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Pneumoperitoneum in a patient with pneumothorax and blunt neck trauma

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ABSTRACT

INTRODUCTION: Blunt trauma as a cause of pneumoperitoneum is less frequent and its occurrence without a ruptured viscus is rarely seen.
PRESENTATION OF CASE: We report a case of blunt neck trauma in which a motorcycle rider hit a fixed object causing severe laryngotracheal injury. The patient developed pneumothorax bilaterally and had pneumoperitoneum despite no injury to the internal viscus. Bilateral chest tube drainage and abdominal exploratory laparotomy was performed.
CONCLUSION: Free air in the abdomen after blunt traumatic neck injury is very rare. If pneumoperitoneum is suspected in the presence of pneumothorax, exploratory laparotomy should be performed to rule out intraabdominal injury. As, there is no consensus for this plan yet, further prospective studies are warrant. Conservative management for pneumoperitoneum in the absence of viscus perforation is still a safe option in carefully selected cases.

1. Introduction

Patients with severe tracheobronchial injuries may present with dyspnea and the clinical signs may include soft tissue emphysema (38%), pneumomediastinum (72%) and pneumothoraces (7%).[1] Pneumoperitoneum is predominantly a radiological diagnosis with several causes including perforated viscus, air entry through the abdominal wall, diaphragm, or the retroperitoneum.[2] However, isolated pneumoperitoneum is exceptionally rare.[1] The intraabdominal pressure exceeds intrathoracic pressure by an average of 20–30 cm H_2O during both inspiration and expiration, therefore simple pneumothorax should not necessarily lead to pneumoperitoneum. On the other hand, patients with tension pneumothorax may develop pneumoperitoneum due to the rapidity of build-up of intrathoracic pressure and therefore, high intrathoracic pressure is required to cause dissection of air through the retroperitoneal space.[3]

The dilemma for surgeons is to decide whether CT-detected pneumoperitoneum in posttraumatic patients with concurrent pneumothorax is attributable to a benign abnormality or does it indicate a potential surgical emergency. Herein, we report a rare case of pneumoperitoneum after blunt traumatic neck injury.

2. Presentation of case

A 45-year-old man who was riding a motorcycle collided with a parked vehicle and suffered major injuries mostly to the face and neck. At the scene, the patient was hemodynamically stable with a Glasgow Coma Scale (GCS) score of 15. Later on, the patient developed signs of respiratory distress that required intubation. The intubation process was difficult with several attempts. On arrival, the vital signs showed pulse of 112/min, respiratory rate 24 min, blood pressure 121/65 mmHg, SaO_2 of 82% and a temperature of 36.3 °C. Chest X-ray showed a sizeable pneumothorax on the right side of chest with extensive subcutaneous emphysema (Fig. 1). Chest tube was inserted and the SaO_2 saturation rose to 96%.

Secondary survey showed multiple facial, and neck injuries, extensive surgical emphysema and abdominal distension. Focused assessment for sonography in trauma (FAST) was inconclusive in the view of artifacts. Initial laboratory findings showed hemoglobin 16.1 g/L, hematocrit 50.4%, white blood cell count $35.5 \times 10^3/\mu L$, platelets 159,000/μL, serum lactate 1.05 mmol/l, pH 7.20, PaO_2 71, $PaCO_2$ 57.3, and base deficit of −6.6. A CT scan head showed normal brain findings, whereas neck CT showed fracture of the hyoid bone and the thyroid cartilage with extensive subcutaneous air (Fig. 2).

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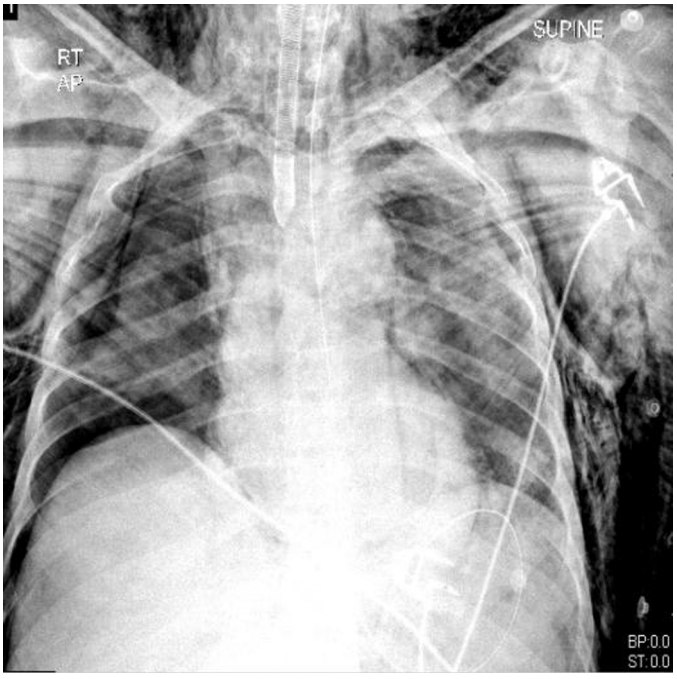

Fig. 1. Chest X-ray showing pneumothorax, extensive surgical emphysema.

