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Imaging of acquired transdiaphragmatic fistulae and communications

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ABSTRACT

Acquired diaphragmatic defects occur secondary to trauma, infection, surgery or neoplasm. These defects can lead to abnormal thoraco-abdominal fistulous communications also. Examples of surgically created diaphragmatic defects are omental, colonic interposition and vascular grafts. Regardless of etiology, these transdiaphragmatic communications provide a direct path for spread of pathology between the abdomen and thorax. If left untreated and unrecognized, these fistulae portend a high morbidity and mortality. Subtle but important diagnostic clues can be present on imaging. This pictorial essay describes commonly encountered imaging findings seen with acquired transdiaphragmatic communications. This knowledge will improve diagnostic confidence of the interpreting radiologist in acute situations and confounding clinical scenarios.

1. Introduction

Transdiaphragmatic communications are thought to be rare with < 100 cases reported in the literature for some of these entities. Fistulae represent abnormal communications between two epithelium-lined surfaces and can be congenital or acquired in etiology [1]. When these occur across the diaphragm, abdominal disease processes can extend into the thorax and vice versa. Over the following paragraphs, we will discuss acquired transdiaphragmatic communications, which can occur in the form of fistulae, hernias, iatrogenic or surgically created conduits.

Diagnosis of transdiaphragmatic fistulae (TDF) is often difficult (Fig. 1A–F). Clinically, pleural fluid analysis often provides the first clue to identification of these fistulae with gastrointestinal pathogens, acidic, biliary or pancreatic contents identified in the pleural fluid aspirate. Associated radiographic findings are often subtle. A multidisciplinary approach is central to disease identification and therapeutic planning. Besides cross-sectional imaging such as CT and MRI, occasionally other imaging modalities such as fluoroscopy and nuclear medicine can have an important role in the definitive diagnosis.

This pictorial essay is a description of the characteristic imaging findings of these under recognized entities. In this essay we will discuss epidemiology and treatment strategies where appropriate (Table 1).

2. Acquired transdiaphragmatic fistulae (TDF)

2.1. Hepatothoracic fistula

2.1.1. Description

Hepatothoracic fistulae, commonly right-sided, represent abnormal communications between the liver and thorax. These can be classified as hepatopleural, hepatopulmonary, biliopleural or bronchobiliary [2]. The bronchobiliary fistulae representing the most severe of these abnormal communications. Although considered rare, their true incidence is not well known. These can be discovered on imaging, typically in patients with recurrent or non-resolving thoracoabdominal disease processes.

2.1.1.1. Etiology and pathogenesis. Hepatothoracic fistulae occur secondary to infection (including, but not limited to Hydatid disease, Amebiasis and Actinomycosis), iatrogenic causes (post-radiofrequency ablation, radiation therapy or hepatic resection), trauma or biliary tract obstruction due to tumors, infection or stenosis [3]. Bile is a potent irritant when present outside bile ducts or gastrointestinal tract [4].

Hydatid disease is a parasitic infestation by *Echinococcus granulosus* or *Echinococcus multilocularis* (tapeworms). The incidence of transdiaphragmatic involvement in hydatid disease is between 0.6 and 16%

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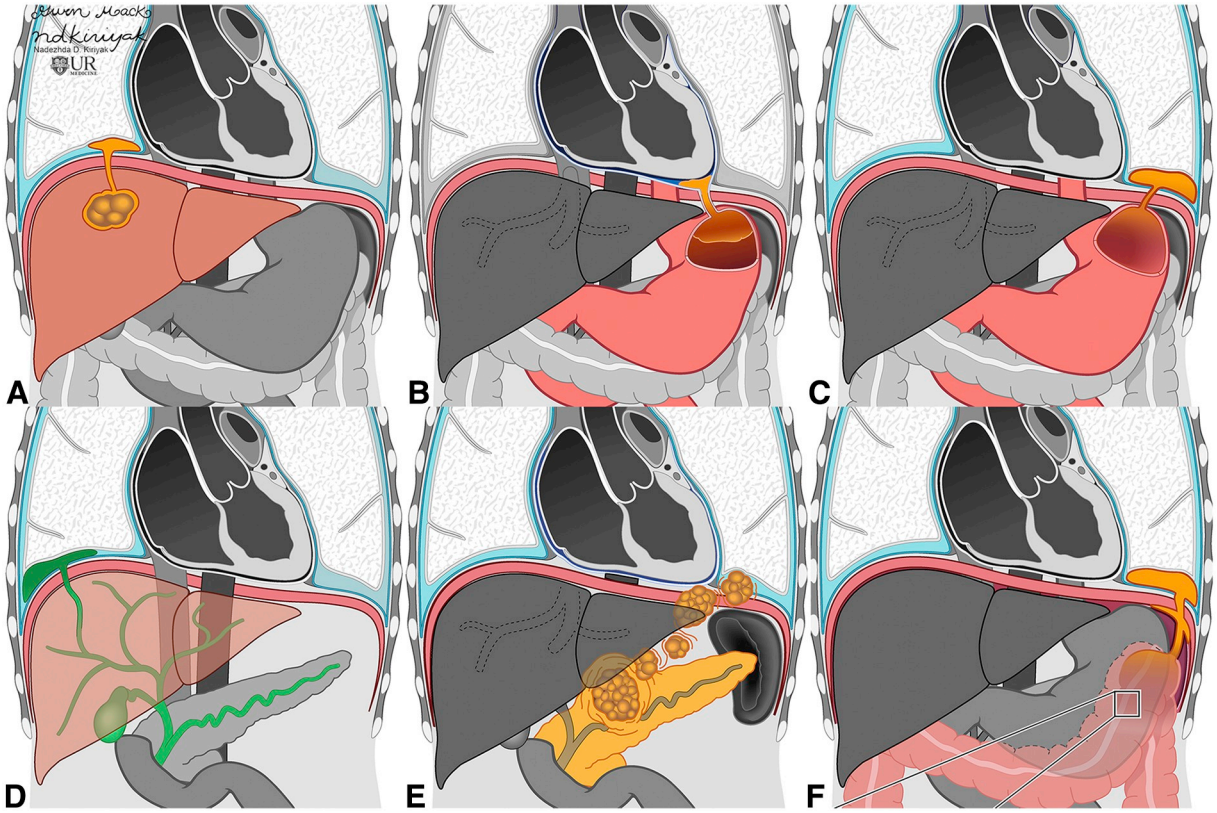

