



A Comparative Study of Intramuscular Pethidine and Intravenous Ketorolac as Analgesic for Postoperative Pain Management in Major Abdominal Surgery in Paediatric Patients

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Abstract

Background: Postoperative pain after surgery causes uneasiness for the patients, however can bring delayed hospitalization, expanded morbidity and respiratory issues and readmission. For postoperative pain control, various techniques and prescriptions have been proposed, like non-steroidal anti-inflammatory drugs (NSAIDs) and narcotics. Ketorolac, an NSAIDs and pethidine, a narcotic analgesic, are widely used for pain management. In this study, the effects of these two medications on children aged 1 to 15 who had abdominal surgery were investigated and compared. The aim of the study is to assess and compare the effect of intramuscular pethidine and intravenous ketorolac as analgesic for postoperative pain management in major abdominal surgery in paediatric patients. **Material & Methods:** This retrospective cohort research was conducted in the Department of Paediatric Anaesthesiology and Surgical ICU, Bangladesh Shishu Hospital and Institute, Dhaka, Bangladesh, from July 2020 to June 2023. The Institutional Ethics Committee approved this study and informed parental written consent was obtained from the parents before collecting the patients' information. **Results:** Between pethidine and ketorolac groups, the mean and standard deviation of postoperative pain one hour after surgery were 3.60 ± 1.21 and 3.79 ± 0.93 respectively. The pethidine pain relief group scale was significantly low ($P < 0.001$). The difference between the two groups' postoperative pain intensity 2 hours after surgery was significant ($P = 0.006$), at 3.49 ± 1 and 3.60 ± 1.15 respectively. The variation in postoperative pain intensity in the pethidine group was measurably lower than the ketorolac group ($P = 0.019$). **Conclusion:** Both of the analgesics, intramuscular pethidine and intravenous ketorolac, are effective for postoperative pain management in major abdominal surgery in paediatric patients. Intramuscular pethidine is more effective than intravenous ketorolac but to some extent ketorolac found safer than pethidine.

Keywords:- Postoperative pain, abdominal surgery, ketorolac, pethidine, analgesic.

INTRODUCTION

According to Keeri-Szanto and Heaman (1972), intramuscular analgesic drugs given continuously on demand are generally

regarded as providing insufficient pain control for patients in the post-operative period. This is likely due to the intermittent nature of drug administration, as well as variability in

absorption rates and possibly a failure of the medical and nursing staff to recognize the patient's need for analgesia.^[1] In terms of remarkable outcomes like decreased oxygen consumption and CO₂ production, catecholamine release, cardiac morbidity, intracranial pressure, intraocular pressure, blood loss and improved wound healing, post-operative pain prevention and management should be taken into consideration.^[2]

It has been demonstrated that a wide variety of medications, including clonidine, morphine, fentanyl, buprenorphine, pethidine and non-steroidal anti-inflammatory drugs (NSAIDs), are capable of relieving pain. A synthetic opiate agonist in the phenylpiperidine class is meperidine hydrochloride, also known as Pethidine. When administered intramuscularly (IM), Pethidine, in particular, is extremely effective in treating post-operative pain. Pethidine has a number of side effects, including hypotension, nausea, vomiting, decreased gastrointestinal (GI) motility, itching, respiratory depression, tachycardia and physical dependence.^[3,4] Ketorolac trometamol is a brand-new non-opioid analgesic in the NSAID class,^[5,6] that can be taken orally or intravenously or after major abdominal surgery, it has been demonstrated to have clinically useful morphine-sparing effects.^[7]

This study aims to compare the analgesic effect of intramuscular Pethidine and intravenous ketorolac in the management of postoperative pain in major abdominal surgery in paediatric patients under general anesthesia.

Objectives

- General objective: The study aims to find the use and feedback of different postoperative pain killers used in abdominal surgery. This study targeted the use of Pethidine and Ketorolac to manage the postoperative pain management in paediatric patients.
- Specific objective: The purpose of this study was to compare the effectiveness of intramuscular Pethidine and intravenous ketorolac as analgesic for postoperative pain management in major abdominal surgery in paediatric patients.

MATERIAL AND METHODS

This retrospective cohort study was conducted in the Department of Paediatric Anaesthesiology and Surgical ICU in Bangladesh Shishu Hospital and Institute, Dhaka, Bangladesh during July 2020 to June 2023. This study included 124 children undergoing abdominal surgery age range 12 months to 15 years.