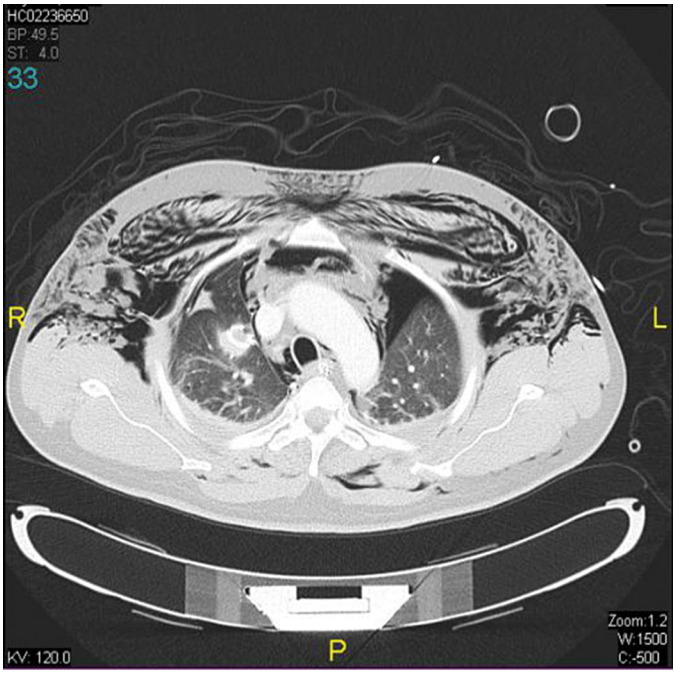

Fig. 3. CT chest showing bilateral pneuomthorax, pneumomediastium and extensive surgical emphysema.

CT chest showed mild to moderate sized pneumothorax of the left side as well with extensive pneumomediastinum and pneumopericardium (Fig. 3). CT abdomen revealed a considerable amount of pneumoperitoneum and no signs of bowel injury (Fig. 4a and b).

A left sided chest tube was inserted to relieve the pneumothorax and the decision was made to perform an urgent exploratory laparotomy to rule out hollow viscus injury. The patient was transferred to the operating room where the pneumoperitoneum was confirmed and careful inspection of the viscera did not reveal any evidence of bowel perforation or solid organ injury and also, the diaphragm was found to be intact.

To rule out vascular injury of the neck, CT angio was done and revealed a left vertebral artery occlusion (Fig. 5), that was treated conservatively using anticoagulation therapy.

A direct laryngoscopy showed edematous airway and so dexamethasone was given for 3 days and the plan was to go for extubation trial and if failed to perform tracheostomy. Two days later, the patient was extubated; however, he could not tolerate the extubation and developed respiratory distress that required re-intubation. The next day, the patient underwent an elective open tracheostomy. After 17 days post admission, the patient was fully ambulatory, eating well and was discharged.

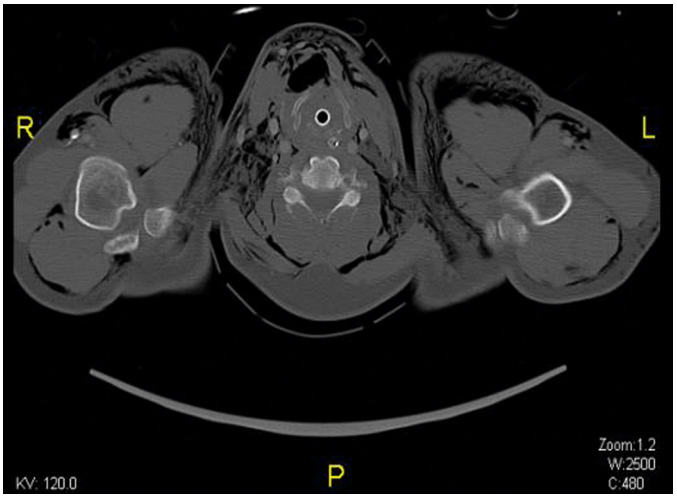

Fig. 2. Neck CT scan at the level of the thoracic inlet showing extensive surgical emphysema, dissection of the fascial planes of the neck and both shoulders.

