



## CONFIRMATION OF EPIDURAL SPACE BEFORE CATHETER PLACEMENT: A SIMPLE MEASURE TO PREVENT SEVERITY OF CORD INJURY

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<p><b>Article Info</b> <i>Received 15/06/2015</i> <i>Revised 27/06/2015</i> <i>Accepted 20/07/2015</i></p> <p><b>Key words:</b> Epidural Anaesthesia, Cord Injury, Spine Ultrasonography, APAD.</p>	<p><b>ABSTRACT</b> Epidural anaesthesia is a preferred technique to provide effective analgesia and hasten perioperative recovery. Epidural block is usually safe, but rarely can lead to devastating neurological complications. Previous literature reveals the etiology behind such neurological complications, tools to identify injury, pathological changes after cord injury and the therapeutic measures. What should be the preventive measures to minimize such devastating neurological catastrophe is yet to be explored? This case highlights a grave neurological complication as a result of anatomical variation and measures for its prevention.</p>
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### INTRODUCTION

Epidural anaesthesia remains an integral part of balanced anaesthesia practice to provide prompt analgesia, hasten post-operative recovery and decrease the post-operative complications [1,2]. Usually neurological complications of the spine are due to lack of skills to identify the epidural space and inadequate knowledge about its anatomy. Such risk of neurological complications increases exponentially with old age, obesity, diabetes, coagulation abnormalities and spinal deformities [3-5]. In spite of the appropriate anatomical knowledge of the epidural space, sometimes anatomical variations can lead to devastating neurological misfortune. Here we present an unusual neurological complication leading to spinal cord damage during epidural catheter placement, due to near total obliteration of the epidural space. Pre-procedural ultrasound of the spine can be a promising non-invasive way to enhance the anatomical clarity of the space. Confirmation of the epidural space before catheter

placement can help to prevent neurologic injury as a result of unusual anatomical variations.

### Case summary

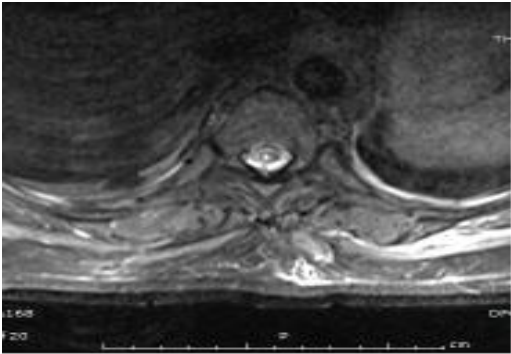
A 74 years old male patient with an asymptomatic solitary pulmonary nodule (adenocarcinoma lung) in left upper lobe of the lung was posted for left upper lobe wedge resection. Patient was a known diabetic for the past 25 years, well controlled on oral hypoglycemics with no autonomic neuropathy. On examination patient was obese (BMI 32 kg/m<sup>2</sup>), spine appeared normal for curvatures, but spinous processes were not easily palpable. His vitals were within normal range, with normal auscultation of heart and lung except for decreased air entry in left upper zone. CXR, CECT and PET-CT showed large 3x3cm mass lesion in left upper lobe abutting the costal pleura. His bronchoscopy and PFT were normal. Cardiac assessment was normal with negative TMT for inducible ischemia.



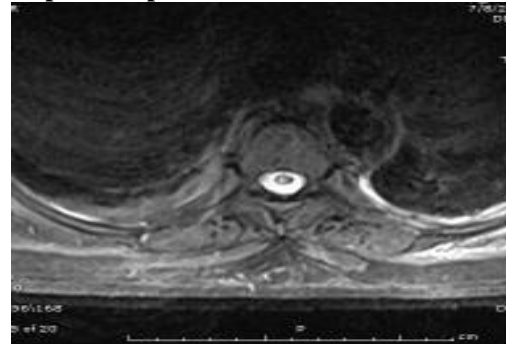
Rest of the investigations were within normal limits. After securing intravenous access and connecting routine monitoring, patient was positioned for epidural catheter placement. Following cleaning and draping, local anaesthesia was given at D10-11 inter-vertebral space and epidural space localization was done with 16G touhy epidural needle using LOR technique with air. 1<sup>st</sup> two attempts were unsuccessful, and finally epidural space was located at a depth of 6.8 cms and 2 ml of saline was injected without resistance. The catheter was inserted upto 15 cms from the needle hub following which the patient complained of numbness in right lower limb. The catheter was subsequently withdrawn 1 cm and finally fixed at 10 cm marking. A test dose of 3ml 2% xylocaine with adrenaline was given which was found to be negative when checked after five minutes. The patient was induced, airway secured with 39F DLT, epidural infusion of 0.125% bupivacaine started and surgery proceeded for left upper

