

Determination of Epidural Catheter Position by Fluoroscopic Technique and Analysis of Efficacy of Epidural Analgesia: A Prospective Observational Study

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Abstract

Epidural Anaesthesia with insertion of catheter is a commonly practicing technique to provide intraoperative anaesthesia and also for the post operative analgesia. But when we combine the epidural anaesthesia with General or spinal Anaesthesia, we often may not able to confirm the catheter position and its efficacy as sometimes it may end in failure later to produce anaesthesia or analgesia as desired. Hence we tried to identify the position of the tip of the epidural catheter with injection of a contrast agent with fluoroscopy in the immediate post operative period and compared the efficacy of post operative analgesia with catheter position for the patients in whom the epidural space identification was done using the conventional and common technique of loss of resistance to air.

Methods: Study subjects were the patients who scheduled to undergo elective infraumbilical surgery using spinal anaesthesia combined with epidural anaesthesia. Study objective were explained & consent obtained from the 50 patients who agreed to participate. In this study, loss of resistance to air was used to identify the epidural space and all the cases were submitted for fluoroscopy imaging using contrast agent to ascertain the tip of the catheter and the spread of the contrast which was compared with the analgesic efficacy in the postoperative period.

Observations: The epidural catheter placed in the intended space that is two spaces above the point of insertion was about 20%, one space above was 28%, on the same space of insertion was 32% with paravertebral and intra vascular placement of 12% and 8% respectively. We found that the incidence of the wrong or misplacement of the epidural catheter were high for the conventionally used loss of resistance to air technique for identifying the epidural space which may necessitate to use increased volume of the drug to make the analgesia effective in the malpositioned catheter patients or failure in the wrongly placed catheters.

Conclusions: The conventional use of the loss-of-resistance to air technique to identify the epidural space, frequently ends up in inappropriate placement of epidural catheters. Hence, when performing this procedure, catheter position ascertained by fluoroscopy may guide to adjust the dose of the analgesic drugs or to alter the position of the catheter to avoid the failures and to provide successful postoperative analgesia.

Keywords: Epidural Anaesthesia, Catheter Tip, LOR to Air, Fluoroscopy.

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Introduction

Epidural anaesthesia is a universally proven technique and performed successfully for the various surgical procedures from neck to foot either as a solo technique or might be combined with other techniques like spinal or general anaesthesia to prolong or supplement intraoperative anaesthesia. Apart from blunting the stressful reactions and sympathetic over activity due to the surgical procedures, it also significantly reduces the pain induced pulmonary, circulatory and metabolic complications which are quite common in the postoperative period. Hence its role in providing the effective postoperative analgesia is substantially important.

The commonly used method to identify the potentially negative epidural space is the loss of resistance to air technique. Being a blind technique, which mostly relies on the perception of the hand, it may be wrongly placed in a cystic lesion in the ligaments. Sometimes it is possible to erroneously place the catheter in the paravertebral space, subarachnoid space, subdural space or intravascularly which may end in failure of the technique to provide anaesthesia or analgesia. Even if the epidural needles have been placed in the proper epidural space, the catheters might have been inappropriately placed against the intended position which might cause inadequate anaesthesia or analgesia, undesirable motor block, excessive changes in the haemodynamics or pain relief in irrelevant area.

Epidural contrast studies with fluoroscopy have been increased in the interventional pain procedures nowadays. Hence the same imaging techniques may be used to confirm the epidural space, to locate the tip of the catheter and to determine the spread of the

drugs in the epidural space. So that the clinical uses of epidural anaesthesia will be used safely and effectively.

We conclude that confirming the placement of the epidural catheter with fluoroscopy by injecting contrast agents through the epidural catheter postoperatively may enhance the quality of post operative analgesia and to lessen the untoward side effects.

Aim

1. To Determine epidural catheter placement by using an imaging agent after doing lumbar epidural in midline approach by insertion of 16G Tuohy needle using loss of resistance to air
2. To analyze its analgesic efficacy in post operative pain relief

Methodology

Study subjects were patients scheduled to undergo infraumbilical surgery using combined spinal with epidural anaesthesia. Study objective were explained & informed consent obtained from the 50 patients who agreed to participate.

