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CASE REPORT

Bupivacaine pleural effusion mimicking a hemothorax after a thoracoscopic microdiscectomy with epidural anesthesia

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Abstract

Purpose Post-operative pain after video-assisted thoracoscopic surgery is often treated using thoracic epidural analgesics or thoracic paravertebral analgesics. This article describes a case where a thoracic disc herniation is treated with a thoracoscopic microdiscectomy with post-operative thoracic epidural analgesics. The patient developed a bupivacaine pleural effusion which mimicked a hemothorax on computed tomography (CT).

Methods The presence of bupivacaine in the pleural effusion was confirmed using a high performance liquid chromatography method.

Results The patient underwent a re-exploration to relieve the pleural effusion. The patient showed a long-term recovery similar to what can be expected from an uncomplicated thoracoscopic microdiscectomy.

Conclusion A pleural effusion may occur when thoracic epidural analgesics are used in patents with a corridor between the pleural cavity and epidural space.

Keywords Thoracic disc herniation · Thoracoscopic microdiscectomy · Epidural anesthesia · Hemothorax · Bupivacaine

Introduction

The purpose of this article is to share our encounter and experience with a rare complication of a bupivacaine pleural effusion (BPE) mimicking a hemothorax after thoracoscopic microdiscectomy (TMD) with post-operative thoracic epidural analgesics (TEA). Knowledge of the possibility of this complication may prevent its occurrence in the future.

Illustrative case

A 42-year old female was referred to our outpatient clinic by the neurosurgery department of a tertiary medical center because of a symptomatic thoracic disc herniation (TDH) with spinal cord compression to evaluate potential surgical treatment options.

The patient had been suffering from a bilateral thoracic radiculopathy for several years and developed a symptomatic myelopathy two-and-a-half years prior to her referral.

Upon first presentation, the patient presented in an electric wheelchair. Neurological examination showed an hypoesthesia from the level of her xiphoid down to her toes with sensory ataxia and a diffuse paraparesis of medical research council (MRC) grade 4. Both the sensory and motor deficits were slightly worse on the left side.

Magnetic Resonance Imaging (MRI) showed a significant right paracentral disc herniation with spinal cord compression without myelopathy at the Th6-Th7 level and a slightly smaller left paracentral disc herniation at Th7-Th8, see Fig. 1.

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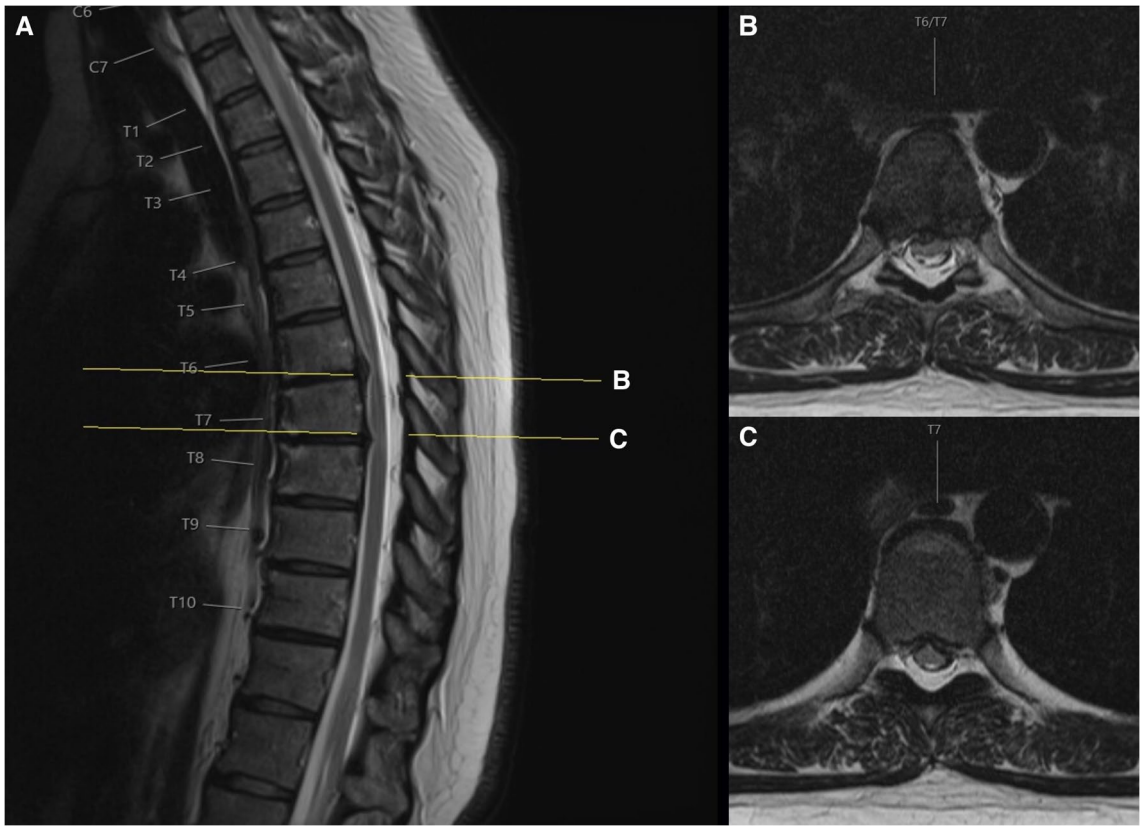