3. Discussion

The present case report describes a rare case with pneumoperitoneum after blunt traumatic neck injury. The association of pneumoperitoneum with pneumothorax is considered relatively rare.[4] Traumatic pneumomediastinum followed by pneumoperitoneum may occur in up to 10% of post-blunt chest trauma. In more than 95% of cases, it results from air leaking from ruptured alveoli into the interstitial space.[4]

Notably, CT abdomen of our patient showed air within the ligamentum falciform (Fig. 4a) which can possibly be another route for transmission of air from the subcutaneous plane into the peritoneal cavity.

Experimental studies showed that interstitial emphysema develops, when intratracheal pressures exceed 40 cm H_2O, pneumomediastinum develops at pressures of 50 cm H_2O, and combined subcutaneous emphysema and pneumoperitoneum can appear at pressures of 60 cm H_2O and greater.[5] As intrathoracic pressure increases, the air dissects along the sheath of adjacent vessels into the mediastinum. The air can then dissect into various spaces, including the pleural space and along the thoracic great vessels and esophagus into the retroperitoneum, where it may rupture into the peritoneal cavity and cause pneumoperitoneum.[6] Also, rupture of the diaphragm, which is an unusual injury following blunt abdominal trauma, is another possible cause of pneumoperitoneum and must be suspected in all patients with massive trauma.[7]

A ruptured abdominal viscus may occur simultaneously with a pneumothorax in some cases.[3] It has been proposed that in polytrauma cases with combined pneumothorax and pneumoperitoneum, a visceral perforation may have occurred, permitting only the leakage of air and not of bowel contents.[8] The clinical

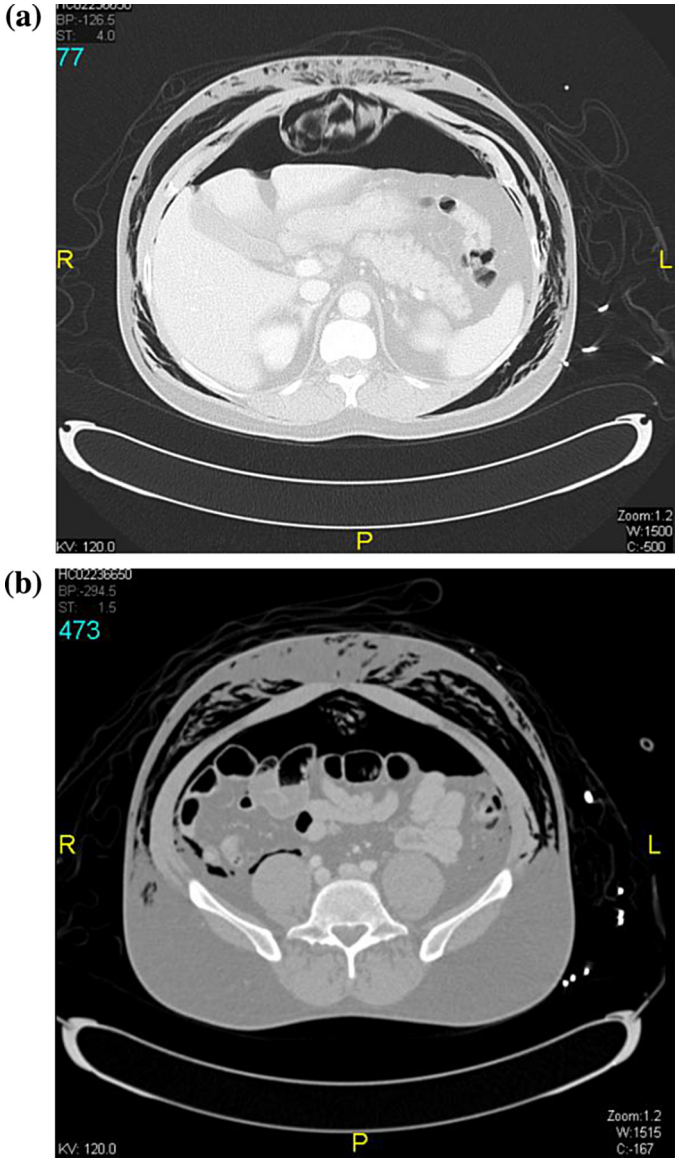

Fig. 4. (a, b) CT abdomen showing pneumoperitinneum and surgical emphysema.

