Empyema following Percutaneous Catheter Drainage of Upper Abdominal Abscess*

Scott L. Samelson, M.D.; and Mark K. Ferguson, M.D., F.C.C.P.

Percutaneous catheter drainage is a standard therapy for management of selected intra-abdominal abscesses. We describe three patients in whom this technique caused complicated thoracic empyemas. All patients required thoracotomy for decortication despite initial thoracostomy tube drainage. In each case, the percutaneously placed drainage catheter was found traversing the costophrenic angle, leading to direct communication between the pleural space and the abscess cavity. Review of the anatomic relationships of the inferior pleural margin to the lower ribs may help prevent this technical error.

CT = computed tomography; PCD = percutaneous catheter drainage; WBC = white blood cell count

The number of patients undergoing percutaneous catheter drainage (PCD) of intra-abdominal abscesses from hepatic, renal, pancreatic, diverticular, and posttraumatic causes is increasing. The results compare favorably to open surgical drainage, with success rates of 85 to 100 percent and complication rates of 0 to 5 percent for PCD. Known complications include hemorrhage, hemotherax, pneumothorax, elevated intracerebral pressure, and subcutaneous abscess. As interventional radiologists have grown more aggressive in their approach to abdominal abscesses, we have recognized empyema as a new serious thoracic complication of percutaneous drainage. This report describes our recent experience with the problem of empyema following PCD.

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CASE REPORTS

Three instances of PCD that resulted in thoracic empyema occurred over a two-year period. Their case reports follow.

CASE 1

A 64-year-old man was transferred from another institution with a three-week history of right upper quadrant pain, fever to 40°C, and leukocytosis with left shift (WBC of 13.8 with 30 bands). Computed tomography (CT) revealed a probable liver abscess. Because the patient continued to spike fevers, PCD was performed. Purulent material was obtained from the liver lesion and Enterooccus grew on culture. Intravenous antibiotics were administered. The patient's condition temporarily improved, but after three days, he again began to spike fevers. Serial chest roentgenograms revealed progressive opacification of the right side of the chest, for which a chest tube was placed. Purulent fluid was obtained with a pH of

*From the Department of Surgery, the University of Chicago, Chicago.
†Cardiothoracic Fellow.
‡Associate Professor of Surgery.
Reprint requests: Dr. Ferguson, University of Chicago, MC 5035, 5841 South Maryland, Chicago 60637

REFERENCES

1 Brooks H. Two cases of an abnormal coronary artery of the heart arising from the pulmonary artery: with some remarks upon the effects of this anomaly in producing cirrhoid dilatation of the vessels. J Anat 1885; 20:26-9
9 Huang TY, Hsueh Y, Tsung SH. Endocardial fibroelastosis and myocardial calcification secondary to anomalous right coronary artery arising from the pulmonary trunk. Hum Pathol 1985; 16:959-60

FIGURE 3. Right oblique subcostal view. Color flow mapping shows a retrograde pattern demonstrating retrograde systolic and diastolic flow from the right coronary artery (RCA) into the pulmonary trunk (PT).
6.9, glucose level of 30 mg/dl, and Gram stain with many polymorphonuclear cells and Gram-positive cocci. The improvement in his chest roentgenogram was minimal. A subsequent CT scan revealed a multiloculated fluid collection in the right hemithorax with a thickened peel over the visceral pleura. Thoracotomy and decortication were performed. The findings at surgery confirmed the complicated empyema but also revealed that the percutaneous drain had penetrated the diaphragm and right lower lobe of the lung. The diaphragmatic defect was repaired and new drains were placed in the liver abscess. The patient's condition improved and he was discharged from the hospital ten days later.

**Case 2**

A 35-year-old man with a history of Caroli's disease underwent a right hepatectomy. Postoperatively, he developed a perihepatic fluid collection and began spiking fevers. Percutaneous drainage was performed, and a large collection of bile that cultured positive for Enterococcus was obtained. Antibiotics were administered. After temporary improvement for five days, his fevers returned accompanied by opacification of the right side of the chest. A chest tube was placed and drained purulent bilious material that also cultured positive for Enterococcus. His clinical condition and chest roentgenogram did not improve, necessitating thoracotomy and decortication. A complicated loculated empyema was found, and the percutaneous drain was seen traversing the pleural space and diaphragm. The diaphragmatic defect was repaired. The patient's condition improved and he was discharged from the hospital two weeks later.

**Case 3**

A 44-year-old woman with a diagnosis of idiopathic thrombocytopenic purpura underwent splenectomy and drainage of a pancreatic pseudocyst in 1986. In 1990, she developed left upper quadrant abdominal pain and had a fever. A chest roentgenogram revealed a small left pleural effusion. Thoracentesis produced culture-negative serous fluid. Computed tomography revealed a left subdiaphragmatic abscess. Percutaneous drainage was performed, and purulent material culture positive for Escherichia coli was obtained. Her condition temporarily improved, but her fevers returned along with progressive opacification of the left side of the chest. A chest tube was placed; the pleural fluid had a pH of 6.6 and glucose level of less than 10 mg/dl. No clinical or roentgenographic improvement occurred, and decortication was performed. A complicated empyema was found, along with the percutaneous drain traversing the left pleural space and diaphragm. The diaphragmatic defect was repaired. Intraoperative cultures also grew E. coli. The patient's condition improved and she was discharged from the hospital ten days later.

