Original Article

Advancement of epidural catheter from lumbar to thoracic space in children: Comparison between 18G and 23G catheters

Dalim Kumar Baidya, Dilip Kumar Pawar, Maya Dehran, Arun Kumar Gupta[1]

Departments of Anaesthesia and Intensive Care, [1]Radiology, All India Institute of Medical Sciences, New Delhi, India

Abstract

Backgrounds and Objectives: Lumbar-to-thoracic advancement of epidural catheter is a safe alternative to direct thoracic placement in children. In this prospective randomized study, success rate of advancement of two different types and gauges of catheter from lumbar-to-thoracic space were studied.
Materials and Methods: Forty ASA I and II children (up to 6 years) undergoing thoracic or upper-abdominal surgery were allocated to either Group I (18G catheter) or Group II (23G catheter). After induction of general anesthesia a pre-determined length of catheter was inserted. Successful catheter placement was defined as the catheter tip within two segment of surgical incision in radio-contrast study. Intra-operative analgesia was provided by epidural bupivacaine and intravenous morphine. Post-operative analgesia was provided with epidural infusion of 0.1% bupivacaine+1mcg/ml fentanyl.
Observations and Results: Catheter advancement was successful in 3 cases in Group I and 2 cases in Group II. Five different types of catheter positions were found on X-ray. Negative correlation was found between age and catheter advancement [significance (2-tailed) =0.03]. However, satisfactory post-operative analgesia was obtained in 35 cases. Positive correlation was found between infusion rate, the number of segment of gap between desired level and the level reached [significance (2-tailed) =0.00]. 23G catheter use was associated with more technical complications.
Conclusion: Advancement of epidural catheter from lumbar to thoracic level was successful in only 10-15% cases but satisfactory analgesia could be provided by increasing the infusion rates.

Key words: Advancement of epidural catheter, children, lumbar to thoracic space

Introduction

Thoracic epidural analgesia is commonly used for thoracic and upper-abdominal surgeries in adults. Due to technical difficulty and risk of complications in anesthetized children, advancement of epidural catheter from lumbar/caudal space up to the thoracic level has been advocated as a safe alternative to direct thoracic placement.[1,2] Failure rate of caudal-to-thoracic advancement of 20G/21G catheter in infants was reported to be 32% in epidurography.[3] Failure rate of 83% has been reported in children for advancement of 18G epidural catheter from caudal-to-lower thoracic space (T_{12})[4] and 19G catheter from lumbar-to-lower thoracic space (T_{12}).[5] The cause of high failure rate could be kinking, coiling, or paravertebral passage of catheter due to the resistance offered by nerve roots, dural sleeves, or adipose tissues during advancement.[6,7] There is no prospective study so far on advancement of catheter up to upper thoracic level and that comparing two different types/gauges of catheter.

The aim of this study was radiographic assessment and comparison of the success rate of advancement of 18G multiport and 23G uniport epidural catheters from lumbar-to-upper thoracic space in children.

Materials and Methods

After Institutional Ethics Committee approval and informed parental consent, 40 children of ASA I-II physical status aged up to 6 years and scheduled for elective thoracic and upper-abdominal surgeries were included. All the children

Address for correspondence: Dr. Dalim Kumar Baidya,
Department of Anaesthesia and Intensive Care, All India Institute of Medical Sciences, Hostel 8, Room No 67, All India Institute of Medical Sciences, New Delhi – 110 029, India.
E-mail: dalimkumarb001@yahoo.co.in

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were premedicated with intravenous midazolam 50 μg/kg. Anesthesia was induced with thiopentone and vecuronium 0.1 mg/kg. The children were randomly allocated to one of the two groups. In group I, 18G catheters were inserted through 17G Touhy needles. In group II, 23G catheters were inserted through 19G Touhy needles. After tracheal intubation, epidural catheter was placed at L_2–L_3/L_3–L_4 interspace using the loss-of-resistance to saline technique. In case of difficulty to thread the catheter through the needle tip, needle angulation was adjusted to make the needle tip more cephalad. No catheter was advanced against resistance. In case of technical problems such as dural/bloody tap, catheter was advanced through the next higher space. The length of the epidural catheter to be inserted was determined as the depth of epidural space plus the distance between the level of catheter insertion and the desired level (i.e., dermatome of surgical incision). All the catheters were of same make (Portex) and were inserted by experienced Anesthesiologists regularly practicing pediatric anesthesia. Iohexol 0.3 ml (23G catheter) or 0.5 ml (18G catheter) was injected through the catheter and X-ray was taken immediately after surgery to confirm the location of the catheter tip, which was assumed to be at the midpoint of the radiocontrast spread. Postoperative X-ray (AP view) of chest and abdomen is routinely performed after thoracic and upper-abdominal surgeries to confirm the placement of drains, tubes, and lines. Epidurography was combined in these cases with the same X-ray and no separate radiation exposure was made. All the epidural injections were made by the same person with patients in supine position. The X-ray films were checked by a radiologist unaware of the gauge of the catheter used. Successful catheter placement was defined as the catheter tip at the level of ±2 segments of the desired level. The gap between the level of catheter tip in X-ray and the desired level was recorded. We presumed that lesser gap will enhance the chance of successful epidural analgesia.

