Ketamine plus Bupivacaine versus Nalbuphine plus Bupivacaine Caudal Anaesthesia in Pediatric Subumbilical Surgeries

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Abstract

Background: Caudal anaesthesia is used as pain control for many sub umbilical surgical procedures.
Objectives: This study intended to Estimate length of analgesia (1ry outcome) Track haemodynamics and detect side effects
Patients and methods: This prospective randomized double blind observational study was conducted on 60 healthy paediatric patients recruited from Qena university hospital, South Valley University, Qena, Egypt, undergoing elective lower abdominal and pelvic surgeries were allocated to two groups according to mode of blocking agents and caudal region during the study duration from May 2019 to August 2020
Results: efficacy of ketamine bupivacaine versus nalbuphine bupivacaine to provide intraoperative and postoperative pain relief. The time to first analgesic administration was longer in the ketamine bupivacaine group about (8 hrs) than nalbuphine bupivacaine about (5.8 hrs).,
Conclusion: Caudal nalbuphine and caudal ketamine are safe in pediatric surgeries in the lower half of the body and effectively reducing postoperative pain with longer duration of analgesia in ketamine group than nalbuphine group with no obvious side effects in both groups.

Keywords: Caudal anesthesia ; Ketamine; Nalbuphine .
***Correspondence:** khalidaraga@gmail.com.
DOI: 10.21608/svuijm.2021.54591.1059
Received: 24 November, 2020.
Revised: 1 January, 2021.
Accepted: 9 January, 2021.
Published: 13 January, 2024

Cite this article as: Khalid Ahmed Mohamed, Hatem Saber Mohamed, Mohamed Abdel rahman Soliman (2024). Ketamine plus Bupivacaine versus Nalbuphine plus Bupivacaine Caudal Anaesthesia in Pediatric Subumbilical Surgeries. *SVU-International Journal of Medical Sciences*. Vol.7, Issue 1, pp: 187-193.

Introduction

Regional anaesthesia has been used for children since the starting of the 20th century not as adjuvant to general anaesthesia but as a main anaesthetic for sub umbilical procedures **(Dalens, 2000).**

Caudal anaesthesia is used for pain control for many sub umbilical surgeries. It has been detected that pre-surgical caudal analgesia decreases the stress response of surgery and anaesthesia **(Dalens, 2000).** Early it was used in children and infant who were described as unfit and poor risk for general anaesthetics. **(Sethna and Berde,2000).**The care in paediatric regional anaesthesia was changed after readmenstration of spinal anaesthesia as a safe alternative way to general anaesthesia with the fact that epidural single shot injections and peripheral nerve blocks provided postoperative analgesia withvery excellent safety **(Abajian et al.,1984).**

Local anaesthetics in addition to adjuvants have described to enhance the injectate of the caudal block to prolong the duration of analgesia**.(Kaur et al.,2016).**

Caudal block is one of the most favourable paediatric regional anaesthesia for children and infants who require operations under umbilical level, for example extremity surgeries, rectal, inguinal, lower urogenital. Caudal Block is easy to perform and provides effective analgesia for both postoperative and intraoperative period.

Despite there are some studies which describe caudal anaesthesia as the main anaesthetic method in some cases for infants and children, caudal anaesthesia is still associated with general anaesthesia for majority of the cases **(Brenner et al., 2010**).

Caudal block, in association with light general anaesthesia, may be significant in those with co-morbidity, premature children, as well as those with medical diseases such as muscular atrophy or cardiac disease. Although , the risks and benefits of caudal epidural block must be estimated on an individual basis **(Johr and Berger, 2004).**Caudal blocks are initially performed after administration of general anaesthesia in infant. Traditional teaching depend on the sensation of “give” or “pop” detected by the operator as the needle penetrate the sacrococcygeal ligament and the absence of resistance to the local anaesthetic injection.

However the block is easily administrated , the success rate is less than 100% and varies with the operator experience. many studies have described the parameters accuracy to predict successful caudal needle placement. These include an audible “swoosh” on lower back auscultation during injection, a decrease in heart rate during injection of the drug and at the end of the procedure a lax anal sphincter, **(Krishna et al., 2004).**

Patients and methods:

This study was conducted at Qena university hospital after approval by of the ethical committee of Qena faculty of medicine and written parental consent. The study was conducted on 60 healthy paediatric patients undergoing elective lower abdominal and pelvic surgeries were allocated to two groups according to agents used . No analgesics or sedatives were given, pre or intra operatively, to the children to avoid interference with the result of the study.

Inclusions criteria:

-Age: 1-6 yrs.

-Sex: no gender distinction.