lobe wedge resection, which was uneventful. In the post-operative period patient complained of immobility of bilateral lower limbs (right >left). No improvement in motor power was noted even after discontinuation of epidural infusion. Immediately, an MRI scan was planned that revealed generalized ligamentum flavum thickening, most prominent at D9-10 and D10-11 levels (Fig 1) depicting almost obliterated epidural space, and narrowed central spinal column. Intramedullary hyper intensity was seen in the right half of spinal cord extending from the inferior edge of D4 vertebra to D12 vertebra which was suggestive of cord edema. Above and below D9-11 intervertebral space, epidural space was found to be preserved within the normal dimensions (fig 2,3). The patient was subsequently put on the steroids and neuro-protective therapy. Over the course of 3 months he regained motor power of 3/5 and able to ambulate with the help of support.

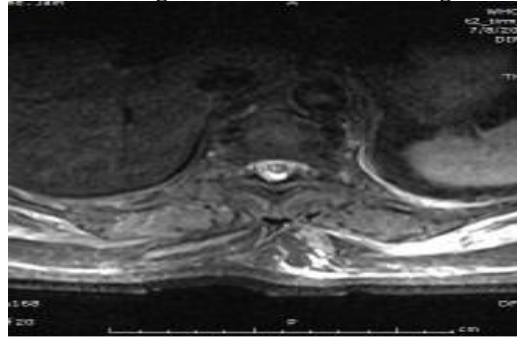
**Figure 1. D10 space showing cord injury with thickened Ligamentum Flavum and central cord edema**



**Figure 2. Cross section through D8 vertebrae with normal epidural space**



**Figure 3. Cross section through D12 vertebrae showing normal epidural space**



## DISCUSSION AND CONCLUSION

Placement of epidural catheter is usually safe, but in a rare instance neuraxial blockade can lead to spinal cord damage that may leave the victim paraplegic or even quadriplegic [6]. Aetiological factors attributable to adverse neurological outcome are primarily non-anaesthetic medical causes such as pre-existing multiple sclerosis, viral myelitis, embolic phenomenon, prolonged arterial hypotension, intrathecal medications, neurotoxic medications or prolonged hyperlordosis [7-9]. Still a proportion of these cases could be related to anaesthetic

technique which may result from inadequate technical skills of performer, equipment malfunctioning and patient's non-cooperation. Rarely anatomical aberrations of the epidural space, either congenital or acquired (acquired difficulties include ligamentum flavum hypertrophy often contributing to spinal stenosis, foraminal stenosis and disc prolapse) could be contributing factors [3].

In this case, near total obliteration of the epidural space in the selected vertebral space for performing the procedure was the main causative factor. As the needle was



advanced through the ligaments, there was sudden loss of resistance with dry tap. Saline was injected through epidural needle and epidural catheter was threaded smoothly and test dose was negative. In the post-operative ward inability to move his both lower limbs (right >left), raised the suspicion for neurological complication as the cause of paraplegia. Our suspicion got clarified only after MRI of the spine revealed near total absence of space (T9-T11) with normal spaces above and below the site of puncture. Cord oedema was observed on right half of the spinal cord. Intraneural injection of local anaesthetic was suspected as the foremost possible cause of cord oedema, but we found that the absence of epidural space due to the generalized ligamentum flavum thickening had led to intraneural placement of epidural catheter (an acquired anatomical variation).

Similar cord injuries following epidural anaesthesia were previously reported in which catheter lying in the vicinity of the cord and intraneural local anaesthetic injections were found as major contributors of cord damage and edema [10]. Mayall et al suggested risk of accidental damage to the spinal cord during epidural anaesthesia is avoidable. Either the procedure is abandoned on complaint of lancinating pain during needle insertion or the needle is inserted below the termination of the spinal cord whenever 'practical and medically appropriate', and if needle insertion is required above the termination of the cord, it must be performed with an awake patient in all but 'rarest' circumstances [11]. Such suggestions if strictly

followed can prevent grave neurological complications, but in current practice these recommendations are not universally applicable. Pre-procedural neuraxial ultrasonography is a new screening modality to reveal the anatomical aspects of the epidural space, identification of needle trajectory, calculating the pre-procedural epidural depth, facilitating epidural catheter insertion and identifying pathological aspects [12,13]. Ultrasonography aids to achieve steady control of needle insertion while avoiding multiple attempts and inadvertent spinal cord injury during difficult neuraxial blockade [14].

