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Original Research Article

Effect of Paracetamol Vs Ibuprofen as Preemptive Analgesia in Pediatric Tonsillectomy

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Abstract

Introduction: Post-tonsillectomy pain in children is often significant and affects recovery and oral intake. Preemptive analgesia reduces pain sensitization. Paracetamol and ibuprofen are commonly used, but their comparative efficacy remains unclear.

Aims and Objectives: To compare the efficacy of preemptive paracetamol versus ibuprofen in reducing postoperative pain and analgesic requirement in children undergoing tonsillectomy.

Materials and Methods: This was a prospective, randomized, double-blind, comparative study conducted at Dinhata Subdivisional Hospital over 1 year, including 120 pediatric tonsillectomy patients, randomly assigned to receive preemptive paracetamol or ibuprofen, and compared for postoperative outcomes.

Results: The age ($p = 0.87$) and gender ($p = 0.71$) distribution were comparable between both groups. Ibuprofen showed significantly lower pain scores at 2, 6, and 12 hours ($p = 0.001$, 0.002, 0.01 respectively), while the difference at 24 hours was not significant ($p = 0.08$). Time to first rescue analgesia was longer with ibuprofen (8.3 ± 1.7 vs 5.6 ± 1.4 hours, $p = 0.0001$), and total analgesic requirement was lower (18.9 ± 5.4 vs 28.5 ± 6.2 mg/kg, $p = 0.0003$). Postoperative complications were similar in both groups ($p > 0.05$).

Conclusion: Preemptive administration of ibuprofen provides superior postoperative analgesia compared to paracetamol in pediatric tonsillectomy, with longer pain-free duration and reduced need for rescue analgesics. Both drugs are safe, but ibuprofen may offer better clinical efficacy in the early postoperative period.

Keywords: Pediatric Tonsillectomy, Preemptive Analgesia, Paracetamol, Ibuprofen, Postoperative Pain, FLACC Scale.

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Introduction

Tonsillectomy is one of the most frequently performed surgical procedures in pediatric otorhinolaryngology worldwide. Despite advancements in surgical techniques and perioperative care, postoperative pain remains a significant concern in children undergoing this procedure. Pain following tonsillectomy is often moderate to severe in intensity, particularly during the first 24–48 hours, and can negatively affect oral intake, hydration status, sleep quality, and overall recovery. Inadequate pain control may also lead to increased anxiety in both children and caregivers, prolonged hospital stay, and higher risk of postoperative complications such as dehydration and secondary hemorrhage due to poor cooperation with oral intake and medications [1,2]. The concept of preemptive analgesia has gained importance in modern anesthetic practice. Preemptive analgesia refers to the administration of analgesic agents before the onset of noxious surgical stimuli to prevent central and peripheral sensitization, thereby reducing postoperative pain intensity and analgesic requirements. By blocking the establishment of altered central processing of afferent input, preemptive strategies aim to improve postoperative comfort and functional recovery [3]. In pediatric patients, this approach is particularly relevant because effective pain assessment and communication are often challenging, making proactive pain control essential. Among the various analgesic agents used in pediatric practice, paracetamol (acetaminophen) and ibuprofen are two of the most commonly prescribed non-opioid medications. Paracetamol is widely used due to its excellent safety profile, minimal gastrointestinal side effects, and suitability in children of all age

groups. Its mechanism of action is primarily central, involving inhibition of prostaglandin synthesis in the central nervous system and modulation of serotonergic pathways, although its exact mechanism remains incompletely understood [4]. However, paracetamol lacks significant peripheral anti-inflammatory activity, which may limit its effectiveness in surgeries associated with substantial inflammatory response, such as tonsillectomy. Ibuprofen, a non-steroidal anti-inflammatory drug (NSAID), acts through reversible inhibition of cyclooxygenase (COX-1 and COX-2) enzymes, thereby reducing prostaglandin synthesis at both peripheral and central levels. This dual mechanism provides analgesic, antipyretic, and anti-inflammatory effects. Because postoperative pain following tonsillectomy is largely driven by local inflammation in the tonsillar fossae, ibuprofen is theoretically more effective in controlling pain in this setting [5].

