RESEARCH ARTICLE

Comparison of intravenous ibuprofen and paracetamol for peri-operative analgesia in paediatric day care tonsillectomy: Research article

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Abstract

Objective: To determine the effectiveness of intravenous ibuprofen and acetaminophen as perioperative analgesics in paediatric patients undergoing day-care tonsillectomy with general anaesthesia.

Method: The quasi-experimental study was conducted at the Anaesthesia Department of Pak Emirates Military Hospital, Rawalpindi, Pakistan, from July 2021 to June 2022, and comprised paediatric patients aged 5-12 years undergoing day-care tonsillectomy with general anaesthesia. The subjects were divided into two equal groups. Patients in Group I received intravenous ibuprofen 7mg/kg and patients in Group P received intravenous paracetamol 10mg/kg immediately after induction of anaesthesia. All patients received standard general anaesthesia with endotracheal intubation. The primary outcome measured was revised faces pain score immediately after recovery and at the time of discharge 6 hours later. Adverse events were also noted. Data was analysed using SPSS 26.

Results: Of the 100 patients, there were 50(50%) in Group I; 21(42%) boys and 29(58%) girls with mean age 7.82±1.903 years. The remaining 50(50%) subjects were in Group P; 25(50%) boys and 25(50%) girls with mean age 7.68±1.812 years. At baseline, 44(88%) patients in Group I and 42(84%) in Group P reported no pain, while 6(12%) and 8(16%) patients in the two groups, respectively, reported pain (p=0.56). At discharge, 35(70%) patients in Group I and 18(36%) in Group P reported no pain ($p<0.001$). Adverse events were not significantly different between the groups ($p>0.05$).

Conclusion: Intravenous ibuprofen was found to be a superior pain-killer than intravenous paracetamol for peri-operative care of paediatric patients in day-care tonsillectomy.

Keywords: Acetaminophen, Analgesia, Ibuprofen, Paracetamol, Revised faces pain score, FPS-R. (JPMA 73: 58; 2023)

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Introduction

According to the Declaration of Montreal, adequate relief of pain is a cardinal human right and "it is the right of all people to have access to pain management without discrimination".[1] The paediatric age group is prone to post-operative pain as much as adult population, but they cannot verbalise, and, hence, it is undertreated and under-rated in this age group.[2] This might be due to hindrances faced in the assessment of pain that depends on a number of factors like child's perception of pain, age and clinical condition.[3] Adequate pain relief is part and parcel of modern-day anaesthesia, and paediatric age group is no exemption. With the increasing trend of day-care surgeries, opioid painkillers have largely been replaced by regional anaesthesia, peripheral nerve blocks and non-steroidal anti-inflammatory drugs (NSAIDs).[4] The post-operative pain relief in abdominal and lower abdominal surgeries have been provided by peripheral nerve blocks and field blocks, but for procedures like tonsillectomy, there are no definite peripheral nerve blocks. Tonsillectomy is mostly a short day-care procedure in expert hands and opioids are not adequate for this short and same-day intervention due to their drawbacks of enhancing hospital stay, post-operative nausea and vomiting (PONV), respiratory depression and pruritis.[5] Therefore, opioid-sparing anaesthesia seems a logical choice in this situation. With recent advancements, multiple options are available to avoid opioids, such as regional blocks, acupuncture medicine and nonpharmacological techniques, including cryotherapy, distraction techniques, and breathing and relaxation exercises.[6] There are quite a few drugs that have opioid-sparing effect, like ketamine, dexmedetomidine, paracetamol, ibuprofen, gabapentinoids and ketorolac.[7] However, there are limitations related to all these drugs. Ketamine can cause laryngospasm in children with upper respiratory tract infection[8] and diclofenac may cause ulceration and bleeding in gastrointestinal tract though it is superior to paracetamol in analgesia terms. Ketorolac has adverse renal profile and increases the risk of bleeding.[9]

Ibuprofen's opioid-sparing effect has been suggested in placebo-controlled trials[10] but its superiority to paracetamol is yet to be established. The current study was planned to determine the effectiveness of intravenous (IV) ibuprofen and acetaminophen as perioperative analgesics in paediatric patients undergoing day-care tonsillectomy with general anaesthesia.

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Patients and Methods

The quasi-experimental study was conducted at the Anaesthesia Department of Pak Emirates Military Hospital (PEMH), Rawalpindi, Pakistan, from July 2021 to June 2022. After approval from the institutional ethics review committee, the sample size was calculated using the World Health Organisation (WHO) calculator via Open Epi[11] by estimating the total number of cases received over a period of 12 months with confidence interval (CI) 95% of error, power of test 80% and patient proportion 0.31(P1) and 0.13 (P2). The sample was inflated by >20%. The sample was raised using non-probability consecutive sampling technique from among those who came to the operation theatre (OT) for tonsillectomy. Those included were paediatric patients of either gender aged 5-12 years having American Society of Anaesthesiology (ASA) physical status I or II.[12] Children with special needs having delayed milestones, mute, speech or hearing problems were excluded.

