

# Traumatic Rupture of the Right Hemidiaphragm: Scintigraphic Diagnosis\*

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＝ 국문초록 ＝

## 외상성 우측 횡경막 파열의 간신티그램 진단

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외상에 의한 횡경막파열은 신속한 진단이 매우 어렵다. 이는 임상증상 및 일반적인 방사선학적 소견이 특이성이 없고, 많은 다른 외상이 동반되어 임상적으로나 방사선학적으로 진단하기 힘들기 때문이다. 더우기 외상성 횡경막파열은 좌측에 비해 우측에서는 매우 드물다.

저자들은 임상검사와 단순 흉부-X선 사진상에서 진단이 어려웠던 우측 외상성 횡경막 파열등 3예에 대해서 간신티그램을 시행하여 몇가지 특징적 소견을 관찰할 수 있었다. 즉 간신티그램 상에서 관찰된 횡경막파열의 특징적인 소견은 1) 횡경막 탈출에 의한 간우엽의 용기 2) 용기부기저부의 예각형성 그리고 3) 횡경막교약에 의한 띠모양의 냉소이었다. 그러나 이들 3가지 소견은 반드시 모두가 나타나지 않을 뿐만 아니라 같은 환자에서도 신티영상의 촬영방향에 따라 나타나는 수도 있고 나타나지 않을 수도 있었다. 그러므로 우측 횡경막내 외상성파열로 인한 간등의 허니아를 진단하기 위해서는 다각도로 신티영상 촬영을 하여야 할 것이다.

### Introduction

Diaphragmatic rupture complicating blunt trauma is often not promptly recognized after injury. Early diagnosis is compromised by lack of specific clinical signs and plain film findings or the presence of multiple injuries which may confuse clinical evaluation. Moreover, traumatic rupture of the right hemidiaphragm is far less frequent than that of the left hemidiaphragm, accounting only 8% to 30% of all traumatic rupture of the diaphragm<sup>1)</sup>.

We report 3 cases of the traumatic rupture of the right hemidiaphragm, which showed characteristic appearance of scintigraphy. Hepatic scintigram is very useful method for the diagnosis of the traumatic right hemidiaphragmatic hernia.

### Case Reports

**Case 1.** A 45-year-old woman was admitted with multiple injuries due to a pedestrian traffic accident. There were diffuse tenderness in the upper abdomen and multiple contusions in the right lower thorax. Fracture of the right distal femur was also noted. Chest radiography showed moderate elevation of the

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right hemidiaphragmatic contour with mild blunting of the right costophrenic sulcus (Fig. 1-A). A subsequent hepatic scintigraphy revealed a round superior bulging of the right hepatic lobe with acute angulation at the base on the anterior and RAO images. In addition, there was a band-like photon defect at the

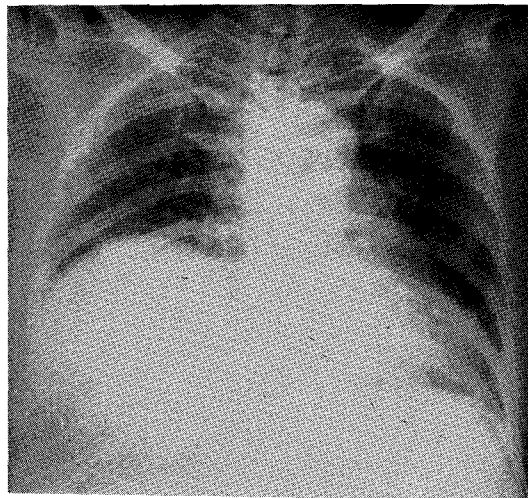


Fig. 1-A. AP chest showing elevation of the right hemidiaphragm with mild blunting of the right CPS.

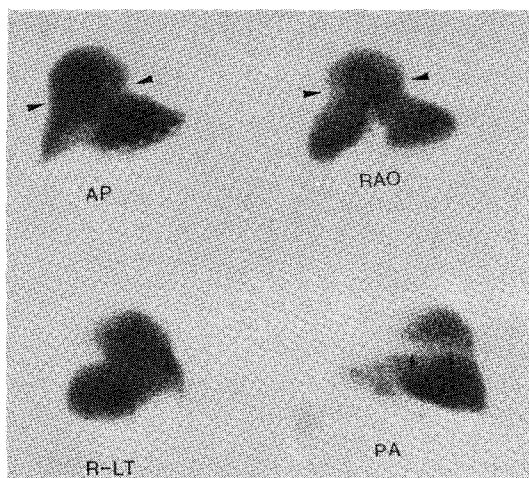


Fig. 1-B. Hepatic scintigram showing a superior bulge with a ring constriction of the right hepatic lobe on AP and RAO images (arrow heads). There is a band-like photon defect at the neck of the superior bulge on posterior image (arrows).

neck of the bulge of the right lobe on the posterior image (Fig. 1-B). At surgery, an 8-cm linear tear was found in the right hemidiaphragm with herniation of the liver through the rent. The liver was unremarkable except small laceration in the right dome.

