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# Comparative evaluation of combined ilioinguinal iliohypogastric block versus caudal block using ropivacaine and clonidine for paediatric postoperative analgesia following inguinal hernia repair

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### ABSTRACT

**Background:** Inguinal hernia repair is a commonly performed surgery in children. Various regional techniques have been used for postoperative analgesia however the duration of analgesia is limited by local anesthetics. **Objectives:** To compare the postoperative analgesia and complications of combined ilioinguinal iliohypogastric block versus caudal block following inguinal hernia repair surgery in children using 0.2% ropivacaine and clonidine (1 µg/kg). **Methods:** Forty children of age one month to three years undergoing inguinal hernia repair were randomly allocated to two Group C (receiving Caudal block) and group I (receiving combined ilioinguinal iliohypogastric block). Ropivacaine 0.2% and clonidine 1 µg/kg used. Patients were evaluated for pain postoperatively at 30 minutes, 1, 1 ½, 2, 4, 8, 12 and 24 hours. **Results:** Both techniques were effective for postoperative analgesia following hernia repair in children for 24 hours postoperatively. **Conclusion:** Both combined Ilioinguinal iliohypogastric and caudal block were effective for postoperative analgesia for 24 hours using ropivacaine 0.2% and clonidine 1 µg/kg following inguinal hernia repair in children and no complications were seen in any of the two blocks.

**Key words:** Caudal, Clonidine, Ilioinguinal Ilioypogastric, Paediatric Analgesia, Ropivacaine

## INTRODUCTION

Modern paediatric anaesthesia is incomplete without the use of regional anaesthetic techniques<sup>1</sup>. Inguinal hernia repair is a commonly performed surgery in children. Management of pain after hernia repair surgery in children may be achieved by intraoperative opioids, regional anaesthesia and postoperative systemic analgesics. Various regional techniques involving Caudal block<sup>2-5</sup> paravertebral block, lumbar epidural block, combined ilioinguinal iliohypogastric nerve block<sup>5-7</sup>, wound infiltration<sup>2,7</sup> with local anaesthetic agents have been used with varied success for postoperative analgesia after inguinal hernia repair.

Ropivacaine, a newer local anesthetic agent, is known to be a safer substitute, with lesser central nervous system effects and cardiac toxicity than bupivacaine<sup>8-11</sup>. Clonidine is an  $\alpha_2$ -adrenergic agonist drug and its addition to local anesthetics has shown to further enhance the duration

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**How to cite this article:** Sapra SS, Saxena KN, Taneja B, Bansal S, Sarin YK. Comparative evaluation of combined ilioinguinal iliohypogastric block versus caudal block using ropivacaine and clonidine for paediatric postoperative analgesia following inguinal hernia repair. Northern Journal of ISA. 2018;3: 9-14.

and quality of central and peripheral nerve blockade and decrease the need for supplemental analgesia in the postoperative period<sup>12-15</sup>. Combination of Ropivacaine and clonidine 2 µg/kg has advantages of prolonged analgesia over Ropivacaine alone.

There is no study using combination of ropivacaine and clonidine with clonidine in a dose of 1 µg/kg in pediatric population in caudal and ilioinguinal iliohypogastric blockade

This study compared the effect of caudal block using ropivacaine and clonidine 1 µg/kg versus combined ilioinguinal iliohypogastric block using the same drugs for postoperative analgesia following inguinal hernia repair in children.

## METHOD

This prospective randomized study was conducted in the department of Anaesthesiology of our Hospital following Institutional Review board approval. 40 ASA grade 1 children of age group one month to three years recruited for inguinal hernia repair surgery formed the study population. Written informed consent was taken from the parents of the children.

Children whose parents refused consent for study or children allergic to local anaesthetics, non steroidal anti inflammatory drugs and opioids, with coagulation abnormality or bleeding disorders, with infection at the site of block, with any abnormality or disease of the spine, or with any systemic illness were excluded from the study

A detailed pre anaesthetic checkup was carried out in all the cases. Patients were randomly allocated by computer generated random tables to one of the two groups comprising 20 patients each. In the patients in Group I, combined ilioinguinal iliohypogastric block was performed and Group C patients received caudal block.

All children were premedicated with oral midazolam (0.5 mg/kg). After 20 minutes, the patient was taken to the operative room and standard monitoring devices (electrocardiogram, pulse oximetry and non invasive arterial blood pressure) were attached to the patient.

After taking the baseline values, anaesthesia was induced by 8% sevoflurane in O<sub>2</sub>/N<sub>2</sub>O (1 : 1) via facemask and concentration of sevoflurane was reduced thereafter. The intravenous access was then established. Injection fentanyl (2 µg/kg) was given intravenously. Proseal LMA

was inserted according to the age of the patient. After PLMA insertion, spontaneous breathing was maintained through an Ayre's T piece. In all the patients, paracetamol suppository (20 mg/kg) was given per rectally.