Fig. 1 Sections of the pre-operative T2 magnetic resonance image (MRI). **A**. Midsagittal view with yellow lines indicating the level of the transverse sections displayed in **B** and **C**. Images show a clear thoracic disc herniation at Th6-Th7 (B) and Th7-Th8 (C) compressing the spinal cord without signs of myelomalacia

Computed Tomography (CT) showed no calcification of the disc herniation or spinal deformities.

Both a costotransversectomy and thoracoscopic approach were considered. Given the paracentral localization and the clear ventral compression on the spinal cord visible as a "U-sign" (see Fig. 1B), a thoracoscopic approach was deemed more likely to have a favorable neurological outcome.

Given the frequent extensive post-operative pain associated with TMD [2], we opted to place an epidural anesthetic catheter pre-operatively. The patient underwent a TMD on both Th6-Th7 and Th7-Th8 through a right sided approach. An intercostal harpoon was placed under CT guidance to determine the affected discs during surgery.

An X-ray obtained within the first hour after surgery showed a small apical pneumothorax of 10 mm on the right side, which was to be expected, and an adequate position of the chest tube. In accordance with standard protocol, a second X-ray on the first day after surgery showed no residual pneumothorax, after which the chest drainage system was closed for six hours. Afterwards, a third X-ray was obtained without any signs of complications, after which the chest tube was removed.

The post-operative pain was sufficiently managed with epidural bupivacaine 6,25 mg/sufentanil 5 mcg per hour in addition to the oral paracetamol and pregabalin the patient was prescribed pre-operatively.

On the second day after surgery, the patient developed dyspnea and the CT showed a pleural effusion, see Fig. 2. Given the high density of the effusion (21,23 HU), it was suspected for a hemothorax, either as a late surgical complication or resulting from the removal of the chest tube.

The department of thoracic surgery was consulted and the patient underwent uniportal video-assisted thoracoscopic surgical (VATS) procedure through one of the TMD incisions. During the VATS procedure, 800 cc of clear, non-hemorrhagic fluid was drained. Since there had been no surgical, radiological or clinical signs of a cerebrospinal fluid (CSF) leak, an effusion of epidural analgesia through the operative corridor was suspected. The epidural catheter was removed and a intercostal catheter administering ropivacaine was placed in addition to a regular chest tube. An X-ray showed minimal residual pleural effusion and no signs of a pneumothorax on the second day after the VATS, after which the chest tube was removed.

