Original Article

Dexamethasone Role in Opioid Sparing Pediatric Below Umbilical Surgery Anesthesia - Randomized Control Trial

Muhammad Shazad[1], Saqib Ismail[2], Aiman Ikram[3], Omer Jalil[4] and Saman Omer[5]

ABSTRACT

Objective: To examine the differences between dexamethasone ketamine opioid sparing anesthesia technique with propofol ondansetron in pediatric surgery anesthesia.

Study Design: Randomized control trial study

Place and Duration of Study: This study was conducted at the operating rooms and ICU of Mohiuddin teaching hospital, Mirpur, Azad Kashmir from June 2025 to December 2025.

Methods: Post approval from institutional ethical review board, we randomized ASA I-II pediatric patients. Fifty subjects stratified into two sections, Dexamethasone Ketamine (DK) and Propofol ondansetron (PO). All patients underwent below umbilical surgeries with oro tracheal tube. Primary outcome of interest was prolongement of duration of analgesia and secondary outcomes nausea and vomiting ,rescue opioid analgesia and wound condition.

Results: Fifty pediatric patients meeting inclusion criterion split into two sections at random: DK and PO. The duration of block analgesia improved in group DK than group PO but remained insignificant ($p = 0.065$). Dexamethasone also spared the rescue opioid in group DK as compared to group PO ($p = 0.149$). Dexamethasone ketamine combo improved the duration and decrease rescue opioid consumption with significant reduction in postoperative pain ($p <0..005$) and nausea vomiting ($p = 0.297$). Wound condition remained satisfactory during hospital stay and in follow up at OPD.

Conclusion: Dexamethasone ketamine combo provides longer duration of analgesia in pediatric surgical patients alongside decreased opioid consumption and lower incidence of nausea and vomiting compared to propofol ondansetron combo making it a better opioid sparing anesthesia technique in multimodal analgesia with good wound healing in pediatric surgery anaesthesia.

Key Words: Dexamethasone, Ketamine, Propofol, Ondansetron, Opioid sparing.

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INTRODUCTION

Opioid sparing to opioid free anesthesia is a move forward from vision of multimodal to preemptive analgesia and anesthesia. Co induction to auto co induction every anesthetist employ for lowest complications for surgical patients with a balanced analgesia and anesthesia technique.

[1.] Assoc. Prof. Anaesthesiology / Professor Paediatric Surgery[2] / Senior Registrar[3] / Assistt. Prof. General Surgery[4] / Asstt. Prof. Pharmacology and Therapeutics[5], Mohiuddin Islamic Medical College, Mirpur, Azad Kashmir.

Correspondence: Dr. Muhammad Shazad, Associate Professor Anesthesia, Mohiuddin Islamic Medical College, Mirpur Azad Kashmir.
Contact No: 03312772213
Email: mshazad1977@yahoo.com

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Reduction in adverse effects is an essential goal in multimodal analgesia.[1] Pain management always require a combination for lasting effect.[2] Single shot usually the strategy to reduce infections[3] but require effective adjuvants to prolong the effective analgesia.

Opioid induced complications leads to thoughts for different mechanisms to manage intraoperative and postoperative pain management. Different intravenous anaesthesia agents been used in pediatric surgery anesthesia but near ideal intravenous anesthetic agent with analgesic activity is Ketamine. Ketamine, magnesium, dexmedetomidine, xylocaine and many others been employed to get an opioid free analgesic technique. We also made a combo of ketamine with dexamethasone as their synergistic effect not only provide an ideal anesthesia but equivalent analgesia with minimal adverse effects. Ketamine and dexamethasone also provide beneficial effect with nerve blocks and a prolong effect of analgesia with minimal rescue analgesia and minimal complications[4]. Propofol most widely used intravenous anesthetic agent but adverse effects like hemodynamic instability and propofol infusion syndrome requires meticulous

reviewing before using it appropriately. Ondansetron and propofol both exhibits antiemetic properties. Dexmedetomidine exhibits excellent characteristics in sedation and anesthesia but it's sympatholytic effect leads to bradycardia and hypotension. It's use need to be very carefully gauged in pediatrics as autonomic nervous system not fully developed and so been experimented in combination with ketamine[6]. Dexamethasone been used as intravenous, regional and perineurally for its anti-inflammatory, anti-emetic and analgesic activity. It's synergistic effect with local anesthetics makes it's an ideal choice to be used neuraxially, systematically and perineurally. Ketamine also been employed extensively in so many ways for a balanced effective technique.[7,8,9] Combining it with ketamine leads to a potent technique alongside local nerve blocks to not only contain polypharmacy but in prevention of chronic pain syndromes.[10]

In this study we strived to find an ideal anesthesia and analgesic technique in pediatric anesthesia that is pre emptive, multi modal and opioid sparing which may lead to a complete opioid free anaesthesia methodology in our next study. We compared it with a conventional technique of propofol so maximum data can be extracted for future studies.

