Original Article

Postoperative pain relief in pediatric surgery patients: Effect of intravenous paracetamol in comparison with diclofenac suppository

Zikrul Bashir[1], Md.Nazmul Islam[2], Mohammad Ashrafur Rahman[3], Sayed Ariful Islam[4] , Paresh Chandra Sarker[5]

[1]Junior Consultant (Anaesthesiology), Modernized District Hospital, Joypurhat, [2]Asst. Professor (Anaesthesiology), OSD–DGHS; Attached: Kurmitola General Hospital, Dhaka. [3]Asst. Professor (Anaesthesiology), Sir Salimullah Medical College Mitford Hospital, Dhaka, [4]Anaesthesiologist,Sir Salimullah Medical College Mitford Hospital,Dhaka , [5] Professor, (Anaesthesiology), Senior Consultant, Delta Hospital, Dhaka.

Corresponding Author: E-mail: bashirzikrul30@gmail.com

Abstract

Background: *Pain is a major problem regarding quality of life in children undergoing surgical operation.Pain assessment is the most important and critical component of pain management. Oral and rectal paracetamol formulations are associated with a slower onset of action and more variable analgesic activity than IV acetaminophen, making them less useful in preoperative and acute care settings.*

Objective: *To find out the effect of intravenous paracetamol in releiving postoperative pain in pediatric patients.*

Settings and study design: *This randomized clinical trial study was conducted in the Anaesthesiology department of Sir Salimullah Medical College Mitford Hospital,Dhaka from February' 2014 to August' 2014. A total of 100 cases were taken, they were randomly divided into two groups in which one group received intravenous paracetamol and another group received diclofenac suppository for the same operation performed on them, age of the children were between 4-12 years, and all were ASA grade I. Pain relief was assessed with VAS score from 30 minutes after surgery up to 6 hours with regular follow up and comparison made between the two groups.*

Results: *In this study, comparisons by mean visual analog scale between intravenous paracetamol with diclofenac suppository groups were done. VAS score showed both analgesic reduces pain, but diclofenac suppository was found better post operative pain reliever than intravenous paracetamol within observed 30 min to 2 hours. However observed after 6 hours, diclofenac suppository group is significantly better than intravenous paracetamol group in relieving post operative pain by measuring VAS.*

Conclusion: *Our study showed that diclofenac suppository is more effective than IV paracetamol in relieving postoperative pain. However paracetamol is definitely a viable alternative to the NSA IDs, especially because of the lower incidence of adverse effects, and should be the preferred choice in high-risk patients. It may be appropriate to combine paracetamol with NSAIDs,but future studies are required especially after major surgery.*

Key Words: Visual Analog Scale, Paediatric patients, Paracetamol, Diclofenac sodium.

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Introduction:

Pain in children is a complex phenomenon, as it is difficult to differentiate crying or restlessness due to pain from that of hunger or fear. Pain triggers complex biochemical and physiological stress response and induces impairment in pulmonary, cardiovascular, neuroendocrinal, gastrointestinal, immunological and metabolic functions[1].

Pain after surgery under general anaesthesia has been identified as the most prevalent and long-lasting symptom of postoperative morbidity among paediatric patients[2]. Opioids and non-steroidal anti-inflammatory drugs are commonly used to treat postoperative pain[3].

Diclofenac is used to treat pain after surgical operations. It eases pain and reduces inflammation. It works by blocking the effects of cyclo-oxygenase enzymes (COX), thereby fewer prostaglandin are produced, which means pain and inflammation are eased[4]. Its suppository form is a good option for post-operative analgesia in pediatric patients because of its convenience and duration of analgesia[5]. But long-term administration of them may cause rectal irritation, hemorrhage at the operated part, gastrointestinal bleeding, and renal insufficiency[6].

Intravenous (IV) paracetamol is licensed for the short-term treatment of mild to moderate pain, especially following surgery and for the short-term treatment of fever[7]. The onset of analgesia occurs rapidly within 5-10 minutes of IV paracetamol administration. The peak analgesic effect is obtained in 1 hour and its duration of action is approximately 4-6 hours[8]. Absorption of paracetamol following rectal administration is slower and more variable than with IV or oral administration[9]. High initial doses are needed to achieve therapeutic plasma concentrations and therefore the rectal route is not the preferred route of administration of paracetamol for the immediate relief of post-operative pain[10]. Where alternative routes are unavailable, IV paracetamol is mostly used in association with NSAIDs and opioids to allow a reduced dose of these analgesics, that have a worse adverse effect profile, to be given, rather than as monotherapy[11].