Patients in group I were given combined ilioinguinal iliohypogastric block by landmark based technique as described by Dalens<sup>16</sup>. With the child in supine position, under all aseptic precautions, a 24 gauge short bevel needle was inserted at the junction of the internal three quarters and external quarter of the line joining the Anterior Superior Iliac Spine (ASIS) to the umbilicus. The needle was directed downwards and internally at a 45 degrees angle, towards the middle of the inguinal ligament. The classic 'fascial' pop was felt as the needle reached the aponeurosis of the external abdominal oblique muscle. At this position, 0.2% ropivacaine and clonidine (1 µg/kg), a total volume 0.4 ml/kg, was injected after aspiration.

Patients in group C received caudal block<sup>3</sup>. With the child in lateral position, flexion of hips was done with the dependent leg less flexed. Sacral cornua was located either by palpating near the cephalad margin of the gluteal crease or by palpating the Posterior Superior Iliac Spine (PSIS) and taking the line b/w them as one side of an equilateral triangle. The depression inferior to the cornua, that is, the sacral hiatus was identified and caudal needle was inserted at an angle of 45 degrees. While advancing the needle a decrease in resistance to needle insertion was felt as it pierced the sacrococcygeal membrane. At this point 0.2% ropivacaine and clonidine (1 µg/kg), a total volume 1 ml/kg, was given after aspiration in four quadrants.

In both the groups, assessment was done at 30 mins, 1 hour, 1 hour 30 mins, 2, 4, 8, 12 and 24 hours in the postoperative ward.

COMFORT behavior scale<sup>17</sup> of pain was used to assess pain at the above mentioned intervals using parameters- Alertness, Calmness- agitation, Crying, Physical movement, Muscle tone and Facial tension.

Each parameter was scored from 1 to 5. This makes 6 the lowest possible score (no pain) and 30 the highest (the greatest pain). The cut-off scores indicating a need for medication administration were 17 and higher.

When using the COMFORT Behavior Scale to assess a child, we should be in a position that permits a full view of the child's face and body. Observation lasts a full two minutes, confirmed by watch or alarm clock, and is

concluded with a gentle touch to the infant's arm or leg to determine muscle tension.

If the score was less than 17, then the patient was presumed to have adequate analgesia. If the score was 17 and higher, rescue analgesia was given.

Time of requirement of first analgesia and total amount of rescue analgesia was noted in the two groups. First line of rescue analgesia was syrup ibuprofen in a dose of 10 mg/kg which was given in case the comfort score was 17 or higher in the postoperative period at the mentioned time intervals. In case pain was not relieved with ibuprofen, injection fentanyl (1 µg/kg) I/V was to be given as the second line of treatment.

Leg stimulation test was done to assess for any weakness in the lower limbs. It was done by stroking the plantar aspect of the feet and looking for withdrawal of the lower limbs. It was performed for both the legs.

Complications were noted and compared in the above two groups.

Patients were also attended whenever the child experienced pain or discomfort.

Statistical analysis was done using SPSS statistical software and P<0.05 was taken as level of statistical significance.

For quantitative data (pain score, consumption of analgesics), for comparison b/w the two groups, difference between the two means was observed by t-test for normally

distributed data and Mann Whitney test (non parametric) for non normal distributed data. Power of our study was 80%.

For paired observations (comparison of observation at different periods of time), paired t-test, for normally distributed data and Wilcoxon Ranksum (non parametric) test for non normal distributed data was applied.

## RESULTS

Forty patients were taken up for the study, and were randomly allocated to the two groups of 20 patients in each group; Group C- Caudal block group and Group I-combined ilioinguinal iliohypogastric block group.

Both the groups were comparable in terms of age, weight, height and sex distribution.

Both combined Ilioinguinal iliohypogastric block and Caudal block were effective for post operative analgesia following hernia repair in children. In both groups, COMFORT SCORE (CS) was taken and compared (Table 1).

The comparison of COMFORT scores at different time intervals showed lower values for combined Ilioinguinal iliohypogastric block than Caudal block. However, the difference in the values was not statistically significant at any time.

