

UNEXPECTED TENSION PNEUMOTHORAX COMPLICATED BY DOUBLE-LUMEN CATHETER INSERTION IN PATIENT WITH MECHANICAL VENTILATOR

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ABSTRACT

Introduction: Tension pneumothorax is an emergency situation with a high mortality rate which can be caused by trauma/iatrogenic. We report a case of tension pneumothorax observed after insertion of a double-lumen catheter in a patient on a mechanical ventilator.

Case: A 70 year old man with a mechanical ventilator was designed to install a double-lumen catheter in preparation for hemodialysis. After insertion of a double-lumen catheter, the patient's saturation decreased, breath sounds from the right hemithorax decreased. A chest X-ray shows a collapsed right lung and flattened diaphragm. A needle thoracocentesis was performed at the 2nd ICS, the right mid-clavicular line, and continued with the installation of a WSD at the 5th ICS, the right anterior axilla line. The result is a clinical improvement.

Discussion: Tension pneumothorax is not an uncommon complication in mechanical ventilated patient, but its occurrence immediately after insertion of a double-lumen catheter is extremely rare. Subsequent decline in respiratory and cardiovascular function can be life-threatening if not detected early enough and managed properly. With the needle thoracocentesis and insertion of a WSD tube, the patient's clinically condition significantly improved.

Conclusion: Tension pneumothorax is an emergency situation with a high mortality rate which can be caused by trauma/iatrogenic. With the needle thoracocentesis and insertion of WSD tube, a clinical improvement in the patient's condition was evident.

Keywords: tension pneumothorax, double-lumen catheter, mechanical ventilator

ABSTRAK

Pendahuluan: Tension pneumothorax merupakan keadaan gawat darurat dengan angka kematian tinggi yang bisa disebabkan karena trauma atau iatrogenik. Kami melaporkan kasus tension pneumothorax yang diamati setelah pemasangan double-lumen kateter pada pasien dengan ventilator mekanik.

Gambaran kasus: Seorang pria usia 70 tahun dengan ventilator mekanik direncanakan pemasangan double-lumen kateter untuk persiapan hemodialisis. Setelah pemasangan double-lumen kateter, saturasi oksigen pasien menurun, suara napas dari hemithorax kanan menurun. X-ray dada didapatkan gambaran paru kanan kolaps dan diafragma yang mendatar. Dilakukan tindakan needle thoracosentesis di ICS 2 linea mid-klavikula kanan dan dilanjutkan pemasangan selang WSD di ICS 5 linea axilla anterior kanan. Hasilnya terdapat perbaikan klinis.

Diskusi: Tension pneumothorax bukanlah komplikasi yang jarang terjadi pada pasien dengan ventilasi mekanik, tetapi kejadiannya segera setelah pemasangan double-lumen catheter sangat jarang terjadi. Penurunan fungsi pernapasan dan kardiovaskuler selanjutnya dapat mengancam jiwa jika tidak terdeteksi cukup dini dan dikelola dengan baik. Dengan tindakan

needle thoracocentesis dan pemasangan selang WSD didapatkan perbaikan klinis kondisi pasien secara nyata.

Kesimpulan: Tension pneumothorax merupakan keadaan gawat darurat dengan angka kematian tinggi yang bisa disebabkan karena trauma atau iatrogenik. Dengan tindakan needle thoracocentesis dan pemasangan selang WSD didapatkan perbaikan klinis kondisi pasien secara nyata.

Kata Kunci: tension pneumothorax, double-lumen kateter, ventilator mekanik

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Introduction

Tension pneumothorax is an emergency situation with a high mortality rate which can be caused by trauma or iatrogenic⁽⁶⁾. Patients with mechanical ventilation are more likely to experience tension pneumothorax so that the detection and treatment of pneumothorax quickly and precisely can help minimize patient morbidity and mortality⁽¹⁾.

Tension pneumothorax occurs by a “one-way valve” mechanism of air leakage from the lungs or through the chest wall. Air is trapped in the pleural cavity and quickly collapses the lung. The side of the mediastinum is pushed to the opposite side of the pneumothorax. Signs of tension pneumothorax include: tachypnea, respiratory distress, tachycardia, hypotension, deviation of the trachea away from the side of the pneumothorax, distended neck veins, absence of breath sounds on the side of the pneumothorax, percussion acquired hyperresonance and cyanosis (delayed manifestations), and decreased pulse oximeter saturation. Hypoxaemia and hypercapnia occur in severe cases⁽²⁾.

The diagnosis of pneumothorax in critical illness can be established based on the patient's history, physical examination and radiological examination, although the appearance of a pneumothorax on a supine X-ray may differ from the classic appearance on an upright X-ray^(1,2).

Tension pneumothorax is usually treated in an emergency with a decompression needle (needle decompression or also called needle thoracocentesis) by inserting a large needle catheter into the pleural space (pleural cavity). the location of the puncture in the second intercostal (ICS II) in the midclavicular line⁽²⁾. Thoracostomy is the definitive treatment and uses the negative pressure generated by closed water drainage (WSD). The chest tube is inserted into ICS II or III mid-clavicular line (Monaldi position). The tube can also be placed on ICS IV or V in the anterior axillary line (Bulau position)⁽⁶⁾. Here we present a case of tension pneumothorax immediately after insertion of a

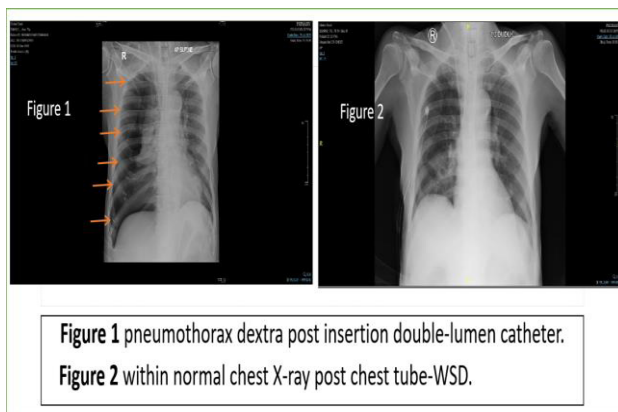
double-lumen catheter in a mechanically ventilated patient.