Anesthesia was maintained with oxygen, nitrous oxide, isoflurane, and intermittent vecuronium. Analgesia was provided with epidural 0.5% bupivacaine 0.2 ml/kg and intravenous morphine 200 μg/kg. Intraoperative rescue analgesia was provided with further doses of intravenous morphine 50 μg/kg.

Postoperative pain was assessed by a modified visual analog score (VAS) in children ≥ 5 years and by objective pain scale[8] in children < 5 years. Pain score 0–3 was considered to be no/mild pain; 4–7 moderate pain; and score >7 severe pain. Postoperative analgesia was provided with epidural infusion of 0.1% bupivacaine with fentanyl 1 μg/ml for 72 h. Infusion was started @ 0.1 ml/kg/h following an initial bolus of 0.1 ml/kg and further titrated with increments/decrements of 0.05 ml/kg/h up to a maximum of 0.3 ml/kg/h to keep the target pain score < 4. Postoperative pain assessment and titration of epidural infusion were done by an anesthesiologist unaware of the group of the patient. Exposed part of the epidural catheter and the filter was kept wrapped with opaque dressing.

Vitals were recorded every 15 min intraoperatively and postoperatively for first 2 h, two hourly for next 10 h and then six hourly for 72 h. Complications such as nausea, vomiting, pruritus, urinary retention, sedation, respiratory depression, and neurodeficit were recorded. Epidural catheter insertion site was observed for any inflammation and leak. Tachycardia and bradycardia were defined as the heart rate 20% more or less than the baseline value, respectively. Likewise, systolic and diastolic hypertension and hypotension were defined as the systolic and diastolic blood pressure 20% more or less than the baseline value, respectively. Desaturation was defined as SpO_2 < 93%.

Based on the results of the pilot study conducted with 10 cases in each group, with gap as the primary parameter, it was determined that to have 80% power of the study with error < 5%, we needed 18 cases in each group. Statistical analysis was performed using SPSS 15.0 version. Discrete variables were analyzed by using chi-squire test and Fischer's exact test. Continuous variables were analyzed by using Man-Whitney U test. Pearson correlation with 2-tailed significance was used for computing correlation.

Results

All demographic data were comparable between the groups [Table 1]. Only three catheters in group I and two catheters in group II were successfully advanced. The mean time taken for the epidural catheter placement, number of needle adjustments, and the gap between the desired level and the level reached were significantly more in group II [Table 2]. Radiographic studies revealed a variety of catheter positions in the epidural space [Table 3 and Figures 1–6].

Unilateral spread of contrast was found in four patients in group I and in six patients in group II. Among them, in group I, one patient had paravertebral placement and two patients demonstrated transforaminal passage of contrast [Figure 6]. In group II, one patient had paravertebral placement [Figure 5], and in five patients contrast spread was unilateral without any transforaminal passage.

Intraoperatively, ≥2 episodes of tachycardia were observed in four children in group I and in three children in group II. One patient in each group had three (maximum) episodes of tachycardia and both these patients required rescue analgesia.

