

MULTIMODAL ANALGESIA FOR ADULT TONSILLECTOMY: SYSTEMATIC REVIEW AND CLINICAL ALGORITHM

Nigora Nusratovna Abdullaeva

Aziza Kozimovna Zakirova

Abstract

The problem of adequately managing pain after tonsillectomy in adult patients remains unresolved, largely due to the risk of delayed complications such as dehydration and late postoperative hemorrhage. This review provides a critical analysis of current surgical and pharmacological strategies for pain management. Traditional opioid monotherapy is considered ineffective and unsafe. The implementation of multimodal analgesia (MMA) protocols incorporating nonsteroidal anti-inflammatory drugs (NSAIDs), gabapentinoids, long-acting local anesthetics, and systemic glucocorticosteroids is therefore justified. Based on an analysis of relevant scientific literature published between 2021 and 2025, an optimized clinical management algorithm was developed that may reduce overall opioid requirements by 35–40% and shorten the rehabilitation period [1,2].

Keywords: Tonsillectomy, postoperative pain, multimodal analgesia, NSAIDs, local anesthetics, quality of rehabilitation, opioid-sparing effect.

Introduction

Tonsillectomy has remained one of the most common elective procedures in otorhinolaryngological practice for many decades [3]. The main indications for tonsillectomy in adult patients include chronic decompensated tonsillitis, recurrent peritonsillar abscesses, and obstructive sleep apnea syndrome. Despite significant technological advances and the introduction of coblation, laser, and ultrasonic dissection techniques into clinical practice, the intensity of postoperative pain remains the major limiting factor in rehabilitation. In this setting, pain is characterized by high intensity and prolonged duration and, according to patients' subjective assessments, may sometimes be more severe than pain following abdominal or orthopedic procedures [4].

The pathophysiological mechanisms underlying pain after tonsillectomy are complex. During surgery, unavoidable trauma occurs to the pharyngeal nerve plexus, which is formed by branches of the glossopharyngeal and vagus nerves. Surgical trauma initiates a local inflammatory cascade involving the release of prostaglandins, bradykinin, histamine, and substance P. This markedly lowers the sensitivity threshold of nociceptors and leads to the development of primary hyperalgesia. According to statistical studies, up to 85% of adult patients rate their pain as extreme during the first 3–5 days [5]. A characteristic feature of this procedure is a “second peak” of pain on postoperative days 5–7, which is associated with the lysis of the fibrinous coating, exposure of deep nerve endings, and reactive spasm of the pharyngeal constrictor muscles [6].

Inadequate pain control leads to pronounced odynophagia, which may result in refusal to consume fluids and food, subsequently causing dehydration, electrolyte disturbances, and nutritional depletion. Persistent pain activates the sympathoadrenal system, resulting in tachycardia and arterial hypertension. In the setting of incomplete angiogenesis in the surgical wound, systemic hypertension may contribute to secondary late hemorrhage requiring emergency hemostasis in the operating room [7]. Opioid monotherapy, which was historically used for postoperative pain management, is now considered inappropriate because of the high incidence of systemic adverse effects, including respiratory depression, nausea, vomiting, and excessive sedation. This highlights the need to develop and implement flexible and safe multimodal analgesia regimens.

Materials and Methods

To develop a scientifically justified clinical algorithm, a systematic search and analysis of relevant medical literature were conducted. The search was performed in the electronic databases PubMed, Scopus, Cochrane Library, and Web of Science for the period from 2021 to 2025. The following MeSH terms and combinations were used: “tonsillectomy pain management,” “multimodal analgesia in otolaryngology,” “post-tonsillectomy hemorrhage,” and “local infiltration anesthesia.” A total of 142 publications were identified during the initial screening stage.

The inclusion criteria were randomized controlled trials (RCTs) or meta-analyses; patients aged 18–65 years; assessment of pain intensity using validated scales, including the Visual Analog Scale (VAS) or Verbal Rating Scale (VRS); and detailed reporting of adverse events and the incidence of hemorrhagic complications. Studies

involving pediatric populations, case reports, and studies with insufficient statistical power were excluded from the analysis.

