Postoperative Respiratory Distress Complicating Attempted Paravertebral Blockade: A Case Report and Review of the Literature

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Citation

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Abstract

Paravertebral blockade is a useful adjunct for pain relief following thoracotomy. We describe a patient where a presumed paravertebal catheter was the cause of acute respiratory distress on postoperative day number two in a patient who underwent a thoracotomy. The catheter was placed using a well-described loss of resistance technique which, by itself, may increase the risk of complications associated with this block in patients who have had a prior thoracotomy. Computed tomographic images revealed an intrapleural catheter which was discontinued leading to a resolution of the patient's symptoms. This case underscores the importance of using additional confirmatory modalities beyond the loss of resistance technique when placing a paravertebral catheter in patients who have had a prior thoracotomy.

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INTRODUCTION

We report a case of acute respiratory distress on postoperative day number two in a patient who underwent a thoracotomy and in whom a presumed continuous paravertebral catheter was placed for postoperative pain relief. The catheter was found to be intrapleural and removed. Though commonly employed as a pain relief modality for patients following thoracotomy, paravertebral blockade using a well-described loss of resistance technique in this surgical population has been suggested to decrease the risk of inadvertent pleural puncture. However, thoracotomy itself may lead to pleural scarring which may alter the anatomy encountered during placement of the paravertebral block and subsequently make the loss of resistance technique less reliable. There is a paucity of literature describing this type of complication associated with continuous paravertebral blockade in patients with a prior thoracotomy.

CASE REPORT

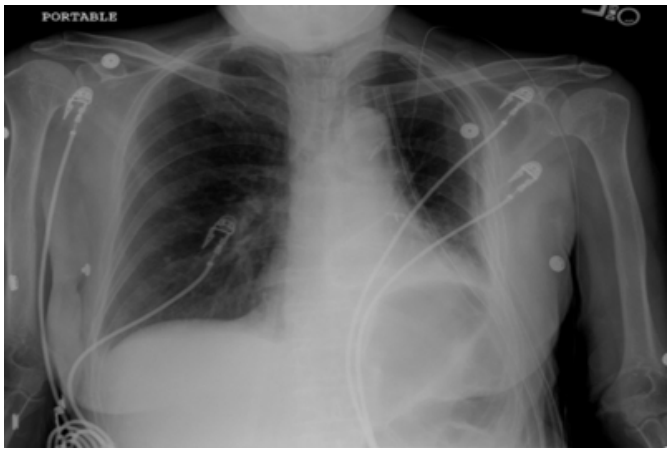
A 65 yr-old woman with a central left upper lobe mass and moderate chronic obstructive pulmonary disease was scheduled for a left upper lobectomy through a left thoracotomy. She had no other significant past medical or surgical disease, weighed 50 kg and was 60 inches tall.

Following uncomplicated general anesthesia, a continuous thoracic paravertebral block was planned for post-operative analgesia after it was determined that a preoperative thoracic epidural had failed. The patient was placed in the right lateral decubitus position, and a 17-gauge Touhy needle was inserted 3 cm lateral to the T7 spinous process. The needle was advanced perpendicular to the skin in all planes until the transverse process was encountered. The needle was walked in a cephalad direction until the costotransverse ligament was appreciated, and advanced 1.5 cm when loss of resistance was encountered using an air-saline technique. After negative aspiration, a 19-gauge FlexTip Plus™ epidural catheter (Arrow International, Inc., Reading, PA, USA) was advanced 5 cm without paresthesia and secured. A test dose using 3 ml of 1.5% lidocaine with 1:200,000 epinephrine was negative. 6 ml of 1% lidocaine was injected through the catheter and resulted in decreased sensation to light touch and pinprick in a T5-T8 distribution on the left side. A continuous infusion of 0.125% bupivacaine at 6 ml/hr resulted in good pain control throughout the first postoperative day. The patient's chest tubes were placed to

water seal thirty hours after paravertebral catheter placement. Twelve hours later the patient demonstrated severe dyspnea and left-sided pleuritic chest pain. The patient's blood pressure was 136/76 mmHg, heart rate was 80 beats/min, respirations were 20 breaths/min, and SpO2 decreased from 98% on room air to 95% on 3 liters nasal cannula. A chest radiograph revealed a new left apical pneumothorax and a pleural effusion as shown in figure 1.

Figure 1

Figure 1: Chest radiograph after presentation of respiratory symptoms revealing new left-sided pneumothorax and pleural effusion.



Computed tomography of the chest utilizing nonionic intravenous contrast to rule out pulmonary embolus revealed a left-sided hydropneumothorax with associated volume loss and a radiopaque catheter extending into the left pleural space as shown in figures 2 and 3.

Figure 2

Figure 2: Computed tomographic image of the chest, coronal view; the catheter is visualized intrapleurally.

