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Caudal block in pediatric patients: Clinical profile

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Abstract

Caudal block can be performed as a single shot caudal or a continuous caudal using catheter techniques. Single shot caudal blocks are used for ambulatory and minor procedures while continuous catheter techniques are used for in-patients undergoing more extensive procedures. This study included 72 children, of both genders, coming for various elective infra-umbilical surgical procedures such as herniotomy, orchidopexy, circumcision etc. Ethical clearance from institutional ethical committee was obtained. Informed consent was obtained from the parents before including the children in the study. In group A, the mean baseline heart rate was 122.67±9.08 per min which decreased to112.97±8.70 at 5 mins. The heart rate gradually decreased to 93.03±5.33 per min at 30 mins and 90.43±5.80 at 60 mins. The mean baseline heart rate in group Bwas 121.92±8.52 per min which decreased to 112.19±9.79 at 5 mins and gradually decreased to 90.17±6.96 at 30 mins and 90.82±5.53 at 60 mins. However, there was no significant difference in the heart rate between the two groups at any time interval.

Keywords: Caudal block, catheter techniques, pediatric patients

Introduction

The sacral canal is the continuation of the lumbar spinal canal. It communicates laterally with the anterior and posterior sacral foramina. Inferiorly, it terminates at the sacral hiatus. The canal contains the terminal part of the dural sac, ending between S1 and S3, but generally at S2, on a line joining the posterior superior iliac spines. The five sacral nerve roots and the coccygeal nerve, which constitute the cauda equina, all transit the canal. The sacral epidural venous plexus, a part of valveless internal

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vertebral venous plexus, generally ends at S4, but may extend throughout the canal. It tends to lie against the anterior wall of the canal, but this is an inconsistent feature and is very much at risk from needle or catheter puncture. Also found in the canal is the filum terminale, the non-nervous terminal filament of the spinal cord, which exits through the sacral hiatus to attach to the back of coccyx. The remainder of the canal is filled with epidural fat, the character of which changes from the loose texture in children to a more fibrous, closed mesh structure in adults. This difference gives rise to the predictability of caudal local anaesthetic spread in children and its unpredictability in adults [1, 2].

Caudal block can be performed as a single shot caudal or a continuous caudal using catheter techniques. Single shot caudal blocks are used for ambulatory and minor procedures while continuous catheter techniques are used for in-patients undergoing more extensive procedures [3].

Most children will not accept this procedure while awake, and so they are sedated or anaesthetised prior to receiving caudal block. Once the child is anaesthetised and all the vitals are stable, the child is placed in the left lateral or prone position. Under strict aseptic precautions the following landmarks are palpated: Posterior superior iliac spines, sacral cornua and sacral hiatus between the cornua.

After identifying the midline, a finger is run down the tips of thoracic and lumbar spine towards the sacrum where the sacral hiatus may be palpated as a depression between the two sacral cornua. Alternatively, a finger is run upwards towards the sacrum after identifying the tip of the coccyx, which then palpates the hiatus. The sacral hiatus is also found at the apex of the equilateral triangle based on a line drawn between the two posterior superior iliac spines [4].

Once the sacral hiatus is identified, the hiatus is punctured with a short beveled 1.5 inch 23 gauge needle. The bevel of the needle should be placed anteriorly to prevent the penetration of anterior table of sacrum. The needle is inserted at an angle of 60-70° to the skin, until the characteristic-give‖ is felt, which indicates that the sacrococcygeal ligament is pierced. On entering the space, the needle is lowered to an angle of 20° and advanced 2-3 mm to make sure that the entire bevel is inside the space [4].

The ultrasound-guided caudal block was first described by Klocke and colleagues in 2003 and has, since then, has gained increasing popularity. Several studies from various ethnic populations have repeatedly reported very high successful rates (96.9-100%) of ultrasound-guided caudal injection. The patient can be placed in prone or lateral decubitus position. Usually, a 7-13MHz, liner transducer will suffice for most caudal epidural injection; however, a 2-5MHz, curved transducer may be needed in obese patients. The ultrasound transducer will be first placed transversely at the midline to obtain the transverse view of sacral hiatus the two sacral cornua appear as two hyperechoic structures. Between the sacral cornua are two band-like hyperechoic structures; the superficial one is the SCL, and the deep one is the dorsal surface of sacral bone. The sacral hiatus was the hypoechoic region between the 2 band-like hyperechoic structures. At this level, the ultrasound transducer is rotated 90 degrees to obtain the longitudinal view of sacral hiatus under longitudinal view, the block needle is inserted using the “in-plane” technique. The block needle can be visualized in real time, piercing the SCL, entering the sacral hiatus, but cannot be visualized beyond the apex of sacral hiatus. Therefore, without knowledge of dural sac termination from image study in advance, it is suggested that advancement of needle tip beyond the apex of sacral hiatus be limited to 5mmto avoid dural puncture because the distance between the apex of sacral hiatus and dural sac termination can be as short as less than 6mm [5].