Inclusive criteria: Patients having abdominal surgery, age range of 12 months to 15 years, willingness to engage in the study, absence of mental issues, lack of coagulation diseases and chronic pain syndrome, absence of gastrointestinal bleeding and peptic ulcer history, absence of seizures history were elected as samples.

Exclusion criteria: Occurrence of any sedative and careful intricacies that brought about a difference in careful and sedative strategies, for example, startling increment or diminishing in circulatory strain and rate of dysrhythmia needing treatment, the patient was excluded from the review.

The required sample size 62 patients from each group were observed for this study. The standard deviation of postoperative pain was 1.17, the test power was 80%, and the least significant difference between the two groups was 0.8 and the sample size estimation formula was used to compare the two means. The study included 124 patients who met the inclusion criteria. To guarantee blinding, information was gathered by one individual and the mediation was directed by another. Patients were at first managed premedication (intravenous midazolam 0.05 mg/kg) and afterward, moved to the working room and were put under broad sedation utilizing sodium thiopental 5 mg/kg, fentanyl 1-2 µg/kg and atracurium 0.5 mg/kg. Anesthesia was maintained with 1.15% isoflurane or 1-2% sevoflurane and a mixture of oxygen and nitrous oxide after intubation (50 percent to 50 percent).

Before being extubated and after the conclusion of the medical operation, the patients were divided into two groups, A and B, using a randomized block technique. Group B received 1 mg/kg of intramuscular Pethidine, while group A received 0.5 mg/kg of intravenous ketorolac. In recovery area, the children's' discomfort was assessed using a common paediatric pain scale, including age 0-5 years FLACC Scale, age 4-12 years Faces pain scale named oucher scale, age 6 and above VAS (visual analogue scale), numeric rating scale and CHEOPS (children hospital of eastern Ontario pain scale). Analgesic (ideally 0.5 mg/kg of intramuscular Pethidine), were administered if the patients' pain intensity was higher than 4 on the Wong Baker pain scale. Data were collected through a data collection sheet, by observation using questionnaire and

by clinical examination. Statistical analysis was done as mean \pm standard deviation (SD) for quantitative variables and percentage was calculated for qualitative variables. Difference between two independent groups was compared by unpaired student's t-test using SPSS for windows 10.0. P-value < 0.05 were considered statistically significant. The study was approved by the Ethics Review Committee of Bangladesh Shishu Hospital and Institute, Dhaka. Informed written consent was taken from all participants prior to study.

RESULTS

124 kids going through abdominal surgery were arbitrarily isolated into two groups of 62 patients each. Pethidine and ketorolac groups had mean ages of 77 (14-162) months and 84 (15-176) months, respectively. BMI of the study patients were found 17.56% and 21.73% in the groups respectively [Table-1]. The study patients were going through some specific operations. Cholecystectomy was most often performed activity among the review groups 19(30.65%) in pethidine group and 17(27.42%) in ketorolac group respectively. The other performed activities were Laparotomy, Stoma closure, Nephrectomy, Appendicectomy, Abdominoperineal pull-through excision of choledochal cyst and Splenectomy [Table-2]. In both groups, the mean and standard deviation of consciousness level as well as the intensity of postoperative pain were observed in this study. From the two groups we found receiving Ketorolac had significantly higher levels of consciousness both upon admission to the recovery room and one hour after the operation ($P < 0.05$). In any case, no massive contrasts were seen in the cognizance level until 24 hours after medical procedure in the two gatherings ($P =$

0.081)[Table 3]. Pain intensity and extra analgesics got in the two groups are inscribed the next. We observed in the patients after surgery 38.71% in pethidine group and 48.39% in ketorolac group felt severe pain in the VAS score, for this they need additional dosage. However, the intensity of pain was different between the two groups at 2 hours after surgery and being lower in the pethidine 16.13% groups. No distinctions were found in the extra analgesics got between the two groups. The opportunity to first opiate organization, portion of opiates and metoclopramide were not different between the two groups. In spite of this, the length of stay in the recuperation room was higher in the ketorolac bunch [Table-4]. Frequency distribution of severe pain between Pethidine and Ketorolac group in different time interval, maximum patients followed in ketorolac group was constantly higher than pethidine group. Which justified the slow pain relief in patients given intravenous ketorolac

than intramuscular pethidine [Figure-1]. Some adverse effects followed in the patients treated by pethidine and ketorolac respectively. From them nausea, vomiting, dizziness, seizure, was common in pethidine treated patients on the other hand, nausea, vomiting, somnolence, headache, pruritus, oliguria found common in ketorolac treated patients [Table-5].