-ASA I&II

-Type of surgery: any elective lower abdominal or pelvic surgery including:

*Inguinal hernia repair.

*correction of hypospadias.

*correction of fistula after hypospadias.

*correction of undescended testis.

*Hydrocele.

Exclusion criteria

Any contraindication to caudal anaesthesia,

Methods

Preoperative assessment History taking from the mother for cyanosis during sukling, repeated chest infection, bleeding tendency, hepatic and renal problems History taking from the mother for cyanosis during sukling, repeated chest infection, bleeding tendency, hepatic and renal problems convulsions or any neurological diseases, asthmatic attack, history of allergy and sensitivity to any drug and previous anaesthetic experiences

Anaesthetic procedures: The procedure of anaesthesia was consistent in all patients.All operations were performed in the morning as first case of the list to standardize circadian changes in the level of stress hormone .On arrival to the operation room non-invasive arterial blood pressure , ECG limb lead II and peripheral oxygen saturation were monitored .General anaesthesia was performed using sevoflurane inhalation, after satisfactory depth of anaesthesia had been attained ,an intravenous peripheral cannula (22-gauge) was introduced after sterilization, an endotracheal tube of suitable size will be located deprived of the usage of neuromuscular blocking agents.

Caudal Block technique

- After the child was anaesthetized, and earlier to surgery, the child is located in the left lateral situation with the upper hip flexed 90 degree and the lower hip 45 degree.
- Disinfection with alcohol and wearing sterile gloves.- Epidural puncture in the most proximal region of the sacral hiatus, cranial to the advantage of the equilateral triangle. The palpation index finger of the left hand lies on the spinous process of S4.

-A short 20 to 22-gauge beveled needle is advanced at 45 to 90 angles at the level of sacrococcygeal ligament into the skin. After puncture the membrane, The needle is only progressive no more than 1-3mm after loss of resistance in younger infants since the dural sac and the epidural veins may ends at about S3 –S4 .Settlement of the needle in the epidural space is definite by the lack of resistance to injection of saline and lack of subcutaneous swelling on injection.

- If unintentional puncture of a sacral epidural vein happens, the needle must be removed and redirected until there is no blood flow naturally or on gentle aspiration.
- Injection of anaesthetic drugs completed according to the group fitted to.
- Patients were separated into two equal groups according to the kind of local anaesthetic introduced 30 patients in every group.

Group A: 30 patients received bupivacaine 0.25% mixed with nalbuphine 0.1 mg/kg body weight.

Group B : 30 patients received bupivacaine 0.25% with ketamine 0.25 mg/kg body weight.

Statistical analysis

Recorded data were analyzed using the statistical package for social sciences, version 20.0 (SPSS Inc., Chicago, Illinois, USA). Quantitative data were expressed as mean± standard deviation (SD). Qualitative data were expressed as frequency and percentage.

Results

There is no significant difference between both groups in sociodemographic data as seen in (**Table.1**). There is no significant statistical difference in heart rate between both group (**Table.2, Fig.1**). There was statistically significant difference between both group in duration of analgesia (**Table.3**). However, there were no significant differences between the studied groups regarding SaO_2 (**Table.4).**

Table 1. Socio demographic data of the studied groups

Variables		Group A N=30	Group B N=30	P value
Age (years, mean ± SD)		3.97±1.6	3.7±1.7	.551
Sex	Male	30(100%)	28(93.3%	.150
	Female	0	2(6.7%)	
Weight (kg, mean ± SD)		19.07±5.4	17.5±5.7	.292

