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WJCC mainly publishes articles reporting research results and findings obtained in the field of clinical medicine and covering a wide range of topics, including case control studies, retrospective cohort studies, retrospective studies, clinical trials studies, observational studies, prospective studies, randomized controlled trials, randomized clinical trials, systematic reviews, meta-analysis, and case reports.

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Lung ultrasound for the early diagnosis of acute lung injury: A case report

Xin Zheng, Na Liu

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Abstract

BACKGROUND

The extensive availability of ultrasound (US) technology has increased its use for point-of-care applications in many health care settings. During anaesthesia and surgery, acute respiratory failure or pulmonary oedema are common life-threatening events that, if not recognized and treated appropriately, result in a high mortality rate.

CASE SUMMARY

We report a patient under anaesthesia whose lung US examination showed multiple vertical artefacts (B-lines) in the lung tissue, indicating pulmonary oedema. The respiratory state improved with the resolution of the pulmonary oedema after our treatment.

CONCLUSION

We believe that US of the lungs may be a useful tool for dynamic respiratory monitoring at the bedside during anaesthesia.

Key Words: Lung ultrasound; Acute respiratory failure; Ultrasound; Lung; Case report

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Core Tip: The extensive availability of ultrasound (US) technology has increased its use for points of care applications in many health care settings. During anesthesia and surgery, acute respiratory failure or pulmonary edema are common life-threatening events that, if not recognized and treated appropriately, result in a high mortality rate. We report on a patient under anesthesia whose lung US examination showed multiple vertical artifacts (B-lines) in the lung tissue, indicating pulmonary edema. The respiratory state was improved with the resolution of pulmonary edema after our treatment. We believe that US of the lungs may be a useful tool for dynamic respiratory monitoring at the bedside during anesthesia.

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INTRODUCTION

Lung ultrasound (US) (LUS) is now a standard tool for the diagnosis of acute lung injury (ALI), which refers to a clinical syndrome characterized by bilateral lung injury, severe diffuse failure of the lung, and even hypoxemia[1]. Perioperative lung injury is the main cause of excess health care use, avoidable mortality, and postoperative morbidity[2]. If not recognized and treated appropriately, cases of mild pulmonary injury with nonspecific signs and symptoms would increase the morbidity and mortality rate[3]. Focused US (point-of-care US) is defined as an ultrasonic evaluation at the bedside, where an ultrasonic evaluation is conducted in real time[4]. These images are collected by the anaesthesiologist perioperatively, and they can immediately be integrated into the medical decision-making process. The reported case shows the importance of performing LUS to evaluate respiratory function in the operating room.

CASE PRESENTATION

Chief complaints

On arrival at the operating room, the patient presented with increased respiratory effort.

History of present illness

An 89-year-old man diagnosed with acute intestinal obstruction was scheduled to undergo laparoscopic exploration.

History of past illness

No basic past illness.

Personal and family history

His personal history shows no abnormalities.

Physical examination

His heart rate was 103 beats per minute, his blood pressure was 120/74 mmHg, and his respiratory rate was 22 breaths per minute.

Laboratory examinations

An arterial blood gas analysis was taken immediately, which showed a PH value of 7.25, partial oxygen pressure of 59 mmHg, partial carbon dioxide pressure of 48 mmHg.

Imaging examinations

His chest X-ray on the first day of admission showed no abnormal findings except for mild right pleural effusion (Figure 1). Bedside ultrasonography was performed and displayed the disappearance of lung sliding and the presence of multiple B-lines in both lungs (Figure 2).

