ORIGINAL RESEARCH

Ultrasound guided Versus traditional method for caudal epidural anaesthesia in paediatric patients : Heart Rate Variations

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ABSTRACT
After obtaining the approval of ethical committee and parental written informed consent, a total of 70 children undergoing elective lower abdominal surgeries under caudal epidural anaesthesia were included in the study. After having met inclusion and exclusion criteria, patients were randomized based on computer generated randomization table into one of the two groups.

- **Group A:** Caudal block by traditional method and whoosh test.
- **Group B:** Caudal block using ultrasound.

A thorough pre-anaesthetic evaluation was done. Detailed medical and personal history was obtained. A detailed physical examination was done. In the present study we found no statistically significant difference between group A and group B with regards to mean age (33.49±22.61 and 37.71±23.63 months respectively; p = 0.44), mean weight (11.31±3.97 and 11.74±3.48 kgs respectively; p = 0.63). In the present study, only 4 patients in group A had increase in heart rate of >15% from baseline value while none in group B and was statistically nonsignificant (p<0.122).

Key words: Caudal epidural anaesthesia, paediatric patients, heart rate variations

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INTRODUCTION

The history of epidural anaesthesia goes way back to 1901, when two French clinicians Jean. E. Sicard and Fernand Cathelin working independently injected cocaine through the sacral hiatus thus pioneering caudal epidural block. Sicard applied the technique purely for nonsurgical purpose of pain relief in patients with sciatica and tabes. However, Cathelin used the technique for surgical anaesthesia, considering it to be a safer alternative to spinal anaesthesia for inguinal hernia repair.[1]

The caudal block thus given was found to be adequate for perineal surgeries. In 1909 Stoeckel used caudal block in obstetrics whereas Lawen used in surgery. The next significant advance came when Hingson and Edwards adapted the continuous spinal analgesia technique of Lemmon to caudal method. They demonstrated that the level of spinal segment block through the caudal approach could be raised by increasing the volume of injected solution[2].

In 1943 Adams, Lundy and Seldon proposed the use of ureteral catheter for continuous caudal anaesthesia whereas continuous drop method was introduced by Bloch[2].

In the year 2012, a study was conducted by Zhonghua YX, Liu JZ, Wu XQ, Li R to compare ultrasound imaging and classic method of surface landmarks and whoosh test for identification of caudal epidural space. 102 American Society of Anesthesiologists (ASA) I–II pediatric patients aged from 1 month to 8 years scheduled for urologic or perineal surgery were included. Patients were randomly assigned into 2 groups- ultrasound group (n=52) and control group (n=50). Sacral cornua and sacral hiatus sites were determined by ultrasonic imaging or classic method of anatomical surface landmarks. Caudal puncture was made in the patients of both groups. After the caudal puncture was successful local anesthetic was injected slowly into caudal space. The positive reaction in caudal space was monitored simultaneously by ultrasound and classic swoosh test. In ultrasound and control groups, the number of puncture attempts was

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1.10±0.30 vs 1.56±0.63. The duration of puncture (1.40±0.39) vs (3.23±1.23) min, the success rate at the first puncture attempt 90.4% vs 66% and the total puncture success rate 100% vs 92% respectively. After the injection of local anesthetic, the positive rate of sacral needle insertion of ultrasonography and whoosh test were 97.96% vs 62.24% respectively [3,4].

The results in ultrasound group were superior than those in control group or with classic test and the difference had statistical significance (p<0.01). Hence they concluded that Ultrasonic positioning and monitoring for pediatric caudal block was both scientific, reasonable and accurate. It is superior to traditional method and has clinical application values for caudal block in children[3].

The aims of this study was to compare heart rate variations between traditional method & ultra sound guided method of caudal epidural anaesthesia.

METHODOLOGY

INCLUSION

- ASA physical status I and II.
- Age between 1 to 11 years.
- Patients undergoing elective lower abdominal surgeries.
- Parental consent.
- Duration of surgery less than 1 hour.

EXCLUSION

- Patients allergic to local anaesthetics.
- Patients with coagulation abnormalities.
- Patients with spinal abnormalities and neurological deficits.
- Patients with infection at the site of caudal block.

SAMPLE SIZE

Total sample size is 70 patients.

Caudal block using ultrasound. -35.

Caudal block by traditional method and whoosh test. -35.

Randomisation was achieved by computer generated randomisation chart.

After obtaining the approval of ethical committee and parental written informed consent, a total of 70 children undergoing elective lower abdominal surgeries under caudal epidural anaesthesia were included in the study.

After having met inclusion and exclusion criteria, patients were randomized based on computer generated randomization table into one of the two groups.

- **Group A:** Caudal block by traditional method and whoosh test.
- **Group B:** Caudal block using ultrasound.