Figure 1: Frequency distribution of severe pain between Pethidine and Ketorolac group in different time interval

Table 1: Demographic characteristics of the study patients (N=124).

Demographic characteristics	Postoperative Pethidine group n=62	Postoperative Ketorolac group n=62
Age (months)	77 (14–162)	84 (15–176)
Weight (kg)	23 (8–37)	27 (14–40)
Height (cm)	46 (64–168)	37(73–159)
BMI (%)	17.56%	21.73%

Table 2: Operations included Ketorolac and Pethidine (N=124).

Name of operations	Number of patients treated by-	
	Pethidine	Ketorolac
Cholecystectomy	19(30.65%)	17(27.41%)
Laparotomy and resection anastomosis	10(16.13%)	8(12.9%)
Stoma closure	6(9.68%)	3(4.84%)
Nephrectomy	5(8.06%)	3(4.84%)
Appendicectomy	7(11.29%)	9(14.52%)
Abdominoperineal pull-through	6(9.68%)	5(8.1%)



Excision of choledochal cyst and Roux-En-Y hepaticojejunostomy	5(8.06%)	14(8.68%)
Splenectomy	4(6.45%)	3(4.84%)

Table 3: The mean and standard deviation of the level of consciousness and postoperative pain in the two groups.

Time variable	Level of consciousness			Postoperative pain intensity		
	Pethidine (n =62)	Ketorolac (n =62)	P- value	Pethidine (n =62)	Ketorolac (n =62)	P- value
Into Recovery	2.33 ± 0.95	3.60 ±1.09	<0.0001	4.58 ± 1.23	4.70 ± 1.05	0.511
1 hour after surgery	1.05 ± 0.42	1.60 ± 0.51	<0.0001	3.60 ± 1.21	3.79 ± 0.93	< 0.001
2 hours after surgery	1 ± 0.11	1.65 ± 0.25	<0.0001	3.49 ± 1	3.60 ± 1.15	0.006
6 hours after surgery	1 ± 0.11	1 ± 0.11	1	2.84 ± 0.50	3.33 ± 1.06	0.1
12 hours after surgery	1 ± 0.11	1 ± 0.11	1	2.42 ± 0.15	3 ± 1	0.510
24 hours after surgery	1 ± 0.11	1 ± 0.11	1	1.84 ± 0.50	2.42 ± 0.5	0.522
P (between the two groups)	0.081			0.019		

Table 4: Frequency distribution of severe pain and the mean and standard deviation of the received additional analgesic dosage in the two groups

Time variable	Severe pain (higher than 4)			Additional analgesic dosage received		
	Pethidine (n = 62)	Ketorolac (n = 62)	P-value	Pethidine (n = 62)	Ketorolac (n = 62)	P-value
Into Recovery	0 (0)	0 (0)	1	0	0	1
1 hour after surgery	24(38.71%)	30(48.39%)	0.59	10.45 ± 3.39	11.67 ± 4.13	0.85
2 hours after surgery	10(16.13%)	18(29.03%)	0.42	10.21 ± 2.95	11.47 ± 2.69	0.56
6 hours after surgery	6(9.64%)	10(16.13%)	0.031	10.11 ± 2.62	11.33± 2.55	0.59
12 hours after surgery	3(4.84%)	4(6.45%)	0.95	9 ± 0.91	11.13 ± 2.13	0.23
24 hours after surgery	0 (0%)	0 (0%)	1	0	0	1

Table 5: Postoperative adverse events in Pethidine and Ketorolac group

Adverse events	Postoperative Pethidine group n=62	Postoperative Ketorolac group n=62
	N (%)	N (%)
Nausea	22(35.48%)	20 (32.26%)
Vomiting	19 (30.46%)	17 (27.42%)
Somnolence	3 (4.83%)	7 (11.29%)
Dizziness	8 (10%)	6 (9.68%)
Headache	1(1.61%)	3 (4.83%)



Seizure	10 (6.45%)	4 (6.45%)
Pruritus	10 (16.12%)	12 (19.35%)
Cardiovascular	3 (4.83%)	3 (4.83%)
Oliguria	6 (9.68%)	8 (9.68%)
Respiratory	2 (3.22%)	1(1.61%)

DISCUSSION

We found that use of ketorolac decreased pain and the length of stay in the recovery room in current comparative study between two groups consisting 62 paediatric patients. Though no massive distinction was seen between narcotic dose and the initial stage of getting analgesics in the two groups, analgesics administration time for patients getting ketorolac was more limited.