Table 1: Demographic and surgical data of both the groups

	Group-18G (n = 20)	Group-23G (n = 20)	P value
Age (months)	48.70 ± 25.45	38.50 ± 24.73	0.18
Sex (male/female)	13/7	13/7	
Weight (kg)	13.44 ± 4.85	12.75 ± 5.02	0.69
Duration of surgery (min)	146.50 ± 16.23	146.50 ± 15.98	
Type of surgery			
Thoracic/upper abdominal	11/9	11/9	

Table 2: Technical and procedural data of both the groups

	Group-18G (n = 20)	Group-23G (n = 20)	P value
Needle adjustment	2	8	0.07
Duration of procedure (min)	10.80 ± 1.67	12.85 ± 2.58	0.01
Catheter advanced (segment)	2.15 ± 2.49	1.25 ±2.02	0.09
Gap between the desired level and the level reached (segment)	6.35 ± 2.71	7.90 ± 2.75	0.05

Table 3: Radiographic data of both the groups (Values represent number of patients)

Catheter positions	Group I (18G)	Group II (23G)
Successful; course of the catheter straight [Figure 1]	3	2
Course apparently straight, reaching a few segments above; but forms wavy loops/coils below near the insertion point [Figure 2]	5	2
Coiled near the insertion site [Figure 3]	10	14
Doubled back from higher space [Figure 4]*	1	1
Reached para-vertebral space [Figure 5]	1	1

** In both the cases catheters were withdrawn by a few centimeters and epidural infusion continued [Figure 4].*

In the other patients, tachycardia was transient and subsided after injecting a top up of vecuronium or increasing the depth of anesthesia. There were no episodes of significant bradycardia, hypotension, or hypertension. Two patients in each group had an episode of desaturation, but these episodes were transient during lung retraction. Trachea of all patients was extubated at the end of surgery.

In the postoperative period, 5 out of 40 patients (three patients in group I and two patients in group II) continued to have moderate to severe pain in spite of epidural infusion. Infusion was discontinued in these patients, catheters withdrawn up to 4 cm inside the epidural space and analgesia provided with epidural morphine 50 μg/kg 12 hourly and per-rectal paracetamol. These five patients were excluded from the analysis of postoperative infusion requirement. Review of radiographs in these patients showed that one patient in each group had paravertebral catheter placement, while two patients in group I and one patient in group II had catheters coiled near the insertion site.

Two patients in each group had moderate pain in the immediate postoperative period up to 30 min. Thereafter, none of the patients in either group reported moderate/severe pain. Mean infusion rate in group I was 0.13 ml/kg/h and in group II was 0.14 ml/kg/h (P = 0.70).

Significant negative correlation was found between the number of segment of catheter advancement and age of the children. (Pearson correlation = -35%, sig. [2-tailed] = .035; Figure 7). Negative correlation was found between catheter advancement and weight, but it was not statistically significant (Pearson correlation = -28%, sig. [2-tailed] = .080). Significant positive correlation was found between infusion rate and gap segments (Pearson correlation = +85%, sig. [2-tailed] = .000).

During infusion, three patients in group I developed catheter occlusion. In two of them, obstruction was relieved after the catheters were withdrawn by 1 cm and in one patient, obstruction was relieved by a saline bolus. Radiographs showed that the first two catheters were coiled and kinked near the insertion site, while the third catheter was coiled near the insertion site without any kink.

There were two dural taps in group I. In both these patients, epidural catheter placement was successful through the next higher space. There was no bloody tap. One child in group I complained of mild pruritus on the first postoperative day, which resolved automatically. No episode of nausea, vomiting, respiratory depression, sedation, or motor blockade occurred in any group. Incidence of urinary retention could not be assessed as urinary bladder was

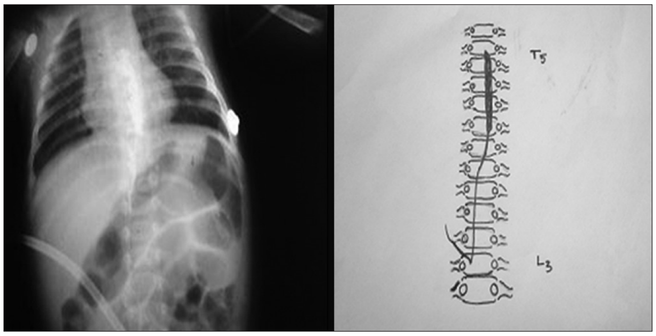

Figure 1: Successful catheter placement in a 6-month-old child

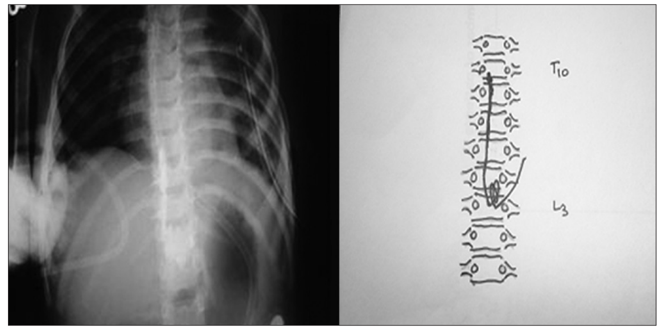

Figure 2: Epidurography in a 2.5-year-old child. Catheter advanced three segment above and formed coils near the insertion point