A thorough pre-anaesthetic evaluation was done. Detailed medical and personal history was obtained. A detailed physical examination was done. Patients were advised fasting for 6 hours. Routine investigations such as Hb, platelet count were carried out.

In the preoperative holding area, all patients were premedicated with inj glycopyrrolate 0.01mg/kg and inj. ketamine 5mg/kg IM.

Inside the operation theatre, standard non-invasive monitors were attached and baseline HR, BP, SpO2 were recorded. Anaesthesia was induced with sevoflurane 2-4% in oxygen via facemask and peripheral venous access was taken.

Under strict aseptic precaution the following procedure was carried out:

GROUP A: The patient was put in left lateral position. Sacral cornua and hiatus was palpated. The skin over sacrococcygeal ligament was punctured using 22 gauge hypodermic needle. The needle was inserted at 45-60 degree angle to skin surface and advanced until a pop (piercing sacrococcygeal ligament) was felt. The needle was then lowered to 20-30 degree angle to the skin and advanced 2-3 mm further into the sacral canal. A stethoscope was placed over lower lumbar spine and 2-3 ml of air was injected (whoosh test) which confirmed caudal epidural space. After negative aspiration for blood and CSF, 1 ml/kg of 0.25% bupivacaine was injected and then the patient was turned supine.

GROUP B: The patient was put in left lateral position. In the transverse plane, sacral hiatus was first scanned at sacral cornua using a portable SonoSite ultrasound machine and a linear array transducer (13-6MHz) with a sterile sheath. The depth and gain settings were adjusted to obtain optimal image quality. Any abnormalities of sacrum and sacral hiatus were noted. In the longitudinal plane, the ultrasound image of hiatus was positioned in the middle of ultrasound screen. A 22 gauge needle was inserted at 45-60 degree angle to skin surface in an in-plane technique. Once the needle was visualized in the caudal space on the ultrasound imaging, 1 ml/kg of 0.25% bupivacaine was injected. It was confirmed by localized turbulence or dilatation of hiatus on ultrasound imaging. The patient was then turned supine.

After performing the block in both groups sevoflurane was switched off and sedation was maintained with inj. midazolam 0.05mg/kg and inj fentanyl 1microgram/kg along with O2 by face mask.

Motor movements were tested by pinprick method 10 min after LA injection and then skin incision was performed.

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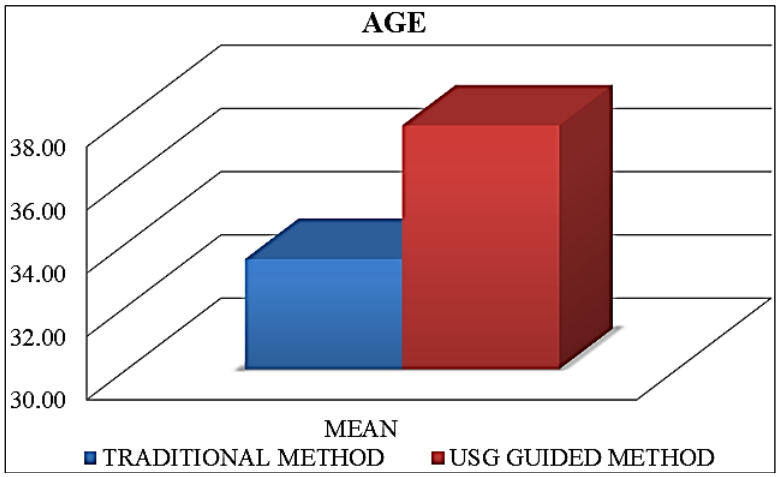
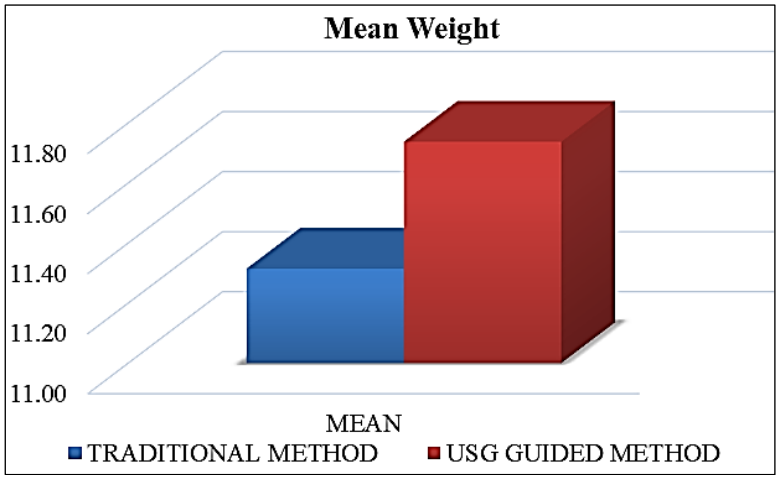
RESULTS

