International Journal of Contemporary Pediatrics
Gupta N et al. Int J Contemp Pediatr. 2019 May;6(3):1119-1123
http://www.ijpediatrics.com
pISSN 2349-3283 | eISSN 2349-3291

DOI: http://dx.doi.org/10.18203/2349-3291.ijcp20191500

Original Research Article

The randomised prospective comparative study to see the duration of analgesia following intravenous or rectal acetaminophen after adenotonsillectomy in children

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Received: 26 March 2019
Accepted: 03 April 2019

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ABSTRACT

Background: The greatest advance in pediatric pain medicine is the recognition that untreated pain is a significant cause of morbidity and even mortality after surgical trauma. Author compared the analgesic efficacy and duration of analgesia of rectal acetaminophen and I.V. acetaminophen.
Methods: A total of 80 children in the age group of 2-5 years were randomly selected and divided into 2 groups. Group I received 15 mg/kg I.V. paracetamol and group II received 40 mg/kg rectal acetaminophen. Post-operative pain scores were measured using Face, Legs, Activity, Cry and Consolability scale and duration of analgesia were recorded and compared.
Results: The pain scores in group I was lower immediately after extubation and at 30 minutes post extubations but at one, two and four hours the pains score were comparable in both the groups. At 6 hours, the pain score was significantly more in I.V. group and also the duration of analgesia was 9-10 hours in rectal acetaminophen group where as in I.V. group, it was 5-6 hours.
Conclusions: Rectal acetaminophen 40 mg/kg produces prolonged analgesia as compared to I.V. paracetamol 15 mg/kg and also is more convenient and cost effective and is devoid of side effects of I.V. cannulation.

Keywords: Adenotonsillectomy, I.V. paracetamol, Rectal acetaminophen

INTRODUCTION

Postoperative pain and its complications have long been a concern to medical professionals. Optimal perioperative pain management can consequently reduce post-operative complications, enhance recovery after surgery and shorten the length of hospital stay.[1] While pain is a major cause of post-operative agitation, children's inability to express their feelings generally prevents them from receiving adequate doses of analgesics.[2]

A variety of medications, including opioids, non-steroidal anti-inflammatory drugs and acetaminophen have been recommended for pre-emptive analgesia. In general, opioids should be avoided in children as they can increase post-operative vomiting and cause sedation, nausea and respiratory depression. NSAIDS on the other hand may lead to gastrointestinal bleeding and trigger severe asthmatic attacks. Acetaminophen has thus gained growing popularity as a safe analgesic, especially in children.[3]

Oral acetaminophen produces an unpredictable plasma concentration, may not be accepted by all children and administration after surgery may be limited by post-operative nausea and vomiting.[4] Alternatively, the rectal route can be used after induction of anesthesia. However, it may be less acceptable to some patients and plasma concentrations may be unpredictable and may not achieve therapeutic levels in some cases.[5-7] Although plasma levels are more predictable with intravenous paracetamol there are few studies actually comparing the clinical efficacy of I.V. acetaminophen with other routes.

So, author conducted a comparative study between intravenous and rectal acetaminophen in terms of efficacy and duration of analgesia in children after tonsillectomy with or without adenoidectomy.

METHODS

After obtaining approval from institutional ethical committee, this study was conducted in a hospital setting on 80 patients of age group 2-5 years, weighing less than 30 kg and undergoing tonsillectomy or adeno-tonsillectomy. Informed written consent was taken from parents of children enrolled in study. Exclusion criteria were children undergoing emergency surgery, having known hypersensitivity to acetaminophen, having a known history of active and severe renal, hepatic, respiratory or cardiac disease.

Patients were randomly divided into two groups:

- Group I- Patients received 15 mg/kg I.V. acetaminophen during surgery.
- Group II- Patients received 40 mg/kg acetaminophen rectally during surgery.