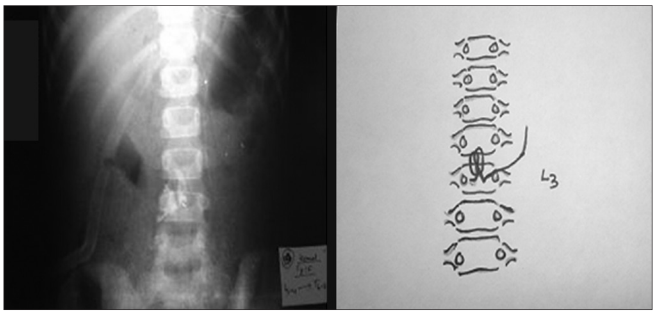

Figure 3: Coiling of an epidural catheter with surrounding extravasations of contrast at the insertion point in a 5-year-old child

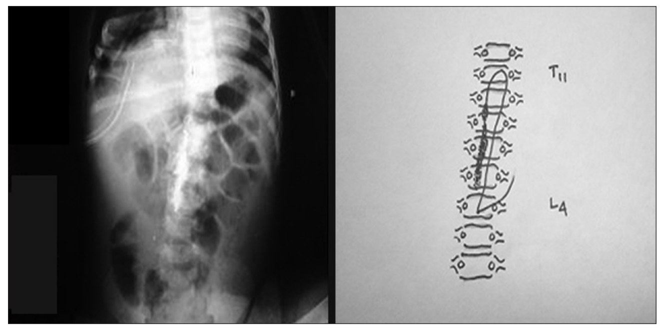

Figure 4: Epidurography in a 5-month-old child showing the catheter has doubled back from T_{12}

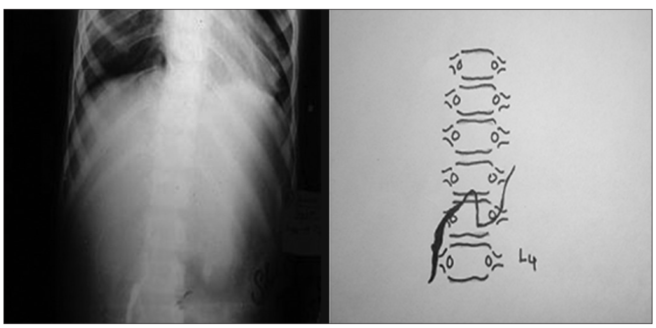

Figure 5: Paravertebral catheter placement in a 4-year-old child

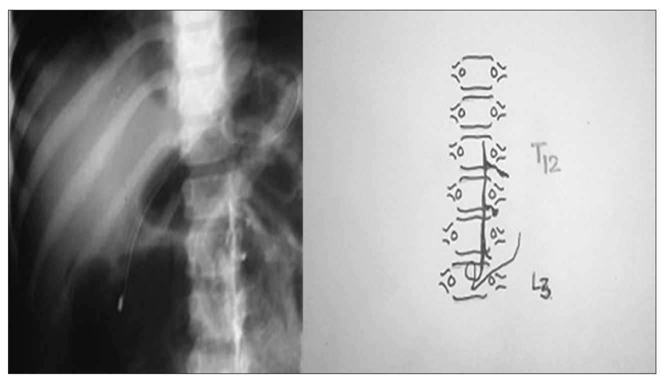

Figure 6: Unilateral spread of contrast with transforaminal passage in a 5-year-old child

