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Case report

Veteran player tips the scale — V/Q SPECT-CT proves decisive in blunt chest trauma. Case report and brief literature review

Ewa Witkowska-Patena, Andrzej Mazurek, Mirosław Dziuk
Department of Nuclear Medicine, Military Institute of Medicine

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Abstract

A 29-year-old patient after blunt chest trauma with right lung atelectasis and pulmonary empyema was referred for lung ventilation and perfusion scintigraphy before right-sided pneumonectomy. Radionuclide imaging revealed severely reduced perfusion and lack of ventilation in the collapsed right lung. Additionally, it showed a matching lobar perfusion-ventilation defect in the lower left lobe, which, apart from consolidation area in posterior basal segment, appeared normal in computed tomography. A normal perfusion and ventilation pattern was observed in the upper left lobe. Since it was found to be the only functioning lobe, pneumonectomy was excluded from possible treatment options.

KEY words: lung volume reduction surgery, V/Q SPECT-CT, blunt chest trauma

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Introduction

Blunt chest trauma, with its morbidity of 36% and a mortality rate reaching 77%, is one of the most common causes of death, especially in individuals under the age of 40 [1–3]. Blunt thoracic injuries are responsible for approximately 8% of all trauma admissions, with motor vehicle accidents the dominant (90%) injury mechanism [4]. Blunt chest traumas are usually (70–90%) diagnosed in patients with multiple injuries and only 30% of patients have blunt trauma limited to the chest [2, 4, 5].

The most common lung lesions in blunt chest trauma patients are pulmonary contusions and lacerations, atelectasis, and aspiration of gastric content, blood or foreign bodies [4]. Lung contusions are seen in 17–70% of patients with severe trauma and appear to be one of the most important factors increasing morbidity and mortality rates [6–8].

The diagnostic approach to chest trauma is traditionally based on computed tomography (CT) and X-ray. Though nowadays outdated, ventilation and perfusion (V/Q) scintigraphy can also play a significant role in evaluating posttraumatic pulmonary complications as it yields information on lung function, which the radiological images are lacking [9].

Here we present a case of a multi-organ trauma patient with lung atelectasis and pulmonary empyema in whom V/Q scintigraphy revealed lung abnormalities much more severe than CT scans suggested and thus proved to be decisive in treatment planning.

Correspondence to: Ewa Witkowska-Patena
Department of Nuclear Medicine, Military Institute of Medicine
128 Szaserów St, 04–141 Warsaw, Poland
Tel: +48 22 261 816 117; Fax: +48 22 610 46 44
E-mail: ewitkowska-patena@wim.mil.pl

Case report

A 29-year-old patient after multi-organ trauma suffered a year before was referred to the nuclear medicine department for lung V/Q scintigraphy before right-sided pneumonectomy. A car accident in which the patient had participated resulted in multiple spinal fractures, tetraplegia and blunt chest trauma with bilateral pulmonary contusion and right lung atelectasis. Despite treatment the collapsed lung did not re-expand and subsequent CT scans showed multiloculated effusion in the right pleural cavity, suggestive of pleural empyema. The fluid persisted despite long-term chest tube drainage. The patient started having recurrent fevers and his condition deteriorated. Right lung resection was suggested as a possible treatment and the patient was referred for preoperative lung perfusion scintigraphy.

Hybrid SPECT-CT lung perfusion scintigraphy with technetium-99m-labeled macro-aggregates of albumin (99mTc-MAA) revealed a severely reduced perfusion in the right lung. A matching ventilation defect was seen in Technegas ventilation scans. In

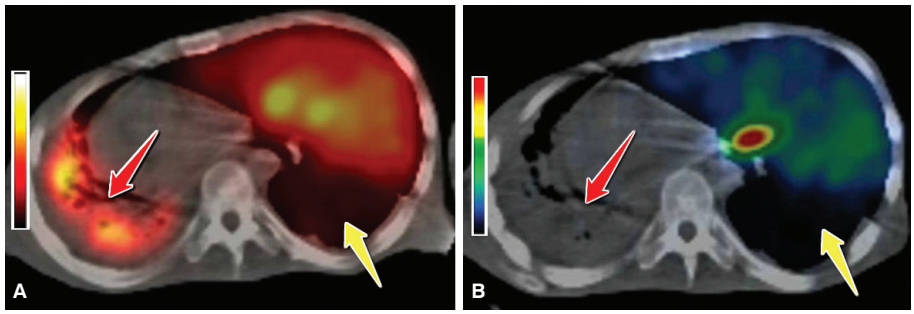

Figure 1. Perfusion (99mTc-MAA) and ventilation (Technegas) SPECT-CT transaxial scans. Perfusion (A) and ventilation (B) SPECT-CT transaxial scans show a collapsed right lung with severely reduced perfusion (A, red arrow) and lack of ventilation (B, red arrow). Matching defect of perfusion and ventilation is present in the lower left lobe (A, B, yellow arrows). The upper left lobe shows a normal perfusion and ventilation pattern