After shifting the patient into operation theatre and attaching the monitors, intravenous cannula was secured. Under aseptic precautions in sitting position, epidural was initiated with 16G Tuohy needle in the space as decided by the theatre anaesthesiologist and epidural space was identified with loss of resistance to air technique. After reaching the epidural space, catheter was inserted gently and 5cm of catheter was kept inside the epidural space with aim of placing the catheter tip about two vertebral levels above the point of entry. After securing the catheter, a test dose of 2ml of Lignocaine 1.5% with adrenaline 1 in 2

lakh was administered to rule out the intrathecal or intravascular placement of the catheter. Then spinal anaesthesia was instituted through the interspinous spaces below the epidural and appropriate dose of 0.5% hyperbaric Bupivacaine was administered as required for the surgery.

Post operatively patient was shifted to the fluoroscopy room and imaging was done by injecting the contrast agent omnipaque350 (iohexol) 3ml through the epidural catheter.

After obtaining image by fluoroscopy,

1. Level of entry of epidural catheter
2. Location of tip of the catheter were confirmed & recorded

If the catheter was found in the paravertebral space, it was withdrawn incrementally and positioned inside epidural space. Postoperatively pain relief was initiated with a bolus dose of 8 ml of 0.125% Bupivacaine & then 0.125% Bupivacaine with fentanyl 2mics/ml infusion at the rate of 4-6 ml/hr for 24-36 hours. Post operative analgesia was monitored using visual analogue scale.

Patient with a pain score of 3 or more than 3 was treated with 2 to 5ml bolus of 0.25% Bupivacaine and subsequently the infusion rate was increased correlating with the catheter position and the type of surgery

Inclusion criteria

- Infraumbilical surgery using combined spinal & epidural anaesthesia
- ASA I – II

Exclusion criteria

- Any contraindication to regional anaesthesia
- Known history of allergy to radio-opaque dye
- Severe cardiac, hepatic or renal impairments.

Observations

- 1. Catheter Tip as Intended: Out of 50 patients, in 10 patients (20 percent) only the catheter tip was placed exactly in the intended space in the epidural cavity that is two vertebral levels above the point of skin entry.(fig1)

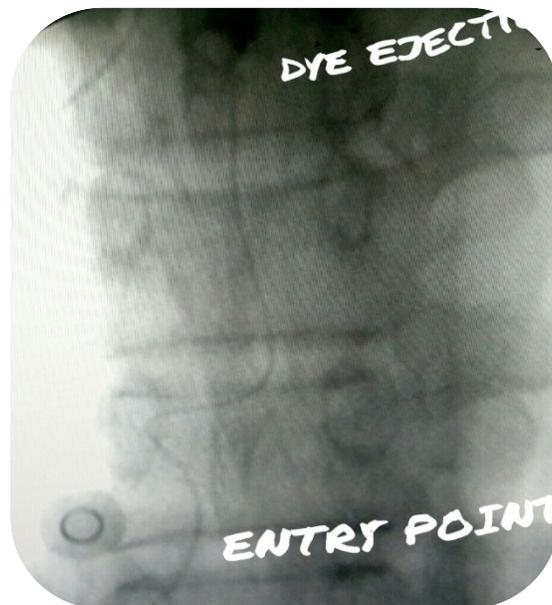


Figure 1

Patients observed in this group were found to have VAS score 3 or less than 3. There was no requirement of additional analgesic doses and the same rate of infusion was continued for them.

2. Catheter Tip at One Space Above: Out of 50 patients, in 14 patients (28 percent) catheter were placed one space above the point of skin entry or one space below the intended level. (fig2)

Patients observed in this group were found to have VAS score 3 to 6. They required an additional bolus dose of 2-3 ml of 0.25% Bupivacaine and the rate of infusion was increased to 6-8ml/hr.

