INTRODUCTION

Intrathoracic ectopic liver is a rare condition (1-4). In most patients, it is found incidentally during chest radiography as a mass usually located in the right lower area of the thorax adjacent to the diaphragm, although ectopic liver on the left side of the thoracic cavity is also reported (4). Intrathoracic ectopic liver is usually associated with congenital diaphragmatic defect, mimicking a lung mass on CT scan (5). In these patients, percutaneous transthoracic biopsy or surgery is necessary to exclude bronchogenic cancer.

A finding of intrathoracic ectopic liver in the presence of an intact, normal diaphragm is an extremely rare congenital anomaly, with only 18 reports to date in the English literature (6). However, there are no radiologic reports of intrathoracic ectopic liver without diaphragmatic defect using dynamic chest CT. We described a patient with intrathoracic ectopic liver without diaphragmatic defect that appeared as a subpleural mass abutting the diaphragm with isodense enhancement to liver tissue during arterial and delayed phase images on dynamic chest CT.

CASE REPORT

A 37-year-old woman visited our hospital due to indigestion. She had no respiratory symptoms. Colonoscopy showed a small benign polyp in her colon.

Chest radiographs showed a 3.5 × 3 cm sized mass that was round in shape with smooth margins, in the lower lobe of her right lung (Fig. 1A). Unenhanced and contrast-enhanced 16-multiphasic detector CT (MDCT) (LightSpeed, GE Healthcare, Milwaukee, WI, USA) of the chest was obtained by using multi-detector row CT with 120 kVp, 70 mA, 2.5-mm collimation, a pitch of 6, and a reconstruction interval of 2 mm. The data were reconstructed with a 2.5-mm section thickness for the transverse scan and with...
a 1.2–2.0-mm section thickness for the coronal scans. The round region of interest (ROI) was adjusted to encompass as much as possible of the portion of the mass on the unenhanced, arterial, and delayed CT scans, and the mean CT attenuation value was subsequently calculated. Each ROI measurement was performed twice by 2 investigators (Lee and Ryu). On unenhanced CT scans, the lesion had a density of 54 ± 4.3 Hounsfield units (HU), similar to liver tissue (Fig. 1B). Arterial phase enhancement images were obtained 45 seconds after administration of 100 mL of iodinated contrast agent (Iopromide, Ultravist 300, 300 mg/mL, Schering, Berlin, Germany) at a rate of 2 mL/min (Fig. 1C), and delayed phase enhancement images were obtained 90 seconds after administration of contrast agent with coronal reconstruction (Fig. 1D).

Chest CT with arterial phase enhancement showed a solid mass of 74 ± 4.8 HU with a smooth surface abutting the diaphragm (Fig. 1C). Coronal reconstruction images with delayed phase enhancement showed a solid mass of 88 ± 5.0 HU (Fig. 1D). CT showed a subpleural mass abutting the liver with isodense enhancement to liver tissue during the arterial and delayed phases. The mass abutted the diaphragm at acute and obtuse angles (Fig. 1D). Intrathoracic ectopic liver is very rare, hence, in the differential diagnosis of the patient, we suspected an intrapulmonary mass such as a carcinoid tumor or pleural tumor such as localized fibrous tumor of pleura. A percutaneous transthoracic lung biopsy to obtain a definitive diagnosis, showed that the mass was composed of hepatocytes without significant pathologic abnormalities. We therefore performed surgery to exclude a malig-

Fig. 1. A 37-year-old woman with intrathoracic ectopic liver.
A. Chest radiograph showing a 3.5 cm sized mass (arrow) in the lower lobe of the right lung. The mass is ovoid in shape with smooth margins.
B. Transverse unenhanced CT scan showing a lesion (arrow) with a density of 54 ± 4.3 Hounsfield units, similar to liver tissue.
C. Chest CT with contrast enhancement showing mass with smooth margins (arrow) abutting the diaphragm and liver. The mass and liver are isodense during the arterial phase.
D. Coronal reconstructed chest CT with contrast enhancement during the delayed phase showing a subpleural mass (arrow) abutting the diaphragm with isodense enhancement to liver tissue.
E. Intraoperative view showing the ‘mushroom-like’ appearance of the intrathoracic ectopic liver (arrows) over the diaphragm.
F. Histological examination, showing that the lesion is relatively well encapsulated (arrow), with histologic features similar to those of normal hepatic parenchyma (hematoxylin and eosin stain, × 40).
G. One year follow-up coronal MRI with half-Fourier acquisition single-shot turbo spin-echo showing a small amount of focal fluid collection of high signal intensity (long arrow) at the site of previous masses on a hypointense thin band of the intact diaphragm (short arrow).
nant condition. We observed 2 masses with thin capsules located on the diaphragm that measured 3.5 × 3 cm and 2.0 × 2.0 cm, respectively (Fig. 1E). The masses were separate from the lung and liver, and the diaphragm showed thinning without defect. The masses abutting the diaphragm were completely removed. The final pathologic report showed that the mass was composed of liver tissue, indicating an intrathoracic ectopic liver (Fig. 1F). After 1 year follow-up, coronal MRI using the half-Fourier acquisition single-shot turbo spin-echo (HASTE) technique showed the intact diaphragm with focal fluid collection (Fig. 1G).

