The Egyptian Journal of Hospital Medicine (January2023) Vol. 90 (2), Page 3203-3208

Caudal Block for Analgesia in Pediatrics Undergoing Hypospadias Repair Surgery under General Anesthesia

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ABSTRACT

Background: The treatment of anesthetic patients increasingly includes postoperative pain management. Many methods of controlling juvenile pain have been devised, with caudal blocking being the most widely used.

Objective: The aim of the current study was to evaluate the efficacy of pain management during and after hypospadias correction surgery in pediatric patients under general anesthesia alone and general anesthesia combined with caudal block. **Patients and methods:** A total of 42 pediatric patients scheduled for hypospadius repair surgery, were equally divided into two groups (21 in each); *Group G* received general anesthesia only and *Group GC* received general anesthesia combined with caudal block.

Results: *Group G* had significantly higher dose of intraoperative fentanyl (16.09±1.99 microgram) versus (13.71±1.71microgram) in *Group GC*. Regarding the duration since the first analgesia request, it was significantly longer in *Group GC* (96±0.106 min) when compared to *Group G* (34.67±4.69). All cases of *Group G* needed analgesics while only (22.8%) of *Group GC* needed analgesics. Face, Legs, Activity, Cry, and Consolability scale (FLACC) score was significantly lower in *Group GC* from immediately postoperative until 8 hours compared to *Group G*. FLACC score was non-significantly lower in both groups of study 12 hours and 24 hours post-operative.

Conclusion: General anesthesia combined with caudal block was safe and effective for post-operative pain control than general anesthesia only in pediatrics patients undergoing hypospadius repair surgery.

Keywords: Caudal Block, Repair Surgery, General Anesthesia, Pediatrics, Clinical trial, Zagazig University**.**

INTRODUCTION

One of the most difficult underdiagnosed and mistreated medical issues is pain, especially in youngsters. The Joint Council on Accreditation of Healthcare Organizations now recognizes pain as the fifth vital sign and permits practitioners to monitor it frequently. Since postoperative pain can make a kid uncooperative and restless, it is preferable to delay its beginning and lessen its intensity **(1).** Regional anesthesia is frequently used in conjunction with general anesthesia in pediatrics underwent surgical procedures. Benefits of this approach include a smooth intraoperative course, a decreased need for general anesthesia, a faster and easier recovery, and effective postoperative pain management **(2).**

The use of systemic analgesics and postoperative discomfort are considerably reduced by regional anesthesia procedures. The caudal route is one of the easiest, safest, and most effective pediatric surgical methods. Caudal blocks are commonly used to provide supplementary intraoperative anesthesia as well as postoperative analgesia in pediatrics underwent surgical procedures below the umbilicus. Caudal analgesia can decrease the amount of inhaled and IV anesthetics required. It can also decrease the stress reaction to surgery, promote a quick, painless recovery, and give great immediate postoperative analgesia [(3)].

Bupivacaine is the most commonly used local anesthetic in caudal block, and it provides reliable, long-lasting anesthesia and analgesia [(4)].

Regional anesthesia, alone or in combination with light general anesthesia, provides several advantages for the pediatric patients. The most significant advantage is intraoperative and postoperative pain control. Other benefits include inhibition of unwanted reflexes like laryngospasm during circumcision And perianal surgeries, earlier ambulation, earlier hospital discharge, reduced need for non-narcotic analgesics after discharge [(5)]. Pediatric surgical facilities frequently perform penile surgery such as circumcision, revision of circumcision, penile torsion repair, chordee repair, and repair of hypospadias. In light of the importance of pain management in these patients, there is disagreement over the analgesic technique that is most reliable and secure for reducing perioperative pain in these young patients [(6)]. This study compared the effectiveness of general anesthesia alone versus caudal block in addition to general anesthesia in controlling pain during and after hypospadias correction surgery in pediatric patients.

PATIENTS AND METHODS

A total of 42 pediatric patients were selected from Urology outpatient clinic in Zagazig University Hospitals who are prepared to undergo Hypospadias repair surgery, aged from 2- 5 years old.

Inclusion criteria: Parents or first-degree guardians are willing to sign informed consent. Pediatric male patients aged 2 to 5 years undergoing hypospadias repair surgery. ASA class I or II. Body mass index (BMI) is neither more in value than 85% (i.e. Obese) nor below the value in 5% (underweight) of the children in the same age and gender.