METHODS

Ethical approval from review board of Mohiuddin Islamic Medical College, Mirpur, Azad Kashmir was taken. Informed written consent taken from all study participants. Inclusion criteria meeting fifty consecutive patients were divided into two sections, section DK (dexamethasone ketamine) and section PO (propofol ondansetron) each with twenty-five patients. Randomized using a computer generated pattern to ensure allocation concealment. Section assignments placed in sealed opaque envelope that opened sequentially by medical officers to assign the allocated intervention. All patients had a running intravenous cannula and standard monitors (non invasive blood pressure, pulse oximeter and ECG) before induction. Ringer's lactate used for fluid management. All patients in section DK received intravenous dexamethasone 0.1mg/kg with 1 mg/kg ketamine over 30 seconds. Atracurium 0.5 mg/kg given intravenously. The endotracheal tube inserted after loss of consciousness and eye lash reflex. In case, eye lash reflex is still intact further boluses of 0.5mg/kg ketamine intravenously will be used.

In group PO, patient received intravenous 1mg/kg Propofol over 30 seconds. Nalbuphine 0.1 mg/kg given. The endotracheal tube was inserted after loss of consciousness and eye lash reflex. In case, eye lash reflex is still intact further boluses of 0.5mg/kg propofol intravenously given. All endotracheal tube insertions was done by consultant anaesthetist. Group DK also received periilioinguinal block with intravenous dexamethasone 0.1mg/kg while group PO will receive subcutaneous nerve infiltration at incision site by the operating surgeon. Bupivacaine 0.25% in a safe dose of 1mg/kg given in both groups. Our primary outcome of interest was duration of analgesia as request time for first request for rescue analgesia by patient or attendant for postoperative pain at surgical site in hours. Secondary outcomes included rescue opioid analgesia as per WHO step ladder approach and nausea vomiting requiring medical treatment.

RESULTS

SPSS 27 used for all data entries and their interpretations between groups. This study included fifty elective pediatric surgical patients divided into two groups. Group DK consisted of 24 males and 1 female and with a minimum age was 10 months and maximum 9 years. Group PO consisted of 21 males and 4 females with minimum age of 10 months and maximum 8 years. General presentation of two groups in table 1.

56% underwent herniotomy and other elective below umbilical pediatric surgeries. The primary outcome measure of this study was the duration of block which was quantified by first complain of pain by patient or attendant mainly mothers and assessed using Wong Baker Faces (WBPS) and Modified Objective Pain Scores (MOPS) by medical officers blinded with groups. WBPS and MOPS found significant pain difference at 1st and 6th hours in group PO when compared with group DK (Table 2,3).

Table No.1: General Demographics

Category	Dexamthasone Ketamine group	Propofol Ondansetron group	P value
AGE	10 MONTHS 9 YEARS	10 MONTHS 8 YEARS	
GENDER	MALE 24 FEMALE 1	MALE 21 FEMALE 4	
WEIGHT	MALE 6.7 KG FEMALE 34 KG	MALE 4.5 KG FEMALE 37 KG	P= 0.782
ASA KETAMINE	I 9 II 16 1.7mg/kg mean	I 8 II 17	P= 0.785
PROPOFOL		1.9 MG/KG MEAN	

Table No. 2: Wong baker pain score in number of patients in group DK & PO

Groups	No Pain	Mild Pain	Moderate Pain	Severe Pain	P Value
		WONG BAKER FACES	1ST HOUR		
GROUP DK GROUP PO	13 5	11 06	01 13	0 1	<.001
		WONG BAKER FACES	6TH HOUR		
GROUP DK GROUP PO	13 6	08 08	04 11	0 0	0.054
		WONG BAKER FACES	12TH HOUR		
GROUP DK GROUP PO	20 17	4 6	1 2	0 0	0.614