**Case 2.** A 58-year-old woman was admitted with stuporous mentality following an automobile accident. Physical examination revealed multiple abrasions and swelling on the right frontal and temporal areas. The abdomen was soft and nontender, but mildly distended. There was a fracture involving the right distal tibia. A brain CT showed a small epidural hematoma at the right parietal region. A chest radiography showed apparent elevation of the right hemidiaphragmatic contour without evidence of other abnormality (Fig. 2-A). A hepatic scintigraphy demonstrated round bulge of the right lobe with a ring-like constriction of the base of the bulged portion in the anterior and RAO images (Fig. 2-B). At operation, a 10-cm long linear laceration was noted to involve the right hemidiaphragm with protrusion of the right hepatic lobe into the thorax.

**Case 3.** A 58-year-old woman was struck by a car in the right hip, and brought to the emergency room. There was tenderness at the right hip and

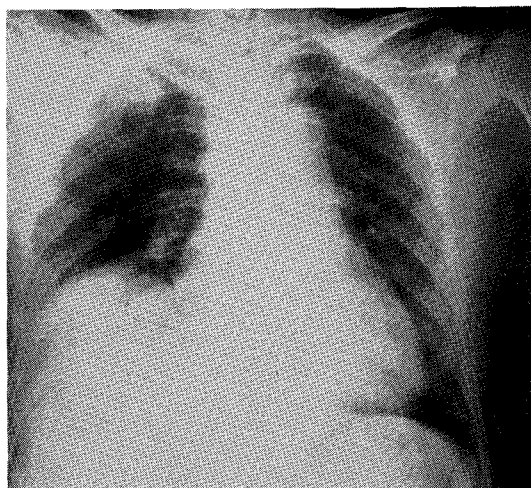


Fig. 2-A. AP chest showing elevation of the right hemidiaphragmatic contour.

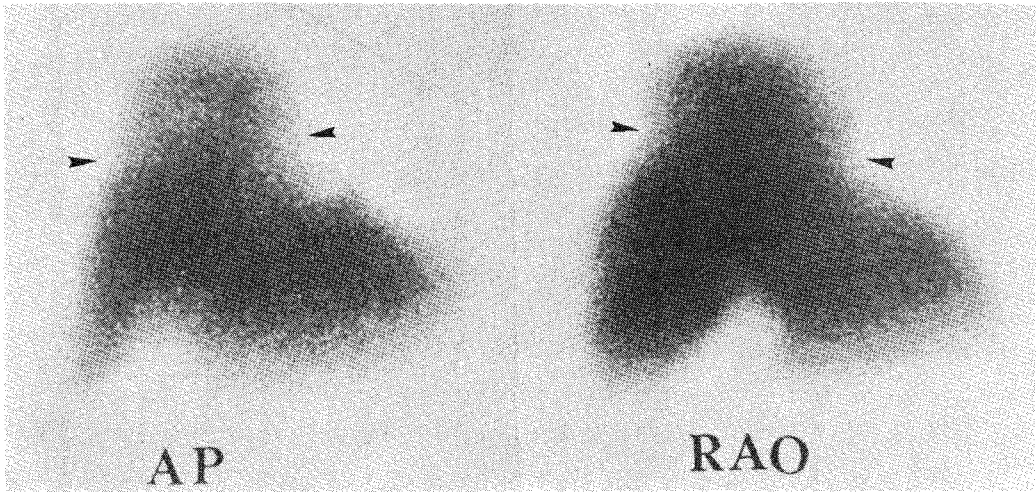


Fig. 2-B. Hepatic scintigram showing abnormal elevation of the right hepatic lobe with a ring of compression (arrow heads). No band-like photon defect was not demonstrated in this case.

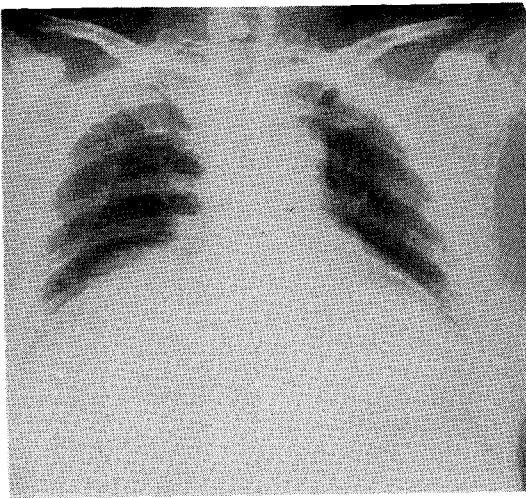


Fig. 3-A. AP chest showing lobulated elevation at the medial aspect of the right hemidiaphragm.

