

CASE REPORT

Pneumomediastinitis following internal jugular vein central line insertion: Case report and review of literature

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ABSTRACT

Complications related to central venous catheters (CVCs) in the postoperative period can be fatal. We recently had a case of pneumomediastinitis. A 77 years old woman with left femoral neck fracture due to a fall was admitted to Rajace Hospital. The next day after the operation the patient presented with tachypnea and respiratory distress. Tracheal intubation was performed and mechanical ventilation was started. The central line was inserted in left internal jugular vein. Anteroposterior chest radiography revealed air space shadowing in left lung at middle and lower lobes probably due to infiltration, consolidation or collapse. The CT scan reported that pneumomediastinum was detected in superior and anterior of mediastinum. Minimal pleural effusion and consolidation was also detected in right lung, especially in the dependent area. The tip of the catheter was seen at the anterior part of mediastinum. Clinical findings described before declared that the patient had suffered from aspiration pneumonia which may have been occurred during the surgery. The central venous line was removed after proving its malpositioning. The patient recovered with conservative treatment and was discharged from the hospital six days after surgery. This case highlights the clinical importance of comparing CT scan to the chest x-ray accuracy in diagnosing the chest complications.

Key words: Central venous catheters; Central vein catheterization; Mediastinum; Pneumomediastinitis; Pneumomediastinum; CT scan

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INTRODUCTION

There is a dramatic increase in central venous catheters use;¹ and due to their reliability and low rate of complications they are also used as a route of administering medications, blood products, nutritional fluids and evaluation of volume status.^{1,2} Pneumomediastinitis is a life-threatening condition and has rarely been reported as a central venous catheter-associated complication. We describe a case of 77 year old woman who underwent orthopedic surgery and developed pneumomediastinitis after central vein catheterization (CVC). Although there was no obvious sign of the above mentioned problem in her chest x-ray films.

CASE REPORT

A 77 year old woman with left femoral neck fracture due to a fall was admitted to Rajace Central Trauma Hospital. The patient underwent open reduction and internal fixation

at the 5th day of hospitalization. The patient received spinal anesthesia. During the operation the patient was resuscitated with 1500 ml normal saline and one pint of packed cells. The next day after the operation the patient developed tachypnea and respiratory distress. O₂ saturation decreased as detected by pulse oximetry (SpO₂ =80%).

Tracheal intubation was performed and mechanical ventilation with SIMV mode (TV=400 ml, RR=14/min, PEEP=5 cmH₂O) was started. The central line was inserted in left internal jugular vein. The catheter was made of polyurethane and was 2.5 mm in diameter and 25 cm in length. Her right internal jugular vein was not available due to previous attempts at CVC. Several attempts in order to insert the catheter were not successful and also the flow of blood from the catheter was not adequate at first.

Anteroposterior chest radiography was obtained; revealing

pneumomediastinitis following internal jugular vein central line insertion

air space shadowing in right lung at middle and lower lobes probably due to infiltration, consolidation or collapse (Figure 1).



Figure 1: The chest x-ray film before the surgery

The chest X-ray as a part of the preoperative work up showed kypho-scoliosis and an increased heart size; both lung fields were clear (Figure 2).



Figure 2: The chest X-ray film when the CVC was inserted, show air space shadowing in right lung at middle and lower lobes probably due to infiltration, consolidation or collapse

Laboratory tests showed a significant increase in WBC count which was serially documented (7000 – 6300 – 9100 – 13400). Other laboratory test results are listed as: Hb = 9.4 mg/dl, Na = 140, K = 4.8, Blood sugar = 112. 7.

So considering the findings of the chest x-ray and patient's clinical condition chest computed tomographic (CT) scan was considered necessary. The CT scan reported that the air was detected in superior and anterior of mediastinum. Minimal plural effusion and consolidation was also detected in right lung, especially in the dependent area. The tip of the catheter was seen at the anterior part of mediastinum. Increased anteroposterior diameter of the chest cage was seen due to some degree of emphysematous change. Some

degree of kyphosis was also noted (Figure 3).