Following the final screening and filtering process, 42 full-text studies were included in the review. The findings of these studies were considered to have a high degree of reliability.

Results and Discussion

The results of the analysis indicate that the use of individual analgesic agents does not provide stable control of nociception throughout the entire wound-healing period, which may last up to 10 days. A pathogenetically justified approach is the concept of multimodal analgesia (MMA), based on the synergistic use of medications with different mechanisms of action at the minimum effective doses. This approach makes it possible to block the transmission of pain impulses at the peripheral, conductive, and central levels of the nociceptive system [8].

Characteristics of Multimodal Analgesia Components

MMA Component	Mechanism of Action	Clinical Effect	Level of Evidence
Systemic NSAIDs (Ibuprofen, Ketorolac, Lornoxicam)	Inhibition of COX-1/COX-2 isoenzymes and reduction of prostaglandin synthesis	Provides stable baseline analgesia and reduces local inflammation	Class I, Level A
Local infiltration (Ropivacaine, Bupivacaine + Epinephrine)	Reversible blockade of sodium channels in peripheral nerve fibers	Complete elimination of pain sensation during the first 4–8 hours after surgery	Class IIa, Level B
Glucocorticosteroids (Dexamethasone 4–8 mg IV, single dose)	Stabilization of cell membranes and suppression of pro-inflammatory cytokine expression	Reduces exudative edema of the soft palate and provides an antiemetic effect	Class I, Level A
Gabapentinoids (Pregabalin, Gabapentin, administered prophylactically)	Modulation of the $\alpha 2\delta$ subunit of voltage-gated calcium channels	Prevents central sensitization and reduces the neuropathic component of pain	Class IIb, Level B

Particular attention should be paid to the safety of NSAID use in otorhinolaryngological practice. The belief held by some clinicians that NSAIDs substantially increase the risk of hemorrhagic complications because of their antiplatelet effects is not supported by data from large meta-analyses conducted in

recent years. It has been established that the use of agents such as ibuprofen or lornoxicam does not result in a statistically significant increase in the rate of repeat surgical interventions for postoperative bleeding compared with placebo. At the same time, these agents provide an effective analgesic window, making it possible to minimize or completely avoid the use of opioids such as codeine and tramadol, which are associated with a high incidence of postoperative nausea and vomiting.

A critically important stage is local infiltration anesthesia before tissue dissection, also known as preemptive analgesia. Infiltration of the tonsillar fossae with ropivacaine or bupivacaine combined with epinephrine blocks afferent impulses before surgical trauma occurs, thereby preventing the development of the “wind-up” phenomenon, characterized by excessive excitation of spinal neurons. Early restoration of swallowing function, approximately 2 hours after surgery, promotes natural moistening of the mucous membrane, prevents drying of the wound surface, and reflexively reduces spasm of the pharyngeal constrictor muscles.

Intraoperative intravenous administration of dexamethasone (4–8 mg), as recommended by ERAS (Enhanced Recovery After Surgery) protocols, inhibits the synthesis of inflammatory mediators. This minimizes edema of the soft palate and uvula caused by the thermal effects of electrocautery, facilitates respiratory and speech functions, and helps prevent postoperative nausea and vomiting (PONV).

Conclusion

The transition to standardized multimodal analgesia protocols represents the modern **gold standard** in ENT surgery. The synergistic combination of preemptive local infiltration with ropivacaine, systemic adjunctive administration of NSAIDs, and intraoperative administration of dexamethasone provides multilayered, pathogenetically targeted control of nociception. This strategy may allow for the complete avoidance of opioid analgesics, reduce reactive postoperative edema, and improve patients’ quality of life. Optimization of analgesic therapy not only accelerates reparative processes in the tonsillar fossae but also demonstrates direct economic benefits by reducing the frequency of repeat hospitalizations due to late hemorrhage and dehydration.

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