

# Perioperative Safety and Efficacy of Pre-Surgical Multimodal Analgesia versus Intravenous Opioids in Children Undergoing Infraumbilical Urogenital Surgery

S Jani Noopur<sup>1</sup>, P Butala Bina<sup>2</sup>

<sup>1</sup>Assistant Professor, Department of Cardiac Anaesthesia and Critical Care, U.N. Mehta institute of cardiology and Research Center, Ahmedabad, Gujarat, India,

<sup>2</sup>Professor and Head, Department of Anaesthesia, Transplant Anaesthesia and Critical Care, Institute of kidney disease and Research Centre, Institute of transplantation sciences (IKDRC-ITS), Ahmedabad, Gujarat, India.

## Abstract

**Background:** MMA (multimodal analgesia) alleviates pain through blockade of multiple nociceptive and inflammatory pain receptors along the pain pathway. Thus it maximizes pain control and minimizes drug induced adverse effects especially of opioids. We studied safety and efficacy of MMA comprising anti-inflammatory, local anaesthetics and alpha 2 agonist (in caudal block) against conventional opioid analgesia in children undergoing infra-umbilical urogenital surgery. **Subjects and Methods:** A randomized, prospective, single blind study was conducted in 40 patients aged between 1-8 years. After pre-medication, patients were given general anaesthesia with controlled ventilation via LMA. In Multimodal analgesia group, pre-surgical caudal block was given with Inj.Bupivacaine 0.25 % ( 1ml/kg) +Inj.Clonidine (1mcg/kg).Paracetamol 30mg/kg inserted per rectally. In Opioid group, pre-surgical intravenous Fentanyl (2 mcg/kg) was given. Intra-operative fentanyl requirement, hemodynamic parameters ,sevoflurane dial concentration, side effects like nausea , vomiting, respiratory depression, emergence agitation, excessive sedation and post-operative fentanyl requirement(0.5mcg/kg, on demand/FLACC score>4 at 1,4,6 hrs) were noted. Patients were observed for 6 hrs in postoperative period. **Result:** We found significant increase in postoperative analgesic requirement in opioid group (18/20; p<0.001), while intra-operative opioid requirement was statically insignificant between both the groups (p=0.17).Though linear decreasing trend in intraoperative inhalational agent requirement was observed in MMA group. Both the groups were comparable in terms of adverse effects. **Conclusion:** Presurgical MMA with caudal block and rectal paracetamol is safe and efficacious in children undergoing infraumbilical surgery.

**Keywords:** Multimodal analgesia, caudal block, clonidine.

**Corresponding Author:** S Jani Noopur, Assistant Professor, Department of Cardiac Anaesthesia and Critical Care, U.N. Mehta institute of cardiology and Research Center, Ahmedabad, Gujarat, India.  
E-mail: [noopurnaik89@gmail.com](mailto:noopurnaik89@gmail.com)

Received: 06 January 2021

Revised: 28 February 2021

Accepted: 04 March 2021

Published: 05 June 2021

## Introduction

Acute paediatric pain management is increasingly characterized by multimodal analgesia (MMA)/balanced approach in which smaller doses of opioid and non- opioid analgesics (esp. Regional blocks) are combined to maximize pain control and minimize drug induced adverse effects mainly of opioids.

Pediatric infra-umbilical urogenital procedures are included in ERAS(Enhanced recovery after surgery) programme nowadays and advocate the use of MMA.<sup>[1,2]</sup> MMA allows early recovery, decreased incidences of pulling out of drain and urinary catheter and subsequent utilization of resources in postoperative period.<sup>[3,4]</sup> Selection of multimodal therapies is a challenge because for each surgery many potential combinations

are possible, but relatively few have been evaluated in rigorous trials; especially in children. We studied MMA combination of local anaesthetic and clonidine in caudal block along with rectal paracetamol.

