Case Report

Advantage of Ultrasonogram in Perioperative Detection of Pneumothorax

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Introduction

Pneumothorax is a potentially serious complication associated with blunt injury to the chest wall. Diagnosis is usually made with a combination of clinical signs and symptoms which may be subtle, and plain chest radiography. However supine chest x-ray has low sensitivity for traumatic pneumothorax. Diagnosis of pneumothorax in the perioperative area can be difficult due to lack of ready availability of equipments and trained personnel. Ultrasound allows anaesthetist to quickly rule out this potentially life threatening complication in the perioperative period[1].

Case Report

A 32 yr old man was brought to the casualty with history of trauma and blunt injury abdomen with tachycardia-102/minute, hypotension-90/60mmHg, tachypnea-28/minute and oxygen saturation (SPO_2) of 96% with 4 litres oxygen along with diffuse tenderness, guarding and distension of the abdomen. Chest X ray showed multiple ribs fractures on left side with no evidence of hemo/ pneumothorax (Fig 1). With further deteriora tion of haemodynamic parameters, emrgency laparotomy was planned.

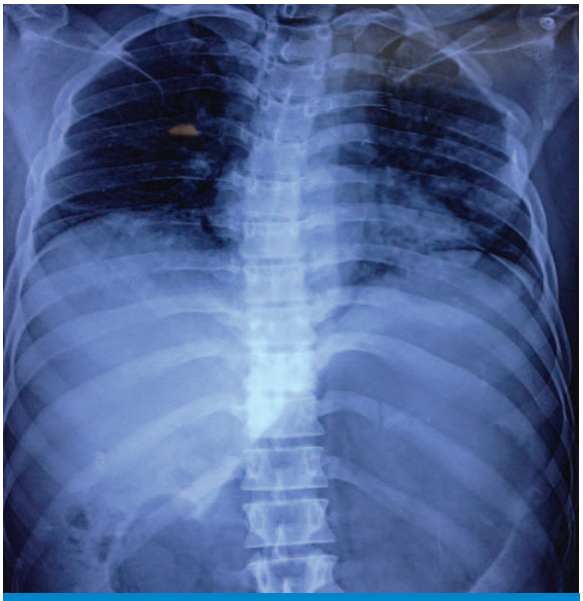


Fig 1 - Preoperative Chest X-Ray

On shifting the patient to the operation theatre, heart rate - 124 /min, non invasive blood pressure - 80/60 mmHg, respiratory rate - 30 /min and oxygen saturation was 85% with 100 % oxygen.With decreased chest wall movement, reduced air entry and a hyper resonant percussion note on left side, pneumothorax was suspected and an immediate bed side ultrasound was done. It confirmed the presence of pneumothorax with typical absence of lung sliding sign seen using brightness mode (B- mode) and barcode sign using motion mode (M- mode).

On insertion of intercostal drainage tube(ICD), gush of air in under water seal was noticed, confirming the presence of pneumothorax. Oxygen saturation improved and air entry increased on left side immediately after ICD insertion. Surgery was commenced as planned under general anaesthesia. Haeomoperitoneum of 2 litres with splenic injury was noticed for which splenectomy was done. With spontaneous and adequate respiratory effort along with stable haemodynamic parameters, patient trachea was extubated and shifted to post anaesthesia care unit with ICD tube in situ for postoperative monitoring. Postoperative chest x-ray shows ICD in situ (Fig 2).

Fig 2- X-Ray After ICD Insertion

Fig 3 - USG - Absence of comet tail sign

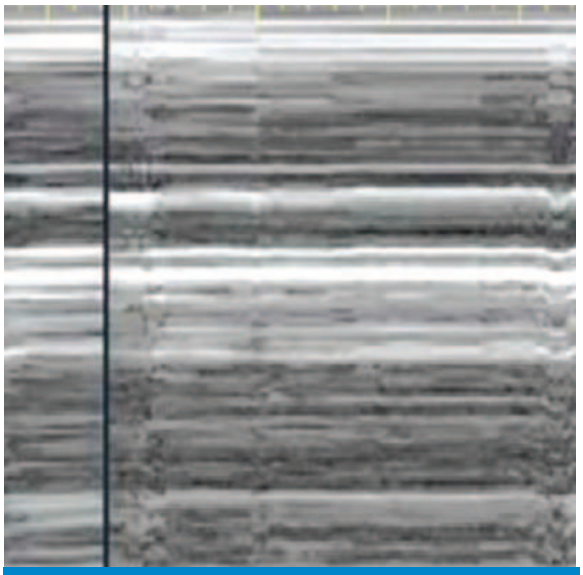


Fig 4 - Barcode Sign

Discussion

Pneumothorax is the presence of air in the pleural space.It can be either spontaneous or traumatic.Traumatic pneumothorax may be due to penetrating and non penetrating chest trauma.Diagnosis of a pneumothorax is based on clinical examination, chest radiography, and computed tomography (CT) scanning[1]. Pneumothorax is an uncommon and potentially dangerous problem, especially during general anaesthesia, when the patient cannot complain of respiratory difficulty or pain, and with positive pressure ventilation, which increases the risk of tension pneumothorax[2]. During the history and examination, the anesthetist should be made aware of any precipitating factors that may put a patient at risk of a pneumothorax. Modalities for pneumothorax detection are not readily available while patients are under general anesthesia. The signs of a pneumothorax in a patient under anesthesia can be nonspecific and difficult to interpret. Signs include difficulty in maintaining adequate ventilation, increased airway pressure, decreased in saturation, hypotension, heart rate changes, distended neck veins, altered breath sounds on the side of the pneumothorax, and possibly unilateral chest expansion with tracheal deviation[3].The application of positive pressure ventilation to even a small asymptomatic pneumothorax can cause progression to a life-threatening tension pneumothorax and addition of nitrous oxide can compound it[1].

