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CASE REPORT

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Point of Care Ultrasound Assessment of Hypoxemia

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Abstract

Point of care ultrasound has the advantages of rapid, real-time and radiation-free, and has been widely used in clinical practice. The combination of Bedside Lung Ultrasound in Emergency Protocol (BLUE) and Focus Assessed Transthoracic Echocardiography Protocol (FATE) has good application value in the etiological diagnosis of perioperative hypoxemia. The author combined BLUE protocol and FATE protocol to diagnose perioperative hypoxemia.

FATE protocol: Parasternal long axis, positioning: left sternal margin between the third and fourth costal; Parasternal short axis, parasternal long axis rotated 90 degrees clockwise; Apical four chamber heart section, in the heart beat the most obvious probe to the left shoulder; Under the xiphoid four chamber heart section, probe down to parallel to the xiphoid.

BLUE protocol: The upper blue point: the midclavicle line 2-4 intercostal; Lower blue point: near the nipple; PLAPS point: lower blue point extending to midaxillary line; Diaphragmatic point: the junction of the diaphragm and the midaxillary line.

Abbreviations: PLAPS: Posterolateral Alveolar and/or Pleural Syndrome; NBP: Noninvasive Blood Pressure; PACU: Post-Anesthesia Care Unit; ICU: Intensive Care Unit; CT: Computed Tomography

Case Presentation

The first case

The patient, male, 64 years old, admitted for diagnosis of hypertensive cerebral hemorrhage. He had a history of hypertension for 15 years, had no history of cardiopulmonary diseases. After the operation, the patients were admitted to PACU, and there were no abnormal vital signs. When the patient is awake, NBP is 150/80mmHg, heart rate 65time/min; SPO_2 was 80% after resuscitation in PACU after intracerebral hemorrhage. There were no symptoms of dyspnea such as shortness of breath and irritability, and auscultation showed no obvious abnormality. Bedside lung ultrasound showed multiple B-lines in both lungs and diagnosed pulmonary edema. Furosemide 10mg iv improved gradually, 30min later SPO_2 was 90% and he returned to the ward.

The second case

The patient was a 54-year-old female with no history of cardiopulmonary diseases. Admitted for diagnosis of thoracic vertebra fracture. After thoracic fracture surgery, the patient was awakened in 20 min, the endotracheal tube was removed after meeting the indications, and SPO_2 decreased slowly, 10 min later SPO_2 was 86% and auscultation was normal. Bedside lung ultrasound showed multiple B-lines in both lungs, and cardiac ultrasound showed no abnormality. Acute lung injury and pulmonary edema were diagnosed. Furosemide 5mg iv and methylprednisolone 40mg iv improved gradually and was sent back to the ward.

The third case

A 39-year-old male patient was diagnosed with abscess of lower extremity and underwent emergency abscess incision. He had been diabetic for 5 years. After admission to the operating room, SPO_2 was 90%, heart rate was 120beats/min, blood pressure was 115/60mmHg, and there was no obvious abnormality in lung by auscultation. Bedside lung ultrasound showed multiple B-lines in both lungs, as seen from the figure 1, there are many B-lines on ultrasound, indicating pulmonary edema and cardiac ultrasound showed no abnormality, which was diagnosed as septic acute lung injury. Ambroxol 300mg

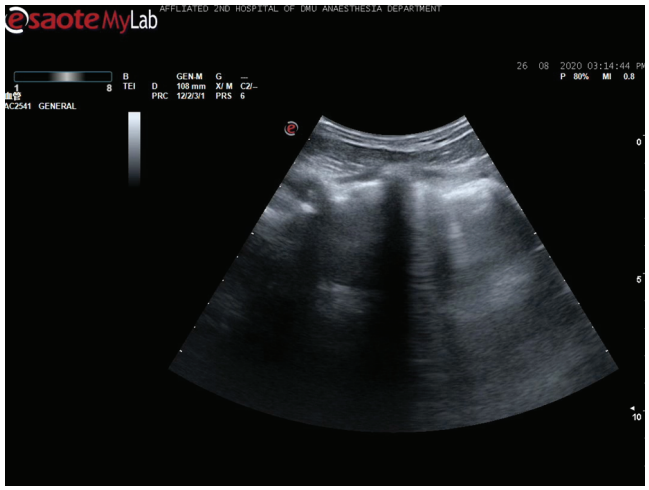

Figure 1: Imagin of pulmonary edema.

was administered intravenously and blood pressure was maintained at 110/60mmHg with norepinephrine. Postoperative SPO_2 was 92%, heart rate was 100beats/min, and blood pressure was 117/55mmHg and was sent back to the ward.