significance and outcomes of CT-detected pneumoperitoneum in blunt trauma patients raise two questions in regards to the source of the free air and the optimal management approach that should be followed. Nishina et al.,[9] suggested non-operative approach in the setting of pneumoperitoneum if the following conditions are present; a thorough physical examination, no peritoneal signs, pneumothorax, negative diagnostic peritoneal lavage and gastrointestinal swallow series, no intraperitoneal effusion on ultrasonography or CT scan and close observation with repeated physical examinations and ultrasonography. In some cases, to rule out bowel leak, imaging with oral contrast may be needed. However, it may not be informative as the leak may be too small, it may have sealed, it may take long time to opacify the bowel, and the patient may be uncooperative.[10]

In the study by Kane and colleagues, approximately 80% of blunt trauma patients with CT-detected pneumoperitoneum did not have an abdominal injury requiring surgery; however, the series in this study was too small to draw a solid recommendation. When there is a question as to whether an operation is warranted in a trauma patient with pneumothorax, pneumomediastinum, and CT-detected pneumoperitoneum, the CT findings need to be assessed

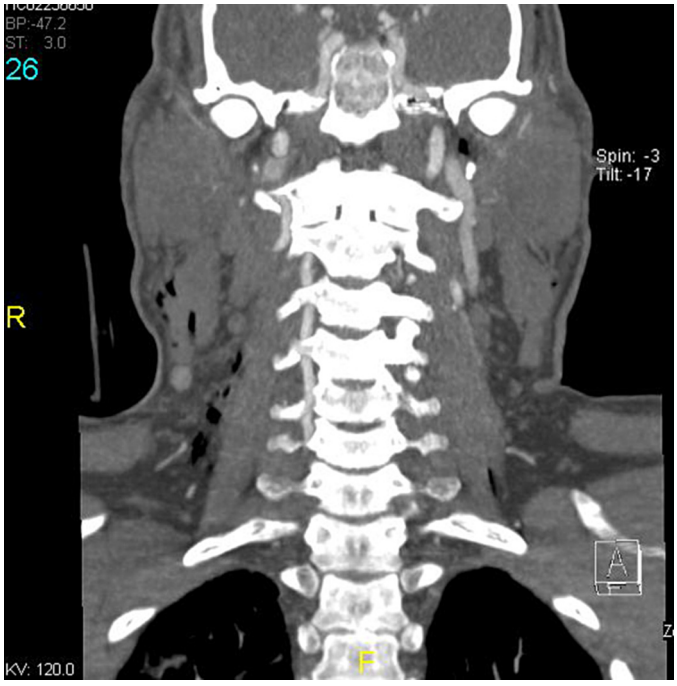

Fig. 5. CT angio: Left vertebral artery occlusion.

very carefully. The classic CT findings that mandate surgical exploration include free peritoneal fluid and mesenteric or bowel wall thickening.[11] Recently, Marek et al.[12] (2014) evaluated 78 cases and concluded that CT scans may detect free air that is not always clinically significant. Of note, free fluid, seatbelt sign or radiographic signs of bowel trauma in the presence of pneumoperitoneum is highly predictive of injury and these patients should be explored. Hefny et al.[13] (2014) showed that free intraperitoneal air found on abdominal CT scan of blunt trauma patients (21 cases) was an unreliable radiological finding for bowel perforation and the decision for laparotomy should be based on combined clinical and radiological findings. Subsequently, they added that conservative management with active observation may avoid unnecessary laparotomy. However, the authors highlighted that their study is a retrospective analysis with small sample size and wide range of confidence intervals of the calculated outcomes and the results have to be read with caution.

Our patient was sick, intubated not suitable for serial clinical examination, the presence of abdominal pain could not be confirmed. The amount of pneumoperitoneum was enormous and it was clearly very difficult to ignore. Although non-operative management was an option, we decided to go ahead with exploratory laparotomy in our case for definite diagnosis particularly as the patient was on mechanical ventilation with high white blood cell count and base excess. We believe that laparotomy was the best approach in this situation based on the fact that complication of missed bowel injury may warrant exploration laparotomy even with equivocal signs.

4. Conclusion

Free air in the abdomen after blunt traumatic neck injury is very rare. In a patient with pneumothorax, if pneumoperitoneum is suspected, exploratory laparotomy should be performed to rule out intraabdominal injury. As, there is no consensus for this plan yet, further prospective studies are warrant. Conservative management for pneumoperitoneum in the absence of viscus perforation is still a safe option in carefully selected cases.

Conflict of interest

The authors of this case report declined to declare any competing interests.

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None declared.

Ethical approval

Medical research centre at Hamad Medical Corporation, Qatar has approved this case report (IRB#14289/14).

Authors' contributions

SYH was involved in study design, data collection and, writing manuscript, HA: data analysis and interpretation, drafting and manuscript review, INM: data analysis, interpretation, and drafting manuscript, HA: study design, data interpretation, and review manuscript, AE: data analysis and interpretation, drafting and manuscript review.

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