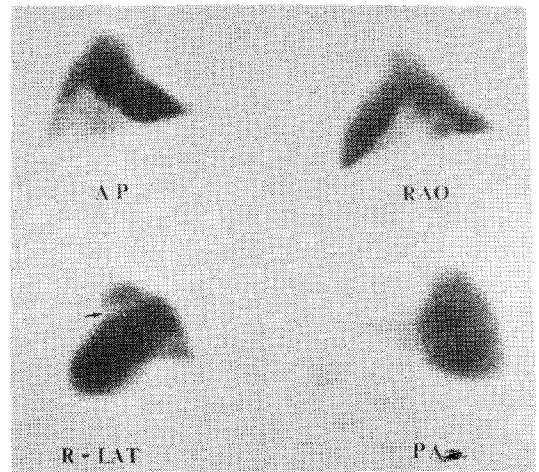


Fig. 3-B. Hepatic scintigram showing characteristic bulge with a ring of constriction on all of images. There is a band-like photon defect at the neck of the superior bulge on right lateral view (arrow).

thigh. The initial chest radiography showed no evidence of definite abnormality. Under the diagnosis of subtrochanteric fracture of the neck of the right femur, open reduction was performed. Ten days after operation, dyspnea and shortness of breath developed. Follow-up chest radiography showed a lobulated elevation of the right hemidiaphragmatic contour at the medial portion (Fig. 3-A). A hepatic scintigram disclosed bulging of the dome of the right

hepatic lobe with a ring-like constriction at its base and band-like photon defect on the right lateral image (Fig. 3-B). At operation, an 8 cm long transverse tear accompanied by herniation of the small bowel loops and the right hepatic lobe were found.

## Discussion

The incidence of diaphragmatic rupture in patients dying with multiple trauma is 5.2%<sup>1)</sup>. This condition is caused by either penetrating or blunt trauma with penetrating injury having more common<sup>2-4)</sup>. Rupture of the left hemidiaphragm is 10 to 20 times more common than that of the right hemidiaphragm. The rarity of the right-side involvement is explained on the basis of the buffering effect of the liver<sup>1-6)</sup>.

Since the delay in operative repair increases the morbidity and mortality, the importance of early recognition of the diaphragmatic rupture has been emphasized<sup>2,6)</sup>. Because of the attention to other serious injuries, the paucity of physical signs and clinical symptoms, and the ambiguity of radiologic findings, the early diagnosis of diaphragmatic injuries is often delayed<sup>1,2,4,6-9)</sup>.

In the right-sided tears, since the liver frequently seals the laceration and prevents the herniation of other abdominal viceras, the preoperative diagnosis is missed more frequently<sup>1,2,6)</sup>. To make an early diagnosis of rupture of the right hemidiaphragm, a high idea of suspicion should be maintained in cases of blunt trauma, where clinically there are pain in the right upper quadrant, where there is an elevation of the right hemidiaphragm on chest radiography, or where there are rib fractures in the right lower thorax<sup>2,4-6)</sup>.

To establish the early and definitive diagnosis, various radiologic methods have been used such as the chest radiography, ultrasonography, liver scintigraphy or computed tomography<sup>1-6,8,9)</sup>. Suggestive radiographic findings of the chest radiograph include an apparent elevation of the right hemidiaphragm, changes in the right lower lung usch as atelectasis, contusion, hemothorax or pneumothorax and diminished movement of right hemidiaphragm<sup>1-6)</sup>.

Hepatic scintigraphy is a safe, efficacious, and accurate means to diagnose rupture of the right hemidiaphragm with hepatic herniation by demonstration not only the abnormal bulge superiorly of the liver, but the ring of constriction where the liver was firmly wedged through the laceration<sup>2-6)</sup>. But a band-like photon defect area created by constriction of the diaphragm at the site of herniation can not be seen on all views of the liver scintigram.

The 3 cases of traumatic rupture of the right hemidiaphragm reported in this paper showed characteristic appearance of the herniated liver by hepatic scintigraphy. The scintigraphic findings were a bulge superiorly of the right hepatic lobe with a ring of constriction and a band-like photon defect area created by the constriction of the diaphragm at the site of herniation. The last finding was seen on the particular view, not all view, of the liver scintigraphic images.

In conclusion, (1) hepatic scintigraphy is very useful modality in the evaluation of elevated diaphragm following multiple injury for the diagnosis of diaphragmatic hernia; (2) scintigraphic findings of the right hemidiaphragmatic hernia are superior bulging with a ring constriction and band-like photon defects at the neck of the bulge; and (3) these specific findings were shown only on the particular view, requiring multidirected images

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