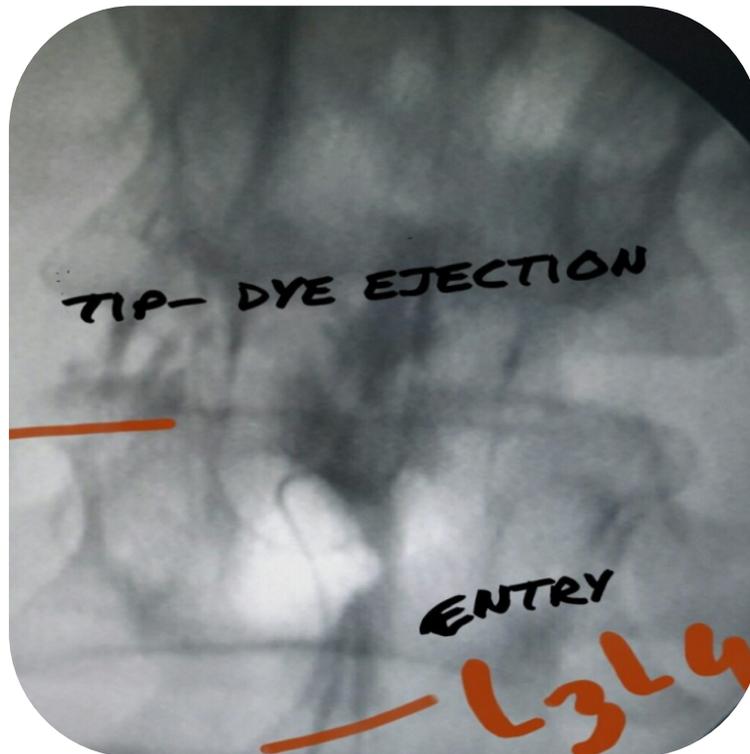


Figure 2

3. Catheter Tip at The Level of Skin Entry: Out of 50 patients, in 16 patients (32 percent) catheter tip were found to be almost at the same vertebral level of skin entry. In these cases, catheter were coiled at the cephalad level and pushed caudad to almost at the same level of skin entry

point. (fig.-3) Patients who belonged to this group were found to have a VAS score of 6 to 8 and they required an of additional bolus dose of 3-5 ml of 0.25% Bupivacaine and the rate of infusion was increased to 8-10ml/hr.



Figure 3

4. Catheter Tip at Paravertebral Space:

Out of 50 patients, in 6 patients (12percent) catheter tip were found to have at the paravertebral space by passing through the intervertebral foramen along the exiting nerve root. (fig4)

In 5 patients, epidural anaesthesia were not initiated intraoperatively and found to have the catheter tip in paravertebral space were pulled out to retain the catheter inside the epidural space.

Postoperative epidural infusion was continued like those other group patients and the same was titrated as per the VAS score.

In one patient who was posted for fracture tibia and femur surgery, combined spinal and epidural anaesthesia was initiated. But when epidural was started in the middle of the surgery, found to have inadequate anaesthesia and converted to general anaesthesia. Later in the post-extubation period, epidural imaging was done with fluoroscopy and the catheter tip was found in the paravertebral space on the side of the surgery. It resulted in inadequate anaesthesia. Again the catheter was pulled back into the epidural space and post-operative analgesia was continued as usual

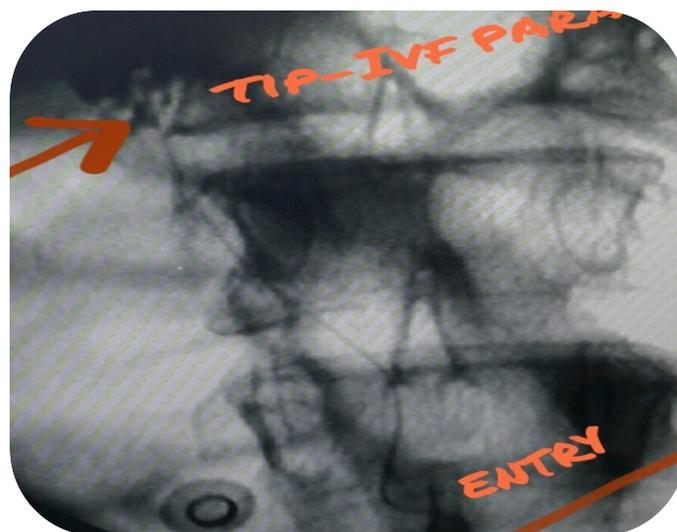


Figure 4

Discussion

Usage of fluoroscopy with injection of contrast agents have been rapidly increasing in recent times for both diagnostic as well as therapeutic interventions. In this situation, doing an epidural imaging with fluoroscopy after injecting a contrast agent to confirm the position of the catheters may increase the quality of anaesthesia and post operative analgesia including the safety of the patient. Though it is not a costly procedure, availability of the fluoroscopy is more important.