All children were fasted and premedicated with intramuscular glycopyrrolate 0.01 mg/kg. Peripheral I.V. assess was secured by a trained phlebotomist and anesthesia was induced with propofol 3-5 mg/kg and tramadol 1 mg/kg. Succinylcholine 1 mg/kg was given to facilitate intubation. Anesthesia was maintained with halothane 0.5% in O_2/NO_2 mixture and vecuronium 0.08 mg/kg. All children received ondansetron as an antiemetic before surgery. Blood pressure (BP), heart rate (HR), respiratory rate (RR) and oxygen saturation were continuously monitored. After induction, patients in group I received 15 mg/kg of I.V. acetaminophen and in group II 40 mg/kg acetaminophen rectally. After surgery, patient was reversed with Inj. neostigmine 0.05 mg/kg and glycopyrolate 0.01 mg/kg. Patient was extubated after through suctioning of oral cavity and transferred to the recovery room. HR, BP, RR and oxygen saturation were continuously monitored.

Post-operative pain was assessed by FLACC scale which ranges from 0-10 with 0 being no pain and 10 the worst pain (Table 1).

Table 1: FLACC scale.

Parameter and Score 0 1 2			
Face	No particular expression or smile	Occasional grimace or frown, withdrawn, disinterested	Frequent to constant frown, clenched jaw, quivering chin
Legs	Normal position relaxed	Uneasy, restless, tense	Kicking or legs drawn up
Activity	lying quietly, normal position moves easily	squirming shifting back and forth, tense	Arched, rigid and jerking
Cry	No cry (awake or asleep)	Moans or whimpers, occasional complaints	Crying steadily, screams or sobs, frequent complaints
Consolabilty	Content, relaxed	Reassured by occasional touching, hugging and talking to distractable	Difficult to console or comfort

Intramuscular diclofenac was used at FLACC score of more than 3. The first pain scoring was done immediately after extubation and then at 30 min, 1, 2, 4 and 6 hours post-extubation.

The duration of analgesia was from the administration of acetaminophen to FLACC score >3, when I.M. diclofenac was given as rescue analgesia. Adverse effects like vomiting and sedation were also noted.

The results were compiled and statistically analysed using chi-square test for non-parametric data and ANOVA for parametric data. Post hoc students paired t-test was applied wherever indicated using SPSS software. Author have used mean and standard deviation to represent the average and typical spread of value of variable $P < 0.05$ was considered statistically significant.

RESULTS

Total 80 patients were enrolled in this study. The demographic profile of patients including weight (kg), age (months), gender, duration of surgery (minutes), and length of stay in recovery room (hours) were comparable

and there was no statistically significant difference in two groups (Table 2). Immediately after extubation and for the first 30 mins, pain score was significantly lower in group I. Then at one, two and four hours the pain score in both the group became comparable but at six hours the pain score became significantly higher in patients of group I who received I.V. paracetamol (Table 3) and (Figure 1). The duration of post-operative analgesia was 314.10±88.44 minutes in Group I (I.V. paracetamol) where as in group II it was 533.60±79.86 minutes. This came out to be statistically highly significant (Table 4) and (Figure 2).

Table 2: Demographic profile.

Variable	Group I I/V paracetamol	Group II rectal paracetamol	P value
Weight (kg)	13.56±0.47	13.64±0.61	>0.05
Age (months)	36.1±20.7	35.3±25.9	>0.05
M/F	33/7	33/8	>0.05
Duration of operation (minutes)	57.6±15.8	56.8±12.7	>0.05
Length of stay in recovery room (hours)	67±8.7	67.2±13.1	>0.05

Table 3: Pain scores measured on FLACC scale.

Time after extubation	Group I I.V. Paracetamol	Group II rectal paracetamol	P value
Immediately after	06±0.2	1.1±0.2	<0.05
30 minutes	1.2±0.2	2±0.3	<0.05
One hour	2.0±0.2	2.1±0.2	>0.05
Two hours	2.72±0.2	2.22±0.2	>0.05
Four hours	2.86±0.2	2.36±0.2	>0.05
Six hours	3.90±0.2	2.82±0.2	<0.05

P value <0.05 is highly significant, P value >0.05 is non-significant.