## Subjects and Methods

A prospective randomized single blind study included 40 patients aged between 1-8 years of either sex with ASA risk I/II, weighing 8-20 kg posted for infra-umbilical urogenital surgery. Institutional ethical board approval was obtained (Institute Ethics Committee, Version 01\_Dated 16/10/2018, Date of approval: 31/10/2018). Written informed consent was obtained from parents before enrolment. Patients with altered

renal function test, coagulopathy, recent active respiratory tract infection, spine or back deformity/infection, patients with h/o allergy to local anaesthetics were excluded. The study was carried out between November 2018- July 2019. Detailed history, physical examination and routine blood investigations were undertaken for all patients. All the procedures were carried out in conformity with provision of declaration of Helsinki 2013. All recruited patients were randomized into two groups according to computer generated random number table. Group MMA (Multimodal analgesia); Group OPIOID.

Children were fasted for 8 hrs for fatty food, 6hrs for solid and formula food, 4hrs for breast milk and 2 hrs for clear liquids. All the patients were premedicated with oral midazolam (0.5mg/kg) half an hour before proposed time of surgery. IV access was secured with 22G/24G IV cannula in recovery room and IV fluid started at 2-4ml/kg/hr. After achievement of satisfactory parenteral separation, patients were brought inside operation theatre. In the Operation theatre, routine monitors such as ECG, NIBP, and SpO<sub>2</sub> were placed. Baseline hemodynamic parameters (systolic blood pressure, diastolic blood pressure, mean arterial pressure, heart rate, and oxygen saturation) were recorded. General anaesthesia was induced in all patients with Inj.fentanyl (0.5mcg/kg), Inj. Glycopyrrolate (4mcg/kg), Inj. Propofol (3-4mg/kg) IV. After achieving adequate jaw relaxation, SGD (supraglottic device) of appropriate size was inserted to secure airway. After confirming proper placement, SGD was fixed. As per group selected patients were given MMA or opioid. In Multimodal analgesia group presurgical caudal block was given with 22G, 1.5 inch hypodermic needle in lateral decubitus position under all aseptic and antiseptic precautions. Sacroccygeal ligament was pierced and caudal space was confirmed with WHOOSH TEST.<sup>[5]</sup> Inj. Bupivacaine 0.25%(1ml/kg)+ Inj. Clonidine (1mcg/kg) was injected after negative aspiration of blood/CSF. Paracetamol 30mg/kg inserted per rectally. Patients who developed subcutaneous swelling or resistance to injection were considered failed block and excluded from the study. In Opioid group presurgical Inj.Fentanyl (2 mcg/kg) IV was given. The study was conducted in teaching hospital. All the procedures were done by senior residents and supervised by consultant anaesthesiologist. Data were collected by junior residents.

Patients were maintained for initial 15 minutes after insertion of SGD, with 2-3%sevoflurane (3 L 50% O<sub>2</sub> + 50 % N<sub>2</sub>O) and intermittent Inj.Atracurium(bolus dose of 0.5mg/kg followed by the maintenance dose of 0.1mg/kg) to achieve steady state of anaesthesia before surgical stimulation.<sup>[6]</sup> Afterwards, sevoflurane was titrated (0.8-3%) to keep vitals within 20% of baseline. If even after 20 minutes of analgesia, on surgical stimulation it requires >50% inhalational agent (from baseline dial setting) to maintain hemodynamics within 20% of baseline, Inj. fentanyl (0.5 mcg/kg IV bolus) was

given as required. Here the baseline parameters considered were after achieving steady state of anaesthesia. If patients moves on 60s of surgical stimulation, it will be considered as failure of caudal block and patients will be excluded from the study. We did BIS guided pilot cases in 15 patients and derived allowable lowest sevoflurane dial concentration - 0.8% in MMA group and 1% in IV opioid group. Following parameters were recorded at baseline, after induction, 5 minutes after MMA/opioid, before surgical procedure and 5, 10, 20, 30 min after beginning of surgery followed by every 30 min till surgery lasts and immediate post extubation: Intra-operative fentanyl requirement, Heart rate, NIBP, SpO<sub>2</sub>, ETCO<sub>2</sub>, Sevoflurane dial concentration, Side effects like post-operative pain (by FLACC score/self reporting at 1, 4, 6 hrs), nausea, vomiting (treated with Inj. Ondansetron 0.15mg/kg), respiratory depression (SpO<sub>2</sub> ≤ 93 % or Respiratory rate ≤ 10 / min or requiring oxygen), emergence agitation, excessive sedation, Post-operative fentanyl requirement (0.5mcg/kg, on demand/FLACC score >4)

At the end of the surgery, SGD was removed under deeper plane of anaesthesia after reversal of neuromuscular blockade (Inj. Neostigmine 50 mcg / kg + Inj. Glycopyrrolate 4 mcg / kg) and anal sphincter tone was assessed. If it is not relaxed; it was considered as failed caudal block,<sup>[7]</sup> and patients were excluded from the study. Patients were monitored for 6 hrs in recovery room for side effects and postoperative fentanyl requirement. Patients were shifted out of recovery room when modified alderate score >9.