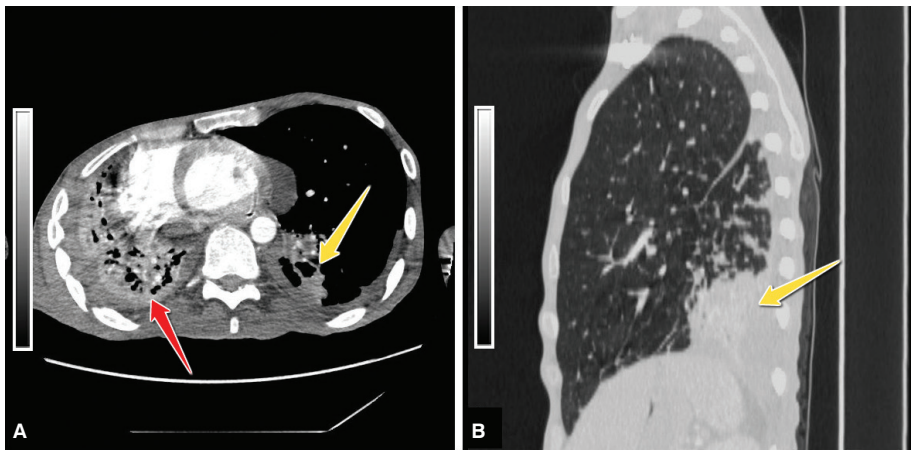

Figure 2. Thorax CT scans. Transaxial thoracic CT scan shows right lung atelectasis with patent bronchi and fluid in the right pleural cavity (A, red arrow). Parenchymal consolidation in the left lower lobe and fluid in left pleural cavity is also observed (A, B, yellow arrows)

low-dose CT scans we observed an almost completely collapsed right lung with air bronchogram, fluid in the right pleural cavity and displacement of thoracic structures to the right (Figure 1A, B). CT scans also showed parenchymal consolidation in the posterior basal segment of the left lung with a small amount of fluid in the left pleural cavity (Figure 2A, B). Otherwise there were no pathological findings. However, perfusion scintigrams revealed an almost complete lack of perfusion in the left lower lobe (Figure 1A, 3A). Technegas scans showed matching ventilation defect in this area (Figure 1B, 3B). The only area with preserved normal perfusion-ventilation pattern was the upper left lobe. As V/Q scintigraphy suggested the patient's gaseous exchange was maintained by a single lobe, which notably increased operative risk, the right-sided pneumonectomy was excluded from possible treatment options.

Discussion

In clinical practice CT scan is the primary diagnostic tool to quickly detect lung injury in post-traumatic setting [10]. However, the utility of nuclear medicine imaging in emergency was also vastly studied [9].

Perfusion scintigraphy may reveal lung contusion as a region of diminished perfusion before radiological changes occur [9]. Esme et al. showed that 99mTc-DTPA (diethylene triamine pentaacetic acid) aerosol clearance rate increases significantly in the

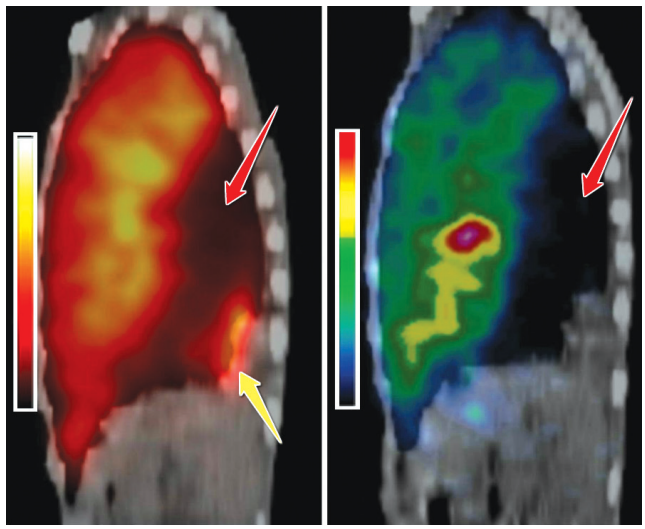

Figure 3. Perfusion (99mTc-MAA) and ventilation (Technegas) sagittal SPECT-CT scans. Matching perfusion-ventilation defect in the lower left lobe is visible (A, B, red arrows). Perfusion in the lower left lobe is preserved only in the parenchymal consolidation area in the posterior lateral segment (A, yellow arrow)

acute period in patients after blunt chest trauma. What is more, this was also observed in patients with normal CT scans suggest-

ing that 99mTc-DTPA lung scan is a more sensitive test to detect mild lung injury. The authors concluded that the scan may serve as a useful adjunct and supportive method to chest CT scan, especially when the clinical status of the patient is not consistent with the chest CT findings [10].

Acute care setting applications of nuclear medicine may also include diagnosing ARDS, inhalation injury, foreign body or gastric contents aspiration, tracheoesophageal fistula and embolic complications of trauma such as thromboembolism, fat embolism and air embolism [9]. In patients after penetrating lung trauma it was proved useful in diagnosing liver-spleen laceration or hematoma, traumatic pleurobiliary fistula, diaphragmatic herniation of the liver as well as posttraumatic intrathoracic splenosis [11–15].

Despite lung V/Q scintigraphy was proven effective, it is radiologic imaging that dominates in emergency setting. However, as lung scintigraphy yields functional information and often provides reliable diagnosis before any radiologic changes occur it should be considered as a valuable adjunct to CT and X-ray. Although auxiliary, it is still in the game.

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Conflicts of interests

No potential conflicts of interests were disclosed.

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