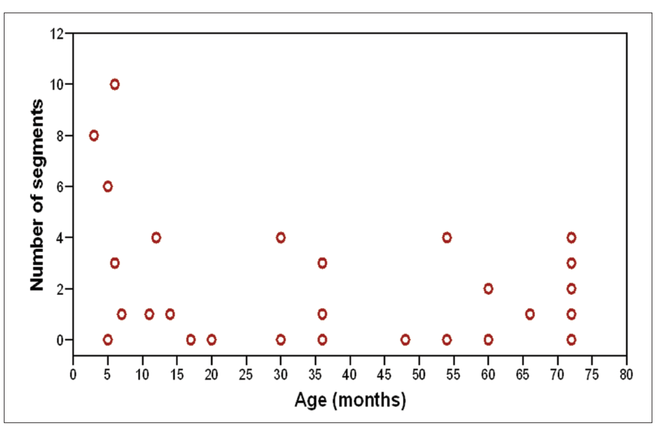

Figure 7: Relationship between age and catheter advancement

catheterized at the beginning of surgery in all the cases. No inflammation or discharge was found at the skin site in any of the patients.

Discussion

Blanco *et al.* reported 17% success rate of lumbar-to-thoracic advancement of 19G catheter in abdominal surgeries with a target level of T_{12}.[5] In our study, desired level was T_6 to T_4, and we defined it as successful if the catheter tip reached ±2 segment of the desired level. Catheter placement was successful in 15% patients in group I and 10% patients in group II. Catheter advancement was more successful in infants (four out of five). It is postulated that in infants absence of lumbar lordosis that develops as a consequence of walking and standing after 1 year of age,[4] less density of epidural fat,[9] and thinner nerve roots produce less obstruction to the advancing catheter. Epidural fat in infants has a spongy gelatinous appearance with distinct spaces between individual fat lobule.[10] All these factors contributed to better success of catheter advancement in infants. The reported success rate in caudal-to-thoracic advancement of 18G catheter is only 17% in children > 1 year as compared with 52% in infants.[4]

Radiographic confirmation of epidural catheter placement is used when catheter is advanced from lumbar/caudal route to thoracic space.[3,5] Blanco *et al.* used 0.3 ml iohexol for 19G catheter[5] and Valairucha and co-workers used 0.5–0.7 ml iohexol for 20G catheter.[3] We followed the formula used by Valairucha *et al.*,[3] i.e., injectate dye (ml) = catheter volume (ml) + 0.2 ml and catheter tip was determined to be at the midpoint of the radiocontrast spread. 0.5 ml iohexol was injected in the 18G catheter (catheter volume 0.3 ml) and 0.3 ml iohexol in the 23G catheter (catheter volume 0.1 ml). This provided good contrast spread and the interpretation of X-ray picture was easy. The injection pressure and the posture of the patient can influence spread of solution in the epidural space; therefore, all the contrast injections were given by same person with the patients in supine position.

Advancement of epidural catheters without resistance does not guarantee successful placement and the resistance offered by the adipose tissue and nerve roots makes the advancing catheter coil or double back.[10] Inadvertent passage of a 20G styleted catheter (Portex) through the lumbar intervertebral foramen into the paravertebral space has been reported in an infant.[11] In our study, though the catheters were not passed against resistance, they were sited at different positions.

Epidurographic studies have demonstrated that more symmetric and circumferential spread occurs with increasing volume of solution and thus despite a variety of catheter positions and pattern of solution spread satisfactory epidural anesthesia is achieved.[12,13] Unilateral spread of contrast was seen in 10 patients (4 patients in group I and in 6 patients in group II). Five of them had clinically adequate and uniform analgesia probably because of uniform distribution of analgesic solution.

Novel approaches such as electrical stimulation of the epidural nerve roots by electrode placed at the tip of the advancing epidural catheter and visualization of muscle contractions at the respective dermatomes and ultrasound-guided epidural catheter placement have been described.[14] Ultrasound has been used to assess the neuraxial structure, depth of the epidural space, and monitor the local anesthetic injected into the epidural space. It can help in faster epidural placement and reduce dural puncture[15] and has the potential to monitor the advancement of the catheter in the epidural space.[14] In young infants direct visualization of catheter tip may be possible, but in older children surrogate markers such as displacement of dura by injecting saline may be used to identify advancing catheter.[16] However, adequate training and experience are required to perform ultrasound-guided epidural catheterization in children and proper use of ultrasound for advancement of epidural catheter from lumbar/caudal space up to thoracic level is yet to be defined.[15]

In the present study, time required for epidural catheterization using 23G catheters was longer and more number of needle adjustments was required than with use of 18G catheters. Epiduroscopic has revealed that when epidural needle is inserted perpendicularly, the catheter tip after exiting through the needle, raises the dura like a tent impairing its further cephalad movement,[6] and changing the needle angulation cephalad helps in threading the catheter beyond needle tip. Sage *et al.* have reported more difficulty in threading 23G catheters compared to 21G catheters, through lumbar route in children.[17]

During epidural infusion, 23G catheters developed occlusion in three patients. Higher incidence of kinking and obstruction of 23G catheter has been previously reported,[17] as being thinner, it was more likely to kink and its single orifice is more likely to get obstructed by soft tissue.