The fourth case

The 82-year-old male patient had left lung cancer surgery and had no history of cardiopulmonary disease. In PACU, SPO_2 was 92% and auscultation was normal. After 30 minutes, SPO_2 decreased to 85%, and the patient complained of dyspnea. Bedside lung ultrasound showed multiple B-lines in both lungs especially the ventilatory side of lung, and cardiac ultrasound showed no abnormality, which was diagnosed as acute lung injury and pulmonary edema. Methylprednisolone was not improved the hypoxemia after 40mg intravenous injection, and was sent to ICU.

Discussion and Conclusion

Perioperative hypoxemia is a major challenge in anesthesia, and the common causes are pulmonary edema, pneumothorax, and atelectasis. Pulmonary edema is common in single-lung ventilation and neurosurgery, pneumothorax is common in laparoscopic operation error, and atelectasis occurs in a high proportion under general anesthesia. The accuracy of auscultation in clinical diagnosis of the above conditions is low, and patient transfer is associated with certain risks, because it is necessary to transfer to CT room for exact diagnosis. Studies have confirmed that bedside ultrasound can quickly diagnose pulmonary edema, pneumothorax and atelectasis, and the accuracy is comparable to CT [1,2].

Point of care ultrasound has been widely used in anesthesia department, emergency and anesthesia intensive care unit, such as acute respiratory distress syndrome and acute respiratory failure [3-5], Among them, Lichtenstein DA, et al. from France actively promoted the diagnosis of pulmonary diseases by bedside ultrasound and proposed the BLUE protocol [6], as of great significance and creates the first ultrasound lung assessment. Focus assessed transthoracic echocardiography protocol, can be used to quickly evaluate cardiac function and is easy to learn [7]. It is suitable for anesthesia and other non-cardiology department.

With the aging of China, the proportion of critically ill surgical patients is increasing day by day. Bedside tools are needed for rapid diagnosis of unexplained hypotension and hypoxemia, and dynamic evaluation of treatment results is naturally better. Patients with critical medical treatment also have difficulty in transportation. Based on experience in critical medical treatment, point of care ultrasound can be used to evaluate patient's volume; pulmonary edema and dynamic assess the treatment effect [8-10]. Combined with cardiopulmonary ultrasound evaluation, the author can quickly diagnose the causes of perioperative hypoxemia and determine the cardiopulmonary function of patients, especially for emergency patients, because the auxiliary examination of emergency patients is not comprehensive enough.

Emergency surgery patients were in critical condition, and common cardiopulmonary function examination items were missing. Such as echocardiography and lung function examination, leading to the patient's cardiopulmonary function is unknown. There are also extremely critical patients who are rushed from the emergency department to the operating room without relevant laboratory tests, known as the green channel. The author participated in the training of china critical ultrasound research group. According to the author's clinical experience, bedside cardiopulmonary assessment can be completed in 5 minutes, which is a very valuable bedside tool.

Point of care ultrasound assessment of cardiopulmonary function has been recognized by experts in critical care medicine and widely used in clinical practice [11], the Chinese Critical ultrasound Research Group (CCUSG) has trained 30,000 students in bedside ultrasound, and the anesthesia discipline should also actively promote the training and promotion of bedside ultrasound technology.

In conclusion, point of care ultrasound can quickly diagnose pulmonary edema and determine the cause of hypoxemia, which has more advantages than auscultation. Point of care ultrasound can provide visual evidence for the diagnosis and treatment of critical patients throughout the whole process, thus influencing clinical decisions and improving clinical outcomes. At the same time, the use of point of care ultrasound should not be limited to a specific profession, procedure or organ system, and can be performed as required [12,13].

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Availability of Data and Materials

The datasets availability from the corresponding author on reasonable request.

Contributions

Yang Haitao, Su Yang collected the data, Xiong Ying, Zhao Linyan, designed the study, Su Yang wrote the paper.

Ethics Approval and Consent to Participate

Ethics approval number: dy2y/2021071.As the study is a retrospective one and emergency, the need for patient consent was waived.

Consent for Publication

Written informed consent was obtained from the patient for publication of this case report and any accompanying images.

Competing Interests

The authors declare that they have no competing interests.

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Not Applicable.

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