Sample size was calculated using variable "Requirement of pain medication in 24 hrs" of study by Khalil et al,<sup>[8]</sup> with alpha error of 0.05 and beta error of 0.02 using SPSS version 20. Continuous variable data are presented as Mean +/- SD. Categorical variable data are presented as percentage. Analysis of variance (ANOVA) of the data for the various parameters was done using student's paired t- test for intra-group comparison, unpaired t-test for intergroup comparison for quantitative data and chi-square test for qualitative data. The test for significance was done using Medcalc statistical software. The significance of ANOVA was judged as follows - p > 0.05 not significant, < 0.05 significant, and < 0.001 highly significant.

## Results

A total of 39 patients were analysed out of 40 patients enrolled to study. Both the groups; Group MMA and Group OPIOID were comparable in terms of demographic data [Table 1].

Though intraoperative fentanyl requirement was comparable between both the groups, postoperative fentanyl requirement was significantly higher in opioid group [Table 2].

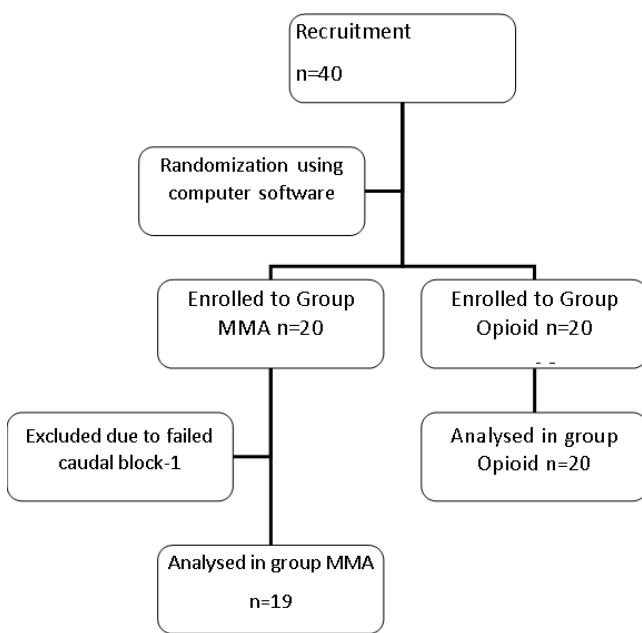
Hemodynamic parameters remained stable throughout the study in both the groups. In MMA group, sevoflurane dial

**Table 1: Demographic Data**

	Group MMA	Group OPIOID	P-Value
Age (Years)	4.05 +/-1.86	3.15 +/- 1.80	0.13
Weight (Kg)	12.55+/-2.25	12.4+/-3.05	0.86
Duration Of Surgery (Minutes)	53.15+/-34.0	48.5+/-24.97	0.62
ASA Grading (I:II)	17:2	18:2	

**Table 2: Intraoperative and Postoperative Opioid Requirement**

	Group MMA	Group OPIOID	P-Value
Intra-operative fentanyl requirement	1/19 (5%)	4/20 (20%)	0.17
Post-operative fentanyl requirement	0/19 (0%)	18/20 (90%)	<0.0001



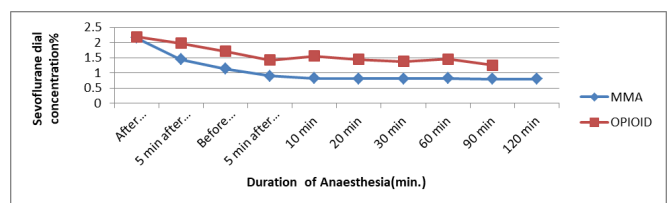
**Figure 1: Consort chart**

concentration showed linear decreasing trend, while in opioid group it showed peak and through pattern [Figure 2].

