Original Research Paper

Volume - 14 | Issue - 12 | December - 2024 | PRINT ISSN No. 2249 - 555X | DOI : 10.36106/ijar

Anaesthesiology

TO EVALUATE THE TIME OF ONSET OF CAUDAL BLOCK WITH ROPIVACAINE VERSUS ROPIVACAINE WITH MAGNESIUM SULPHATE USING PERFUSION INDEX AS THE INDICATOR IN PAEDIATRIC PATIENTS UNDERGOING LOWER ABDOMINAL SURGERIES UNDER GENERAL ANAESTHESIA WITH CAUDAL BLOCK- A RANDOMISED CONTROL TRIAL

Dr Sandhya K	Professor MBBS MD Anaesthesia Bangalore Medical college and Research Institute Krishna Rajendra Road ,Kalasipalya Bangalore 560002
Dr Pratheeksha Kudva	Professor MBBS MD Anaesthesia Bangalore Medical college and Research Institute Krishna Rajendra Road ,Kalasipalya Bangalore 560002
Dr Deepan P*	Professor MBBS MD Anaesthesia Bangalore Medical college and Research Institute Krishna Rajendra Road ,Kalasipalya Bangalore 560002*Corresponding Author

ABSTRACT **OBJECTIVES:** Primary: To determine the time of caudal block onset with ropivacaine versus ropivacine with magnesium sulphate using perfusion index as an indicator in paediatric patients undergoing lower abdominal surgeries under general anaesthesia with caudal block. Secondary: To measure hemodynamic parameters like heart rate, Systolic blood pressure, diastolic blood pressure and mean arterial pressure and compare between the above-mentioned groups. **MATERIALS AND METHODS**: After taking approval from institutional ethics committee 74 children aged 3 -10 years undergoing elective infraumbilical surgery at hospitals attached to BMCRI with body weights ≤40 kg and who and expected to receive caudal analgesia were enrolled. General anaesthesia was administered using propofol for induction with atracurium for relaxation and fentanyl with target bispectral index level of 40 to 60. Patients were intubated and mechanically ventilated with 6 ml/kg of tidal volume and PEEP of 3cmH20 and PIP of 10 in case of pressure controlled ventilation, respiratory rate and I:E ratio adjusted accordingly to maintain an ETCO2 of 35 to 40 mm Hg throughout the procedure. Pulse oximetry, electrocardiography, gas analysis, oropharyngeal temperature, bispectral index, and EtCO2 concentration were used as standard monitors. The medical personnel administering the caudal block were blinded. 74 patients were allocated to two groups after randomization. In the control group caudal block was administered with 1ml per kg of 0.2% ropivacaine and in the test group 0.2% ropivacaine with 50mg Magnesium sulphate was administered. Time taken for the perfusion index to double was noted. Data obtained was subjected to statistical analysis. **RESULTS:** The P value obtained by comparing the two groups for time taken for block onset using independent t test was 0.002 which was statistically significant with magnesium sulphate group having a delayed onset when compared to ropivacaine group. **CONCLUSION:** We hereby conclude that while using magnesium sulphate as an additive for caudal block with ropivacaine the relatively delayed time of block onset is to remembered and if need arises other methods of analgesia to be utilised until the block onset is confirmed.

KEYWORDS : Perfusion index, caudal block, magnesium sulphate.

INTRODUCTION

Analgesia plays an important part in the practice of paediatric anaesthesia. Its very important to provide adequate anaesthetic depth and analgesia in paediatric patients to prevent detrimental hemodynamic variations in the intraop period. Regional anaesthesia specifically caudal analgesia is a valuable tool in pain management in paediatric patients[1]

Caudal block with ropivacaine has been used widely as an analgesic tool in paediatric patients undergoing surgery because of its preferential sensory and motor blockade at varying drug concentrations2. Magnesium is called as "Nature's physiological calcium channel blocker". Magnesium is a NMDA (N methyl D aspartate) antagonist. It has been suggested that the NMDA receptor antagonists induce pre-emptive analgesia when administered before tissue injury occurs, because these can prevent the induction of central sensitization from peripheral nociceptive receptors.Magnesium is called as "Nature's physiological calcium channel blocker"[3].

It is often very difficult to assess the quality of analgesia in children intra-operatively as most of the regional blocks are performed under general anesthesia or sedation in contrast to adults. Conventionally one waits to see the patient's response to surgical skin incision to make a clinical decision of working caudal block. Unsuccessful block causes a rise in HR and blood pressure on skin incision due to pain. Perfusion index is a reliable andnon invasive method of confirmation of caudal block onset as shown by various clinical studies in the past[4]..