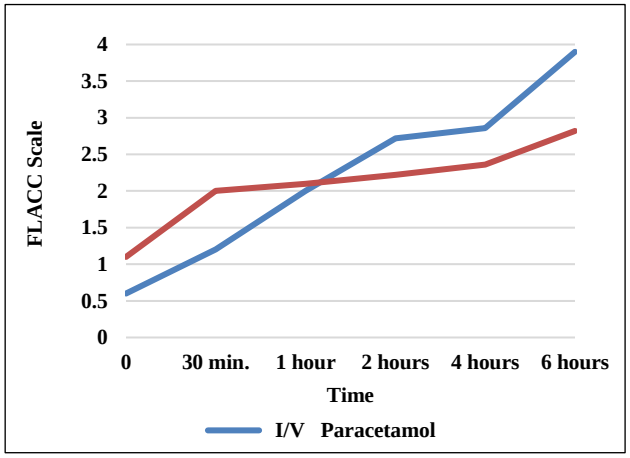

Figure 1: Mean pain score by FLACC scale.

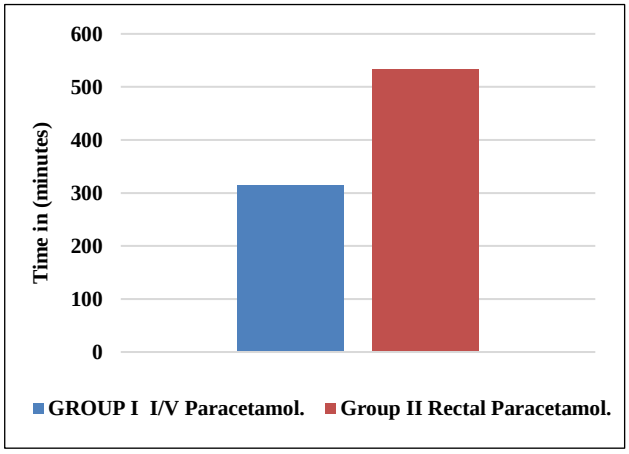

Figure 2: Duration of post-operative analgesia.

Table 4: Duration of post-operative analgesia.

Parameters	Group I (I.V. paracetamol)	Group II (rectal paracetamol)	P value
Duration of analgesia (min)	314.10±88.44	533.60±79.86	<0.05

P value <0.05 is highly significant.

DISCUSSION

Acetaminophen is recognized as one of the most commonly used synthetic, non-opioid, centrally acting analgesic agents. It represents a key part of pain management in patients with cancer, and is used preoperatively, intraoperatively and post-operatively in a wide range of surgical setting, offering effective and fast pain relief.[8-10]

It has become one of very few non opioid analgesia available in oral, rectal and I.V. formulation.[11] It is considered as the first line treatment of pain as per WHO guidelines of pain management with few drug interactions.

The rectal route has been preferred for administration for various reasons such as the need to bypass the first pass metabolism, in unconscious or uncooperative patients or in children, where the oral route is not convenient, to avoid using parenteral route and to avoid gastric irritation.[12] The extensive vascular supply in rectum allow for good absorption. If medicine is absorbed in upper part of rectum, it is carried into portal circulation via the superior hemorrhoidal vein, whereas if absorbed from lower part of rectum, it enters systemic circulation directly.