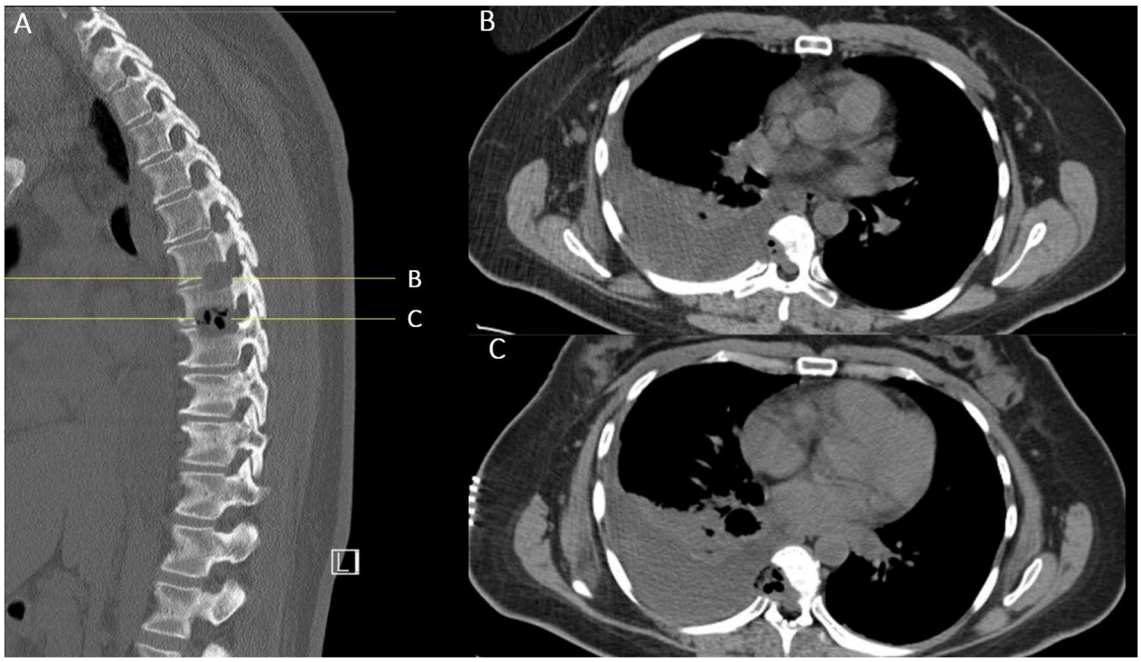

Fig. 2 Computed tomography (CT) image obtained on the second day after surgery. **A**. Paramedian sagittal image in bone setting showing the transcorporal corridors on levels Th6-Th7 and Th7-Th8. **B** and **C**. Transverse image on spinal levels Th6-Th7 (B) and Th7-Th8 (C) in lung setting showing the surgical corridors as well the pleural effusion on the right side (Hounsfield Unit 21,23)

To verify our suspicions, the pleural effusion fluid was sent for a beta-2-transferrin (B2T) test to rule out a CSF leak indefinitely, for bacterial culture to rule out infectious complications and for a qualitative bupivacaine test. The fluid was negative for B2T, bacterial cultures were negative and the fluid was positive for bupivacaine.

The patient was discharged one week after the TMD. During the first few weeks after surgery, the patient experienced post-operative pain in her right flank. During the first year after her surgery, the patient reported an unchanged hypoesthesia and improved bladder control. The mild paresis improved completely in the right leg and partially in the left leg to a MRC grade 5 and 4 respectively. This allowed the patient to walk using a walking aid.

Discussion

Observations

Post-operative pain is a well-known concern following thoracic surgery. Chronic post-operative pain is reported to occur after 5–33% of VATS surgeries. Prophylactic pain management using a regional technique, e.g. TEA or paravertebral catheter analgesia (TPA), is recommended. [3]

This case illustrates that an unforeseen complication of a bupivacaine pleural effusion imitating a hemothorax can occur after a TMD with post-operative TEA. Knowledge of this complication can be prevented by choosing alternatives to TEA, e.g. a TPA. [7] In our case, this complication showed to be potentially life-threatening with a fast progressing dyspnea.