Exclusion criteria: Children having a known history of medication allergies previous history of neurological, psychiatric, or developmental issues. History of using sedatives or analgesics on a regular basis or recently. Skin infection at the injection site. Congenital spine malformation, convulsions, and bleeding illnesses in the

Received: 13/10/2022
Returned: 16/12/2022

past. All patients underwent physical examination which included vital signs, cardiac, chest condition, thereafter routine laboratory investigations was done.

Patients were kept fasting (8 hours for solid meals, 6 hours for light meals and 2 hours for clear liquids and water). After routine pre-operative evaluation, standard monitors was connected to the patients, Electrocardiogram, noninvasive blood pressure, pulse oximetry and baseline parameter was recorded (mean arterial pressure, heart rate, and peripheral oxygen saturation). Intravenous (IV) line was inserted for all patients after inhalational induction. Patients were divided into two groups by a computer-based randomization table; Group G received general anesthesia alone and Group GC underwent a caudal block and general anesthesia.

Pre-oxygenation with 100% oxygen for 3 minutes was done before start induction. Anesthesia was induced inhalation ally using sevoflurane 4-6%. Then intravenous line was inserted and 0.5-1mcg/kg fentanyl and 0.5mg/kg atracurium was administered. Using the formula (age/4) + 4, a suitable-sized oral endotracheal tube was implanted. After tracheal intubation, patients were mechanically ventilated using volume-controlled ventilation (6–8 ml/kg) to achieve an end-tidal CO2 level of 32–35 mmHg. To address the fluid deficit and maintain fluid balance, lactated Ringer's solution was administered intravenously to all patients in accordance with their weight.

Sevoflurane was used to maintain anesthesia at minimum alveolar concentrations of 1.0 to 1.2 (MAC).

All patients were monitored with standard monitors: ECG, noninvasive blood pressure, and pulse oximetry and $ETCO_2$. Adverse effects such as bradycardia and hypotension was recorded if present, if hypotension occurs (decrease in MAP more 20% from baseline) it was treated with normal saline and if necessary, ephedrine, if bradycardia occurs (HR <60 beats/min it was treated with 0.02mg/kg atropine. Fentanyl was given at a dose of 0.5µg/kg if tachycardia has occurred after exclusion of other causes of tachycardia and total dose of fentanyl was calculated. For general anesthesia combined with caudal block (Group GC): after general anesthesia induction, caudal block were be performed under aseptic condition.
Neuromuscular block was reversed using (0.05-0.07 mg/kg) neostigmine with 0.02 mg/kg atropine. Once the children's spontaneous Breathing has returned, tracheal extubation was performed.

Ethics Approval:

This study was ethically approved by the Institutional Review Board of the Faculty of Medicine, Zagazig University. Informed consents were obtained from all parents after discussing the study design including procedure, drugs, and possible adverse effects. This study was executed according to the code of ethics of the World Medical Association (Declaration of Helsinki) for studies on humans.

Statistical Analysis

The collected data were introduced and statistically analyzed by utilizing the Statistical Package for Social Sc iences (SPSS Inc., Chicago, IL, USA) version 26.0 for windows. Qualitative data were defined as numbers and percentages. Chi-Square test and Fisher's exact test were used for comparison between categorical variables as appropriate. Quantitative data were tested for normality by Kolmogorov-Smirnov test. Normal distribution of variables was described as mean and standard deviation (SD), and independent sample t-test/ Mann-Whitney U test was used for comparison between groups. P value ≤0.05 was considered to be statistically significant.

RESULTS

Regarding age and BMI, there was no statistically significant difference between the tested groups (Table 1).

Table (1): The two groups under study's demographic information.

Variable	Group G (n=21)	Group GC (n=21)	*P* value
Age (years) Mean ± SD	3.14 ± 1	3.67 ± 1.24	0.140
BMI (kg/m^2) Mean ± SD	13.58 ± 1.68	15.05 ± 2.38	0.068

Data are expressed as mean ± SD, Group G: General anesthesia group, Group GC: General anesthesia combined with caudal block group, BMI (body mass index=weight/ square height), P> 0.05 was considered nonsignificant.

As shown in table 2, there was statistically non-significant difference between the studied groups regarding duration of anesthesia and duration of surgery. Group G showed significantly longer recovery time when compare to Group GC.

Table (2): Patients' surgical data, in the two studied groups.