Case Report

A 70 year old man (height 160cm; weight 43kg) was admitted to the ICU because of unconsciousness and acute renal failure. The patient was scheduled for hemodialysis therapy to improve the patient's hemodynamics. The patient has a history of hypertension and previous ischemic stroke. There was no previous history of diabetes mellitus or lung disease. Drug allergies were also denied.

The patient was intubated using an endotracheal tube measuring 7.5 and the lower limit of the ETT was 20cm and connected to a mechanical ventilator since 4 days of treatment in the ICU. The patient's vital signs were stable with blood pressure 94/79 mmHg, pulse 106x/minute, RR 28x/minute, S SpO₂ 98% with SIMV mode ventilator settings PS 5, PEEP 5, RR 10, FiO₂ 40%. The chest X-ray results showed a normal picture with no infiltrates in both lungs and the heart was not enlarged. The electrocardiogram shows a sinus tachycardia. Laboratory results showed leukocytosis (34,700/microL) and eGR 7mL/min/1.73 m².

The patient underwent a double-lumen catheter in the dextra internal jugular vein and a chest x-ray examination was performed immediately. After insertion of the double-lumen catheter, the patient's saturation decreased dramatically to 82%, the patient's right hemithorax breath sounds disappeared and the results of the patient's chest radiograph showed a collapsed right lung accompanied by a flat diaphragm. The patient immediately underwent an emergency needle thoracocentesis by injecting the largest IV cath (14 G) at the II ICS linea midclavicular dextra, the patient's vital signs improved but the patient's oxygen saturation was persistent at 90% and the patient underwent a WSD chest-tube insertion procedure immediately at the V ICS linea anterior axillary.



The results of a follow-up chest X-ray of the patient showed that there was no pneumothorax with the loss of an avascular radiolucent area on the right chest and a WSD tube with a cranial tip at the level of the 5th right thoracic rib was obtained. The patient's vital signs showed significant improvement with blood pressure 120/89mmHg, HR 119x/minute, RR 33x/minute, temperature 36.4 °C, and SpO2 100% with SIMV mode ventilator PS 10, PEEP 6, RR 8, FiO2 60% .

Discussion

Tension pneumothorax is not an uncommon complication in the mechanically ventilated patient, but its occurrence immediately following insertion of a double-lumen catheter is extremely rare. Once a tension pneumothorax appears, it can cause sudden hypoxaemia followed by hypotension and often spirals out of control leading to cardiac arrest. Therefore, it is necessary to recognize and treat tension pneumothorax quickly so that it can reduce disability and death rates^(1,3,4)

In a study of more than 300 cases of pneumothorax, 56% of cases were traumatic/iatrogenic⁽⁸⁾. Iatrogenic pneumothorax can arise as a complication of various procedures, but the main cause of iatrogenic/traumatic pneumothorax is transthoracic needle aspiration including subclavian venous catheter insertion, thoracocentesis, transbronchial biopsy, pleural biopsy and positive pressure ventilation, even after acupuncture^(3,6,7,8). Burguete et al explained that inserting a subclavian venous catheter has a higher risk compared to

inserting an internal jugular venous catheter. The increased use of real-time sonographic guidance devices for central venous catheter insertion can significantly reduce the risk of pneumothorax in both the subclavian vein and the internal jugular vein⁽⁸⁾.

Iatrogenic pneumothorax can be diagnosed clinically⁽⁶⁾. In this case, there was a sign of a pneumothorax according to Burguete et al, in the form of decreased oxygen saturation (hypoxemia) and also a sign of loss of breath sounds in the right hemithorax. Chest X-ray has long been used for the diagnosis of pneumothorax⁽⁸⁾. Posteroanterior chest radiograph has a sensitivity of 83% for diagnosing pneumothorax⁽⁸⁾ and so far remains the gold standard for diagnosing pneumothorax⁽¹⁾. Hsu et al stated that the chest X-ray shows a radiolucent hemithorax on the affected lung side and an avascular appearance. In one study it was shown that transthoracic ultrasound is more sensitive for detecting pneumothorax compared to chest radiographs^(1,6). Chest CT also has a higher sensitivity than chest X-ray for detecting a pneumothorax but is recommended only in certain cases because it can delay the management of a pneumothorax^(1,5,6).

In this patient, a needle thoracocentesis was performed and continued with the installation of a WSD chest tube. This is in accordance with Hsu et al that most mechanically ventilated patients with pneumothorax require insertion of a thoracostomy tube due to the high risk of tension pneumothorax. In fact, it is not recommended to wait for a chest photo if there are signs of a tension pneumothorax clinically. Prompt needle decompression followed by tube thoracostomy is widely recommended for significant reduction of the pneumothorax with a success rate of 68.6%^(1,6,7,8).

Conclusion

Tension pneumothorax is an emergency situation with a high mortality rate which can be caused by trauma or iatrogenic⁽⁶⁾. Iatrogenic pneumothorax can arise as a complication of various procedures^(3,6,7,8). The

increased use of real-time sonographic guidance devices for central venous catheter insertion can significantly reduce the risk of pneumothorax in both the subclavian vein and the internal jugular vein⁽⁸⁾. Prompt needle decompression followed by tube thoracostomy is widely recommended for significant reduction of the pneumothorax with a success rate of 68.6%^(1,6,7,8).

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