Author observed that pain scores immediately after extubation and at 30 minutes post-extubation were higher in group II (rectal acetaminophen). But later at one, two and four hours, pain scores were comparable in both the groups and at six hours, pain scores become significantly more in group I (I.V. acetaminophen). The duration of analgesia was much longer in group II (9-10 hours) as compare to group I (5-6 hours). It could be due to slower absorption of rectal acetaminophen (that last about 35-45 min) despite the bypass of first hepatic passage, causes this form of drug to reach its peak plasma concentration after about 2-3 hours. In contrast, I.V. acetaminophen reaches its maximum concentration after 15-20 min. Also because of slower absorption, analgesic effects of rectal acetaminophen last longer that I.V. paracetamol.[13-15] Similarly, Mahajan et al, also observed that duration of analgesia in post cesarian patients who received rectal acetaminophen was much longer than those who received I.V. paracetamol.[12]

Similar results like present study were seen by Khalili GR et al, they divided the children undergoing inguinal herniorrhaphy into four groups and gave IV and rectal paracetamol to two groups and placebo rectal and IV drug to other two groups and found that the two forms of drugs were equally effective in reducing the need for additional analgesics to significantly lower level as compared to placebo groups.[16] Also, vomiting was much less frequent in groups receiving acetaminophen than in placebo groups. None of the patients also have vomiting.

Author observed that duration of analgesia in group I was 5-6 hours whereas in group II (rectal acetaminophen) was 9-10 hours that was statistically highly significant and similar results like this study were seen by Capici F et al.[17] They also observed that time to first rescue analgesia was much prolonged in rectal group as compared to IV group. Author also had similar results.

Contrary to this findings, where author have seen increased duration of analgesia with rectal acetaminophen, there are studies where have found rectal acetaminophen to provide erratic and inconsistent analgesia after tonsillectomy.[14,18,19] This variation may be explained by differing analgesic requirements with different surgical techniques, different doses of acetaminophen or the concurrent use of other analgesics agents.[17]

Rectal acetaminophen would be expected to have a slower onset than I.V. acetaminophen. In this study, acetaminophen was given after induction and at least 20 minutes before end of procedure. It might be the reason that pain scores were lower in I.V. paracetamol group initially as compared to rectal acetaminophen group. But thereafter the pain scores become very much comparable. Simila results were seen by Capicci F et al.[17]

Haddadi et al, compared I.V. and rectal acetaminophen in pediatric patients after adenoidectomy.[13] On 4- and 6-hours intervals the pain in rectal acetaminophen group was less than in I.V. acetaminophen group. Demand for additional analgesic medication in rectal acetaminophen receiving group was less than I.V. group. Result showed rectal acetaminophen was superior.[13] Though in this study, at 4 hours interval pain scores were comparable but at 6 hours pain score was significantly more in I.V. group and required rescue analgesia. Despite the advantage of early onset offered by I.V. acetaminophen, the choice of this route over rectal administration should also take into account associated risks and inconveniences. Indeed, the risks associated with I.V. administration of most drugs include infection, phlebitis and local irritation. Furthermore, the time needed for I.V. drug administration, the inconvenience to patients, and the increase direct and indirect costs suggest that the most suitable route of administration should be carefully selected for each patient.[20]

CONCLUSION

So, author concluded that rectal acetaminophen provided a longer duration of analgesia of about 10 hours as compared to I.V. paracetamol that provided duration of only 6 hours and also rectal acetaminophen is much cost effective than I.V. paracetamol which is also an issue of concern in healthcare facilities especially in developing countries like India.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Hurley RW, Wu CL. Acute postoperative pain. In: Miller RD, eds. Millers Anesthesia. 7th ed. Philadelphia; Churchill Livingstone/Elsevier; 2012: 2757-2777.
2. Razavi SS, Shaeghi S, Shiva H, Momenzadeh S. A comparison between Acetaminophen suppository

