pain after the resolution of PNB[9,16].

Risk factors

The study highlighted several factors that were found to contribute to the occurrence of rebound pain. These factors include receiving intravenous dexamethasone prior to surgery, experiencing preoperative pain, undergoing bone surgery, and lacking postoperative systemic analgesia[5,7–9,15]. In additionally, the study indicated that the single-injection technique was an independent factor associated with rebound pain[6,8,15,17].

According to the study, individuals who experience preoperative pain may have a predisposition to encountering rebound pain[6–8,18]. This assertion could be supported by studies across a range of noncardiac surgeries, which have shown that preoperative pain intensity is a significant predictor of severe postoperative pain[8,19]. Patients with preexisting joint pain were more likely to report experiencing rebound pain after undergoing total knee arthroplasty or complete hip arthroplasty with PNBs, as indicated by the study[18].

The study identified several factors linked to rebound pain, including young age, female sex, and orthopedic surgeries, particularly those involving the upper extremity. Notably, rebound pain was 6.5 times more likely to occur in cases after bone surgery compared to those undergoing soft tissue surgery. Furthermore, rebound pain was found to be associated with patients' cognitive functioning and anticipation of postoperative pain[2,6,8,20,21].

The occurrence of rebound pain following the resolution of a single PNB can be heightened. Nonetheless, this effect can be alleviated by combining PNB with central neuraxial block, which aids in diminishing the extent of rebound pain. Furthermore, the emergence of rebound pain after surgery seems to be influenced by the site of the operation and the nature of the procedure performed[22,23]. Due to the limited investigation into the use of PNBs in acute fracture surgery and the distinct nature of postoperative pain in such cases compared to other surgeries, PNBs are considered safe[3].

Prevention and management of rebound pain after resolution of regional block

Administering an analgesic medication 1–2 h before the resolution of the PNB may help reduce the occurrence of rebound pain. Insufficient pain management during the resolution of regional analgesia may stem from a lack of patient education regarding the significance of implementing a pain management strategy, even when experiencing no discomfort, such as utilizing bridging analgesia[24,25]. This statement is supported by the utilization of nonpharmacological approaches, such as educating patients about post-PNB rebound pain and postoperative analgesia. These measures can assist in both preventing and managing rebound pain effectively[3]. In cases of nerve injury, patients might demonstrate artificially low pain tolerance as a result of their expectations concerning PNBs[26]. Such perception can markedly influence both the perception and the management of postoperative pain.

While recent meta-analyses suggest that both perineural and intravenous dexamethasone have comparable effects on the duration of block, 24-h pain scores, and postoperative opioid consumption, individual studies have indicated that perineurally administered dexamethasone may extend the duration of PNB compared to intravenous administration[6,27,28]. Moreover, prior meta-analyses have demonstrated that administering dexamethasone at doses below 0.1 mg/kg can effectively alleviate postoperative pain[29].

Preoperative analgesia can function as preemptive or preventive analgesia, with the goal of diminishing both peripheral and central sensitization[30,31]. Utilizing perioperative multimodal analgesia, which offers the dual advantage of reducing opioid use and decreasing the intensity of postoperative pain, can effectively diminish perioperative opioid consumption[32,33].

The use of perineurally administered gabapentin, acetaminophen, ibuprofen, and dextromethorphan as adjuvants has been demonstrated to help maintain analgesia during the transitional phase as the PNB wears off[34,35]. To reduce the likelihood of rebound pain, it is advisable to refrain from using short-acting opioids and instead employ adjuvant medications such as esmolol, which can modify the pain response[36,37]. Additionally, substances like betamethasone and β2-adrenergic agonists have been reported to reduce the likelihood of rebound pain[38–40].

Administering nonsystemic perineural injections alongside a bupivacaine clinical cure might potentially prevent reversible bupivacaine-induced neurotoxicity and rebound hyperalgesia after the blockade resolves[41–43].

The utilization of combined PNBs may decrease the occurrence of rebound pain. This is evidenced by studies demonstrating that following arthroscopic rotator cuff surgery, axillary and suprascapular ultrasound-guided PNBs reduced the incidence of rebound pain[44]. Moreover, the utilization of combined ultrasound-guided brachial plexus block and suprascapular nerve block has been shown to more effectively reduce postoperative pain compared to a single-injection block within 36 h after arthroscopic cuff surgery[45].

We recognize that this study has limitations; it depended on a small number of databases, may have biased the selection of articles, lacked data analysis, and used outdated references. It also did not involve systematic or meta-analysis.

Conclusion and recommendations

Despite limited clinical and experimental research, rebound pain continues to be a prevalent occurrence following the resolution of regional analgesia. The occurrence of rebound pain is influenced by various factors, including patient characteristics, surgical factors, and anesthesia-related factors. Proper patient education about rebound pain, combined with the utilization of multimodal systemic analgesia before the resolution of PNBs, perineural dexamethasone, and employing a combination of nerve blocks,

has been demonstrated to decrease the incidence of rebound pain. Therefore, clinicians should aim to prevent and manage rebound pain by implementing perioperative multimodal strategies before the resolution of regional blocks.

Ethical approval

Ethics approval was not required for this systematic review.

Consent

Informed consent was not required for this systematic review.

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No funding resource for this systematic review.

Author contribution

This work was carried by the collaboration of all authors who contributed to the conception of the whole process of this review.

Conflicts of interest disclosure

The authors report no conflicts of interest.

Research registration unique identifying number (UIN)

1. Name of the registry: research registry.
2. Unique identifying number or registration ID: reviewregistry 1845.
3. Hyperlink to your specific registration (must be publicly accessible and will be checked): https://www.researchregistry.com/browse-theregistry#registryofsystematicreviews meta-analyses/.

Guarantor

Belete M. Admassie.

Data availability statement

The data and material used to analyze the study are available from the corresponding author on request.

Provenance and peer review

Not commissioned, externally peer-reviewed.

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