However, concerns regarding NSAID-associated adverse effects, particularly postoperative hemorrhage, have historically limited its widespread use in tonsillectomy patients, although recent evidence suggests that ibuprofen may be safe when used appropriately [6]. Several clinical studies have compared paracetamol and ibuprofen for postoperative analgesia in children, but findings remain inconsistent. Some studies suggest superior analgesic efficacy of ibuprofen, with reduced need for rescue opioids and better early pain control, while others report comparable efficacy between the two drugs when administered in appropriate doses [7,8].

Variations in study design, dosing regimens, timing of administration, and pain assessment tools contribute to these differences. The timing of drug administration is an important determinant of analgesic effectiveness. Preemptive administration, rather than postoperative dosing, may enhance analgesic outcomes by preventing sensitization pathways. In pediatric tonsillectomy, where tissue trauma is predictable and uniform, preemptive analgesia provides an ideal model to evaluate drug efficacy [9].

Despite increasing interest in multimodal and preventive analgesia strategies, there is still no clear consensus on the superior preemptive agent between paracetamol and ibuprofen in this surgical population. Given the clinical relevance of optimal pain control and the ongoing debate regarding the comparative effectiveness and safety of these two commonly used drugs, further well-designed studies are warranted.

Establishing the more effective preemptive analgesic agent can help improve postoperative comfort, reduce rescue analgesic requirements, and enhance recovery in pediatric tonsillectomy patients [10].To compare the efficacy of preemptive paracetamol versus ibuprofen in reducing postoperative pain and analgesic requirement in children undergoing tonsillectomy.

Materials and Methods

Study design A prospective, randomized, double-blind, comparative clinical study.

Study setting: Dinhata Subdivisional Hospital, Coochbehar.

Period of study: 1Year

Study population: The study population consisted of 120 pediatric patients scheduled for elective tonsillectomy under general anesthesia who fulfilled the inclusion criteria and were randomly allocated into two groups for comparison of preemptive analgesia with paracetamol and ibuprofen.

Sample size: 120

Inclusion Criteria

- Children aged 5–15 years scheduled for elective tonsillectomy
- Patients belonging to ASA Physical Status I–II
- Patients undergoing tonsillectomy under general anesthesia
- Patients with no history of chronic pain or analgesic use
- Patients whose parents/guardians provided written informed consent
- Patients willing to comply with postoperative pain assessment

Exclusion Criteria

- Children with ASA Physical Status III or higher
- History of bleeding disorders or coagulopathy
- Known allergy or contraindication to paracetamol or ibuprofen
- Use of analgesics, NSAIDs, or steroids within 24–48 hours preoperatively
- Patients with hepatic, renal, or gastrointestinal disease
- Emergency tonsillectomy cases or associated surgical procedures
- Intraoperative complications requiring change in anesthetic plan or extended surgery
- Patients lost to follow-up or with incomplete data collection

Statistical Analysis: For statistical analysis data were entered into a Microsoft Excel spreadsheet and then analyzed by SPSS (version 27.0; SPSS Inc., Chicago, IL, USA) and Graph Pad Prism version 5. Data had been summarized as mean and standard deviation for numerical variables and count and percentages for categorical variables. Z-

test (Standard Normal Deviate) was used to test the significant difference of proportions. Once a t value is determined, a p-value can be found using a table of values from Student's t-distribution. If the calculated p-value is below the threshold chosen for statistical significance (usually the 0.10, the 0.05, or 0.01 level), then the null hypothesis is rejected in favor of the alternative hypothesis. P-value ≤ 0.05 was considered for statistically significant.