MATERIALS AND METHODS

This was a prospective randomised study conducted between February 2024 and September 2024 in the hospitals attached to Bangalore Medical College and Research institute. Our study had the approval from the Institutional Ethics Committee. This study was performed in accordance with relevant guidelines and regulations.Written informed consent was obtained from the parents/guardians. 74 children aged 3 - 10 years undergoing elective infraumbilical surgery at hospitals attached to BMCRI with body weights ≤40 kg and who and expected to receive caudal analgesia were enrolled. The sample size of 34 was needed in each group. However, after including drop out compensation of 10%, sample size of 37 was considered and randomly allocated into either group. Patients fulfilling following criteria were included: Paediatric patients of age between 3 to 10years, patients willing to give informed written consent ,patients belonging to American Society of Anesthesiologist class I&II , patients scheduled to undergo elective infra umbilical surgeries. Following patients were excluded: Patients with congenital heart disease, valvular heart disease, arrhythmia, patients with syndromes involving metabolic pathway,patients undergoing emergency surgeries, patients having allergy to drugs used during anesthesia.

General anaesthesia was administered using propofol for induction with vecuronium/ atracurium for relaxation and fentanyl with target bispectral index level of 40 to 60. Patients were either be intubated or managed with supraglottic airway device and mechanically ventilated with 6 ml/kg of tidal volume and PEEP of 3cmH20 and PIP of 10 in case of pressure controlled ventilation, respiratory rate and I:E ratio adjusted accordingly to maintain an ETCO2 of 35 to 40 mm Hg throughout the procedure. Pulse oximetry, electrocardiography, gas analysis, oropharyngeal temperature, bispectral index, and EtCO2 concentration will be used as standard monitors. The medical personnel administering the caudal block were blinded. 74 patients were allocated to two groups after randomization. In the control group(Group R) caudal block was administered with 1ml per kg of 0.2% ropivacaine with 1ml normal saline and in the test group(Group M) 0.2% ropivacaine with 50mg Magnesium sulphate was administered. Time taken for the perfusion index to double from the baseline value was noted. Heart rate, non invasive arterial blood pressure, end-tidal carbon dioxide concentration, end-tidal sevoflurane concentrations, and peak inspiratory pressure were recorded at both time intervals. Data obtained was subjected to statistical analysis.

RESULT

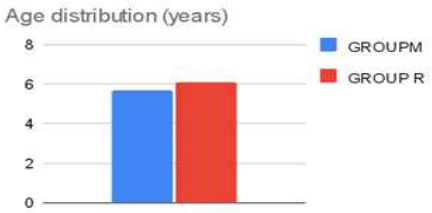
The above parameters were recorded and the following statistical analysis methods were applied and the results were obtained. The collected data was entered in the Microsoft Excel 2016 and was analysed with IBM SPSS Statistics for Windows, Version 29.0.(Armonk, NY: IBM Corp).To describe about the data descriptive

statistics frequency analysis, percentage analysis was used for categorical variables and for continuous variables the mean and S.D was used. To find the significant difference between the bivariate samples in independent groups the independent sample t-test or Mann-Whitney U test was used as on the normality of the data. To find the association of significance in categorical data the Chi-Square test or Fisher's exact test was used. Any other necessary test found appropriate was dealt at the time of analysis, based on the data distribution. In all the above statistical tools the probability value 0.05 was considered as significant level.

The two groups were similar with respect to age and gender distribution and difference was statistically insignificant (p >0.05).

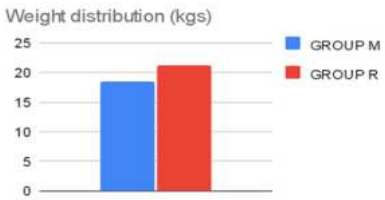
The mean age between two groups was comparable.

Groups		N	Mean	SD
Age	GROUPM	37	5.7	1.81
	GROUP R	37	6.1	1.32



The mean weight between the two groups was comparable.

Groups		N	Mean(kg)	SD
Weight	GROUP M	37	18.5	2.4
	GROUP R	37	21.3	1.9

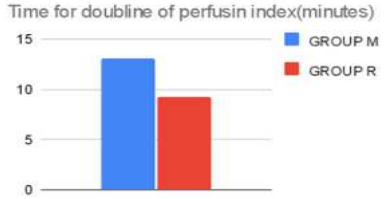


The mean volume of analgesic solution administered was comparable between the two groups.