The patients were booked through the outpatient department (OPD) and detailed pre-anaesthetic assessment was done in the pre-anaesthesia clinic. Parents/guardians were briefed about the purpose of study and their informed consent was obtained.

The subjects were divided into ibuprofen Group I and paracetamol Group P. In the OT, the patients were given inhalational induction with 8% sevoflurane in mixture of 100% oxygen. The IV access was achieved with 22-gauge cannula (B-Braun) after inhalational induction and standard monitoring was attached. Injection propofol 2mg/kg and atracurium 0.5mg/kg was given after achievement of intravascular access and appropriately-sized endotracheal tube was passed. IV nalbuphine 0.2mg/kg, injection metoclopramide 0.1mg/kg and injection dexamethasone 0.1mg/kg were given to all patients at induction. The surgery was maintained with mixture of isoflurane 1.2MAC, 50% oxygen and 50% air.

In Group I, patients were given IV ibuprofen 7mg/kg (Inbufin, Searle Pvt Limited) after induction, and in Group P, the patients were given IV acetaminophen 10mg/kg (Novemol, Novex Pharmaceuticals, Islamabad). All patients underwent standard tonsillectomy and trachea was extubated in the OT after surgery. The children were kept in post-anaesthesia care facility afterwards. They were monitored there until discharge.

The pain score was recorded through revised Faces Pain Scale (FPS-R)[13] at zero hours (15 minutes after being shifted to the post-anaesthesia care unit for recovery) and at the time of discharge, which was about 6 hours later, by the resident anaesthesiologist.

The parameters documented were age, weight, ASA status, duration of surgery, presence or absence of intra-operative pain perception, post-operative pain perception, and presence or absence of PONV. The intra-operative pain perception was measured through the presence of either hypertension or tachycardia or diaphoresis. The post-operative pain perception was measured through FPS-R. In case of intra-operative or post-operative pain perception, rescue analgesic was dispensed in the form of nalbuphine 0.1mg/kg. When heart rate increased >20% of the baseline, a patient was taken as tachycardiac. Hypertension was considered with increase in mean arterial pressure >20% compared to the baseline values, and diaphoresis was defined as sweating.

Data was analysed using SPSS 26. For quantitative variables, mean and standard deviation were derived, while frequencies and percentages were calculated for qualitative variables. FPS-R <4 was taken as 'no pain' and >4 as 'pain'. Chi-square test was used to compute the significance, and $p<0.05$ was considered significant.

Results

Of the 100 patients, there were 50(50%) in Group I; 21(42%) boys and 29(58%) girls with mean age 7.82±1.903 years. The remaining 50(50%) subjects were in Group P; 25(50%) boys and 25(50%) girls with mean age 7.68±1.812 years. Mean weight and duration of surgery were not significantly different between the groups (Table 1).

At baseline, 44(88%) patients in Group I and 42(84%) in

Table-1: Demographic characteristucs of the groups.

Parameters	Group I Mean±SD	Group P Mean±SD	*p*-value
Age (years)	7.82±1.903	7.68±1.812	0.756
Weight (kg)	20.48±4.166	20.40±4.28	0.740
Duration of Surgery (min)	15.38±1.44	15.72±1.525	0.265
Gender	n (%)	n (%)	
Male	21(42)	25(50)	0.274
Female	29(58)	25(50)	
ASA Status			
ASA I	30(60)	25(50)	0.211
ASAII	20(40)	25(50)	

SD: Standard deviation, ASA: American Society of Anaesthesiologists.

Table-2: Perioperative pain perception in study groups.

Parameters		Group I n(%)	Group P n(%)	*p*-value
Revised Faces Pain Score At Zero Hours	No Pain	44(88)	42(84)	0.56
	Pain	6(12)	8(16)	
Revised Faces Pain Score At Discharge	No Pain	35(70)	18(36)	0.001
	Pain	15(30)	32(64)	
Intraoperative pain perception	Yes	1 (2)	6 (12)	0.056
	No	49 (98)	44 (88)	

Table-3: Perioperative pain perception in study groups.

Complications		Group I n (%)	Group P n (%)	*p*-value
PONV	Yes	2(4)	1(2)	0.756
	No	48(96)	49 (98)	
Hypertension	Yes	1 (2)	1 (2)	0.274
	No	49 (98)	49 (98)	
Tachycardia	Yes	1 (2)	4 (8)	0.740
	No	49 (98)	46 (92)	
Diaphoresis	Yes	Nil	2 (4)	0.211
	No	50 (100)	48 (96)	

PONV: Post-operative nausea and vomiting.