NSAIDs have less complications contrasted with narcotics.^[8] Postoperative complexities were not seen in any of the patients of the current study. Patients of the current study in ketorolac group faced more postoperative pain intensity in comparison with pethidine which started to reduce after two hours of surgery. On the other hand, pethidine receiving patients went through less pain intensity but ketorolac needs for additional analgesic dosage. Pethidine is used often in the management of paediatric pain and premedication; Pethidine is a commonly used post-operative analgesic. It is a strong opioid pain-relief medicine. However it works to reduce feelings of pain by interrupting the way nerves signal pain between the brain and the body. A study by Schumacher et al found in his study than pethidine has some side effects like nausea, vomiting, sedation and dryness of mouth though it helped in reducing pain earlier.^[9]

Ketorolac is a NSAID and its anti-inflammatory effect is due to the inhibition of prostaglandin

synthesis. Like other cyclooxygenase inhibitors, ketorolac hinders platelet collection and hence, can increase the risk of bleeding; this effect, on the other hand, was not found in the current study.^[10,11] Different articles have announced various discoveries with respect to the utilization of ketorolac and its impact on increasing the risk of bleeding during or after surgery. However, in the majority of these studies, there was no difference in the increased risk of bleeding between ketorolac and other narcotics,^[12,13] where pethidine has been shown in vitro to block reversibly conduction in mammalian vagus nerve,^[14] and Gissen and colleagues demonstrated that, in a mammalian peripheral nerve, conduction blocks produced by fentanyl and sufentanil were not naloxone-reversible, indicating that the block was not opioid-receptor mediated.^[15] Additionally, ketorolac has been shown to be safe and without side effects in paediatric cardiac surgery, scoliosis surgery, urology surgery and osteotomy in the lower extremities.^[16,17] Although a few articles showed expansion in bleeding during or after surgery the viability of ketorolac in controlling intense pain after abdominal surgery has been proven and factual.^[18,19,20] It has quick viability and can be utilized as a pain relieving during the medical procedure and for pain control after surgery.^[21] In the concentrate by Kay et al., the utilization of ketorolac for kids going through a medical procedure because of bone crack was without confusions; no perceptions were accounted for

in regards to contamination and wound issues, or expanded hazard of deferred bone fix or absence of bone repair.^[14]

In many studies, the utilization of ketorolac after stomach or pelvic surgery, urological surgery, lumbar decompression surgery and cesarean area made significant analgesic effects and decreased the requirement for narcotics.^[22,23,24] Even, reductions in mean arterial blood pressure were seen in patients who received pethidine were highly found. This finding contrasts with those of Patel et al., and Kafle,^[25,26] who described blood pressure as having been maintained better after intrathecal pethidine. In certain studies, only a decrease in the requirement for pain reducing drug for ketorolac application was accounted for. However, it didn't diminish the span of hospitalization and getting back to oral administration of nutrition.^[27] In certain study, though the viability of a solitary portion of ketorolac in diminishing post-operative pain, they likewise showed that ketorolac decreased nausea and vomiting.^[28]

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Limitations of this Study

Our study was a single center study. We could only study a few samples within the study period. There are more patients with tensile affecting their life but they are not coming back to the hospital for proper treatment after tensile recognition and depending on home remedy. After evaluating once those patients we did not follow-up them and have not known other possible interference that may happen in the long term with these patients.

CONCLUSIONS

In conclusion, the existing study shows that intramuscular pethidine is more effective than intravenous ketorolac but to some extent ketorolac found safer than pethidine. Ketorolac is definitely a viable alternative to the pethidine, especially because of the lower incidence of adverse effects. It may be appropriate to combine pethidine with ketorolac, but future studies are required, especially after major abdominal surgery in paediatric patients.

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