Groups		N	Mean	SD
Volume of analgesic solution	GROUP M	37	9.4ml	0.9
	GROUP R	37	10.3ml	0.85

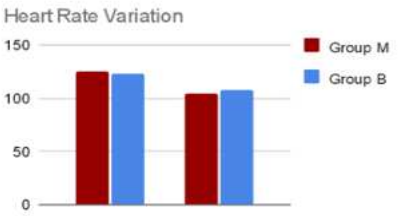
Time taken for the doubling of perfusion in control group (Group R) was 9.18 minutes and in test group (Group M) was 13.09 minutes. The p value between the two groups was 0.002 which indicates it is statistically significant.

TIME FOR DOUBLING OF PERFUSION INDEX	GROUPS	N	MEAN	SD
	GROUP M	37	13.09	0.7
	GROUP R	37	9.18	0.6



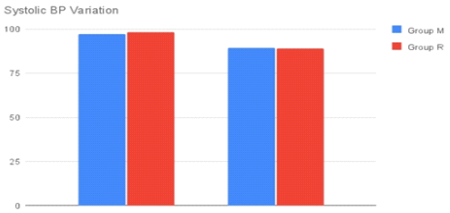
The heart rate variation between two groups was comparable at both time intervals.

TIME FOR DOUBLING OF PERFUSION INDEX	GROUPS	N	MEAN	SD
	GROUP M	37	13.09	0.7
	GROUP R	37	9.18	0.6



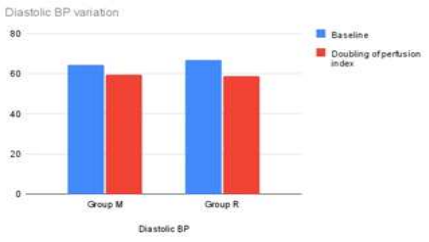
The systolic Blood Pressure variation amongst the two groups were comparable.

SYSTOLIC BP	Baseline	Doubling of perfusion index
Group M	97.33	89.45
Group R	98.23	88.96



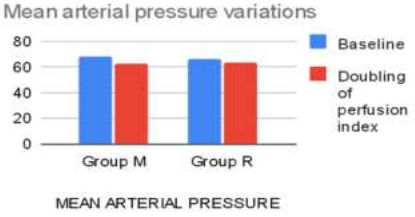
The diastolic blood pressure between the two groups was comparable at both time intervals.

Diastolic BP	Baseline	Doubling of perfusion index
Group M	64.34	59.34
Group R	66.67	58.98



The mean arterial pressure variation between the two groups was comparable at both intervals.

MEAN ARTERIAL PRESSURE	Baseline	Doubling of perfusion index
Group M	68.32	62.45
Group R	66.79	63.45



DISCUSSION

The reason we used perfusion index as an indicator of block onset is because various studies have proven it is a reliable and non invasive tool. For instance in the prospective observational study by Ranjan et all5 on perfusion index as an indicator of working paediatric caudal block under general anaesthesia a they concluded that perfusion Index is a better indicator of block onset when compared to heart rate as all the patients with working caudal block showed doubling of perfusion index from the baseline value while this was not the case with heart rate. .

In the comparitive study conducted by Hatab et all6 they compared

dexmeditomedine and magnesium sulphate as adjuvants to bupivacaine for caudal analgesia in paediatrics and concluded that the Magnesium sulphate group had significantly delayed onset when compared with dexmeditomedine group. In our study we found that magnesium sulphate had significantly delayed onset of block when compared to the control group.

In the prospective double blind randomised controlled study performed by Shruti et all7 on the effect of single dose of magnesium sulphate as an adjuvant to epidural bupivacaine for infraumbilical surgeries on adult subjects they concluded that the magnesium sulphate group had an earlier onset of block when compared to bupivacaine group. In our study we found that magnesium sulphate group had delayed onset of block action when compared to ropivacaine group.

In a comparitive study conducted by A Gupta et all8 they compared ropivacaine with ropivacaine-fentanyl and ropivacaine-fentanyl-magnesium sulphate in epidural anaesthesia for lower limb surgeries and concluded that Magnesium sulphate when combined with fentanyl as an adjuvant has significantly faster time of epidural block onset when compared to ropivacaine and fentanyl alone. In our study we found that MgSO4 when combined with ropivacaine has delayed time of caudal block onset when compared to plain ropivacaine

The limitation to our study was that perfusion index doesnot differentiate between sensory and motor blockade.