Although ultrasonography cannot provide information regarding injectate spreading during caudal epidural injection as fluoroscopy, the presence of unidirectional flow, defined as one dominant color on color Doppler image, in the longitudinal view of sacral hiatus during injection was reported to be predictive of successful caudal epidural injection and comparable treatment outcome as fluoroscopy-guided caudal epidural injection. The ultrasonography could also provide information regarding the cephalad spreading of injectate during caudal epidural injection. Using a curved-array, low frequency (2-5 MHz) [6].

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Methodology

This study included 72 children, of both genders, coming for various elective infra-umbilical surgical procedures such as herniotomy, orchidopexy, circumcision etc. Ethical clearance from institutional ethical committee was obtained. Informed consent was obtained from the parents before including the children in the study.

Inside operation theatre SPO_2, NIBP, ECG monitors were attached. Following induction of anaesthesia with using 8% Sevoflurane in 50/50% oxygen/nitrous oxide an appropriate sized I-gel was placed and IV line was secured. Inj Atropine (15mcg/kg), Inj. Midazolam (0.5mg/kg) and Fentanyl (2mcg/kg) was given. Patient was in spontaneous ventilation via Jackson Rees circuit. The rate of inhaled gases during anaesthesia was adjusted as follows: oxygen/nitrous oxide 50/50% with Sevoflurane value of 1-1.5vol%.

Then the patients were rotated to left lateral recumbent position. After iodine containing skin preparation and draping caudal block was given; one with the conventional method (Group A) the other (Group B) using ultrasound guide(GE LOGIQe portable ultrasound machine, GE 12L-RS linear probe 5-13HZ), and all patients will receive 1ml/kg of 0.25% Bupivacaine.

In group A (conventional method) After identifying the sacral hiatus, a 24 or 23 G hypodermic needle with its bevel facing anteriorly was inserted at an angle of 60-70° to the skin till the sacro-coccygeal membrane was pierced, when a distinct-pop was felt. The needle was now lowered to an angle of 20° and advanced 2-3 mm to make sure that the entire bevel was inside the space. Confirmation of the needle point being in the epidural space was done with the-whoosh test. Then the angle was measured between skin and the needle. After negative aspiration for blood and CSF, to rule out intravascular or subarachnoid placement of needle the drug was injected.

Inclusion criteria

1. ASA grade I or II.
2. Patients posted for elective infra-umbilical surgeries.
3. Age between 6months to 6 years of either sex.

Exclusion criteria

1. Emergency surgeries.
2. Known hypersensitivity to amide local anaesthetics.
3. History of active neurological, cardiac, respiratory and renal diseases.
4. Blood dyscrasias, clotting disorders and platelet count <100000 mm3.
5. Patients with cutaneous infections.
6. Anatomical malformations of the spine.

Results

Mean age in months of group A was 35.42±25.849 and group B was 44.67±26.799 months. The two groups did not differ significantly with respect to their age.

Table 1: Mean age of patients

Group	Mean	SD	*P* value	Statistical significance
A	35.42	25.849	0.141	NS
B	44.67	26.799		

Table 2: Sex distribution

Group	Male	Female	Total
A	30	6	36
B	30	6	36

In group A there were 30 (83.33%) males and 6 (16.66%) females. Group B had 30(83.33%) males and 6 (16.66%) females. The group's were comparable with respect to sex distribution.

Table 3: Mean weight

Group	Mean	SD	*P* value	Statistical significance
A	12.972	5.2671	0.095	NS
B	15.167	5.7284		

The mean weight of the children in group A was 12.97 ± 5.26 kg, group B was 15.167 ± 5.72 kg. The two groups did not differ significantly with respect to weight.

Table 4: Duration of surgery

Group	Mean	SD	*P* value	Statistical significance
A	68.19	36.978	0.528	NS
B	73.33	31.623		

The mean duration of surgery was 68.19±36.97 mins in group A, 73.33±31.62 mins in group B and it was not significant statistically.

Table 5: Intra-op HR variations

Time interval (in minutes)	Group A Mean ± SD	Group B Mean ± SD	*P* value	Statistical significance
Baseline	122.67±9.084	121.92±8.527	0.719	NS
5	112.97±8.706	112.19±9.792	0.723	NS
10	105.39±7.192	105.56±10.101	0.936	NS
15	101.11±6.404	99.31±9.146	0.335	NS
20	97.47±5.684	94.97±6.789	0.095	NS
25	93.83±4.989	93.28±7.069	0.701	NS
30	93.03±5.333	90.17±6.967	0.057	NS
45	92.38±5.679	90.34±6.898	0.231	NS
60	90.43±5.801	90.82±5.538	0.811	NS
75	89.00±4.954	90.47±5.854	0.496	NS
90	90.36±4.081	89.36±5.938	0.650	NS
105	90.91±2.071	91.00±6.618	0.966	NS
120	89.55±4.180	92.55±8.153	0.290	NS

In group A, the mean baseline heart rate was 122.67±9.08 per min which decreased to112.97±8.70 at 5 mins. The heart rate gradually decreased to 93.03±5.33 permin at 30 mins and 90.43±5.80 at 60 mins. The mean baseline heart rate in group B was 121.92±8.52 per min which decreased to 112.19±9.79 at 5 mins and gradually Decreased to 90.17±6.96 at 30 mins and 90.82± 5.53 at 60 mins. However, there was no significant difference in the heart rate between the two groups at any time interval.