Postoperative pain is under treated for a number of reasons which include, lack of knowledge regarding the effective dose ranges and duration of action of opioids and unfounded fear of respiratory depression and addiction in hospitalized patients experiencing pain. The concept of postoperative pain management by anaesthesiologists is growing. These, along with the advent of intravenous paracetamol with higher safety levels and better techniques of administration of NSAIDs such as diclofenac suppository, have brought about large improvements in the successful alleviation of postoperative pain[12,13].

Paracetamol is a non-opioid agent, and it is believed that it primarily acts upon the central nervous system by way of central cyclooxygenase inhibition, and probably has an indirect influence on the serotoninergic system. It has a good safety profile and easily passes through the blood brain barrier which assures it as an effective analgesic[14]

The purpose of the study to find out the postoperative pain relief in paediatric surgery patients: Effect of intravenous paracetamol in comparison with diclofenac suppository.

In our study, we divided the patients into two groups, one group received paracetamol 15mg/kg intravenously, another group received diclofenac sodium 1mg/kg per rectally for the same type of operation performed on them e.g. repair of hernia, circumcision etc. These drugs were given just before the ending of operations or during the skin closure, Effect of these medications were judged after surgery by assessment of pain scores by VAS and stability of vital signs.

Materials and Methods:

This randomized clinical trial study was conducted in the Anaesthesiology department of Sir Salimullah Medical College Mitford Hospital,Dhaka from February' 2014 to August' 2014.Prior to the commencement of this study,the research protocol was submitted to the ethical review committee of SSMC & Mitford Hospital and approved.Study populations was the patients of either sex,aged between 4-12 years,ASA grade I,patients undergoing elective surgery under general anaesthesia,lasting for 30 to 45 minutes and follow up was done upto 6 hours after surgery. Patients were excluded from the study if they were developmentally delayed, had neurological dysfunction or renal insufficiency,had allergy to any of the study medications and prolonged duration surgery or surgery needing large incision. A total of 100 cases were taken, they were were randomly divided into two groups in which one group received intravenous paracetamol and another

group received diclofenac suppository for the same operation performed on them.

Study procedure: Data were collected using a pre designed data collection sheet containing all the variables of interest.Randomization was done by lottery method. All patients were examined one day prior to surgery which was addressed as baseline value.Heart rate,Sp02,temperature: before induction and every 10 minutes during surgery were recorded. After operation,pain relief was assessed with VAS score from 30 minutes after surgery upto 6 hours with regular follow up and comparison made between the two groups.

Statistical analysis:

Data were processed and analyzed using SPSS (Statistical Package for Social Sciences) for windows,version 17.0. The test statistics used to analyze the data were Student's t-Test (for comparison of data presented on continuous scale) and Chi-square (c2) Test (for comparison of categorical data between groups).The level of significance was set at 0.05 and $p < 0.05$ was considered significant.

Result:

Table 1: Age distribution of the study population :

Age group	Study group		
	Intravenous Paracetamol	Diclofenae suppository	Total
3-5 years	21	19	40
4-7 years	06	14	20
8-12 years	23	17	40
Total	50	50	100
Mean ±SD	6.80 (±2.74)	6.05 (±2.33)	

Table 1 shows mean age was 6.80 (±2.74) years in intravenous paracetamol and 6.05 (±2.33) years in diclofenac suppository.

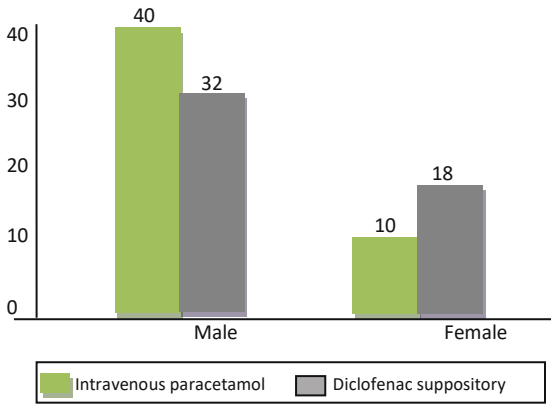

Figure I: Sex distribution:

Sex distribution between the groups were not identical (Figure 1). Male child were significantly higher in both IV paracetamol and diclofenac suppository group.