In our study, incidence of successful placement of epidural catheters in the epidural space was about 80%. This indicates that though the epidural imaging would not have been performed which we all are normally doing in our practice, it would not have affected the success of the epidural block. But if we observe closely, only 20% of the catheters were placed in the intended space which would provide effective anaesthesia or analgesia with limited dose of local anaesthetics and minimal hemodynamic changes in the circulatory system. In the remaining 60% of cases, though it might have been resulted in successful epidural anaesthesia but they would have consumed increased amount of local anaesthetics with unwanted hemodynamic changes. Here we have not used the epidural for anaesthesia but analgesia. Hence we advocate using the fluoroscopy for epidural imaging whenever possible to provide better, precise and safe anaesthesia & analgesia.

Similar to our study, Yokoyama M *et al* [1] concluded that epidurography was useful to indicate epidural catheter position and can help to predict the exact dermatomal distribution of the analgesic block. Yeager M P *et al* [2] also found that fluoroscopy assisted epidural catheter placement had significant correlations with clinical function of the epidural catheter after surgery with

decreased epidural solutions infusion rate in first postoperative day which exactly reflects the results of our study. The incidence of the catheter placement within one interspace in 42 percent of patients in the study published by Sanchez R *et al* [3] was very much higher than our study where it was 28 percent and it may be contributed due to the longer length of the catheter kept inside the epidural space by Sanchez R *et al*.

The incidence of intravascular placement in our study was about 8 percent. In all the cases epidural was not used intraoperatively but after diagnosing postoperatively by fluoroscopy removed the catheters immediately and thereby avoided the unwanted systemic side effects of the local anaesthetics like arrhythmias and cardiovascular collapse. Accidental puncture of epidural vessels during epidural catheter placement was approximately 3 to 12percent in Liu S *et al* [4] study. Intravascular placement of catheter incidence was also comparable to our study. Tetsuya Uchino *et al* [5] demonstrated the high rate of possible deviance from intended placement and how an improper placement yields poor efficacy of epidural anaesthesia during surgery which reflects the exact observations of our study.

In our study, no patients had experienced any allergic reactions to contrast agent (omnipaque) and contrast related complications post operatively. Patients with history of allergic reactions to any drugs and co- morbidities were excluded from our study. We also limited the contrast agent to the maximum of 5ml though we routinely used 3ml only. Hogan Q *et al* [6] used computed tomography to determine the epidural catheter tip position and distribution of the injectate where he used 4ml of contrast agent and to the maximum of 10ml. He also demonstrated the posterior dural structures impedance in distribution of injectate play a

role in a far lateral positioning of catheter and asymmetry of the block.

In addition to all the advantages, Collier *et al* [7] explored atypical or inadequate failed epidural blocks by radiography with contrast injection and found to have subdural spread of the contrast agent. Subdural injection of local anaesthetics may cause a high, patchy, inadequate neuraxial blockade with hemodynamic disturbances which can also be avoided in case of using epidural imaging.

Most of the epidural catheterization had been performed by final year junior residents, difficulties in identifying the catheter in fluoroscopy imaging sometimes and usage of air to the loss of resistance technique are some of the limitations in our study which have to be rectified in further studies to come with a clear conclusion in future.

To summarise, We demonstrated high rate of malpositioning and deviation of the epidural catheters from the intended place to keep the catheter in the epidural space by fluoroscopy imaging with contrast agent. We documented the increased local anaesthetic requirements even in the post operative period and if we would have used in the intraoperative period, would have caused more disturbances in the haemodynamics. It will be detrimental to the high risk patients with having ischaemic or valvular heart disease, chronic kidney failure and chronic liver disease in whom may need a perfect epidural placement of catheters to have a minimal hemodynamic changes.

Conclusion

We conclude that blind insertion of the epidural catheters after identifying the epidural space with loss of resistance to air technique are resulting in high rate of malpositioning from the intended placement site. Hence, We recommend doing routine fluoroscopy imaging of the catheter to verify

its position and it may certainly help to provide a safe and effective anaesthesia as well post operative analgesia further or at least for the high risk cases to avoid untoward complications.

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