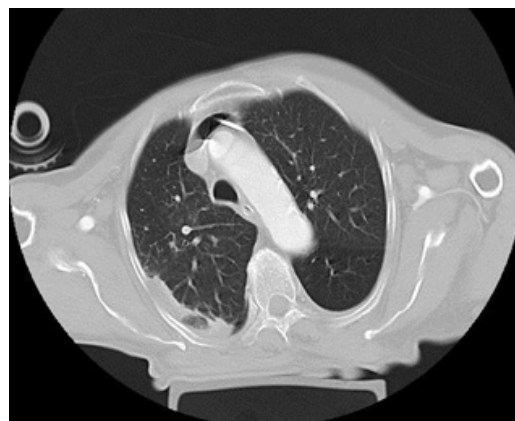


Figure 3: Chest computed tomographic image

To evaluate the possibility of any cardiac problem or associated complication with the malpositioning of the catheter, e.g. atrial wall rupture, pericarditis or cardiac tamponade, echocardiography was done, which showed normal heart function and an ejection fraction calculated as 55%.

Chest computed tomographic images displayed displacement of the tip of the central venous catheter out of the wall of internal jugular vein (white arrows). Minimal plural effusion and consolidation was detected in left lung especially in the dependent area (Figures 3 & 4).

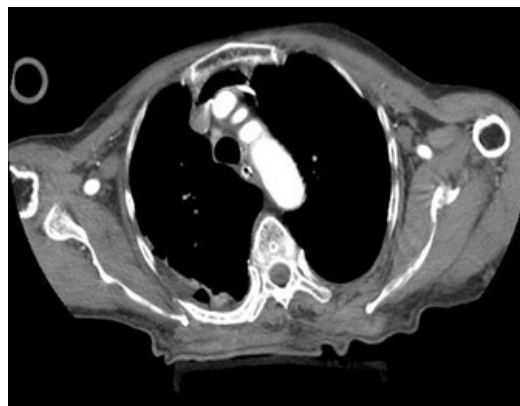


Figure 4: Chest computed tomographic image

Clinical findings and investigations confirmed that the patient had suffered from aspiration pneumonitis which may have been occurred during the surgery. A broad spectrum antibiotic therapy was started.

Soon after the central venous (CV) line was removed due to malpositioning. The patient recovered with conservative treatment and was discharged from the hospital six days after surgery.

DISCUSSION

Vascular erosion and injury during and after the placement

of CV lines has been reported as a rare complication.³ There are few studies which determine the incidence of vascular injury during CVCs. Regarding the results in Mukau et al. study^{1,3} in which retrospectively results of 1058 catheters in 853 patients were collected, the incidence of vascular erosion was reported to be 0.4%.³ Also a recent retrospective analysis by Walshe et al. of 2992 catheters³ indicated that the incidence was 0.17%.

On the other hand CVCs has major advantages such as significant lower infection rate, less thrombotic occlusion,⁴ greater patient acceptance and being more cost-effective⁴ in comparison to the peripheral venous lines for specific indications. Excessive pain at insertion site, infection, bleeding, catheter failure, inadvertent arterial puncture, pneumothorax, phlebitis, venous perforation, cardiac tamponade, Horner's syndrome and malposition of the catheter are the known complications of percutaneous internal jugular venous catheterization.¹ Unpredicted complications associated with internal jugular vein are reported in several case reports that include; complete heart block, carotid jugular arteriovenous fistula, secondary migration to the right subclavian vein etc.⁵ A case of fatal cardiac tamponade has been reported as a result of perforation and infusion of sodium chloride from the right atrium into the pericardial sac in the Orme et al⁶ report.