Computed tomography is considered to be the gold standard for detecting pneumothorax, but not possible intra operatively because of few drawbacks like transporting patient to the scanner, need for a radiation technologist to perform the scan, time consuming, radiation exposure and cost factor[4].

Traditionally, when a clinician suspects a pneumothorax, a chest radiograph is obtained. Chest radiographs are best at detecting a pneumothorax if obtained with the patient in the upright position,but this is not possible for the patient under anesthesia. Moreover the radiographic appearance of a pneumothorax is dependent on gravity, anteroposterior supine radiographs may detect only a large pneumothorax[5].

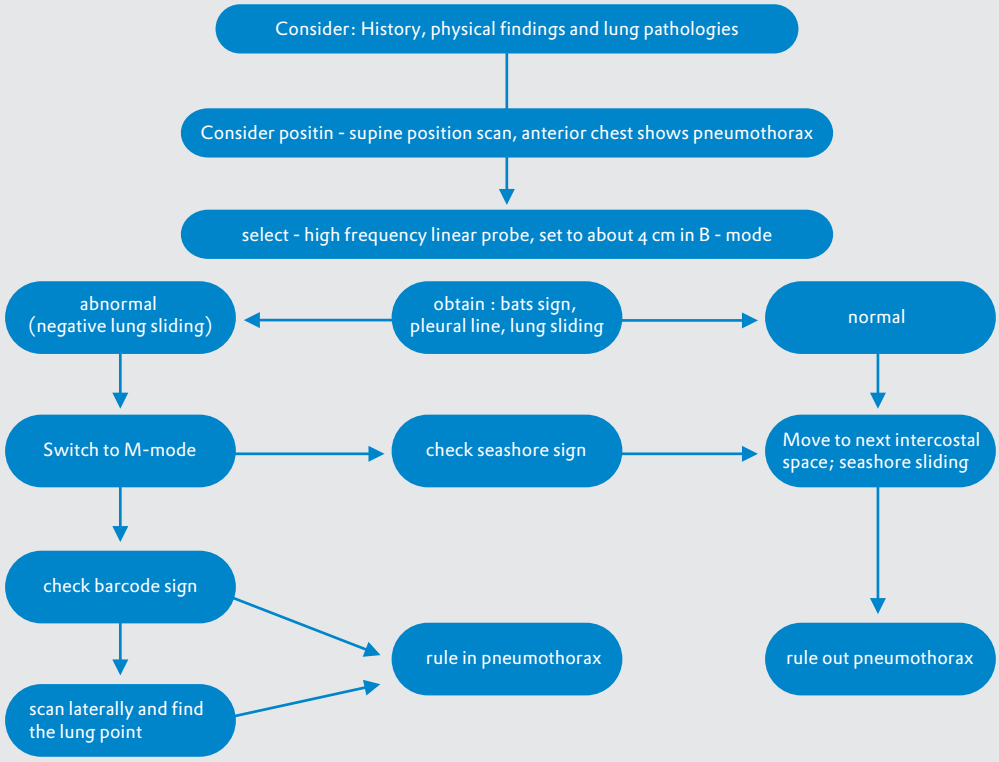
Portable ultrasonography has recently been studied for use in the detection of a pneumothorax. Sonography is a highly effective diagnostic tool that can lead to prompt intervention when life threatening situations arise in the operating room[6]. Bedside ultrasonography is a sensitive screening test for detection of pneumothorax than supine chest radiography in the trauma patient.Ultrasonographic equipment is now easily portable and quickly produces high-quality images[7].

The advantages are decrease in the time it takes to make a diagnosis, omission of radiation exposure to the staff and patient, reduction in cost, completion of diagnosis without the need for a radiologist and ease of use, but with some limitations like, chronic obstructive lung disease can mimic pneumothorax in ultrasound, Sensitivity and specificity can decrease after first 24 hour and in morbidly obese patient, the ultrasound resolution is poor.

Modes In USG

Select a high-frequency linear probe and set the depth to allow viewing of the deep lung area. On most adults this should be at least 4 cm. Begin by selecting B-mode and place the probe on the anterior part of the chest. Obtain the bat sign showing 2 ribs in short axis and identify the pleural line. Check for lung sliding during any respiration(Lung sliding sign, Comet tail sign) (Fig 3). Each time an anomaly is seen, the image should be viewed in M-mode to check for the seashore or barcode sign (Fig 4)[1]. The various modes and its applications are explained in flow chart 1.

Flow chart 1



Pleural line	: Hyperechoic horizontal line indicating the pleural layers
Lung sliding sign	: Dynamic horizontal movement of the pleural line during respiration
Lung point	: Precise area of chest wall where lung sliding stops and is replaced by pneumothorax
Comet tail sign	: Small, vertical tapering hyperechoic lines that diminish distally, caused by air-fluid interface at the pleural line
Seashore sign	: Ground-glass or sandy appearance under the pleural line indicating normal lung tissue
Barcode sign	: Absence of normal seashore sign below the pleural line; replaced with multiple small horizontal lines indicating pneumothorax

Conclusion

The advantages of ultrasonography in diagnosing pneumothorax shows tremendous value to anesthesia providers for use in the operating room and outweigh its few limitations. This case report describes a 32 year old male patient who was posted for emergency laparotomy for blunt injury abdomen, where ultrasound played a vital role in the operating room, diagnosing pneumothorax which was otherwise unidentified. This shows advantages and expanding role of ultrasonography for anaesthetists as an diagnostic, interventional, therapeutic tool in perioperative period.

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