We observed 2 cases of respiratory depression in OPIOID group; whereas none in MMA group. Incidence of emergence agitation were 4 in OPIOID group and 2 in MMA group (p=0.41). No incidences of hypotension, bradycardia, nausea, vomiting, excessive sedation were noted.

## Discussion

The concept of multimodal analgesia (MMA) is based on the apparent synergy between agents interfering with pain path-



**Figure 2: Trends of sevoflurane dial concentration**

ways at multiple anatomic and pharmacologic sites, while limiting the side effects mainly of opioids. Active components of MMA includes NSAIDs, local anaesthetics, antihistaminics (inhibit peripheral nociceptors), local anaesthetics, neuraxial opioid, alpha 2 adrenergic agonist, NMDA antagonist (inhibit dorsal horn nociceptors), systemic opioids, anti-convulsants like gabapentin, pregabalin, magnesium sulphate (central desensitization) and non-pharmacological methods. Caudal block is an important element of MMA and being widely used in children. We have studied the effect of pre-emptive IV opioid (fentanyl i.v.) versus pre-emptive multimodal analgesia (low dose i.v. fentanyl+caudal clonidine and bupivacaine+rectal paracetamol) and found significant increase in postoperative analgesic requirement in IV opioid group, while intraoperative opioid requirement was statistically insignificant between both the groups. Though linear decreasing trend in intraoperative inhalational agent requirement was observed in MMA group. Similar to our study, decreased requirement of opioids with pre-emptive MMA have been demonstrated in children undergoing orchiopexy,<sup>[8]</sup> and laparoscopic appendicectomy as well as in adults undergoing lumbar spine surgery.<sup>[9,10]</sup> To add objective evidence in favour of multimodal analgesia M.Somri et al,<sup>[11]</sup> Studied fifty children undergoing inguinal herniotomy in two groups for catecholamine response: general anaesthesia with caudal block and general anaesthesia with caudal block and low dose

intravenous fentanyl. He suggested that multimodal analgesic approach of adding low dose intravenous fentanyl with caudal block decrease the plasma epinephrine release in children undergoing inguinal herniotomy. In our study, intraoperative fentanyl requirement depends to some extent on variable onset of caudal block. So, postoperative requirement is more significant clinically which clearly state the working caudal block as assessed by anal sphincter tone at end of surgery.

Regional anaesthesia (caudal block in children) has been used in many MMA regime. [12-14] Many studies have demonstrated efficacy of caudal block in infraumbilical urogenital surgery without any untoward complication. [15-21] Similar to our findings, S.Khalil et al, [8] and Samanthray et al, [22] found better postoperative pain relief in caudal group as compared to iv opioid group in children undergoing orchiopexy and cardiac surgery respectively. Additives are often added to caudal block to get extended period of analgesia without significant side effects. Clonidine is alpha-2 adrenergic receptor agonist. The anti-nociceptive action of clonidine is due to suppression of neurotransmission in dorsal horn of spinal cord as well as peripheral sensory A-delta and C nerve fibers. Similar to our study clonidine (1mcg/kg) have been used successfully by many authors. [23,24]

Rectal Paracetamol exerts its analgesic effects by blocking central prostaglandin synthesis, reducing substance P induced hyperalgesia and modulating the production of hyperalgesic nitric oxide in the spinal cord. Though greatest analgesic efficacy had been observed during first two hours. [25]

We have observed linear decreasing trend in sevoflurane dial concentration in MMA group whereas in IV opioid group sevoflurane dial concentration showed trend with peak and through pattern. F.Reinoso Barbero et al, [26] studied 26 children aged 2-15 years, posted for lower limb orthopaedic surgery in two groups for sevoflurane requirement to maintain adequate level of hypnosis guided by BIS. He suggested that potential analgesic effect of combined anaesthesia allows lower dose of hypnotic agents to provoke EEG synchronization (BIS-45-55) as nociceptive perception has been effectively blocked. "Hypnogenic like" effect of caudal epidural block diminishes the need for hypnotic drugs. Similarly, N.M. Solanki et al, [27] demonstrated that at 45 minutes after performing caudal block, number of patients being stable with 0.6% sevoflurane were maximum in both the groups and at 90 minutes most of the patients were hemodynamically stable with 0.6% sevoflurane. While, reduction of inhalational agent requirement by pre surgical caudal analgesia was also demonstrated by Kim et al, [28] in children with cerebral palsy undergoing lower limb surgery and Khalil S et al, [8] in children undergoing orchiopexy.