Result

Table 1: Age Distribution of Study Groups

Age (years)	Paracetamol (n=60)	Ibuprofen (n=60)	Total	p-value
5–7	18 (30%)	20 (33.3%)	38	0.87
8–11	22 (36.7%)	21 (35%)	43	
12–15	20 (33.3%)	19 (31.7%)	39	
Total	60	60	120	

Table 2: Gender distribution

Gender	Paracetamol (n=60)	Ibuprofen (n=60)	Total	p-value
Male	26 (43.3%)	28 (46.7%)	54	0.71
Female	34 (56.7%)	32 (53.3%)	66	
Total	60	60	120	

Table 3: Mean Postoperative Pain Score (FLACC/Wong-Baker)

Time Interval	Paracetamol (Mean ± SD)	Ibuprofen (Mean ± SD)	p-value
2 hours	5.2 ± 1.3	4.1 ± 1.2	0.001
6 hours	4.6 ± 1.2	3.5 ± 1.1	0.002
12 hours	3.2 ± 1.0	2.6 ± 0.9	0.01
24 hours	2.1 ± 0.8	1.8 ± 0.7	0.08

Table 4: Time to First Rescue Analgesia

Group	Mean Time (hours) ± SD	p-value
Paracetamol	5.6 ± 1.4	0.0001
Ibuprofen	8.3 ± 1.7	

Table 5: Total Rescue Analgesic Requirement (24 hours)

Group	Mean Dose (mg/kg) ± SD	p-value
Paracetamol	28.5 ± 6.2	0.0003
Ibuprofen	18.9 ± 5.4	

Table 6: Postoperative Complications

Complication	Paracetamol (n=60)	Ibuprofen (n=60)	p-value
Nausea/Vomiting	8 (13.3%)	6 (10%)	0.54
Secondary Hemorrhage	1 (1.7%)	2 (3.3%)	0.56