Table 2: Mean duration of surgery:

	Study groups		
	Intravenous Paracetamol Mean ±SD	Diclofenac suppository Mean ±SD	P value
Duration of Surgery	44.60 (±7.52)	42.50(±6.86)	0.14

Table 2 shows that mean duration of surgery was 44.60 (±7.52) minutes in intravenous paracetamol and 42.50 (±6.86) minutes in diclofenac suppository group.

Table 3: Preoperative vital signs of at OT table:

AT OT table	Study group		P value
	Intravenous paracetamol	Diclofenac suppository	
Heart rate	108.82(±14.79)	113.20(±9.14)	0.07
Temp	98.0 (±0.53)	98.0 (±0.45)	0.16
SpO_2	98.98 (±0.51)	99.08 (±0.66)	0.40

Table 3 shows no significant relation in mean vital signs between intravenous paracetamol and diclofenac suppository group ($p>0.05$) that was not statistically significant.

Table 4: Comparison of mean visual analog scale between two group 30 minutes after surgery:

	Study groups		
	Intravenous Paracetamol	Diclofenac suppository	P value
Visual analog scale	2.42 (±0.64)	2.31((±0.77)	0.43

Table 4 shows comparison of mean visual analog scale between intravenous paracetamol with diclofenac suppository group. VAS score showed both analgcsic reduccs pain, but diclofenac suppository was found better post operative pain reliever than intravenous paracetamol group.

Table 5: Comparison of mean visual analog scale between two groups 1 hour after surgery:

	Study groups		
	Intravenous Paracetamol	Diclofenac suppository	P value
Visual analog scale	2.54 (±0.72)	2.41((±0.67)	0.35

Table 5 shows comparison of mean visual analog scale between intravenous paracetamol with diclofenac suppository group. VAS score showed both analgcsic reduccs pain, but diclofenac suppository was found better post operative pain reliever than intravenous paracetamol group.

Table 6: Comparison of mean visual analgo scale between two groups 2 hours after surgery:

	Study groups		
	Intravenous Paracetamol	Diclofenac suppository	P value
Visual analog scale	2.42 (±0.64)	2.39((±0.17)	0.74

Table 6 shows comparison of mean visual analog scale between intravenous paracetamol with diclofenac suppository group. VAS score showed both analgcsic reduccs pain, but diclofenac suppository was found better post operative pain reliever than intravenous paracetamol group.

Table 7: Comparison of mean visual analog scale between two groups 6 hours after surgery.

	Study groups		
	Intravenous Paracetamol	Diclofenac suppository	P value
Visual analog scale	2.42 (±0.64)	2.12 ((±0.77)	0.03

Table 7 shows comparison of mean visual analog scale between intravenous paracetamol with diclofenac suppository group. VAS score showed both analgesic reduces pain, and diclofenac suppository was found significantly better post operative pain reliever than intravenous paracetamol group.

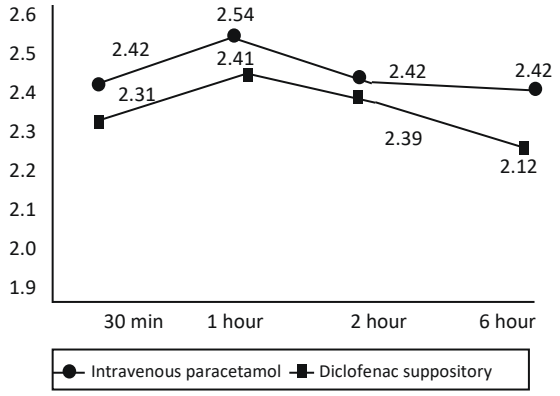

Figure II: Comparison of mean visual analog scale between two groups 30 min to 6 hours after surgery:

Discussion:

Pain is a major problem regarding quality of life in children undergoing surgical operation[1].Pain assessment is the most important and critical component of pain management. Assessing pain in children is an ever challenging as well as a difficult task, mainly because so far no reliable method of assessing and measuring child's pain is available. Cognitive and emotional developments together with psychological defense mechanisms are important variables to be considered with paediatric pain[2]. It was a randomized clinical trial study among the patients who were admitted at the department of paediatric surgery in Sir Salimullah Medical College Mitford Hospital.

The mean age was 6.80 (±2.74) years in intravenous paracetamol and 6.05 (±2.33) years in diclofenac suppository groups. Majority of the study group were male paediatric population (80%) in comparison with female (20%). They were randomly divided into two groups in which one group received intravenous paracetamol and another group received diclofenac suppository for the same operation performed on them.