In our study, antiemetic effect of propofol, use of short acting opioid (Fentanyl) and adequate analgesia might have counterbalanced the usual PONV side effect of opioid. In

contrast to our study, Khalil et al observed increased respiratory adverse events, oxygen requirement and PONV in opioid group. Combination of Isoflurane and opioids might be the possible explanation. No eye contact and no awareness of surroundings were the criteria used to assess emergence delirium. [29] In contrast to our study, some authors have found decrease incidence of emergence delirium with caudal clonidine 2mcg/kg. [30]

Study has several limitations. We have not used anaesthesia agent gas monitoring to titrate inhalational agents, as we want to mimic the scenario in low resource set up. We monitored the patients for 6 hrs in the postoperative period as we want to mimic the scenario of high turn over of the patients. The working caudal block could not be guaranteed before surgery (controlled ventilation) which might have influenced intraoperative fentanyl requirement.

## Conclusion

Pre surgical Multimodal analgesia offers an edge over conventional opioids in children during peri-operative period. Although many combinations are possible, but combination using low dose intravenous opioid, caudal clonidine and local anaesthetic along with rectal paracetamol is safe and efficacious in infra-umbilical urogenital surgery.

## References

1. Vukovic N, Dinic L. Enhanced Recovery After Surgery Protocols in Major Urologic Surgery. *Front Med.* 2018;5:93. Available from: <https://dx.doi.org/10.3389/fmed.2018.00093>.
2. Rove KO, Brockel MA, Saltzman AF, Dönmez Mİ, Brodie KE, Chalmers DJ, et al. Prospective study of enhanced recovery after surgery protocol in children undergoing reconstructive operations. *J Pediatr Urol.* 2018;14(3):252. Available from: <https://dx.doi.org/10.1016/j.jpuro.2018.01.001>.
3. Memsoudis SG, Poeran J, Zubizarreta N, Cozowicz C, Mörwald EE, Mariano ER, et al. Association of Multimodal Pain Management Strategies with Perioperative Outcomes and Resource Utilization. *Anesthesiology.* 2018;128(5):891-902. Available from: <https://dx.doi.org/10.1097/aln.0000000000002132>.
4. Jong RD, Shysh AJ. Development of a Multimodal Analgesia Protocol for Perioperative Acute Pain Management for Lower Limb Amputation. *Pain Res Manag.* 2018;2018:1-9. Available from: <https://dx.doi.org/10.1155/2018/5237040>.
5. Chan SY, Tay HBD, Thomas E. "Whoosh" Test as a Teaching Aid in Caudal Block. *Anaesth Intensive Care.* 1993;21:414-415. Available from: <https://dx.doi.org/10.1177/0310057x9302100407>.
6. Kotwani MB, Malde AD. Comparison of maintenance, emergence and recovery characteristics of sevoflurane and desflurane in pediatric ambulatory surgery. *JOACP.* 2017;33(4):503-508. Available from: [https://dx.doi.org/10.4103/joacp.JOACP\\_194\\_16](https://dx.doi.org/10.4103/joacp.JOACP_194_16).