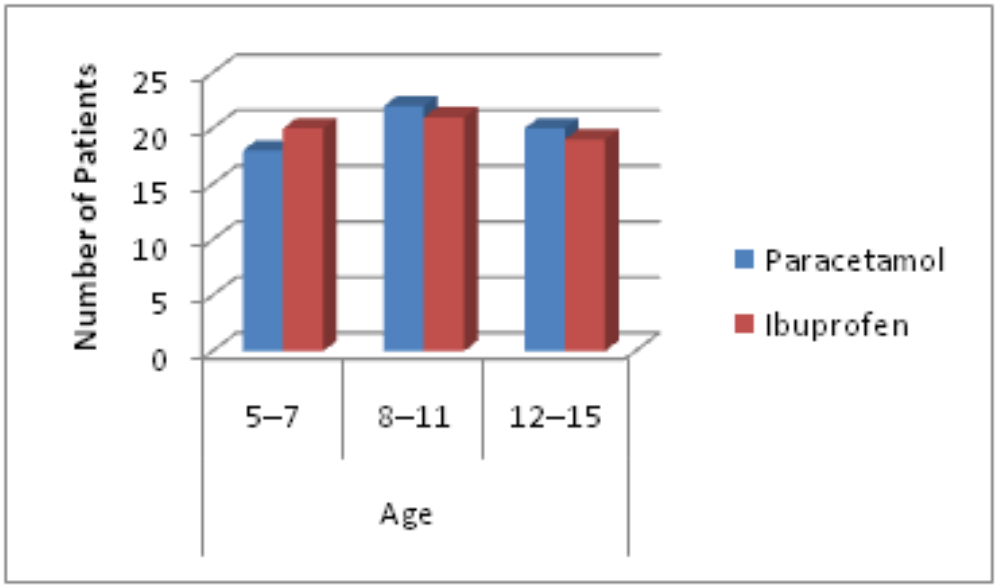

Figure 1: Age distribution of study groups

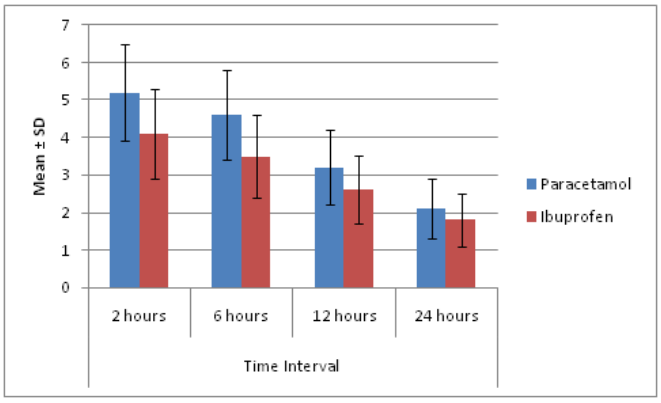

Figure 2: Mean Postoperative Pain Score (FLACC/Wong-Baker)

Age distribution of study groups

Result: In the Paracetamol group, 18 patients (30%) were aged 5–7 years, 22 patients (36.7%) were 8–11 years, and 20 patients (33.3%) were 12–15 years. In the Ibuprofen group, 20 patients (33.3%) were aged 5–7 years, 21 patients (35%) were 8–11 years, and 19 patients (31.7%) were 12–15 years. The distribution was comparable between the groups ($p = 0.87$).

Interpretation: There was no statistically significant difference in age distribution between the two groups, indicating that both groups were well matched for age.

Gender distribution

Result: The Paracetamol group included 26 males (43.3%) and 34 females (56.7%), while the Ibuprofen group included 28 males (46.7%) and 32 females (53.3%). The difference between the groups was not statistically significant ($p = 0.71$).

Interpretation: Both groups were comparable in terms of gender distribution, with no significant difference observed.

Mean postoperative pain score

Result: At 2 hours, the mean pain score was 5.2 ± 1.3 in the Paracetamol group and 4.1 ± 1.2 in the Ibuprofen group ($p = 0.001$). At 6 hours, it was 4.6 ± 1.2 vs 3.5 ± 1.1 ($p = 0.002$). At 12 hours, it was 3.2 ± 1.0 vs 2.6 ± 0.9 ($p = 0.01$). At 24 hours, it was 2.1 ± 0.8 vs 1.8 ± 0.7 ($p = 0.08$).

Interpretation: Ibuprofen showed significantly better pain control in the early postoperative period compared to Paracetamol, while the difference at 24 hours was not statistically significant.

Time to first rescue analgesia

Result: The mean time to first rescue analgesia was 5.6 ± 1.4 hours in the Paracetamol group and 8.3 ± 1.7 hours in the Ibuprofen group ($p = 0.0001$).

Interpretation: Patients receiving Ibuprofen had a significantly longer duration before requiring rescue analgesia, indicating superior analgesic efficacy.

Total rescue analgesic requirement

Result: The total rescue analgesic requirement over 24 hours was 28.5 ± 6.2 mg/kg in the Paracetamol group and 18.9 ± 5.4 mg/kg in the Ibuprofen group ($p = 0.0003$).

Interpretation: Ibuprofen significantly reduced the total requirement of rescue analgesics compared to Paracetamol.

Postoperative complications

Result: Nausea and vomiting occurred in 8 patients (13.3%) in the Paracetamol group and 6 patients (10%) in the Ibuprofen group ($p = 0.54$). Secondary hemorrhage occurred in 1 patient (1.7%) in the Paracetamol group and 2 patients (3.3%) in the Ibuprofen group ($p = 0.56$).

Interpretation: There was no statistically significant difference in postoperative complications between the two groups, indicating similar safety profiles.