CONCLUSION

We conclude from our study that the time taken for doubling of perfusion index from baseline value indicating the onset of caudal block is significantly delayed when MgSO4 is used as an adjuvant with ropivacaine . The implication of this would be that other modes of analgesia should be employed if need arises until the block onset is confirmed.

REFERENCES

1. Anna Uram Benka. Effects of caudal block in pediatric surgical patients: a randomized clinical trial. Brazilian Journal of Anesthesiology (English Edition), Volume 70, Issue 2,2020, Pages 97-103.
2. Habre W, Bergesio R, Johnson C, Hackett P, Joyce D, Sims C. Pharmacokinetics of ropivacaine following caudal analgesia in children. Paediatr Anaesth. 2000;10(2):143-7.
3. Choudhary, S; Bedi, V; Kalluraya, SB; Sharma, S Evaluation of Analgesic Efficacy of Magnesium Sulfate as An Adjuvant to Caudal Bupivacaine in Pediatric Infraumbilical Surgeries – A Prospective Randomized Double-Blind StudyIndian Journal of Pain .
4. Mohamed I A. El-sonbaty, and Ahmed i.a. Sonbaty, Evaluation of Perfusion Index (PI) Efficiency in Paediatric Caudal Block: Is it the Time to Depend on PI Cairo Univ., Vol. 83, No. 2, June 2015: 223-227.
5. Rajan K, Dave N, Dias R, Muneshwar P, Kesarkar N, Saxena V. Perfusion index as a predictor of working paediatric caudal block under general anesthesia- A prospective observational study. J Anaesthesiol Clin Pharmacol. 2022 Oct-Dec;38(4):635-639.
6. Hatab, Mohammed Al-Saeed Abdo Abu; El-Sayed, Salah Ramadan; Allam, Medhat Helaly; Ahmed, Osama Helal; and Elenain, Mohamed M. Abo (2023) "Comparative Study between Dexmedetomidine and Magnesium Sulphate as Adjuvants to Bupivacaine for Caudal Analgesia in Pediatrics," Al-Azhar International Medical Journal: Vol. 4: Iss. 12, Article 10. DOI
7. Shruthi AH, Sudheesh K, Nethra SS, Raghavendra Rao RS, Devika Rani D. The effect of a single dose of magnesium sulphate as an adjuvant to epidural bupivacaine for infraumbilical surgeries: A prospective double-blind, randomized control trial. middle east J anaesthesiol. 2016 feb;23(4):449-55. pmid: 27382815.
8. Gupta A, Tiwari T, Kapoor R, Malik A, Abbas H, Singh PR. Comparative study of ropivacaine with ropivacaine-fentanyl and ropivacaine-fentanyl-magnesium sulfate in epidural anesthesia for lower limb surgeries. Indian J Surg. 2018;80(5):458-463. doi:10.18203/2349-2902.isj20181010.
9. M . Wiegele, P Marhofer, PA Lönnqvist. Caudal epidural blocks in paediatric patients: a review and practical considerations. Br J Anaesth. 2019 Apr;122(4):509-517.
10. Xu Z, Zhang J, Shen H, Zheng J. Assessment of pulse oximeter perfusion index in pediatric caudal block under basal ketamine anesthesia. ScientificWorldJournal. 2013 Sep 19;2013
11. Julien-Marsollier F, Rachdi K, Caballero MJ, Ayanmanesh F, Vacher T, Horlin AL, Skhiri A, Brasher C, Michelet D, Dahmani S. Evaluation of the analgesia nociception index for monitoring intraoperative analgesia in children. Br J Anaesth. 2018 Aug;121(2):462-468.
12. M Wiegele, P Marhofer, PA Lönnqvist. Caudal epidural blocks in paediatric patients: a review and practical considerations. Br J Anaesth. 2019 Apr;122(4):509-517.
13. Santhanam Suresh and Per-Anne Lonnqvist, Regional Anaesthesia in Children Michael Gropper, Lars Eriksson, Lee Fleisher, Jeanine Wiener-Kronish, Neal Cohen, Kate Leslie. Miller's anesthesia 9th ed.Vol.2.San Fransisco,California:Churchill Livingstone Elsevier, 2019, p-2383-2389
14. Allen J. Photoplethysmography and its application in clinical physiological measurement. Physiol Meas. 2007 Mar;28(3):R1-39.
15. Rajan K, Dave N, Dias R, Muneshwar P, Kesarkar N, Saxena V. Perfusion index as a predictor of working pediatric caudal block under general anesthesia- A prospective observational study. J Anaesthesiol Clin Pharmacol. 2022 Oct-Dec;38(4):635-63