Variable	Group G (n=21)	Group GC (n=21)	*P* value
Duration of Anesthesia (Mins) Mean ± SD	137 ± 7.6	138.5 ± 7.4	0.233
Surgery duration (mins Mean ± SD	107.38 ± 7.35	112.19 ± 8.74	0.061
Recovery time (Mins) Mean ± SD	16.33 ± 1.11	10.52 ± 1.47	**<0.001***

Data are expressed as mean ± SD, Min= Minutes, P<0.001 was considered significant, P>0.05 was considered non-significant.

Group G had significantly higher dose of intraoperative fentanyl versus in Group GC. As regarded the time to the first analgesia request, it was significantly longer in Group GC when compared to Group G. All cases of Group G needed analgesics while only 22.8% of Group GC needed analgesics (**Table 3**).

Table (3): Total Intraoperative fentanyl dose, the time to first analgesic request and the need for post-operative analgesia among the studied groups.

Variable		Group G (n=21)		Group GC (n=5)		*P* value
Total dose of intraoperative fentanyl (Microgram) Mean± SD		16.09 ± 1.99		13.71 ± 1.71		**<0.001***
The time to first analgesic request (min) Mean± SD		34.67 ± 4.69		96 ± 0.106		**<0.001***
Variable		No.	%	No.	%	***P* value**
The need for postoperative Analgesia	**No**	0	0	16	67.2	**<0.001***
	Yes	21	100	5	22.8	

Data are expressed as mean ± SD, numbers and percentage. N=number, P< 0.001 was considered significant.

Regarding age and BMI, there was no statistically significant difference between the tested groups (**Table 4**).

Table (4): Heart rate changes at different intervals among the studied groups

Variable	Group G (n=21) Mean ± SD	Group GC (n=21) Mean ± SD	*P* value
Baseline HR (Beat/min)	131.76 ± 9.02	135.1 ± 10.82	0.299
after induction	131.1 ± 10.82	135.14 ± 11.56	0.248
10 minutes	127.57 ± 9.32	128.19 ± 10.03	0.837
20 minutes	128.86 ± 12.02	124.81 ± 8.45	0.214
30 minutes	128.38 ± 11.1	122.05 ± 6.72	**0.031***
40 minutes	126.57 ± 13.16	119.05 ± 7.07	**0.026***
50 minutes	129.38 ± 14.59	116.47 ± 7	**0.001***
60 minutes	127.71 ± 15.12	113.95 ± 6.58	**<0.001***
70 minutes	125.52 ± 13.33	111.62 ± 6.03	**<0.001***
80 minutes	124.52 ± 12.12	109.57 ± 6.14	**<0.001***
90 minutes	125.14 ± 11.14	106.05 ± 6.5	**<0.001***
100 minutes	126 ± 11.06	104.13 ± 7.53	**<0.001***
110 minutes	126.67 ± 9.53	105 ± 7.75	**<0.001***
120 minutes	134 ± 2.74	95 ± 0	**<0.001***

Data are expressed as mean ± SD, HR = Heart rate Min = minute P< 0.001 was considered significant, P>0.05 was considered non-significant.

There was no statistically significant difference between the studied groups regarding Mean Arterial Pressure (MAP) changes up to 90 minutes after induction. But at 100, 110 and 120 minutes Group GC had significantly lower MAP when compared to Group G (**Table 5**).

Table (5): Mean Arterial Pressure (MAP) changes at different intervals among the studied groups.

Variable	Group G (n=21) Mean ± SD	Group GC (n=21) Mean ± SD	*P* value
Baseline MAP mmHg	73.29 ± 5.37	75.24 ± 7.69	0.346
After induction	73.81 ± 5.51	74.67 ± 6.28	0.31
10 minutes	69.62 ± 4.57	73.95 ± 6.26	0.015
20 minutes	69.71 ± 4.06	71.33 ± 5.83	0.303
30 minutes	69.48 ± 3.92	69.81 ± 7.51	0.858
40 minutes	68.24 ± 4.31	67.76 ± 6.85	0.789
50 minutes	66.38 ± 3.97	66.33 ± 7.02	0.979
60 minutes	65.19 ± 2.8	64.95 ± 7.47	0.892
70 minutes	64.33 ± 3.84	62.86 ± 6.78	0.390
80 minutes	64.67 ± 3.62	61.33 ± 6.61	0.050
90 minutes	62.90 ± 3.82	59.95 ± 6.5	0.080
100 minutes	63.60 ± 3.18	57 ± 5.6	**<0.001***
110 minutes	65.11 ± 4.57	55.14 ± 6.38	**<0.001***
120 minutes	69 ± 0	55.5 ± 5.48	**0.010***

Data are expressed as mean ± SD, MAP = mean arterial pressure, Min = minute, P< 0.001 was considered significant, P>0.05 was considered non-significant.