In current study mean duration of surgery were 44.60 (±7.52) minutes in intravenous paracetamol and 42.50(±6.86) minutes in diclofenac suppository group.

In present study there is no significant relation in mean vital signs at OT table between intravenous paracetamol and diclofenac suppository group ($p>0.05$) that was not statistically significant. No significant relation in mean vital signs at 10 to 60 minutes during intraoperative period between intravenous paracetamol and diclofenac suppository group

(p>0.05) that was not statistically significant. This study also revealed no significant relation in mean vital signs at 30 minutes to 6 hours after surgery between intravenous paracetamol and diclofenac suppository group (p>0.05) that was not statistically significant.

In current study, comparisons by mean visual analog scale between intravenous paracetamol with diclofenac suppository group was done. VAS score showed both analgesic reduces pain, but diclofenac suppository was found better post operative pain reliever than intravenous paracetamol within observed 30 min to 2 hours. However observed after 6 hours, Diclofenac suppository group is significantly better than intravenous paracetamol group in relieving post operative pain by measuring VAS.

Paracetamol was found to have analgesic efficacy comparable to that of NSAIDs in many of the studies reviewed, but overall, NSAIDs seem to be superior for postoperative pain management, although there seem to be differences in the efficacies of paracetamol and NSAIDs depending on the type of surgery performed.

On comparing the pain scores between the two groups in our study, there was no statistically significant difference between the two groups for the first 30 min. This can be attributed to the residual effect of intra-operative analgesic.The very low apparent risk of paracetamol therapy suggests a highly favourable risk:benefit ratio, which might justify a role for paracetamol as a near-routine postoperative background analgesic.

Paracetamol rapidly passes the blood-brain barrier, reaches a high concentration in the cerebrospinal fluid and has an anti-nociceptive effect mediated by the CNS[15]. This central effect has been regarded primarily as an indirect and reciprocal influence through cyclooxygenase enzyme inhibition, and probably through the serotoninergic system as well. Besides this central effect, it is accepted that paracetamol has a peripheral anti-inflammatory influence, although this effect is somewhat limited[16].

In a related study by Ziya Salihoglu, MD, Murat Yildirim, MD et al preemptive use of 1g IV paracetamol caused similar decrease in postoperative pain scores and requirement of rescue analgesia[17]. Similarly in another study Semih Arici, Alp Gurbet demonstrated significantly lower post operative pain scores and consumption of rescue analgesia in patients who received 1g IV preemptive paracetamol compared to patients who received normal saline[18].

It was observed that rectal diclofenac (1 mg/kg) was effective from 30 min post- operatively and extended to cover a period of up to 6 h, as evidenced by the reduced pain scores. It can be further assumed that the analgesic action extended beyond 6 h, although a systematic assessment of pain was not carried out during this period. This observation is supported by previous studies by Bone ME and Fell D, who reported a duratin of analgesia for 7.3 h [19]. Few other studies have reported duration of analgesia extending up to a period of 12.45 and 14h [20,21] .

IV aetaminophen may be preferable for some surgical patients because, unlike other analgesics. it does not affect mental status, rates of bleeding, respiratory drive, gastric mucosal integrity, or renal function[22]. However, acetaminophen doeses in excess have been associated with hepatic injury, thus clinicians are encouraged to follow the recommended doses based on the patients weight and the appropriate time intervals when administering repeat doses[23].

Not all the study groups receiving either drugs showed uniformity for reliving post operative pain. A very few patients although receiving paracetamol showed better pain relief and few, though receiving diclofenac, which we found superior analgesic found to be in some distress. This may be due to variation in emotional or psychological makeup which is different in each individual.

Childrens often have congenital anomalies in the perianal regions,surgery performed in this area would be a barrier to insert medications as suppositories,so intravenous formulation of paracetamol can be a good and safe choice of analgesic for pain relief in postoperative peiod or at least it will be helpful in reducing opioid doses and its side effects.We have used these two drugs in minor and short surgeries like repair of hernia and circumcision.Further study by using these two drugs on major surgery including laparotomy are required to clarify the effectiveness of these drugs in relieving acute post operative pain, also by seeing the efficacy of these drugs by needing rescue pain relief by opioids.

Conclusion:

In conclusion, the existing direct comparative studies shows that NSAIDs are more effective than paracetamol,but it is definitely a viable alternative to the NSAIDs, especially because of the lower incidence of adverse effects, and should be the preferred choice in high-risk patients. It may be appropriate to combine paracetamol with NSAIDs, but future studies are required, especially after major surgery

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