7. Dave N, Garasia M. A comparison of the effectiveness of predictors of caudal block in children-swoosh test, anal sphincter tone, and heart rate response. *J Anaesthesiol Clin Pharmacol.* 2012;28(1):17. Available from: <https://dx.doi.org/10.4103/0970-9185.92428>.
8. Khalil SN, Matuszczak ME, Maposa D, Bolos ME, Lingadevaru HS, Chuang AZ. Presurgical fentanyl vs caudal block and the incidence of adverse respiratory events in children after orchidopexy. *Pediatr Anesth.* 2009;19(12):1220–1225. Available from: <https://dx.doi.org/10.1111/j.1460-9592.2009.03164.x>.
9. Liu Y, Seipel C, Lopez ME, Nuchtern JG, Brandt ML, Fallon SC, et al. A retrospective study of multimodal analgesic treatment after laparoscopic appendectomy in children. *Pediatr Anesth.* 2013;1187(1192). Available from: <https://dx.doi.org/10.1111/pan.12271>.
10. Savitha K, Dhanpal R, Kothari A. The effect of multimodal analgesia on intraoperative morphine requirement in lumbar spine surgeries. *Anesth: Essays Res.* 2017;11(2):397. Available from: <https://dx.doi.org/10.4103/0259-1162.194553>.
11. Somri M, Tome R, Teszler CB, Vaida SJ, Mogilner J, Shneefi A, et al. Does adding intravenous fentanyl to caudal block in children enhance the efficacy of multimodal analgesia as reflected in the plasma level of catecholamines? *Eur J Anaesthesiol.* 2007;24(5):408–413. Available from: <https://dx.doi.org/10.1017/s0265021506001414>.
12. Suresh S, Barcelona SL, Young NM, Seligman I, Heffner CL, Coté CJ. Postoperative Pain Relief in Children Undergoing Tympanomastoid Surgery: Is a Regional Block Better than Opioids? *Anesth Analg.* 2002;94:859–862. Available from: <https://dx.doi.org/10.1097/00005539-200204000-00015>.
13. Lako SJ, Steegers MA, van Egmond J, Gardeniers J, Staals LM, van Geffen GJ. Incisional Continuous Fascia Iliaca Block Provides More Effective Pain Relief and Fewer Side Effects than Opioids After Pelvic Osteotomy in Children. *Anesth Analg.* 2009;109(6):1799–1803. Available from: <https://dx.doi.org/10.1213/ane.0b013e3181bbc41a>.
14. Windt ACD, Asehnoune K, Roquilly A, Guillaud C, Roux CL, Pinaud M, et al. An opioid-free anaesthetic using nerve blocks enhances rapid recovery after minor hand surgery in children. *Eur J Anaesthesiol.* 2010;27(6):521–525. Available from: <https://dx.doi.org/10.1097/eja.0b013e3283349d68>.
15. Remadevi R, Praveen P, Pratheeba N. Caudal epidural analgesia in paediatric patients: Comparison of 0.25% levobupivacaine and 0.25% ropivacaine in terms of motor blockade and postoperative analgesia. *Anesth Essays Res.* 2017;11(1):223. Available from: <https://dx.doi.org/10.4103/0259-1162.200231>.
16. Gupta S, Sharma R. Comparison of analgesic efficacy of caudal dexmedetomidine versus caudal tramadol with ropivacaine in paediatric infraumbilical surgeries: A prospective, randomised, double-blinded clinical study. *Indian J Anaesth.* 2017;61(6):499. Available from: [https://dx.doi.org/10.4103/ija.ija\\_712\\_16](https://dx.doi.org/10.4103/ija.ija_712_16).
17. Sanwatsarkar S, Kapur S, Saxena D, Yadav G. Comparative study of caudal clonidine and midazolam added to bupivacaine during infra-umbilical surgeries in children. vol. 33. Nagina Naz Khan; 2017.
18. Bevinaguddaiah Y, Potti LR, Archana S, Pujari VS, Abloodu CM. Caudal levobupivacaine supplemented with caudal or intravenous clonidine in children undergoing infraumbilical surgery: A randomized, prospective double-blind study. *Anesth Essays Res.* 2017;11(1):211. Available from: <https://dx.doi.org/10.4103/0259-1162.200233>.
19. Karupiah NM, Shetty S, Patla K. Comparison between two doses of dexmedetomidine added to bupivacaine for caudal analgesia in paediatric infraumbilical surgeries. *Indian J Anaesth.* 2016;60:409. Available from: <https://dx.doi.org/10.4103/0019-5049.183394>.
20. Saini S, Patodi V, Sethi S, Jain N, Mathur P, Thada B. Comparison of caudal epidural clonidine with fentanyl as an adjuvant to ropivacaine 0.25% for postoperative analgesia in children undergoing various infraumbilical surgeries: A prospective randomized study. *Ain-Shams J Anaesthesiol.* 2016;9(4):493. Available from: <https://dx.doi.org/10.4103/1687-7934.198252>.
21. Shamaa HE, Ibrahim M. A comparative study of the effect of caudal dexmedetomidine versus morphine added to bupivacaine in pediatric infra-umbilical surgery. *Saudi J Anaesth.* 2014;8(2):155. Available from: <https://dx.doi.org/10.4103/1658-354x.130677>.
22. Samantaray D, Trehan M, Chowdhry V, Reedy S. Comparison of hemodynamic response and postoperative pain score between general anaesthesia with intravenous analgesia versus general anaesthesia with caudal analgesia in pediatric patients undergoing open-heart surgery. *Ann Card Anaesth.* 2019;22(1):35. Available from: [https://dx.doi.org/10.4103/aca.aca\\_215\\_17](https://dx.doi.org/10.4103/aca.aca_215_17).
23. Manickam A, Parameswari A, Vakamudi M, Chetan C. Efficacy of clonidine as an adjuvant to ropivacaine for caudal analgesia in children undergoing subumbilical surgery. *J Anaesthesiol Clin Pharmacol.* 2012;28(2):185. Available from: <https://dx.doi.org/10.4103/0970-9185.94839>.
24. Priolkar S. Efficacy and Safety of Clonidine as an Adjuvant to Bupivacaine for Caudal Analgesia in Paediatric Infra-Umbilical Surgeries. *J Clin Diagn Res.* 2016;10(9):13–16. Available from: <https://dx.doi.org/10.7860/jcdr/2016/19404.8491>.
25. Khalili GR, Shafa A, Yousefi R. Comparison of the Effects of Preemptive Intravenous and Rectal Acetaminophen on Pain Management after Inguinal Herniorrhaphy in Children: A Placebo-Controlled Study. *Middle East J Anaesthesiol.* 2016;23(5):543–551.
26. Reinoso-Barbero F, Martínez-García E, Hernández-Gancedo MC, Simon AM. The effect of epidural bupivacaine on maintenance requirements of sevoflurane evaluated by bispectral index in children. *Eur J Anaesthesiol.* 2006;23(6):460–464. Available from: <https://dx.doi.org/10.1017/s0265021506000330>.
27. Solanki NM, Engineer SR, Jansari DB, Patel RJ. Comparison of caudal tramadol versus caudal fentanyl with bupivacaine for prolongation of postoperative analgesia in pediatric patients. *Saudi J Anaesth.* 2016;10(2):154. Available from: <https://dx.doi.org/10.4103/1658-354x.168807>.
28. Kim SH, Chun DH, Chang CH, Kim TW, Kim YM, Shin YS. Effect of caudal block on sevoflurane requirement for lower limb surgery in children with cerebral palsy. *Paediatr Anaesth.* 2011;21(4):394–402. Available from: <https://doi.org/10.1111/>