There was no significant difference among the studied groups at different time periods. FLACC was non-significantly lower in both groups of study 12 hours and 24 hours postoperative (**Table 6**).

Table (6): FLACC Score at different intervals among the studied groups.

Variable	Group G (n=21)	GC group (n=21)	*P* value
Immediately Postop FLACC	4 (4-5)	3(2-3)	**<0.001***
1St hour FLACC	5 (5-6)	3 (2-3)	**<0.001***
2nd hour FLACC	4 (4-5)	3 (2-3)	**<0.001***
4th hour FLACC	4 (4-5)	2 (2-3)	**<0.001***
6th hour FLACC	4 (3-4.5)	2 (1-3)	**<0.001***
8th hour FLACC	3 (3-4)	2 (2-3)	**<0.001***
12th hour FLACC	2 (2-3)	1(0-2)	0.45
24th hour FLACC	1 (1-2)	1 (0-1)	0.52

Values are expressed as median (interquartile range), FLACC (F=face, L=leg, A=activity, C=cry, C= Consolability), P<0.001 was considered significant

FLACC was significantly lower in group GC from immediately postoperative until 8 hours compared to Group G (P<0.001) (**Figure 1**).

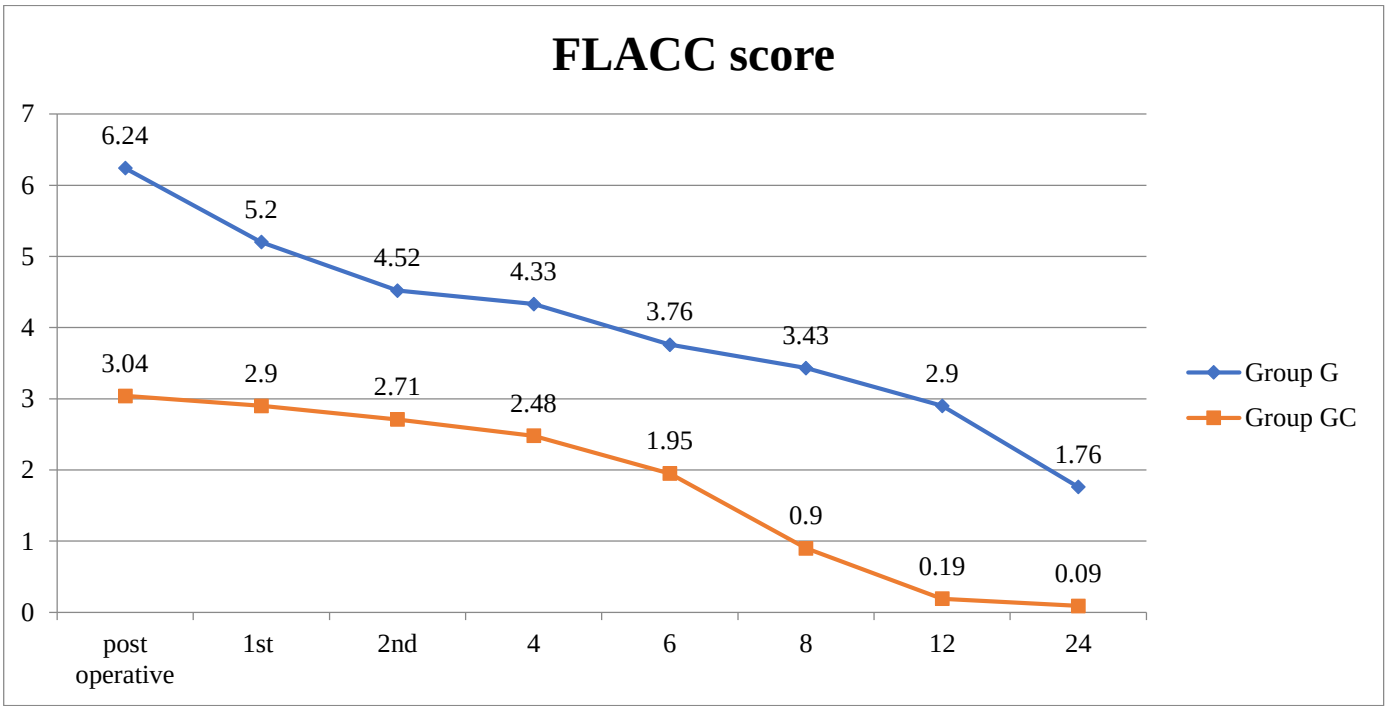

Figure (1): Line graph illustrating FLACC score of the studied groups.

