



Traumatic Rupture of the Diaphragm: CT Diagnosis

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A 30 year old man was admitted to the emergency room after a motor vehicle accident. On admission he was fully conscious with a Glasgow Coma Scale score of 15. Initial vital signs showed blood pressure 136/98, heart rate 117 and oxygen saturation 97%. Physical examination revealed bruises and lacerations on the left upper quadrant of the abdomen with mild local tenderness without any peritoneal signs. Breath sounds in the left lung field were diminished. A tender hematoma was noted in the region of the anterior superior iliac spine. The rest of his physical examination was unremarkable. Laboratory tests showed hemoglobin 13.8, hematocrit 40.6, pH 7.375, PO₂ 250 and bicarbonate 23.4.

Insertion of a catheter into the bladder yielded a small amount of urine with a few

blood clots. Chest X-ray in the emergency room demonstrated significant elevation of the left diaphragm, and an air bubble beneath it [Figure A]. These findings were suggestive of diaphragmatic rupture, and thoraco-abdominal spiral computerized tomography was then performed to confirm the diagnosis. Sagittal and coronal reconstructions [Figure B] showed herniation of the stomach and splenic flexure into the thoracic cavity, with the stomach abutting the posterior aspect of the ribs [Figure C], and an associated pulmonary injury – all typical signs of traumatic diaphragmatic rupture. A fracture of the left acetabulum was also revealed.

On explorative laparotomy a 12 cm tear of the left diaphragm was found with herniation of the stomach, transverse colon

and spleen into the thoracic cavity and a small to medium amount of intraperitoneal blood. After reduction of the herniated organs into the abdominal cavity, the ruptured diaphragm was sutured. A chest tube was inserted into the left thoracic cavity. After consulting with a senior orthopedic surgeon it was decided to treat the pelvic fracture at a later stage.

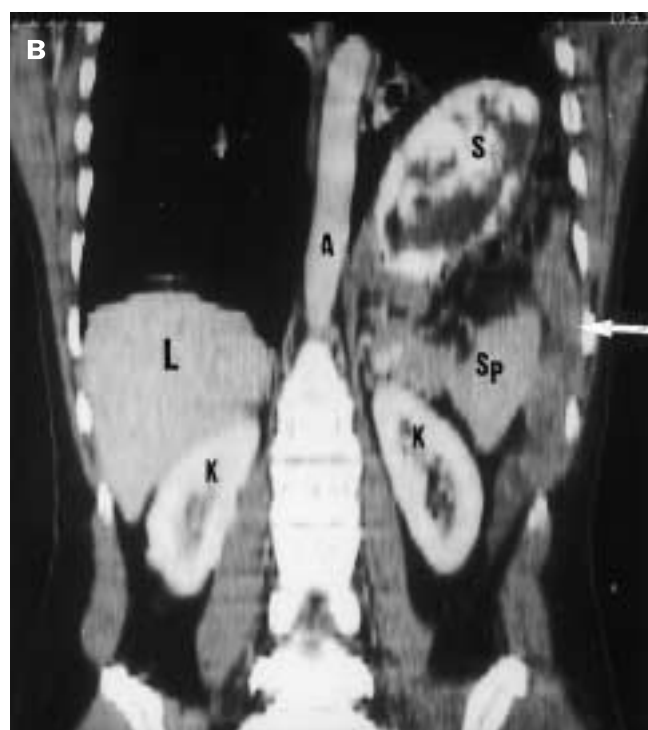
Follow-up chest X-ray immediately after surgery [Figure D] showed an intact diaphragm at the normal level. The patient had an uneventful postoperative recovery.

Discussion

Traumatic rupture of the diaphragm occurs in about 6% of patients who sustain blunt thoracoabdominal trauma. The ratio of left to right-sided injury in blunt trauma is



[A] Chest X-ray shows high position of abdominal organ on the left and lack of distinct contour of the left hemidiaphragm, findings suggestive of rupture of the left hemidiaphragm.



[B] Coronal reconstructions of a spiral contrast-enhanced CT study of the chest and abdomen show the stomach (S) containing contrast material mixed with food, and the left colonic flexure situated in the left hemithorax. A hematoma (arrow) is seen along the lower aspect of the left lateral chest wall (Sp = spleen, A = aorta, L = liver, K = kidney).



[C] Axial CT shows the herniated stomach (S) lying in contact with the posterior left ribs, the "dependent viscera" sign.



[D] Follow-up chest X-ray 1 hour after surgery now shows a distinct contour of the left hemidiaphragm in a normal position.

about 3:1, with 4.5% having bilateral rupture. The left-sided predominance is presumably a result of the position of the liver, which protects the right hemidiaphragm [1,2].

The detection of diaphragmatic injury from blunt trauma poses a diagnostic challenge to both the radiologist and the surgeon. Unless there is a high index of suspicion the injury may be initially overlooked [2]. A conventional chest radiograph serves as the initial evaluation of trauma to the thorax. The finding of stomach or bowel above the diaphragm with a focal constriction at the site of injury is diagnostic of a diaphragmatic injury. This finding, however, may be obscured by pulmonary contusion or aspiration or mimicked by a loculated subpulmonic pneumothorax [3]. Other radiographic findings are non-specific and include elevation and/or indistinct margins of the diaphragm, pleural effusion and contralateral shift of the mediastinum. A possible clue to the diagnosis is the visualization of the tip of a nasogastric tube above the level of the diaphragm.

Spiral CT with sagittal and coronal

reconstructed images is considered the best imaging choice to confirm the diagnosis [4,5]. CT findings include: discontinuity of the diaphragm, an abnormally thickened diaphragmatic crus, herniation of bowel, stomach, or solid organs into the chest, and the "collar sign" [4,5]. This sign is a focal constriction (the collar) of the herniated organ at the site of a diaphragmatic rupture [4]. Another recently described sign is the "dependent viscera" sign: when herniated viscera (bowel or solid organs) are no longer supported posteriorly by the diaphragm, they fall into a dependent position against the posterior aspect of the ribs [1].

Because the sensitivity of any individual sign of diaphragmatic injury is not very high, familiarity with all CT findings of diaphragmatic injury is required and the diagnosis occasionally has to be made on the basis of a single finding [5].

A diaphragmatic injury usually necessitates prompt surgical repair [5]. If the diagnosis is missed or delayed strangulation of hollow viscera may develop. In addition, the pressure difference between the thorax and the abdomen tends to enlarge the rupture, resulting in progres-

sive herniation of the abdominal contents into the thorax [1,5].

References

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