Several studies attempted to delineate various risk factors for vascular erosion caused by a CVC.³ Left-sided subclavian catheters,⁷ large catheters⁸ and older age⁸ have been reported as risk factors of CVC related complications. In our case, old age and left-sided CVC placement were present as two important factors. In addition anatomical features of the left side predispose towards more frequent vascular injury as opposed to the right side.⁷

A cross-sectional study has shown that findings associated to vascular injuries appear 2.5 to 3.6 days after placement of the CV lines.⁹ In the reported case the mentioned complication was readily diagnosed by attention to the clinical condition and the radiologic results. The most probable cause of acute vascular injury in this present case can be a malpositioning of the CVC. The chest x-ray after insertion of central line did not show any significant complication associated with CVC. But the CT scan did show the position of CV line's tip in the anterior part of mediastinum as a sequence of wrong way insertion of CV line.

Pneumomediastinitis predominantly occurs in trauma to head, neck or chest; due to mechanical ventilation, procedures such as dental extractions, tracheotomy,

sternotomy, mediastinoscopy, transbronchial needle aspiration and also decompression during SCUBA diving or air travel.^{10,11} The main causes of pneumomediastinitis have been described as; alveolar rupture with dissection of air into the mediastinum, perforation of esophagus, trachea or a main bronchus as well as dissection of air from the neck or abdomen into the mediastinum. Pneumomediastinum can also be seen in association with mediastinitis.^{10,11}

Several studies reviewed the necessity of chest x-ray after the CVC. When the CV line is indicated for short term use; knowledge of the radiographic catheter tip is normally not required.¹² Uchida's study showed that the appropriate length of CVC inserted through the right internal jugular vein or right subclavian vein could be estimated by the calculated measurement of adding half the length of the right clavicle and the vertical length between the sternal head of the right clavicle and the carina.¹² As a result there is no significant need for a routine chest x-ray after CVCs. Also in another study it was concluded that clinical symptoms were reported in all patients with pneumothorax requiring specific treatment.¹³ Approximately half of the post-procedure chest x-ray controls could be avoided using the proposed clinical decision rule to select patients for radiographic evaluation after CVCs.¹³ In our case, both chest X-ray and CT scan were performed. Clinical condition along with doubtful findings in the chest X-ray obviously indicated the need of a CT scan; however, in most of the other conditions described above, chest X-ray has been the most useful diagnostic tool. The site of the tip of the catheter manifested by the CT scan was quite useful to diagnose acute vascular injury by CVC. Although the mortality rate of this complication has been considered to be significant,¹⁴ the patient's prognosis depends upon awareness of the rare possibility of pneumomediastinitis caused by a CVC.¹⁵

CONCLUSION

In conclusion, pneumomediastinitis should be considered in all patients inserted with central venous lines. Our report highlights the importance of assessing the correct placement of a CV line before administering intravenous therapy. Lack of free blood flow through only one port of a double lumen catheter should alert us. Initial chest film may or may not be able to locate the catheter tip. If in doubt, CT scan should be ordered to determine the definitive diagnosis.

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There was an emergency call from a ward for endotracheal intubation and ventilation as the oxygen saturation of a patient was falling. I enquired if the procedure was tried by the medical officer in charge before raising call to the anesthesiologist (as was the routine) but the reply was in negative. The medical officer was confident with his ability to intubate, so I asked him to proceed with the procedure; but on second thought I went to the respective ward. I observed that the patient was fully conscious, well-oriented and responsive but the pulse oximeter was not showing any reading. So the doctor wanted me to intubate and ventilate him. I inspected the finger to which the probe was attached. I found that it was fixed nicely with a sticking tape. On careful inspection I found that the probe was only partially covering the distal phalanx. So I removed the sticking tape and the probe. To my surprise the probe had been applied wrongly, e.g. in a reverse fashion. I applied the probe correctly and the pulse oximeter started showing a normal reading. Everybody was speechless. But the incidence highlighted the poor professional training of the staff and the need to improve it.

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