Rescue Analgesia was required in 2 patients in group I and one patient in group C. This difference was not found to be statistically significant (p value = 0.548)

COMFORT SCORE	30 mins (Mean±S.D.)	1 hour (Mean±S.D.)	1 hr 30 mins (Mean±S.D.)	2 hrs (Mean±S.D.)	4 hrs (Mean±S.D.)	8 hrs (Mean±S.D.)	12 hrs (Mean±S.D.)	24 hrs (Mean±S.D.)
GROUP I	11.00±3.73	10.35±1.31	11.05±1.09	11.75±1.37	12.95±1.32	13.65±2.25	9.85±1.72	13.95±.22
GROUP C	11.35±4.17	11.05±2.01	11.40±1.19	11.95±1.32	12.80±1.44	13.65±1.09	9.95±1.67	13.90±.308
P value	.781 (NS)	.200(NS)	.340(NS)	.641(NS)	.733(NS)	1.00(NS)	.853(NS)	.560(NS)

\***group I:** combined Ilioinguinal iliohypogastric block group; **group C:** Caudal block group **NS:** Not Significant

Group	No. of patients requiring rescue analgesia	No. of patients not requiring rescue analgesia	Total
Group I	2	18	20
Group C	1	19	20
p value	0.548(NS)		

\***group I:** combined Ilioinguinal iliohypogastric block group; **group C:** Caudal block group; **NS:** not significant

Amount of ropivacaine used in the group C was significantly higher than that in group I, while the amount of clonidine used was the same in both the groups.

Table 3: Total amount of drug used for blocks in both the groups		
Group	Ropivacaine	Clonidine
Group I	2mg/kg	1ug/kg
Group C	0.8mg/kg	1ug/kg
P value	0.000(significant)	1.000(NS)

\***group I**: combined Ilioinguinal iliohypogastric block group;

**group C**: Caudal block group; NS: not significant.

Leg stimulation test was done to look for motor blockade and residual anaesthesia of lower limbs- It was done by stroking the plantar aspect of the feet & looking for withdrawal of the lower limbs. It was performed for both legs.

Children in caudal block group had anesthesia in both the legs postoperatively which resolved completely in all the patients 4 hours postoperatively. No case of leg weakness (motor blockade) was seen in any of the patients in combined ilioinguinal iliohypogastric block group.

Table 4: No. of patients showing postoperative response to stimulation in each leg																
Timing of leg Stimulation	30mins		1 hour		1hr 30mins		2 hrs		4 hrs		8hrs		12hrs		24 hrs	
	I	C	I	C	I	C	I	C	I	C	I	C	I	C	I	C
Groups																
Left leg	20	0	20	0	20	3	20	12	20	20	20	20	20	20	20	20
Right leg	20	0	20	0	20	3	20	12	20	20	20	20	20	20	20	20
P value	0.000 (S)		0.000( S)		0.000 (S)		0.000 (S)		Cannot be computed							

\***group I**: combined Ilioinguinal iliohypogastricblock group; **group C**: Caudal block group NS: Not Significant; S: Significant

Complications seen in the both the groups are compared in Table 5. No known complications of caudal or ilioinguinal iliohypogastric blockade or associated with the use of clonidine were seen in the any of the children in the study.

Table 5: Showing the incidence of complications in both the groups.		
Complications	No. of patients in group I	No. of patients in group C
Intravascular injection	Nil	Nil
Dural puncture	Nil	Nil
Urinary retention	Nil	Nil
Subcutaneous injection	Nil	Nil
Haematoma	Nil	Nil
Leg weakness	Nil	Nil
Vomiting	Nil	Nil
Allergic reactions	Nil	Nil

## DISCUSSION

Our study included paediatric population in the age group of one month to three years. This is a preverbal age group and the amount of pain experienced by this age group is often difficult to assess, especially in infants who cannot communicate their own feelings. Therefore, postoperative

pain was assessed by Pain COMFORT behavior scale<sup>17</sup>. which includes: alertness, calmness- agitation, crying, physical movement, muscle tone, and facial tension. Each category is scored from 1 to 5. This makes 6 the lowest possible score (no pain) and 30 the highest (the greatest pain). The cut-off scores indicating a need for medication administration were 17 and higher.

We found that both the combined ilioinguinal iliohypogastric block and caudal block have proven to be equally effective in providing post operative analgesia to children following inguinal hernia repair.

Comfort behavior scores (Table 1) in the two groups were found to be comparable at all time intervals, with no statistically significant difference. But mean values were slightly lower in the combined ilioinguinal iliohypogastric group compared to the caudal group. A lower score indicates better analgesia.

Both the techniques have shown to provide analgesia for 24 hours post operatively. There have been studies showing comparable effects of these blocks,<sup>5</sup> but their effect lasts for few hours only. Use of ropivacaine with addition of clonidine to the blocks increased the duration of the blockade to 24 hours.

Ropivacaine has better sensor-motor discriminating properties, less neurotoxicity and myocardial depression, and decreased incidence of dysarrhythmias than bupivacaine<sup>8-11</sup>. Clonidine is an  $\alpha_2$ -adrenergic agonist drug and has shown to enhance the duration and quality of analgesia of local anaesthetics in the setting of paediatric regional anaesthesia<sup>12-15</sup>.