[j.1460-9592.2011.03530.x](https://doi.org/10.1460-9592.2011.03530.x).

29. Saxena A, Sethi A, Agarwal V, Godwin R. Effect of caudal clonidine on emergence agitation and postoperative analgesia after sevoflurane anaesthesia in children: Randomised comparison of two doses. *Indian J Anaesth.* 2014;58(6):719. Available from: <https://dx.doi.org/10.4103/0019-5049.147163>.
30. Somaini M, Engelhardt T, Fumagalli R, Ingelmo PM. Emergence delirium or pain after anaesthesia—how to distinguish between the two in young children: a retrospective analysis of observational studies. *Br J Anaesth.* 2016;116(3):377–383. Available from: <https://dx.doi.org/10.1093/bja/aev552>.

**Copyright:** © the author(s), 2021. It is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0), which permits authors to retain ownership of the copyright for their content, and allow anyone to download, reuse, reprint, modify, distribute and/or copy the content as long as the original authors and source are cited.

**How to cite this article:** Noopur SJ, Bina PB. Perioperative Safety and Efficacy of Pre-Surgical Multimodal Analgesia versus Intravenous Opioids in Children Undergoing Infraumbilical Urogenital Surgery. *Acad. Anesthesiol. Int.* 2021;6(1):85-90.

DOI: [dx.doi.org/10.21276/aan.2021.6.1.15](https://doi.org/10.21276/aan.2021.6.1.15)

**Source of Support:** Nil, **Conflict of Interest:** None declared.