

CAES REPORT

Pneumomediastinitis Following Right Subclavian Vein Central Line Insertion

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Abstract

Background: Complications related to central venous catheters in the intensive care unit can be fatal. **Case Report:** An 18 years old lady with acute myeloid leukemia was admitted to An-Najah National University Hospital for a second course chemotherapy. On the day of admission, central line insertion was planned for starting the chemotherapy. The central line was inserted in right subclavian vein. One hour after the insertion, the patient complained of mild chest pain, difficulty breathing, and mild tachypnea. Anteroposterior chest radiography did not reveal pneumothorax, infiltration, consolidation, or collapse. The chest computed tomography scan (CT) detected anterior and superior pneumomediastinum. Minimal pleural effusion was also detected in the right lung, especially in the dependent area. The tip of the catheter was seen lying free in the left side of the mediastinum indicative of perforation with mild air collection suggestive of pneumomediastinum. The central venous line was removed after proving its

malpositioning. The patient recovered within two days with conservative treatment and a new central venous line was inserted with guidance of ultrasound. Chemotherapy was then resumed. **Conclusions:** This case highlights the importance of inserting the central line under the guidance of ultrasound and the superiority of CT scan over the chest x-ray accuracy in diagnosing the chest complications.

Key words: Pneumomediastinitis, Central vein cannulation, Iatrogenic. Subclavian

Introduction

There has been a dramatic increase in the use of central venous catheters due to their reliability and low rate of complications (1-3). They are also used for administering medications, blood products, nutritional fluids and evaluation of volume status in addition to administration of chemotherapy medications. Pneumomediastinitis is a life threatening condition and has been reported as a central

line catheter-associated complication. We describe a case of 18 years old female patient with acute myeloid leukemia who developed pneumomediastinitis after central vein catheterization with no clear sign thereof her plain chest x ray.

Case report

An 18 years old female patient with acute myeloid leukemia was admitted to An-Najah National University Hospital, Nablus, Palestine, for a second course of chemotherapy. On admission, a central venous catheter line was inserted on the right subclavian vein to start the medication. The patient was well before insertion of the line, with no complains. She had stable vital signs, clear chest, and good air entry to both lungs. Her blood pressure was 120/70 mmHg, heart rate 72/min, SaO₂ of 98%, and normal body temperature. Hemoglobin was 14.1 g/dl, white blood count was 6,500/L, platelet count was 439,000 per μ L and red blood cell count was 124. Serum Na was 141 mmol/L, K was 4.6 mmol/L, serum creatinine was 0.48 mg/dl, urea was 25 mg/dl and BUN was 11.7mg/dl. Liver function tests were normal;

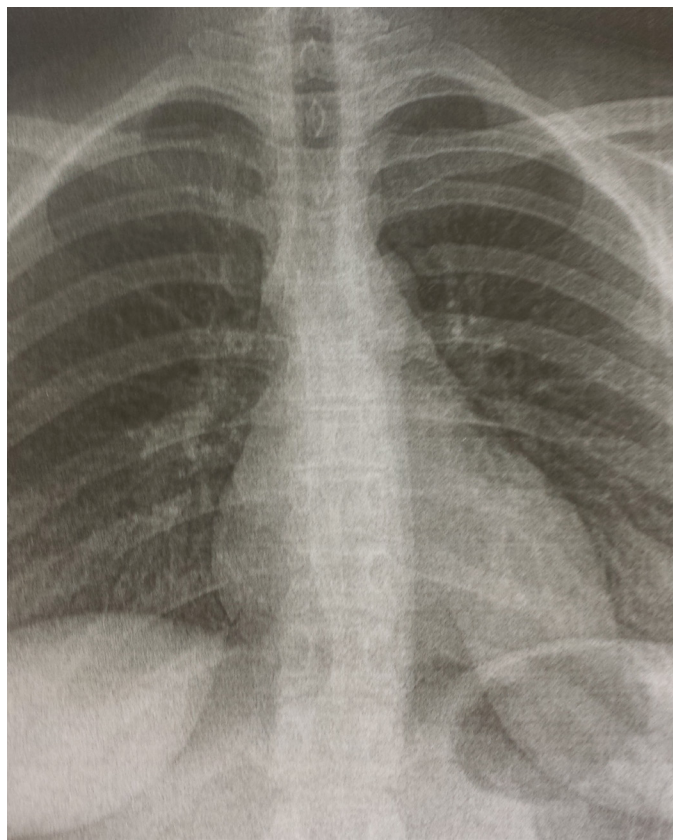


Figure 1. The chest X-ray as a part of the routine examination at the time of admission which did not show any abnormalities.