Murrell *et al.* used 0.1% bupivacaine and fentanyl 1 μg/ml @ 0.2 ml/kg/h for postoperative analgesia for 2 days in infants undergoing major surgery.[18] Meignier and colleagues used 0.25% bupivacaine @ 4mg/kg/day for 48–72 h in children undergoing thoracoabdominal procedure.[19] The infusion requirement in our study was less than these previous studies and the infusion was continued for longer period (72 h). The infusion requirement decreased after 48 h, thereby reducing the average infusion rate.

The gap between the desired level and the actual level the catheter reaches is important because it relates the success of catheter advancement to the efficacy of analgesia obtained. Significant positive correlation between the gap segment and the infusion rate suggests that more the gap higher was the infusion rate required. Though the gap was considerably less in group I than group II (P = 0.05), the difference in the infusion rates was very little. The physical characteristics of the catheters may explain the phenomenon. The multiport 18G catheter has three lateral holes at a distance of 0.5, 1, and 1.5 cm from the tip and the 23G catheter has a single orifice at the tip. Power *et al.* have demonstrated that flow appear first in the proximal hole, then in the middle hole, and finally in the distal hole.[20] The low pressure of continuous infusion might have led the infusion to escape through the proximal hole of 18G catheter, thereby reducing effective catheter length in the epidural space and increasing the distance from the desired level of analgesia. This may have increased infusion requirement in the 18G catheter group, thereby reducing the degree of difference of infusion rates between the two groups.

In our study, continuous epidural infusion of 0.1% bupivacaine and fentanyl 1 mcg/ml was able to provide adequate analgesia in 35 out of 40 cases inspite of high failure rate (87%) of catheter advancement and considerable gap between the desired level and the level reached by the catheter tip possibly by either systemic absorption of epidural fentanyl or cephalad migration of fentanyl and/or bupivacaine through cerebrospinal fluid (CSF). Ginosar *et al.* demonstrated that continuous infusion of epidural fentanyl along with bupivacaine acts via predominantly spinal mechanism.[21] Geoffrey and colleagues studied CSF pharmacokinetics of lumbar epidural fentanyl and reported significant fentanyl concentration in lumbar CSF by 10 min and detectable fentanyl in cervical CSF in all the subjects. They suggested that lumbar epidural fentanyl acts at spinal site and undergoes cephalad migration as a result of passive CSF flow.[22] In the present study, the amount of fentanyl used in epidural infusion was too small to produce sufficient plasma concentration to achieve adequate analgesia following thoracic and upper-abdominal surgery. Local anesthetic spread by diffusion in the spinal canal is also contributes to the analgesic efficacy of the epidural regimen. In a postoperative radiocontrast study in 20 infants undergoing major abdominal surgery, the level of analgesia obtained was higher in the cranial direction than the level of radiocontrast spread, confirming that local anesthetic spread by diffusion in the spinal canal.[23]

Ozalp *et al.* have reported 5% incidence of pruritus following epidural fentanyl and bupivacaine after abdominal surgery.[24] Low incidence of side effects in this study may be due to the low dose of epidural fentanyl used.

The limitation of this study is the small number of cases. Though the results tend to suggest that 23G catheter has more technical difficulty and less chance of reaching the desired segment, to obtain a definite result a study with enrollment of larger number of patients is required.

In conclusion, the success rate of advancement of epidural catheter from lumbar-to-thoracic space was only 10–15% in children. However, in spite of poor success rate good analgesia was obtained in most of the cases. Radiocontrast study should be performed when epidural catheter is advanced from lumbar-to-thoracic space and the finding of the radiocontrast study should be correlated with clinical analgesia, especially when either analgesia is inadequate or catheter malposition or unilateral spread of contrast is found.