Fig. 1. Illustrations demonstrating the different types of trans diaphragmatic fistulae: hepatopleural fistula (A), gastropericardial fistula (B), gastropleural fistula (C), biliopleural fistula (D), pancreaticopleural fistula with pseudocyst (E), colopleural fistula (F).

Table 1
Summary of acquired transdiaphragmatic communications and most common imaging findings.

Fistula	Types	Etiology	Imaging findings*
Hepatothoracic	Hepatopleural Hepatopulmonary Biliopleural Biliobronchial	• Infections (hydatid, amoebiasis, bacterial, actinomycosis) • Injury (blunt, penetrating, iatrogenic) • Neoplasm (primary, metastatic)	• Pleural effusion or air fluid collection, infradiaphragmatic extension • Pneumonia • Hourglass lesion straddling diaphragm (hydatid) • Soft tissue mass continuous with lung consolidation (actinomycosis) • Contrast extravasation into biliary tree, pleura, lung, bronchi
Gastrothoracic	Gastropleural Gastropericardial Gastroaortic	• Surgery (bariatric, esophagectomy with gastric pull through, Nissen fundoplication) • Injury (trauma, perforation after stenting) • Peptic ulcer • Malignancy • Aortic penetrating ulcerations or ruptured aneurysm	• Left pleural effusion • Hydropneumothorax • Contrast extravasation into pleural space with upper GI or CT exam • Diaphragmatic discontinuity ± gastric content in the thorax • Loss of fat plane between aorta and stomach (on CT) • Intragastric contrast extravasation from aorta
Colothoracic	Colopleural	• Infectious or inflammatory bowel disease (including perforated diverticulosis) • Pulmonary infections (actinomycosis/TB) • Malignancy • Penetrating injury • Abdominal surgery	• Pleural effusion or hydropneumothorax • Contrast extravasation into pleural space • Subdiaphragmatic air ± fluid collection • Air-containing tract with focal discontinuity of diaphragm • Pericolic stranding on CT or increased fluid signal on MRI
Pancreatothoracic	Pancreaticopleural	• Chronic pancreatitis • Pseudocyst • Surgical pancreatic resections/percutaneous pseudocyst drainage • Trauma	• Focal opacity on CXR (pseudocyst) • Loculated fluid traversing diaphragm on CT/MRI • Signs of acute/chronic pancreatitis
Nephrothoracic	Nephropleural	• Percutaneous renal surgery/nephrolithotomy • Perinephric abscess • Trauma	• Non resolving ipsilateral pleural effusion • Excreted contrast in pleural effusion on CT urography • Tracer accumulation in pleural cavity with Tc-99m DTPA renography
Transdiaphragmatic	Intrapericardial Hiatal hernia	• Trauma (blunt, penetrating) • Iatrogenic (pleuropericardial window, transdiaphragmatic conduits/drains, vascular grafts) • Infection (diverticular abscess)	• Intrathoracic air/fluid level due to bowel herniation on chest x-ray or CT • Homogeneous opacity with liver/spleen herniation on CXR

Legend: * - a fistulous tract can be found on cross-sectional imaging (CT, MRI, MRCP) on some occasions in all listed communications; CXR – chest x-ray.