DISCUSSION

As regard the recovery time, the present study showed a fasting recovery in general anesthesia combined with caudal block.

The aforementioned findings were consistent with **Lin *et al*. [7]** research, which compared general anesthesia (GA), and GA and caudal anesthesia (CA) during a laparoscopically assisted Soave pull-through for Hirschsprung's disease. The recuperation time was noticeably quicker for the GA and CA group.

Additionally, **Kim *et al.*** [8] discovered, in accordance with our findings, that general caudal block significantly decreased the sevoflurane concentration for removing a smooth laryngeal mask airway in anaesthetized children, decreased airway complications, and sped up recovery time following inguinal hernia repair in pediatrics.

Beyaz *et al.* [9], in a separate study conducted in Turkey, analyzed retrospectively the results of pediatric regional anesthesia procedures in 2200 children and concluded that patients with caudal block had superior operating and postoperative circumstances. They found that 155 patients with hypospadias who had the Snodgrass approach to surgical correction and got a caudal block experienced considerably less intraoperative blood loss than those who only received GA. Furthermore, the length of recovery was noticeably shorter in the caudal block group of patients.

The current study showed that Group GC had a significantly lower dose of intraoperative fentanyl.

This was in concordance with **Lin *et al.*** [7], who had patients underwent caudal block with general anesthesia experienced decreased mean fentanyl and rocuronium bromide dosages during the surgery. They came to the conclusion that caudal block and general anesthesia together produced greater postoperative analgesia.

Moreover, 57 juvenile patients with hypospadias who underwent surgical treatment were included in the study by **Alizadeh *et al.*** [10], of whom 29 and 28 patients were randomly assigned to have a preoperative caudal block or not. The study found that the mean dose of fentanyl administered during the surgery was lower in the caudal block group, although this finding was not statistically significant for fentanyl.

As regarded the time to the first analgesia request, it was significantly longer in Group GC than Group G. All cases in Group G needed analgesics, while only 22.8% of Group GC needed analgesics.

This result was in line with the findings of the **Panda *et al.*** [11] investigation, which showed that Group GC took longer than the general anesthetic only group to request analgesia.

The need for postoperative analgesia was significant lower for analgesia in Group GC.

The research by **Beyaz *et al.*** [9] also demonstrates that the mean dose of postoperative analgesic use was considerably lower in the caudal block group of patients.

The current research discovered that general anesthesia combined with caudal block resulted in greater hemodynamic stability than general anesthesia alone. The current finding was corroborated by **Lin *et al.*** [7], who found that hemodynamic parameters throughout the surgery were more stable in the general caudal group than in Group G.

Moreover, **Mahdy *et al.*** [12] reported that the HR and blood pressure in the present investigation were kept within normal limits with reference to hemodynamics.

The current study showed that FLACC score was significantly lower in Group GC from immediately postoperative until 8 hours compared to Group G.

This was supported by **Lin *et al.*** [7], who found that the FLACC scores in the general anesthetic plus caudal block group were lower at 1 and 6 hours following surgery. Additionally, **Al-Metwally, Mohamed *et al.*** [13] discovered that although other postoperative outcomes are comparable, general anesthesia performs worse than caudal bupivacaine when using FLACC scores for postoperative analgesia in children under the age of six who are undergoing infra-umbilical procedures.

In the current study regarding complications, we found that there were no reported complications in the studied groups.

It was discovered by **Suresh *et al.*** [14] in their study, Caudal Block Research Using the PRAN (Pediatric Regional Anesthesia Network) Database that the operation is secure and ought to be employed frequently because the incidence of problems was minimal, at 1.9% (1.7%-2.1%). Hence, the optimum anesthesia plan for hypospadias correction surgery may involve general anesthesia and a caudal block.