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References

1. Berde C. Epidural analgesia in children. Can J Anaesth 1994;41:555-60.
2. Tsui BC, Seal R, Koller J. Thoracic epidural catheter placement via the caudal approach in infants by using Electrocardiographic guidance. Anesth Analg 2002;95:326-30.
3. Valairucha S, Seefelder C, Houck CS. Thoracic epidural catheters placed by the caudal route in infants: The importance of radiographic confirmation. Ped Anesth 2002;12:424-8.
4. Blanco D, Llamazares J, Martinez-Mora J, Vidal F. Thoracic epidural anaesthesia by the caudal route in paediatric anaesthesia: Age is a limiting factor. Rev Esp Anest Reanim 1994;41:197-9.
5. Blanco D, Llamazares J, Rincon R, Ortiz M, Vidal F. Thoracic epidural anaesthesia via the lumbar approach in infants and children. Anesthesiology 1996;84:1312-6.
6. Blomberg RG. Technical advantage of the paramedian approach for lumbar epidural puncture and catheter introduction. Anaesthesia 1988;43:837-43.
7. Boey SK, Carrie LE. Withdrawal forces during removal of lumbar epidural catheter. Br J Anaesth 1994;73:833-5.
8. Broadman LM, Rice LJ, Hannallah RS. Comparison of physiological and a visual analogue pain scale in children. Canadian J Anaesth 1988; 35 (Suppl):S137-8.
9. Markakis DA. Regional anaesthesia in paediatrics. Anesthesiol Clin North Am 2000;18:355-81.
10. Bosenberg AT, Bland BA, Schulte-Steinberg O, Downing JW. Thoracic epidural anaesthesia via Caudal Route in infants. Anesthesiology 1988;69:265-9.
11. Berkowitz D, Kaye RD, Markowitz SD, Cook-Sather SD. Inadvertent extra-epidural catheter placement in an infant. Anesth Analg 2005;100:365-6.
12. Asato F, Goto F. Radiographic finding of unilateral epidural block. Anesth Analg 1996;83:519-22.
13. Hogan Q. Epidural catheter tip position and distribution of injectate evaluated by computed tomography. Anesthesiology 1999;90:964-70.
14. Tsui BC. Innovative approaches to neuraxial blockade in children: The introduction of epidural nerve root stimulation and ultrasound guidance for epidural catheter placement. Pain Res Manag 2006;11:173-80.
15. Willschke H, Marhofar P, Bosenberg A, Johnston S, Wanzel O, Sitzwohl C, *et al*. Epidural catheter placement in children: Comparing a novel approach using ultrasound guidance and a standard loss-of-resistance technique. Br J Anaesth 2006;97:200-7.
16. Tsui BC, Suresh S. Ultrasound imaging for regional anesthesia in infants, children and adolescents: A review of current literature and its application in the practice of neuraxial blocks. Anesthesiology 2010;112:719-28.
17. Sage FJ, Lloyd Thomas AR, Howard RF. Paediatric Lumbar Epidurals: A comparison of 21-G and 23-G catheters in patients weighing less than 10 kg. Paediatr Anaesth 2000;10:279-82.
18. Murrell D, Gibson PR, Cohen RC. Continuous epidural analgesia in newborn infants undergoing major surgery. J Paediatr Surg 1993;28:548-53.
19. Meignier M, Souron R, Neel JC. Post-operative dorsal epidural analgesia in the child with respiratory disabilities. Anesthesiology 1983;59:473-5.

20. Power I, Thorburn J. Differential flow from multihole epidural catheters. Anaesthesia 1988;43:876-8.
21. Ginosar Y, Columb MO, Cohen SE, Mirikatani E, Tingle MS, Ratner EF, *et al*. The site of action of epidural fentanyl infusions in the presence of local anesthetics: A minimum local analgesic concentration infusion study. Anesth Analg 2003;97:1439-45.
22. Geoffrey KG, Murphy TM, Plummer JL, Kowalski SR, Cherry DA, Cousins MJ. Pharmacokinetics of fentanyl in lumbar and cervical CSF following lumbar epidural and intravenous administration. Pain 1989;38:253-9.
23. Ecoffey C, Dubousset AM, Samii K. Lumbar and thoracic epidural anaesthesia for urologic and upper abdominal surgery in infants and children. Anesthesiology 1986;65:87-90.
24. Ozalp G, Guner F, Kuru N, Kadiogullari N. Post-operative patient controlled epidural analgesia with opioid bupivacaine mixtures. Can J Anesth 1998;45:938-42.

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