and caudal anesthesia in relieving pain after pediatric surgery. Urol J. 2009;1(1):40-4.
3. Kashefi P, Mirdamadi M. Preemptive analgesia with ibuprofen and acetaminophen in pediatric lower abdominal surgery. J Res Med Sci. 2005;10:222-6.
4. Holmér Pettersson P, Öwall A, Jakobsson J. Early bioavailability of paracetamol after oral or intravenous administration. Acta Anaesthesiol Scandinavica. 2004;48(7):867-70.
5. Anderson BJ, Woolard GA, Holford NH. Phharmacokinetics of rectal acetaminophen after major surgery in children. Paediatr Anaesth. 1995;5:237-42.
6. Anderson BJ, Holford NH, Woollard GA, Kanagasundaram S, Mahadevan M. Perioperative pharmacodynamics of acetaminophen analgesia in children. Anesthesiol J Am Soc Anesthesiol. 1999;90(2):411-21.
7. Birmingham PK, Tobin MJ, Fisher DM, Henthorn TK, Hall SC, et al. Initial and subsequent dosing of rectal acetaminophen in children: a 24-hour pharmacokinetic study of new dose recommendations. Anesthesiol J Am Soc Anesthesiol. 2001;94(3):385-9.
8. Kaufman DW, Kelly JP, Rosenberg L, Anderson TE, Mitchell AA. Recent patterns of medication use in the ambulatory adult population of the United States: the Slone survey. JAMA. 2002;287(3):337-44.
9. Breivik H. Postoperative pain: toward optimal pharmacological and epidural analgesia. Pain. 2002;2002:337.
10. Candiotti KA, Bergese SD, Viscusi ER, Singla SK, Royal MA, Singla NK. Safety of multiple-dose intravenous acetaminophen in adult inpatients. Pain Med. 2010;11(12):1841-8.
11. Malaise O, Bruyera O, Reginster JY. Intravenous paracetamol: a review of efficacy and safety in theurapeutic use. Future Neurol. 2007;2(6):673-88.
12. Mahajan L, Mittal V, Gupta R, Chhabra H, Vidhan J, Kaur A. Study to compare the effect of oral, rectal, and intravenous infusion of paracetamol for postoperative analgesia in women undergoing cesarean section under spinal anesthesia. Anesthesia Essays Res. 2017;11(3):594.
13. Haddadi S, Marzban S, Karami MS, Heidarzadeh A, Parvizi A, Nabi BN. Comparing the duration of the analgesic effects of intravenous and rectal acetaminophen following tonsillectomy in children. Anesthesiol Pain Med. 2014;4(1).
14. Viitanen H, Tuominen N, Vääräniemi H, Nikanne E, Annila P. Analgesic efficacy of rectal acetaminophen and ibuprofen alone or in combination for paediatric day-case adenoidectomy. Brit J Anaes. 2003;91(3):363-7.
15. Paseron C, Standard D. The role of intravenous acetaminophen in pain management. Am Soc Pain Man. 2012;13(2):107-24.
16. Khalili GR, Shafa AM, Yousefi RA. Comparison of the effects of preemptive intravenous and rectal acetaminophen on pain management after inguinal herniorrhaphy in children: a placebo-controlled study. Middle East J Anaesthesiol. 2016;23:543-8.
17. Capici F, Ingelmo PM, Davidson A, Sacchi CA, Milan B, Sperti LR, et al. Randomized controlled trial of duration of analgesia following intravenous or rectal acetaminophen after adenotonsillectomy in children. Brit J Anaesth. 2008;100(2):251-5.
18. Gaudreault P, Guay J, Nicol O, Dupuis C. Pharmacokinetics and clinical efficacy of intrarectal solution of acetaminophen. Can J Anaesth. 1988;35(2):149-52.
19. Anderson B, Kanagasundarum S, Woollard G. Analgesic efficacy of paracetamol in children using tonsillectomy as a pain model. Anaesth Intensive Care. 1996;24(6):669-73.
20. Jibril F, Sharaby S, Mohamed A, Wilby KJ. Intravenous versus oral acetaminophen for pain: systematic review of current evidence to support clinical decision-making. Can J Hospital Pharmacy. 2015;68(3):238.

Cite this article as: Gupta N, Bhadrala N, Jasmeen, Saloni. The randomised prospective comparative study to see the duration of analgesia following intravenous or rectal acetaminophen after adenotonsillectomy in children. Int J Contemp Pediatr 2019;6:1119-23.