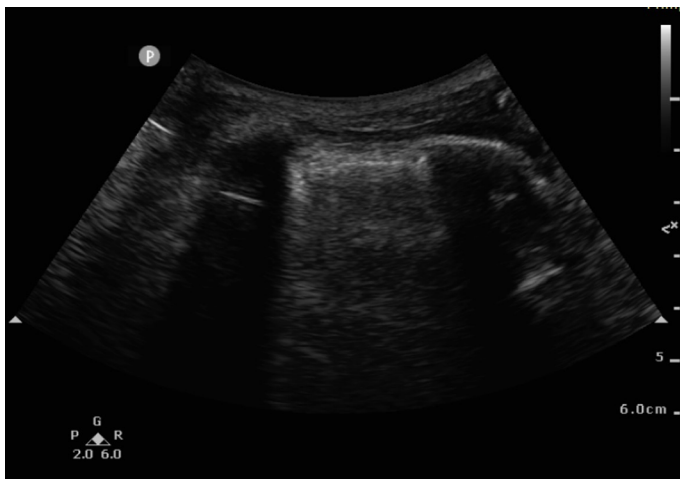
FINAL DIAGNOSIS

We diagnosed pulmonary oedema using sonography.



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Figure 1 Chest X-ray on the first day of admission.



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Figure 2 Ultrasonography shows the presence of B lines.

TREATMENT

Intubation and ventilation were initiated immediately. Controlled ventilation was chosen using FiO_2 100% oxygen and 10-15 cm H_2O positive end-expiratory pressure (PEEP). While the patient was undergoing the lung recruitment manoeuvre with US, we observed that the area of collapsed alveoli reaerated as the PEEP reached 15 cm H_2O . Dobutamine and epinephrine were given after the valve preload, and his haemodynamics gradually stabilized.

OUTCOME AND FOLLOW-UP

After surgery, the patient was sent to the intensive care unit. His respiratory symptoms resolved on the second day (Figure 3), and 100% oxygen was gradually removed. The patient was successfully extubated and discharged after 12 d of hospitalization.

DISCUSSION

The current observational case showed that LUS is an important tool to monitor lung involvement in many different



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Figure 3 A chest computed tomography scan shows the minimal presence of pulmonary oedema on the second day of intensive care unit admission.

situations. Perioperative lung injury complicates postoperative recovery for many patients. The rate of postoperative pulmonary complications is between 11% and 59%, which has led to a significant increase in mortality and morbidity and an increase in the use of hospital resources[5]. Perioperative lung injury includes respiratory insufficiency, gas exchange disorders and pneumonia. Mild lung injury is generally not a threat to life; however, a delayed diagnosis may be harmful because it is associated with compromised circulation and respiration in unstable patients[6].

LUS can be performed at the bedside by an anaesthesiologist in the operating room and can provide accurate images of the lung state with diagnostic and therapeutic relevance[7]. A high sensitivity and specificity of LUS were shown in the diagnosis of pneumothorax and interstitial syndrome[4,8]. Although chest computed tomography (CT) is the gold standard to assess lung involvement[9], it necessitates the transfer of a ventilated patient out of the operating room. CT cannot always be performed promptly. Any delay in the provision of radiological evidence may be deleterious in some instances. LUS examination may be a valid alternative to CT scans[10]. It is not intrusive and is easily repeatable at the bedside, enabling the assessment of lung recruitment following PEEP or any other manoeuvres requiring direct visualization of the lungs.

Lung ultrasonography is useful for the diagnosis and estimation of lung recruitment by PEEP[11]. Several randomised controlled trials reported that patients undergoing laparoscopic surgery receiving 5 cm of H₂O PEEP experienced significantly better oxygenation and less postoperative atelectasis than patients with zero PEEP[2]. Tsubo *et al*[12] used transoesophageal ultrasonography to evaluate the reaeration induced by PEEP of a hyperdense left lower lobe. Researchers noticed that the ultrasonic densities “disappeared” using 15 cm H₂O PEEP for ALI patients. LUS examinations can be used to monitor the responsiveness of each 3- to 4-cm H₂O increase in PEEP until moderate or severe aeration loss becomes normal.

CONCLUSION

As shown by this case report, lung ultrasonography may be a valuable tool to evaluate lung recruitment in real time at the bedside. Intraoperative point-of-care US performed by the anaesthesiologist provides the possibility of assessing lung reaeration in surgical patients. LUS may be an important alternative to chest CT scans in the perioperative setting.

FOOTNOTES

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