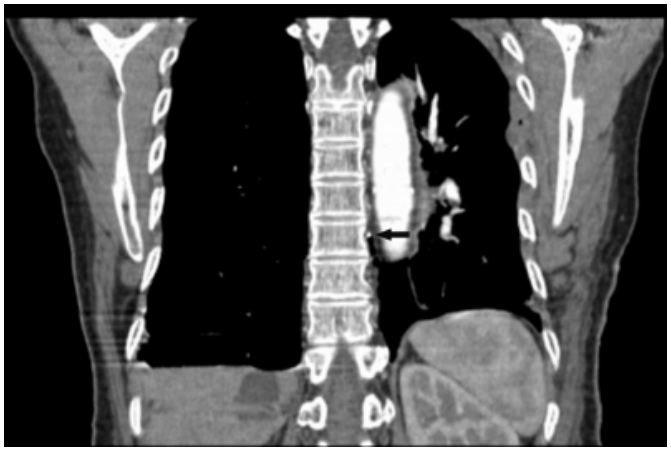
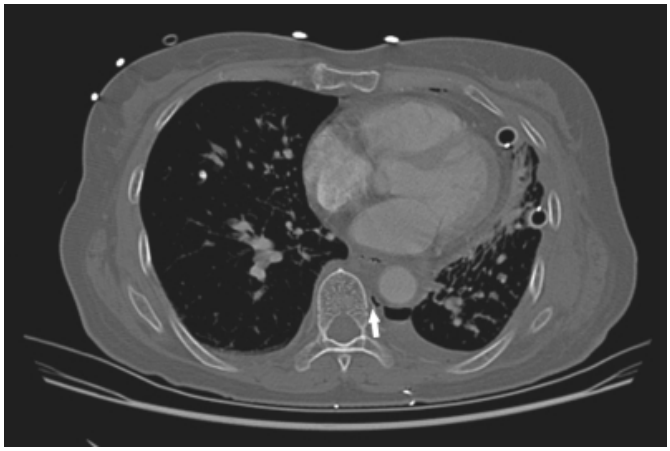


Figure 3

Figure 3: Computed tomographic image of the chest, axial view; the catheter is seen protruding into the left intrapleural space.



The chest tube was returned to wall suction and the catheter was removed, resulting in markedly improved patient comfort and oxygenation. The patient was discharged home, without further pulmonary complication, on postoperative day nine.

DISCUSSION

Paravertebral blockade has been successfully employed as a sole anesthetic for major breast surgery and inguinal herniorrhaphy.[1,2,3,4] The technique is also a useful adjunct for pain relief following thoracotomy, multiple rib fractures, and chronic pain syndromes.[5,6,7,8]

The paravertebral space is a wedge-shaped area bounded anteriorly by the parietal pleura and posteriorly by the superior costotransverse ligament. Intercostal nerves, the dorsal rami, rami communicantes, and the sympathetic chain lie within the area and communicate with the epidural space.[4,5,7] This technique provides unilateral blockade of somatic and sympathetic nerves extending multiple-dermatomes above and below the site of injection.

Prior reviews of paravertebral blockade quote success rates approaching 95% and overall complication rates below 7%.[1,5,6,8] The most common complications are pleural puncture (1.1%) and pneumothorax (0.5%).[6,8] Less common complications described include subdural spread of local anesthetic, total spinal block, and pulmonary hemorrhage.[9,10,11] Multiple authors have suggested that anatomical changes from prior thoracotomy increase the risk of complications due to the formation of scars or adhesions within the paravertebral space.[11,12] Richardson et al. [12] noted

that prior thoracotomy scarring may alter the appreciation of a loss of resistance when utilizing this technique for paravertebral blockade. These reports contradict an earlier review suggesting that the loss of resistance technique provides protection against pleural and parenchymal puncture.[6]

We placed a paravertebral catheter utilizing the loss of resistance technique as described previously in the literature.[14] We assumed correct positioning of the catheter based on a negative aspiration for air, negative test dose, initial T5-T8 sympathetic band, and marked improvement in pain control. In hindsight, the catheter was initially placed in the intrapleural space.

Several methods to minimize the risk of complications associated with paravertebral block have been outlined by numerous authors. Greengrass et al.[4] advocates grasping the needle at a point from its tip that is equal to the estimated depth from the skin to the transverse process. This depth is then noted and the needle is angled to walk off the caudad edge of the transverse process by 1 cm, thus minimizing the possibility of a pneumothorax. Placement of intravenous contrast into the paravertebral space followed by fluoroscopy is an alternative method to confirm passage into the paravertebral space. Naja et al. and Lang[8,15] describe the use of an insulated needle with a nerve stimulator to isolate contractions or paresthesias of the chest or abdominal musculature as a means to verify appropriate placement of the needle. Pusch et al. [16] describe sonographic evaluation to gauge the depth from the skin to the paravertebral space. The sonographic technique predicts maximum needle insertion depth to avoid intrapleural passage. In addition, transduction of a pressure waveform during needle advancement has been used to detect the paravertebral space.[12] Using this method, pressure variations on inspiration and expiration can enable the detection of pleural puncture.

Numerous reports have highlighted the role of intrapleural delivery of local anesthetic in the management of post-thoracotomy pain.[13,17] Inderbitzi et al. [18] describe intentional continuous intrapleural bupivacaine through a paravertebral catheter as a safe method to provide post-thoracotomy pain relief. In this case report, the modest degree of analgesia that resulted from continuous intrapleural delivery of 0.125% bupivacaine may have mimicked the level of analgesia which could have been achieved with a paravertebral catheter. This could account for adequate pain control in the early postoperative period.

Safe and effective placement of a paravertebral catheter begins with a sound understanding of paravertebral anatomy. The anesthesia literature supports the use of paravertebral blockade as a safe technique for sole surgical anesthesia or an adjunct for postoperative pain control. This case illustrates inadvertent intrapleural catheter placement using loss of resistance for paravertebral catheter placement. Though the overall complication rate associated with this technique is low, a review of the recent literature describes additional confirmatory measures to ensure safe placement within the paravertebral space.

Our experience with this patient and utilizing the loss of resistance technique has persuaded us to apply additional modalities to confirm entry into the paravertebral space. In patients with prior thoracotomy, the loss of resistance technique alone is not foolproof. We recommend the use of sonography or needle advancement with pressure monitoring to decrease the possibility of undetected pleural puncture. When performing paravertebral blockade, knowledge of which patients are at increased risk for complications, and the techniques available to diminish the risks, will enhance patient safety and perioperative analgesia.

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