By adding a modest dose of clonidine (1  $\mu\text{g}/\text{kg}$ ) to 0.2% ropivacaine we were able to provide very effective postoperative analgesia that lasted for 24 hours. Thus, the described combination of ropivacaine and clonidine not only reduced the risk for systemic toxicity of local anaesthetic but also improved the analgesic properties of the caudal and ilioinguinal iliohypogastric block. Also, the dose of clonidine (1  $\mu\text{g}/\text{kg}$ ) used in our study suppressed the agitation in children and caused light sedation that proved to be helpful as the children in both the groups were quite, calm and slept peacefully without any pain in the postoperative period.

Previous studies have used 2  $\mu\text{g}/\text{kg}$  clonidine<sup>12,15</sup> in combination with local anaesthetics and have documented excessive sedation as a side effect but we have used clonidine in lesser amount and it has shown equally good results, thus decreasing the side effects of clonidine.

In our study, we used paracetamol suppository in a single dose of 20  $\text{mg}/\text{kg}$  at the time of induction of anaesthesia in addition to the performance of either of the two blocks. This multimodal approach could be a reason of better postoperative analgesia in our study and helped us to decrease the dose of clonidine to 1  $\mu\text{g}/\text{kg}$  from 2  $\mu\text{g}/\text{kg}$ , thus decreasing side effects of the same

In our study, only 2 children in combined ilioinguinal iliohypogastric block group and one child in the caudal block group required rescue analgesia (Table 2). They were given syrup ibuprofen in a dose of 10  $\text{mg}/\text{kg}$ . Ibuprofen is to be repeated every 6 hourly, but none of them required a repeat dose of rescue analgesia.

Ibuprofen was chosen as first line of rescue analgesia as it is safe, easy to administer (can be given orally), without any side effects such as respiratory depression, nausea and vomiting.

Regarding the amount of ropivacaine and clonidine used in the two groups (Table 3), there was a significantly higher amount of ropivacaine used in the caudal group

(2  $\text{mg}/\text{kg}$ ) as compared to that in the combined ilioinguinal iliohypogastric group (0.8 $\text{mg}/\text{kg}$ ). The amount of clonidine used in the two groups was same (1  $\mu\text{g}/\text{kg}$ ). Since both the blocks were equally effective, a lower dose of ropivacaine used for ilioinguinal iliohypogastric block, as compared to caudal block, would result in lower levels of ropivacaine in blood and therefore lesser side effects and decreased chances of ropivacaine toxicity.

Withdrawal response to leg stimulation (Table 4) was included in the study to see for development of any weakness or motor blockade of the lower limbs post operatively. In the previous studies, various other tests have been used like leg raising test, or asking the child to walk have been used to look for motor blockade or leg weakness. But we have included preverbal age group in our study in which children cannot follow commands and many of them cannot walk, so we decided to see for the withdrawal response after stroking the plantar aspect of the feet and looking for withdrawal of the lower limbs. It was performed for both legs.

Children in caudal block group had anesthesia in both the legs postoperatively which resolved completely in all the patients 4 hours postoperatively. No case of leg weakness was seen in any of the patients in combined ilioinguinal iliohypogastric block group postoperatively and all the children responded to stimulation of the both legs at all time intervals.

Known complications (Table 5) such as intravascular injection, dural puncture, rectal perforation, hematoma formation, or subcutaneous injection were not seen in either group. These complications have been seen mostly with caudal block<sup>18</sup>. Also, there was no case of urinary retention reported in our study.

Ilioinguinal iliohypogastric block has been described as free of complications<sup>19,21</sup> but few cases of colonic rupture, pelvic hematoma, and femoral nerve block leading to leg weakness have been reported, although none of these complications were seen in our study. This could be attributed to the technique used for giving combined ilioinguinal iliohypogastric block and to the expertise of the anesthesiologist giving the block.

Also, there were no complications seen associated with the use of clonidine<sup>12-15</sup>. There were no episodes of vomiting or any allergic reactions in any of the two groups.

## CONCLUSION

The combined ilioinguinal iliohypogastric block provides adequate postoperative analgesia for 24 hours in children undergoing inguinal hernia repair surgery using 0.2% ropivacaine and clonidine (1µg/kg) when compared to the caudal block.

Amount of Ropivacaine used in the caudal block group was significantly higher (2.5 times) and resulted in unwanted motor blockade up to 4 hours compared to combined ilioinguinal iliohypogastric block group.

Multimodal approach to pain relief has proven to be very effective in paediatric population with lesser use of opioids and thus less side effects and better outcome.

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