**DISCUSSION**

Ectopic liver is uncommon, but when it occurs, it is often found in the abdominal cavity in the vicinity of the liver, gallbladder, spleen, pancreas, umbilicus, adrenal glands, omentum or surface of the peritoneum (1-3). Due to their defective arterial supply and venous and biliary drainage, ectopic livers may be more prone to hepatocarcinogenesis than normal livers (7). Thus, surgical removal is recommended.

Ectopic livers are classified into 4 types by Collan et al. (8). These consist of 1) an accessory lobe of the liver of considerable size and with a connecting stalk to the liver, 2) a small accessory lobe of the liver attached to the liver, 3) ectopic liver located without connection to the liver, and 4) microscopic ectopic liver tissue. The case described herein, was a class 3 ectopic liver.

The literature suggests several possible mechanisms for development of ectopic liver without diaphragmatic defect. In patients with ectopic liver with connection such as a transdiaphragmatic pedicle and/or diaphragmatic hernia, ectopic liver without diaphragmatic defect could develop with atrophy or regression of the original connection. Another possibility could be the development of an entirely separate liver bud independent of the main hepatic diverticulum without any prior connection (9).

Several methods can establish a diagnosis of intrathoracic ectopic liver. For example, CT combined with percutaneous transdiaphragmatic lung biopsy may be sufficient to establish a diagnosis and exclude a malignant condition (5). CT showing solid intrathoracic masses abutting the diaphragm with isodense enhancement to liver tissue is suggestive of ectopic liver tissue or herniated liver (5). We therefore performed dual phase CT scans, similar to liver protocols with arterial and portal venous phase. Enhancement patterns during dual phase and coronal reconstruction images may be helpful in establishing a diagnosis of ectopic liver. Dual phase CT scans with multiplanar reconstruction using MDCT are suggestive of intrathoracic ectopic liver.

However, chest CT may not provide information on the connection between the mass and the liver, or a diaphragmatic defect, because CT cannot show a difference in density between the liver and diaphragm.

MR imaging can provide higher contrast resolution than CT. The HASTE technique can directly visualize the diaphragm and facilitates easy detection of a diaphragmatic defect (10). MR imaging using T1-weighted spin-echo sequence is optimal to evaluate the diaphragm, because the diaphragm appears as a hypointense thin band of soft tissue (10). The use of liver specific contrast agents such as superparamagnetic ferumoxide may provide a tissue-specific diagnosis (5). Iso-signal masses on the liver and intact diaphragm are reportedly detected on MR imaging (3, 10). T1- and T2-weighted MR images may show iso-signal intensity between the mass and liver. The diaphragm is directly visualized on HASTE MR imaging, as observed at the 1 year follow-up in our patient. MR imaging might thus be the best method to simultaneously detect intrathoracic ectopic liver and diaphragmatic defect.

In conclusion, we described a patient with intrathoracic ectopic liver mimicking a solitary pulmonary nodule. CT showed subpleural masses abutting the diaphragm with isodense enhancement to liver tissue during arterial and delayed phase images.

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횡격막 결손이 없는 환자에서 황곽 내 이소성 간: 증례 보고

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저자들은 횡격막 결손이 없는 환자의 황곽 내 이소성 간 증례를 보고한다. 황곽 내 이소성 간은 단순황화 사진에서 우연히 발견되었다. 황화 역동적 전산화단층촬영 사진에서 횡격막과 붙어 있는 황막하 종괴로 동맥기 영상과 지연기 영상에서 간 조직과 동일한 정도의 조영증강을 보여 황곽 내 이소성 간을 시사하였다.

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