Table No. 3: MOPS pain score in number of patients in GROUP DK & PO

GROUPS	NO PAIN	MILD PAIN	MODERATE PAIN	SEVERE PAIN	P VALUE
		MOPS	1ST HOUR		
GROUP DK GROUP PO	12 5	11 8	2 12	0 0	0.005
		MOPS	6TH HOUR		
GROUP DK GROUP PO	13 7	8 09	4 8	0 1	0.241
		MOPS	12TH HOUR		
GROUP DK GROUP PO	17 17	7 5	1 3	0 0	0.513

Table No.4: Outcomes Measures

Category	**Dexamthasone Ketamine group**		**Propofol Ondansetron group**		P value
DURATION OF NERVE BLOCK	1 HOUR 6 HOURS 12 HOURS	14 06 05	1 HOUR 6 HOURS 12 HOURS	21 01 03	0.065
VOMITING	YES NO	01 24	YES NO	03 22	0.297
RESTLESSNESS	YES NO	02 23	YES NO	00 25	0.149
POSTOPIOID RESCUE	YES NO	0 25	YES NO	2 23	0.149
MOVEMENTS	YES NO	0 25	YES NO	02 23	0.149

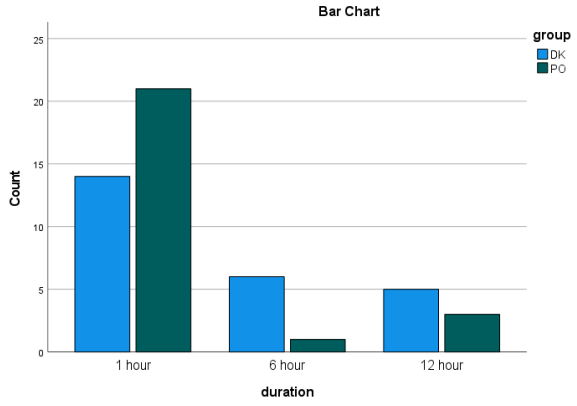

Figure No. 1: Comparison of Duration Block Between Groups

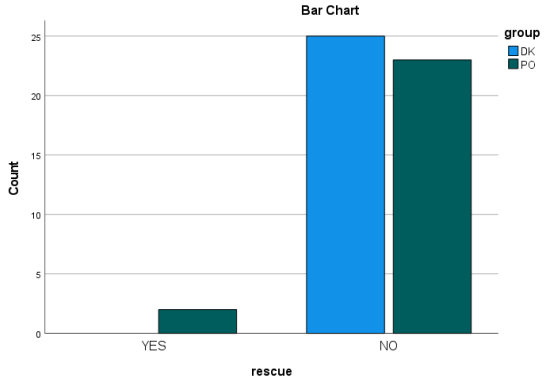

Figure No. 2: Comparison of Rescue Opioids Between Groups

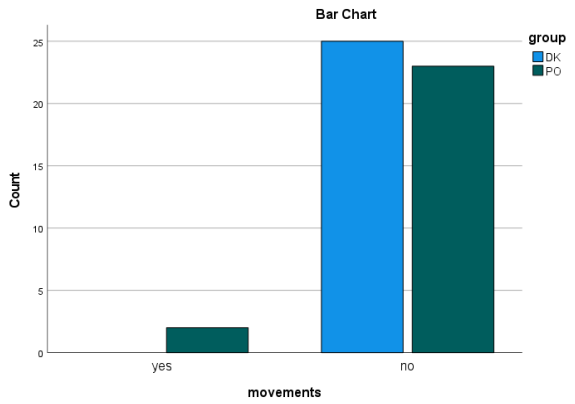

Figure No. 3: Comparison Of Intraoperative Movements Between Groups

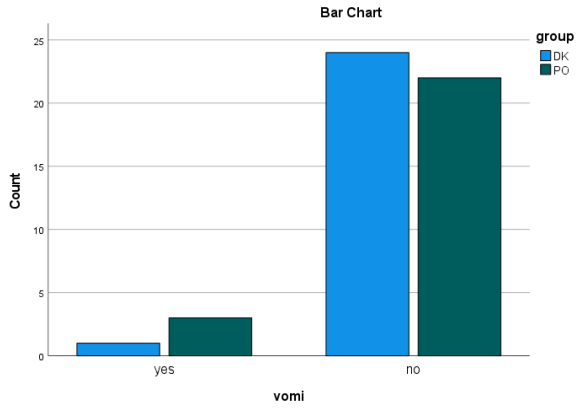

Figure No. 4: Comparison of Nausea Vomiting Between Groups

Duration of nerve block between groups found extended in group DK compared to group PO but non significant (P 0.065) (Table 4 & FIG. 1). The secondary outcome measure of abnormal body movements during surgery were only found in two patients in group PO (P 0.149) (FIG.3). Opioid rescue analgesia following WHO step ladder approach only required in two patients in PO group statistically insignificant P = 0.149 (FIG.2) . Nausea vomiting more in group PO but insignificant (P = 0.297 FIG. 4) . Postoperative restlessness found in two patients of group DK in recovery which resolved spontaneously with O_2. Wound condition remained satisfactory in all patients during admission and follow up visit in OPD. SPO2 remained stable and more than 95 % in both study group patients intraoperatively and in PACU. The statistically significant difference considered as p <0.05 level.

DISCUSSION

Opioid free and opioid sparing anesthesia techniques becoming the new standard in adult and pediatric anesthesia. Our study compared dexamethasone with ketamine enhanced the duration of block in paediatric patients in comparion to propofol and ondansetron to strive forward for an anesthesia technique which is opioid sparing suitable for both elective and emergency pediatric surgeries with minimum resources and less complications. The incidence of any intraoperative nausea vomiting also reduced in dexamethasone metoclopramide group in comparison to propofol ondansetron group.

In our study, we used an opioid sparing technique for moving forward to an opioid free anesthesia technique. We used dexamethasone systematically to see how it will effects the nerve block duration in combination with ketamine in pediatric surgical population. Dexamthasone been extensively studied for prolongation of analgesic effect in spinals, epidurals, caudals, local blocks and also systematically. Perinerally and systematic use of dexamethasone been reviewed and Tan ES[11] found that efficacy of peripheral nerve block duration improved but failed to create a meaningful clinical difference so we used it intravenously to get systematic general benefits also