SGOT (AST) 29.4 units/L, SGPT (ALT) was 10.02 units/L, total plasma protein level was 10.02 g/L and serum bilirubin was 1.28mg/dl. Thirty minutes after insertion of the catheter, the patient started to complain of mild chest pain and difficulty in breathing. On physical examination, she was mildly tachypneic, there was good air entry to both lung fields, no added sounds were noted, her blood pressure was

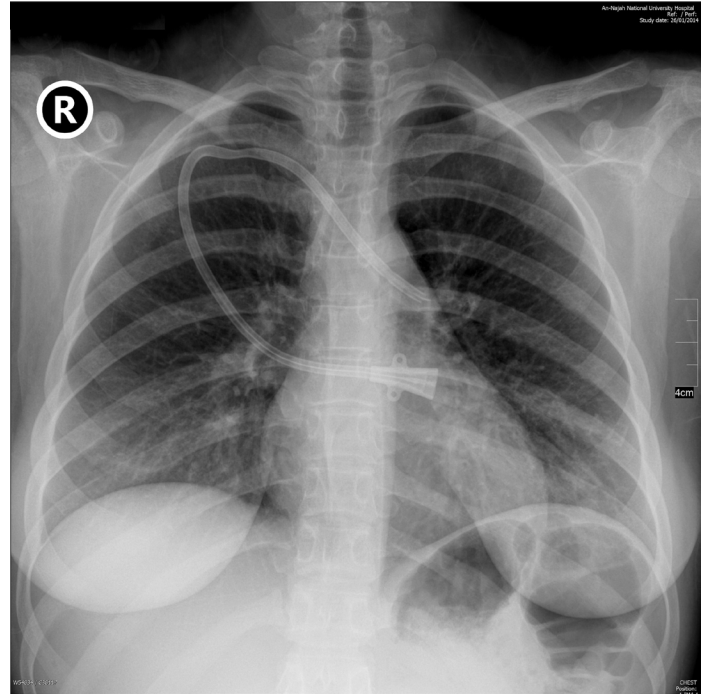


Figure 2. Topogram showing the tip of the catheter was seen lying free in the mediastinum left side as a sign of perforation

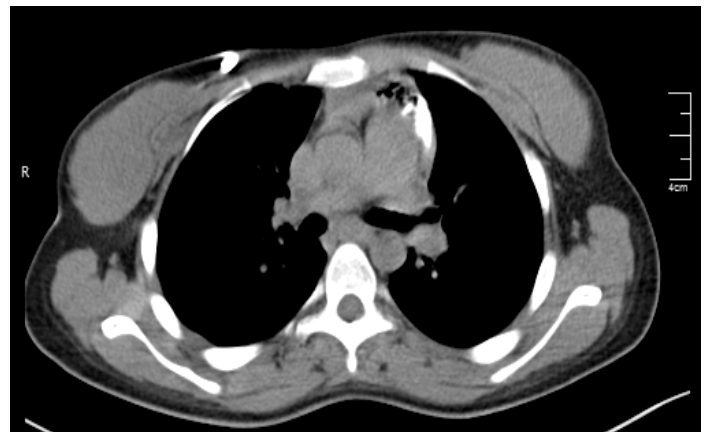


Figure 3. The chest CT scan reported that pneumomediastinum was detected in superior and anterior of mediastinum.