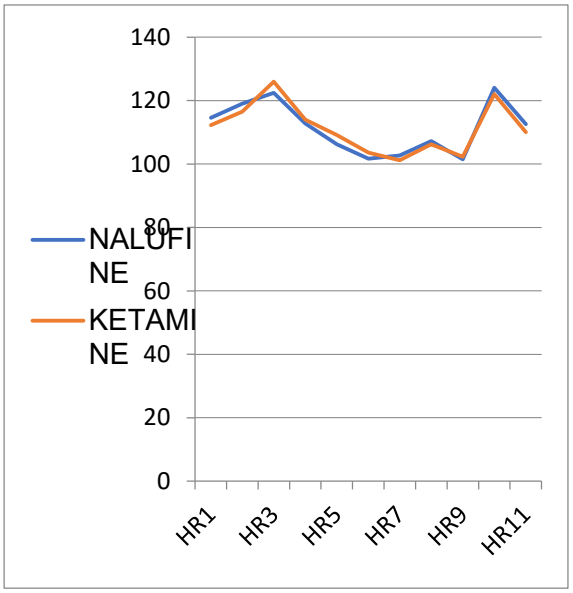

Fig 1.Change in heart rate over time

Table 2. Pathological changes occurred in the studied group

Variables	Group A	Group B	P value
HR baseline	114.6±10.7	112.3±12.2	. 290
HR after induction	119±11.6	116.5±11.3	. 140
HR after surgical stimulation	122.4±11.5	126±10.6	.216
HR after 15	112.8±9.7	114±9.6	.634
HR after 30	106.2±7.3	109.1±9.2	.117
HR after 45	101.7±7.4	103.6±9.3	.397
HR after 1 hour	102.7±7.9	101.2±9.7	. 540
HR after 2 hours	107.2±7.5	106.2±9.3	. 200
HR after 4 hours	101.5±7.7	102.3±8.4	.100
HR after 6 hours	124.1±10.2	122±8.7	.321
HR after 12-24 hours	112.6±9.4	110±9.05	. 210

Table 3. Duration of analgesia

Variables	Group A	Group B	P value
Duration of Analgesia (hr, mean ± SD)	5.8±.69	8.1±.691	000*

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Table 4: Change in SaO_2 over time.

Variables	Group A mean ± SD	Group B mean ± SD	P value
So2 baseline	96.5±3.8	96.2±.66	.640
So2 after induction	99.4±.1	99	. 101
So2 after sursti	98.8±.34	98.6±.47	.069
So2 after 15	98.5±.73	98.8±.40	.086
So2 after 30	98.1±.50	98.8±.40	.070
So2 after 45	98.6±.47	98.5±1.1	.527
So2 after 1 hour	94.9±1.4	94.6±.80	.372
So2 after 2 hours	94.5±.97	94.4±1.3	.830
So2 after 4 hours	94.1±2.1	94.2±1.1	.650
So2 after 6 hours	95±1.3	95.2±1.4	.587
So2 after 12 hours	94.5±1.1	94.8±1.4	. 280
So2 after 24 hours	94.5±1.1	94.4±1.1	.651

** Data presented in (mean ± SD) using t-test for comparison ($p < 0.05$).

Discussion

Caudal analgesia is imaginary to be save, an effective and easy technique for pain management on paediatric patients subsequent to pelvic surgeries and lower abdominal.

The objective of using this technique is to evade the disadvantages of post-operative strees and pain **(El Fawy et al.,2014)**

In this study, statistical analysis of the Hemodynamics of the patients and technical characters did not display any significant differences between the two groups, as regards blood pressure, O2 saturation and heart rate of the patients.

Our results reach agreement with **Farrag et al.,2015)** study on Patients randomly take one of the 2 solutions for caudal epidural injection after introduction of general anaesthesia. Group-BK: Were given a mixture of 0.25% bupivacaine and 0.5 mg/kg of ketamine. Group-BM: Were given a mixture of 0.25% bupivacaine and 50 mg magnesium sulfate. There were insignificant difference in both groups when matched with the mean baseline value. None of the children hurt from bradycardia or hypotension and SaO_2 was within the clinically accepted rate through the

study period. Basal, intraoperative and postoperative evaluations for these vital signs were comparable for 2 groups.

Another study about caudal ketamine prepared by **Abdel-Ghaffar et al.,(2017)** on 80 children (aged 6 months to 6 years) received either 1 ml/kg of 0.25% bupivacaine /ketamine 0.5 mg/kg for caudal analgesia or 0.3 ml/kg of 0.25% bupivacaine /ketamine 0.5 mg/kg sprayed by the specialist around the spermatic cord and upon the ilioinguinal nerve before wound closing for topical analgesia showing that the hemodynamic factors did not show any significant differences over time in each group or between groups.

In our study matching the effectiveness of ketamine bupivacaine versus nalbuphine bupivacaine to offer intraoperative and postoperative pain manggment. The time to first analgesic management was longer in the ketamine bupivacaine group about (8 hrs) than nalbuphine bupivacaine about (5.8 hrs).

Studies measuring caudal ketamine have shown effective analgesia for both intraoperative and postoperative times. Ketamine provided improved pain relief of elongated duration when supplementary to local anaesthetics, ketamine produced analgesia when ordered alone or in mixture with other anaesthetics. Postoperatively, no increase in psychotomimetic properties was described after ketamine. This may be associated to the fact that the children take general anaesthesia during the period when systemic drug concentrations were high enough to cause undesired effects **(Martindale et al.,2004).**

Conclusion

Caudal nalbuphine and caudal ketamine are safe in pediatric surgeries in the lower half of the body and effectively reducing postoperative pain with longer duration of analgesia in ketamine group than nalbuphine group with no obvious side effects in both groups.

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