Group P reported no pain, while 6(12%) and 8(16%) patients in the two groups, respectively, reported pain (p=0.56). At discharge, 35(70%) patients in Group I and 18(36%) in Group P reported no pain (p<0.001) (Table 2). Adverse events were not significantly different between the groups (p>0.05) (Table 3).

Discussion

Ibuprofen proved to be a better analgesic compared to paracetamol in the current study. Ibuprofen has been recently available at the study site as IV preparation, otherwise it was only available as oral preparation and the oral route cannot be used in anaesthetised patient. Also, the peri-operative use of ibuprofen was limited due to unpredictability as a rectal preparation. The IV route was not feasible due to lipophilic nature, but the availability of water-based preparation in United States in which L-lysine is used to create a salt suitable for IV administration, paved the way for IV ibuprofen.[13] The drug used in the current study was Inbufin (Searle Pvt Limited), which is a racemic mixture of S-enantiomer and R-enantiomer with C-max of 40 minutes, estimated volume of distribution 0.11 to 0.211 litres per kg and half-life of 2 hours with predominantly renal excretion.

The most persistently employed IV analgesic for peri-operative period is ketorolac, which is an NSAID. The availability of intravascular preparation of ibuprofen has provided a new alternative. The preference of ibuprofen over ketorolac in children is supported by the fact that efficacy and patient satisfaction of IV ibuprofen is the same as ketorolac[14] but it is more rapidly acting than ketorolac[15] as well as being more cost-effective.[16] Tonsillectomy is most common otorhinolaryngological intervention in children, and it is associated with considerable pain in the first 24 hours even though it is increasingly done as day-care surgery.[17] Therefore, the choice of pain-killer should be such that it provides analgesia to pain of moderate to severe intensity, devoid of sedation and has good safety profile. Opioids are not suitable choice for immediate post-operative period due to the risk of sedation and respiratory depression.[18] Therefore, this shifts the focus to NSAIDs and paracetamol.

Both ibuprofen and acetaminophen have similar opioid (morphine) sparing which implies that both drugs have equivalent analgesic efficacy. Moreover, they can be used as sole analgesic agents for neonates and infants.[19]

A randomised controlled trial (RCT) deemed ibuprofen superior when given intravascularly against paracetamol in reducing temperature at 2-4 hours of commencement of treatment. However, there was no notable difference at 24 hours. Although generally paracetamol is considered a safer drug than ibuprofen, the RCT reported comparable adverse reactions in both groups.[20]

A systematic review comprising 19 studies done in seven different countries and comprising almost 200,000 patients suggested that ibuprofen reduced pain more efficiently than paracetamol.[21]

Another study, comprising adult patients in whom cholecystectomy was done laproscopically and in which ibuprofen was compared to placebo, reported that the anticipative use of IV ibuprofen had significant opioid-sparing effect in the first 24 hours. The bolus preliminary dose of IV ibuprofen reduced pain scores, reduced opioid utilisation and decreased need for rescue analgesia, making it logical option for day-care surgeries.[22]

A study comparing IV ibuprofen and acetaminophen after surgery in patients undergoing septorhinoplasty reported that post-operative pain scores were lower in ibuprofen than acetaminophen group.[23]

Paediatric age group is more vulnerable to adverse effects related to opioids, like respiratory depression, protracted stay in post-anaesthesia care unit, pruritus and PONV.[24] This is more often seen with tonsillectomy in female paediatric patients. Prescription and illicit opioids were responsible for the demise of almost 8,000 children and adolescents in the US from 1999 to 2016.[25] Therefore, the current study planned to use non-opioid analgesia for peri- and post-operative periods. The method of assessment of pain was the self-reporting FPS-R tool, which is considered the most precise and consistent measure of pain perception.[26] Since the study comprised patients aged 5-12 years, therefore pain scores were recorded with ease and certain degree of precision.

The current study has limitations as the paediatric subjects cannot be trusted with self-reporting tools. The intraoperative pain perception could not be precisely measured, and surrogate measures were used to approximate it, which can be a source of bias. Moreover, pain perception is subjective and dependent on individual differences in physiological, emotional and cognitive states leading to lack of standardised methods to gauge pain.

Conclusion

IV ibuprofen was found to be a superior pain-killer than IV paracetamol, and provided better analgesic conditions for peri-operative care of paediatric patients in day-care tonsillectomy.

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Author Contribution:

AZ: Literature search, designing the study and concept.
KM: Study design and concept, drafting.
AS: Questionnaire design, final approval.
SB: Data collection and data analysis.
AK: Data interpretation
AN: Drafting and critical revision.