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Table 6: Intra-Op Changes in MAP

Time interval (in minutes)	Group A Mean ±SD	Group B Mean ±SD	*P* value	Statistical Significance
Baseline	83.89±6.735	83.53±7.197	0.827	NS
5	77.92±6.276	77.78±6.095	0.924	NS
10	75.72±6.341	75.69±6.351	0.985	NS
15	68.61±6.344	68.58±6.335	0.985	NS
20	65.64±3.571	65.58±3.500	0.947	NS
25	67.94±3.355	67.92±3.375	0.972	NS
30	69.57±2.330	69.58±2.310	0.983	NS
45	72.33±2.689	72.44±2.711	0.883	NS
60	73.09±1.151	73.43±1.230	0.327	NS
75	73.23±2.743	73.33±2.992	0.926	NS
90	76.33±7.177	75.18±8.280	0.724	NS
105	77.25±5.972	75.45±6.283	0.490	NS
120	77.08±5.961	75.45±6.203	0.528	NS

The baseline mean arterial blood pressure was 83.89±6.73 mm of Hg in Group A and 83.53±7.19 mm of Hg in Group B which gradually decreased to 68.61±6.34mm of Hg and 68.58±6.33 mm of Hg in Group A and Group B respectively at 15 mins and then it was maintained around the baseline till the end of surgery. There was no statistically significant difference of values between the groups at any point of time.

Table 7: Intra-Op SpO_2 changes

Time interval (in minutes)	Group A Mean ±SD	Group B Mean ±SD	*P* value	Statistical Significance
Baseline	99.92±0.280	99.86±0.424	0.514	NS
5	99.94±0.333	100.00±0.000	0.321	NS
10	99.78±0.540	99.97±0.167	0.043	NS
15	100.00±0.000	99.94±0.232	0.156	NS
20	99.92±0.280	99.94±0.232	0.649	NS
25	99.94±0.232	99.97±0.167	0.562	NS
30	99.97±0.169	99.92±0.280	0.324	NS
45	99.96±0.192	100.00±0.000	0.280	NS
60	99.91±0.288	100.00±0.000	0.116	NS
75	99.93±0.267	100.00±0.000	0.309	NS
90	99.85±0.376	99.64±0.674	0.347	NS
105	100.00±0.000	100.00±6.618	0.373	NS
120	99.92±0.277	100.00±0.000	0.324	NS

In Groups A and B, the mean O_2 saturation ranged from 99.78±% to 100%. There was no statistically significant difference of values between the groups at any point of time.
No episodes of intraoperative hypotension requiring fluid bolus; or bradycardia requiring administration of atropine, were seen in any of the two groups.

Discussion

In our study there was no significant difference between the two groups with regard to age, sex and weight. In our study, age of the children was in the range from 6 months to 72 months. Mean age in months of group A was 35.42±25.849 and group B was 44.67±26.799. The two groups did not differ significantly with respect to their age.

The mean weight of the children in group A was 12.97 ± 5.26 kg, group B was ± 5.72 kg. The two groups did not differ significantly with respect to weight.
In group A there were 30 (83.33%) males and 6 (16.66%) females. Group B had 30(83.33%) males and 6 (16.66%) females. The groups were comparable with respect to sex distribution. These results were similar to the study conducted by Shin KM *et al*. [7].
In the present study, heart rate and blood pressure of all the patients were monitored at regular intervals. The mean baseline heart rate was similar in both the groups. The mean baseline heart rate was 122.67±9.08 per min in group A, 121.92±8.527 per min in group B. There was a sustained fall in heart rates to 112.97±8.706 and 112.19±9.792 per min respectively in the two groups at 5 mins. On commencement of action of caudal block, there was a further decrease in heart rate in both the groups which gradually reached 93.03±5.333 per min in group A and 90.17±6.967 per min in group B at 30 minutes. Later there were no statistically intraoperative and postoperative period till the requirement of rescue analgesia.
Similarly, there was no significant difference in the mean arterial blood pressure between the two groups at any time interval. The baseline mean arterial blood pressure was 83.89±6.735 mm of Hg in group A and 83.53±7.197 mm of Hg in group B which was statistically not significant. It was gradually decreased to 69.57±2.330 mm of Hg and 69.58±2.310 mm of Hg in group A and group B respectively at 30minutes and then it was maintained around the same till the requirement of rescue analgesia. There was no statistically significant difference of values between the groups at any point of time similar hemodynamic stability with respect to heart rate, systolic blood pressure, diastolic blood pressure and mean arterial pressure was seen in previous studies conducted by Erbüyün K *et al*. [8] and Shin KM *et al*. [7].

Conclusion

- Mean age in months of group A was 35.42±25.849 and group B was 44.67±26.799 months.
- The mean weight of the children in group A was 12.97 ± 5.26 kg, group B was 15.167 ± 5.72 kg.
- The mean duration of surgery was 68.19±36.97 mins in group A, 73.33±31.62 mins in group B

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