Mechanism

This complication can occur with any type of surgery in which a connection is made between the epidural space and the pleural cavity. These include thoracoscopic spine surgeries, e.g. TMDs and thoracoscopic vertebrectomies, but also (dorso)lateral approaches where an (unplanned) opening is made to the pleural cavity, e.g. oncological spine surgeries, costotransversectomies or extrapleural approaches to the spine. We pose that the option for combining TEA with surgery where a high likelihood of creating this corridor should be carefully evaluated and if possible, should be avoided by using alternatives like a TPA. [7]

This case also illustrates the fast rate at which the pleural cavity can fill up with fluid from the epidural space. We hypothesize that this is the result from a pressure gradient from the positive pressure in the epidural space of around 10,4 cmH_2O [5] to the negative pressure in the pleural

cavity of around -6 cmH_2O [1]. Interestingly, suction of the chest tube may be counterproductive in the sense that it aims to prevent pleural effusion by inducing a negative pressure of around -25 to 50 cmH_2O [4], but adds to this pressure gradient. [6] In this case the chest tube suction was set to -10 cmH_2O.

Diagnosis

Our suspicion of a bupivacaine pleural effusion was tested using high performance liquid chromatography (HPLD) with a photo diode array detector. This technique can qualitatively verify the presence of bupivacaine, but can only provide insight into its quantity in limited cases. Alternatively, tandem mass spectrometry (LC–MS/MS) is another suitable technique which is frequently applied in many hospital laboratories. The authors propose to test the pleural effusion using one of these techniques in case of a suspected BPE, since these tests are fast and commonly available in medical facilities.

Treatment

The difference in consistency of a BPE and a hemothorax makes different treatment options more suitable. In case of a BPE could a conservative treatment or a needle or chest tube drainage be considered, while this would not be suitable for a hemothorax. A VATS provides the additional option to directly target the source of a bleeding, while this carries no value with a bupivacaine pleural effusion. This illustrates that knowledge of the nature of the effusion has great value in deciding the optimal treatment.

Lessons

This case clearly illustrates that a fast progressing pleural effusion, a potentially life-threatening complication, can occur when the epidural space and the pleural cavity are (surgically) connected and in a patient receiving TEA. The high density of bupivacaine on computer tomography may lead to mistakenly identifying this effusion as a hemothorax and treat it as such. This complication can be prevented by either watertight closure the fistula or by choosing an alternative to TEA, like TPA. The authors pose that a TMD should therefore be considered a contra-indication for the use of TEA. It is unknown how long TEA should be contra-indicated after a corridor between the pleural cavity and the epidural space has been made.

This case lesson is limited by the fact that it is one single case. A large case series of TMDs could also provide information on the incidence of this complication and an estimation of its prognosis. Additionally, our unfamiliarity with this complication caused us to treat it as a hemothorax, where knowledge of this complication may have altered our treatment plan.

Conclusions

Epidural analgesics in combination with a thoracoscopic microdiscectomy may cause a potentially life-threatening and fast-progressing pleural effusion. The analgesics may mimick a hemothorax on computed tomography images. Therefore, we pose that epidural analgesics are contra-indicated when performing a thoracoscopic microdiscectomy and the authors suggest alternative analgesic options, e.g. thoracic paravertebral analgesics.

Author's contributions MtDM: Conceptualization of the report and primary writer of the report
YV: Conceptualization of the report and provided clinical and scientific background
NC: Conceptualization of the report and provided clinical and scientific background
DD: Conceptualization of the report and provided clinical and scientific background
TB: Conceptualization of the report, secondary writer and primary reviewer of the report

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Code availability Not applicable.

Declarations

Ethics approval Ethical approval was waived by the local Ethics Committee of University A in view of the retrospective nature of the study and all the procedures being performed were part of the routine care.

Consent to participate The participant has consented to the participation in this case report.

Consent for publication The participant has consented to the submission of the case report to the journal.

Conflicts of interest/competing interests The authors have no relevant financial or non-financial interests to disclose.

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