Table 1: Mean Age and Weight

	Group A		Group B		P value
	Mean	**Standard Deviation**	**Mean**	**Standard Deviation**	
Age (months)	33.49	22.61	37.71	23.63	0.44
Weight(kg)	11.31	3.97	11.74	3.48	0.63



Graph 1: Mean Age (months)



Graph 2: Mean Weight (kg)

In the present study we found no statistically significant difference between group A and group B with regards to mean age (33.49±22.61 and 37.71±23.63 months respectively; p = 0.44), mean weight (11.31±3.97 and 11.74±3.48 kgs respectively; p = 0.63)

Table 2: Comparison of Gender Distribution

	Female	**Male**	**Total**
Traditional Method	3	32	35
USG Guided Method	7	28	35
Total	10	60	70

Table 3:Heart Rate Variation (increase) (Also refer graph 6)

	Heart Rate Variation (increase)	
	HR < 15%	**HR>15%**
Traditional method	31	4
USG guided method	35	0
Total	66	4

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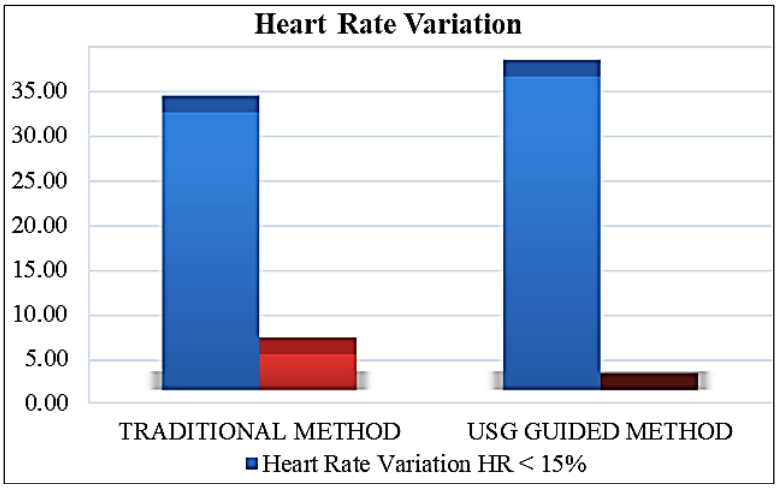

Graph 3: Heart Rate Variation (increase)

In the present study, only 4 patients in group A had increase in heart rate of >15% from baseline value while none in group B and was statistically nonsignificant (p<0.122).

DISCUSSION

In our study, Successful block was defined as no motor or haemodynamic response as indicated by absence of increase in heart rate of 15% more than the baseline values obtained just before the incision. With this criteria, percentage of successful blocks were comparable in group A (31 of 35) and group B (35 of 35) and the difference was statistically nonsignificant (p=0.12). Increase in heart rate of >15% from baseline value was seen in only 4 patients in group A while none in group B. However, this difference did not achieve statistical significance (p<0.122). Motor response after block was seen in only 4 patients in group A while none in group B and hence the difference was statistically nonsignificant (p<0.122).

We recorded four failed caudal blocks-all of them were in traditional method of caudal block and whoosh test. In these patients, there were movements on testing by pin prick method 10 min after the administration of caudal block along with increase in heart rate of 15% more than the baseline value. Hence the block was judged to be inadequate and standard endotracheal tube general anaesthesia was administered as per study protocol.

Zhang YF, Wang LZ, Chang XY, Xiao XH in their study conducted in 2013, compared 140 patients undergoing inguinal hernia repair under caudal epidural anaesthesia, by dividing them in two groups: Group C and Group H. 1 ml/kg of 0.25% ropivacaine was injected after the needle was inserted into the sacral canal in Group C, or after the needle pierced the sacrococcygeal ligament under a transverse ultrasound view in Group H. The success rate of block was similar between two groups (95.7% in Group C vs 92.8% in Group H, P > 0.05). Hence our study results are in agreement with theirs [5] (35 of 35 patients in USG group vs 31 of 35 patients in traditional method and whoosh test group).

In yet another study conducted by Zhonghua YX, Liu JZ, Wu XQ, Li R (2012) 102 ASA I and II pediatric patients aged from 1 month to 8 years scheduled for urologic or perineal surgery under caudal epidural anaesthesia were included. The positive rate of the sacral anesthesia needle insertion in ultrasound and control group were 97.96% and 62.24%, respectively, and the indexes were better than those of the traditional method (p<0.01). As this study used monitoring of the rate of sacral anaesthesia needle insertion in the caudal space to define as successful block without taking into account of motor response or heart rate variation (increase of >15% from baseline value) as done in our study, the results in ultrasound group were superior than those in classic test. Hence this could explain the difference (which is higher) in the success rate between this and our study [3, 6].

CONCLUSION

In the present study, only 4 patients in group A had increase in heart rate of >15% from baseline value while none in group B and was statistically nonsignificant (p<0.122).

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