Acoustic puncture assist device (APAD) which detects and records the pressure changes during the epidural puncture is a tool for real time confirmation of the epidural space and for correct placement of the catheter. When compared with the conventional loss of resistance technique, the use of this device enhances the sense of touch supplemented with an acoustic sound and also provides an objective visible pressure reading [15]. Once epidural space is confirmed by APAD, customarily catheter insertion is safe with reduced chances of cord injury and permanent neurological deficit.

We suggest screening the spine by sonography before procedure for confirming the epidural space before catheter placement. By incorporating the above mentioned preventive measures in routine and in subjects at higher risk of cord injury, we not only prevent cord damage but also reduce devastating neurological catastrophe.

## REFERENCES

1. Moiniche S, Dahl JB, Rosenberg J, Kehlet H. (1994). Colonic resection with early discharge after combined subarachnoid-epidural analgesia, preoperative glucocorticoids and early postoperative mobilization and feeding in a pulmonary high risk patient. *Reg Anesth*, 19, 352-356.
2. Desborough JP. (1996). Thoracic epidural analgesia in cardiac surgery (editorial). *Anaesthesia*, 51, 805-807.
3. Richardson J, Groen GJ. (2005). Applied epidural anatomy. *BJA: CEACCP*, 5, 98-100.
4. Nielsen KC, Guller U, Steele SM, Greengrass RA, Pietrobon R. (2005). Influence of obesity on surgical regional anesthesia in the ambulatory setting: an analysis of 9,038 blocks. *Anesthesiology*, 102, 181-187.
5. Renck H. (1995). Neurological complications of central nerve blocks. *Acta Anaesthesiol Scand*, 39, 859-868
6. Schreiner EJ, Lipson SF, Bromage PR, Camporesi EM. (1983). Neurological complications following general anaesthesia. Three cases of major paralysis. *Anaesthesia*, 38, 226-229.
7. Amoiridis G, Whorle JC, Langkafel M, Maiwurm D, Przuntek H. (1996). Spinal cord infarction after surgery in a patient in the hyperlordotic position. *Anesthesiology*, 84, 228-230.
8. Skouen JS, Wainapel SF, Willock MM. Paraplegia following epidural anaesthesia. (1985). A case report and literature review. *Acta Neurol Scand*, 72, 437-443.
9. Isu T, Iwasaki Y, Akino M, Koyanagi I, Abe H. (1989). Magnetic resonance imaging in cases of spinal dural arteriovenous malformation. *Neurosurgery*, 24, 919-923.
10. Kao MC, Tsai SK, Tsou MY, Lee HK, Guo WY, Hu JS. (2004). Paraplegia after delayed detection of inadvertent spinal cord injury during thoracic epidural catheterization in an anesthetized elderly patient. *Anesth Analg*, 99(2), 580-583.
11. Mayall MF, Calder I. (1999). Spinal cord injury following an attempted thoracic Epidural. *Anaesthesia*, 54, 990-994.
12. Perlas A. (2010). Evidence for the use of ultrasound in neuraxial blocks. *Reg Anesth Pain Med*, 35, S43-46.
13. Rasouljian A, Lohser J, Najafi M, Rafii-Tari H, Tran D, Kamani AA, Lessoway VA, Abolmaesumi P, Rohling RN. (2011). Utility of prepuncture ultrasound for localization of the thoracic epidural space. *Can J Anaesth*, 58, 815-823.
14. Grau T, Leipold RW, Delorme S, Martin E & Motsch J. (2002). Ultrasound imaging of the thoracic epidural space. *Reg Anesth Pain Med*, 27, 200-206.
15. T.J Lechner M, Wijk MGFV, Jongenelis AAJ, Rybak M, Niekerk JV, Langenberg CJM. (2011). The use of a sound-enabled device to measure pressure during insertion of an epidural catheter in women in labour. *Anaesthesia*, 66, 568-573.