125/80 mmHg, heart rate was 85 per minute, WBC 8000/L, SaO₂ 95% on room air. No swelling or hematoma was noted in the neck. Anteroposterior chest radiography did not reveal pneumothorax, infiltration, neither consolidation nor collapse (Figure 1). Laboratory tests showed an unchanged white blood cell count (6500/L). Other laboratory test results included: Hemoglobin = 13.5 mg/dl, Na = 140 mEquivalents /L, K = 4.5 mEquivalent/L, blood glucose = 112 mg/dl. So considering the negative findings of the chest x-ray and patient's clinical condition chest computed tomographic (CT) scan was deemed necessary. The chest X-ray as a part of the routine examination at the time of admission which does not showed any negative findings. Lung topography was undertaken and it showed the tip of the catheter was seen lying free in the mediastinum left side (Figure 2). The chest CT scan showed anterior and superior mediastinal pneumothorax (Figure 3). Minimal pleural effusion was also seen in the right chest cavity, especially in the dependent area (Figure 4). The tip of the catheter was seen lying free in the mediastinum left side as a sign of perforation with mild air collection as sign of pneumomediastinum. The central venous line was removed after proving its malpositioning. To evaluate the possibility of any cardiac problems or associated complication with the malpositioning of the catheter such as atrial wall rupture, pericarditis or cardiac tamponade, echocardiography was performed. This showed normal heart function and an ejection fraction calculated as 60%. The patient recovered within three days. A new central venous line was inserted under ultrasound guidance and chemotherapy was resumed.



Figure 4: The tip of the catheter was seen lying free in the mediastinum left side as a sign of perforation with mild air collection as sign of pneumomediastinum.

Discussion

Vascular erosion and injury during and after placement of central venous lines have been reported as uncommon complications. There are few studies which investigated the incidence of vascular injury during CVC's. MuKau et al. retrospectively reported on 1058 catheters in 853 patients; the incidence of vascular erosion was 0.4% (3,4). A more recent study by Walshe et al. of 2992 catheters indicated that the incidence was lower at 0.17% (5).

The major advantages of CVC's such as significant lower infection rate, low thrombotic occlusion, greater patient acceptance and being more cost effective in comparison to 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 vein catheterization. Subclavian vein catheter insertion may be associated with unpredicted complications. Several case reports have documented arterial puncture, hematoma hemothorax, pneumothorax, air embolism, catheter-related thrombosis, dysrhythmia, atrial wall puncture, catheter in the wrong vessel, sepsis, fatal cardiac tamponade, and chylothorax which is common on the left side (3-6).

Several studies evaluated the various risk factors for vascular erosion caused by CVC-related complications (6-9). In our case it was proven that the incidence of catheter-related complications by CVC is significantly higher in CVC patients with cancer at baseline compared with non-cancer patients. In one cross sectional study, finding associated to vascular injuries appears 2.5 to 3.6 days after placement of the CV lines (10). In the reported case the mentioned complication was readily diagnosed by attention to the clinical condition and radiologic results. The most probable cause of acute vascular injury in the present case can be a malpositioning of the CVC. The chest X-ray after insertion of the central line did not show any significant complication associated to CVC line tip in the anterior part of the mediastinum as a sequence of wrong way insertion of CV line.

Trauma to head, neck, or chest, due to mechanical ventilation procedures such as dental extractions, tracheotomy, sternotomy, mediastinoscopy, transbronchial needle aspiration seems to be the predominant cause of pneumomediastinitis (11,12). Decompression during

SCUBA diving or air travel. The main mechanism of pneumomediastinitis has been suggested is alveolar rupture with dissection of air into the mediastinum, perforation of esophagus, trachea or 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.

The indication of chest X-ray after the CVC has been debated. When the CVC line is indicated for short term use, knowledge of the radiographic catheter tip is normally not required. Uchida et al. showed that appropriate length of CVC inserted through the right internal jugular vein or right subclavian vein could be estimated by calculated measurement of adding half the length of the right clavicle and the vertical length between the sternal head of the right clavicle and carina; consequently, there is no significant need for a routine chest X-ray after CVC's (13). In another study, clinical symptoms were reported in all patients with pneumothorax requiring specific treatment and approximately half of the post-procedure chest X-rays controls could be avoided using the proposed clinical decision rule to select patients for radiographic evaluation after CVC's (14). In our case, both chest X-ray and CT scan were performed. Clinical condition along with doubtful finding in the chest X-ray obviously indicated the need of a CT scan, however in most of other circumstances 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, the patient prognosis depends upon awareness of the rare possibility of pneumomediastinitis caused by CVC.

In conclusion, pneumomediastinitis should be considered in all patients who receive central venous line insertion. Our report highlighted the importance of assising 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. However initial chest X-ray may or may not be able to locate the catheter tip. If in doubt, CT scan should be ordered to determine the definitive diagnosis. We also recommend the use of real-time ultrasound guidance for the insertion of CVC, which is associated with decreased complications, decreased failure rate, and possibly faster than insertion by a standard landmark technique.

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