Discussion

Postoperative pain following pediatric tonsillectomy remains a major clinical concern despite advances in anesthesia and surgical techniques. Effective pain control is essential not only for patient comfort but also for ensuring adequate oral intake, early recovery, and prevention of complications such as dehydration and secondary hemorrhage. In the present study, we compared the efficacy of preemptive paracetamol versus ibuprofen in pediatric tonsillectomy, focusing on postoperative pain scores, time to rescue analgesia, total analgesic requirement, and safety profile. In this study, both groups were comparable in terms of age and gender distribution, indicating effective randomization and eliminating demographic bias. Similar baseline comparability has been emphasized in previous pediatric analgesia trials to ensure valid interpretation of outcomes [11,12]. Our findings demonstrate that

ibuprofen provided significantly better postoperative analgesia compared to paracetamol during the early postoperative period (2–12 hours). Pain scores were consistently lower in the ibuprofen group, which is consistent with the known pharmacological advantage of NSAIDs in controlling inflammatory pain. Tonsillectomy pain is primarily driven by local inflammation and prostaglandin release, making cyclooxygenase inhibition particularly effective [13]. Paracetamol, while effective as a centrally acting analgesic, lacks strong peripheral anti-inflammatory action, which may explain its comparatively higher pain scores [14]. The significantly longer time to first rescue analgesia observed in the ibuprofen group further supports its superior analgesic efficacy. This finding is clinically important, as delayed requirement for rescue analgesia reflects prolonged duration of effective pain control. Similar findings have been reported in pediatric postoperative pain studies where ibuprofen provided longer analgesia duration compared to paracetamol, particularly in surgeries with inflammatory components such as tonsillectomy [15]. Additionally, the total rescue analgesic requirement over 24 hours was significantly lower in the ibuprofen group. This reduction has important clinical implications, as minimizing additional analgesic use reduces potential drug-related adverse effects and improves overall patient recovery. Previous meta-analyses have also demonstrated that NSAIDs reduce opioid and rescue analgesic consumption in pediatric surgical populations without increasing complication rates [16]. One of the most debated concerns regarding ibuprofen use in tonsillectomy is the risk of postoperative hemorrhage. Historically, NSAIDs were avoided due to their platelet inhibition effect. However, recent evidence suggests that ibuprofen does not significantly increase clinically relevant postoperative bleeding [17]. In our study, the incidence of secondary hemorrhage was low and comparable between both groups, supporting the safety of ibuprofen when used in appropriate doses. These findings are consistent with large systematic reviews that have shown no significant increase in postoperative bleeding with ibuprofen compared to paracetamol or placebo [18]. The incidence of postoperative nausea and vomiting was also similar between both groups, indicating that ibuprofen does not increase gastrointestinal side effects in the pediatric population when used as a single perioperative dose. This is in agreement with previous pediatric analgesia studies demonstrating comparable safety profiles between NSAIDs and paracetamol in tonsillectomy patients [19]. The concept of preemptive analgesia may also explain the improved outcomes observed in the ibuprofen group. Administering analgesics prior to surgical incision may reduce central sensitization and peripheral nociceptor activation, thereby decreasing postoperative pain intensity. NSAIDs, due to their anti-inflammatory action, are particularly effective in blocking prostaglandin-mediated sensitization pathways [20]. Overall, our study supports the superiority of ibuprofen over paracetamol as a preemptive analgesic in pediatric tonsillectomy, particularly in the early postoperative period. However, both drugs remain safe, and the choice of analgesic may be individualized based on patient risk factors and clinical setting.

Conclusion

This study demonstrates that ibuprofen is more effective than paracetamol when used as preemptive analgesia in pediatric tonsillectomy. Patients receiving ibuprofen showed significantly lower postoperative pain scores in the early postoperative period, a longer time to first rescue analgesia, and reduced total analgesic requirement over 24 hours. However, both drugs showed comparable safety profiles with no statistically significant difference in postoperative complications, including nausea, vomiting, or secondary hemorrhage. Thus, ibuprofen can be considered a superior preemptive analgesic option compared to paracetamol for better postoperative pain control in children undergoing tonsillectomy, while maintaining an acceptable safety profile.

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