According to **Lin *et al.*** [7], there wasn't an obvious distinction among the two groups in the frequency of postoperative adverse effects, supporting the findings of the current investigation. **Sharma *et al.*'s** [15] research also demonstrated that caudal anesthesia provides superior intraoperative and post-operative analgesia with fewer problems.

CONCLUSION

General anesthesia combined with a caudal block was safer and more efficient for managing post-operative pain in pediatric patients following hypospadias correction surgery than general anesthesia alone. Combining general anesthesia with a caudal block can hasten recovery time, extend the interval before the first request for analgesia, decrease the amount of fentanyl used intraoperatively, lessen post-operative analgesia and pain, and provide more stable intraoperative hemodynamics.

Also, the results demonstrated that the caudal block procedure was safe because it didn't result in an increase in side effects when compared to general anesthesia. The current study was constrained by its single-center design, small sample size, and brief

follow-up period. These findings need to be confirmed by more comparative studies with a larger sample size and longer follow-up in order to pinpoint risk factors for postoperative problems.

Sources of funding: This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Conflicts of interest: There are no conflicts of interest, according to the authors.

REFERENCES

1. **Kubre G, Radhakrishna K (2016**): Dexmedetomidine as anadjuvant to bupivacaine in caudal analgesia in children. Anesth Essays Res., 10(2):227-32.
2. **Ashrey M, Bosat E (2014):** Single-injection penile block versus caudal block in penile pediatric surgery. Ain-Shams Journal of Anaesthesiology, 7:428-32.
3. **Deng M, Xiao J, Tang Z *et al.* (2002**): The Minimum Local Anesthetic Concentration of Ropivacaine for Caudal Analgesia in Children. Anesthesia & Analgesia, 94(6):1465-8.
4. **Khalil S. Campos C, Adel H *et al.* (1999**): Caudal Block in Children. Anesthesiology, 91(5):1279-81.
5. **Ahmed E, Ismail H (2018**): Caudal versus spinal anesthesia in children undergoing lower abdominal operations. Menoufia Med., 31(1):87-91.
6. **Ekstein M. Weinbroum A, Ben-Chaim J *et al.* (2021**): Comparison of Caudal Block vs. Penile Block vs. Intravenous Fentanyl Only in Children Undergoing Penile Surgery: A Prospective, Randomized,Double Blind Study. Front Pediatr., 9:615-22.
7. **Lin Z, Fang Y, Yan L *et al.* (2021):** General versus general anaesthesia combined with caudal block in laparoscopic-assisted Soave pull-through of Hirschsprung disease: a retrospective study. BMC Anesthesiology, 21(1):1-6.
8. **Kim J, Park K, Lee H *et al.* (2010):** Caudal analgesia reduces the sevoflurane requirement for LMA removal in anesthetized children. Korean Journal of Anesthesiology, 58(6):527-31.
9. **Beyaz G, Tokgöz O, Tüfek A (2011):** Regional anaesthesia in paediatric surgery: results of 2200 children. The Journal of the Pakistan Medical Association, 61(8):782-6.
10. **Alizadeh F, Heydari M, Nejadgashti R (2018:** Effectiveness of caudal epidural block on interaoperative blood loss during hypospadias repair: A randomized clinical trial. Journal of Pediatric Urology, 14(5):420-1.
11. **Panda A, Bajwa J, Sen S *et al.* (2011):** Penile block for paediatric urological surgery: A comparative evaluation with general anaesthesia. Indian Journal of Urology, 27(4):457-64.
12. **Mahdy M, Ismail M, Hamrosh S *et al.* (2018):** Comparative Study between Intrathecal and Caudal Epidural Anesthesia in Children for Lower Abdominal Surgery. The Egyptian Journal of Hospital Medicine, 73(11):8039-46.
13. **Al-Metwally M, Al-Saudi M, Abo El Ata A *et al.* (2020):** Caudal block versus Penile block for postoperative analgesia in children undergoing hypospadias repair. Alazhar Medical Journal, 13(1):202-5.
14. **Suresh S, Long J, Birmingham K *et al.* (2015:** Are caudal blocks for pain control safe in children? An analysis of 18,650 caudal blocks from the Pediatric Regional Anesthesia Network (PRAN) database. Anesthesia & Analgesia, 120(1):151-6.
15. **Sharma T, Shah N, Patel J *et al.* (2015):** Comparison of general anaesthesia v/s caudal epidural in paediatric infra umbilical surgeries. International Journal of Biomedical Research, 6(1):311-5.