and improved wound healing. Long duration of action of peripheral nerve blocks always desirable for an opioid free analgesia plan so an adjuvant added with local anesthetics. Catheters also been used for prolonging the effect but associated with other adverse effects including dislodgement and infections[3]. In our observations the wound site remained clean and healthy. Single shot effect can be prolonged with use of multiple adjuvants not only perineurally but also systematically. Due to multimodal approach, pain management pain scores remained lower in dexamethasone ketamine group and no requirement of opioids postoperatively. Otherwise, rebound pain not only very difficult to manage but add on opioid induced complications and chronicity. Good nerve block attenuates central sensitization and also decreases release of pain mediators such as bradykinin and substance P controlling pain and indirectly opioid sparing effects[12]. Effective targeted nerve blocks suppress nociceptive stimulus with incision and traction leading to reduction in intraoperative body movements leading to less anesthesia and analgesia increments[13].

Another important aspect is reduction in incidence of nausea vomiting which may be attributed with no or minimal use of postoperative opioids which is related with mu opioid receptors and that is reflected also with findings of adequate oxygenation thoughout the clinical course[14]. Minimal intraoperative body movements noted only in two patients in propofol ondansetron group requiring additional increments of propofol[15]. This been adequately controlled in dexamethasone ketamine group directing towards a synergistic effect which can be quantified using BIS monitoring[16] in future trials. Similarly, postoperative restlessness only noted in two patients of DK group which can't be attributed to inadequate pain control[17] rather ketamine side effect thou resolved spontaneously with provision

of oxygen. We used and applied two pain scales to increase the reliability of our assesssments and results so appropriate management can be provided.[18]

CONCLUSION

Dexamethasone ketamine combo provides longer duration of analgesia in pediatric surgical patients alongside decreased opioid consumption and lower incidence of nausea and vomiting compared to propofol ondansetron combo making it a better opioid sparing anesthesia technique in multimodal analgesia with good wound healing in pediatric surgery anaesthesia.

Limitations: This study has several limitations. Firstly, the sample size was relatively small, which may have introduced a statistical bias so we are planning for a larger multi centre study to validate our current findings. Chronic pain prevention evaluation not done in our study as ketamine, dexamethasone and nerve blocks all been contributed as a positive role.

Author's Contribution:

Concept & Design or acquisition of analysis or interpretation of data:	Muhammad Shazad, Saqib Ismail, Aiman Ikram, Omer Jalil
Drafting or Revising Critically:	Muhammad Shazad, Saqib Ismail, Saman Omer, Omer Jalil
Final Approval of version:	All the above authors
Agreement to accountable for all aspects of work:	All the above authors

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