**Discussion**

Percutaneous drainage is being performed frequently for intra-abdominal abscess secondary to diverticular, hepatic, pancreatic, and renal sources. The anatomic location of the abscess no longer dictates the drainage technique, with PCD reported for pelvic, subphrenic, subhepatic, retroperitoneal, lesser sac, interloop, hepatic, and appendiceal collections.6-11

Published series of patients treated with PCD report success rates of 85 to 100 percent and complication rates of 0 to 5 percent, which compare favorably to open surgical drainage.12 Several studies have shown similar results in terms of effectiveness, morbidity, and mortality for the two techniques, although hospital stay tends to be longer with PCD.13-14 Recently, these findings have been confirmed for patients comparable by anatomic location and APACHE II score, a standard for evaluating the severity of sepsis.15 In addition, palliation, not cure, may be a worthy goal for certain abscesses. For example, a diverticular abscess may be drained percutaneously so that a one-stage surgical procedure may be performed subsequently.18-14

Reported complications of PCD include hemorrhage, hemothorax, enteric fistulas, pneumothorax, and subcutaneous abscess.4,7 Our three patients indicate that thoracic empyema is an additional hazard of percutaneous drainage of upper abdominal abscesses. This complication appears to be a technical one, due to violation of the pleural space by the drainage catheter. Once communication is established between the pleural space and the abscess, development of empyema is facilitated by the rhythmic fluctuations in negative pressure within the pleural space. The virulence of the progressive pleural infection in our patients is evidenced by the rapid deposition of a thick pleural peel accompanied by multiple loculations. Other factors, such as catheter size, efficacy of drainage of the abdominal abscess, and relative pressure within the abdominal cavity may also play a role, but these remain to be elucidated.

In our three patients, development of empyema as a complication of PCD was heralded by recrudescence of fevers and recognition of a new pleural effusion. The diagnosis of empyema was made rapidly and reliably by thoracentesis. However, percutaneous drainage with a large-bore chest tube was unsuccessful in treating these patients due to the thick peel and multiple loculations evident at the time of exploration. Given these findings, it is unlikely that conservative therapy can be used successfully in the management of post-PCD empyema, unless diagnosed very early.

The anatomy of the pleura and its relationship to the overlying ribs is inconsistent. In many individuals the pleural sulcus extends to the level of the 10th or 11th rib posteriorly. Cognizance of this fact, and the severity of pleural empyema resulting from PCD, should caution interventional radiologists to avoid choosing a transpleural route for performance of PCD. The complication of thoracic empyema secondary to percutaneous drainage of abdominal abscess can be prevented by avoiding violation of the diaphragm and pleural space.

**References**

7. Pruett TL, Simmons RL. Status of percutaneous catheter

Extensive Diffuse Pulmonary Ossification*

Ethan D. Fried, M.D.;† and Thomas A. Godwin, M.D.‡

Diffuse lung injury can either heal normally or progress to fibrosis. Calcification in the setting of fibrosis is common. The appearance of mature woven bone is not. We report a patient with extensive diffuse pulmonary ossification and discuss some of the theories relating to the development of this phenomenon. (Chest 1992; 102:1614-15)

BMP = bone morphogenetic protein; TGF-β = transforming growth factor-β

Metaplastic pulmonary ossification is usually described as dendriform or nodular in patients with chronic inflammatory lung disease or long-standing pulmonary edema. We present the case of a young woman who sustained a severe pulmonary insult and was found at autopsy to have extensive immature bone formation throughout both lungs.

CASE REPORT

This 40-yr-old woman was admitted for elective laser excision of tracheal stenosis after an emergent tracheostomy one year previously for critical tracheal stenosis. Twelve years before this admission, she had had Hodgkin's disease localized in the right side of the neck treated with chemotherapy, local external radiation therapy, and a right-sided neck dissection with a tracheostomy.

Postoperative nausea and vomiting were treated with prochlorperazine. The patient developed acute dystonia that was treated with diphenhydramine. On the third postoperative day, she had a generalized seizure. Her postictal laboratory values included a serum sodium of 116 mEq/L, potassium of 5.0 mEq/L, chloride of 90 mEq/L, bicarbonate of 10 mEq/L, and normal renal function.

Later, the patient was hypotensive and in respiratory distress with decorticate posturing. An emergent computerized tomogram of the head showed mild hydrocephalus.

In the medical intensive care unit (ICU), a bedside ventriculostomy was placed, and normal intracranial pressure was recorded. The patient was maintained on mechanical ventilation and intravenous pressors while her electrolyte levels were corrected, and she woke up within 48 h. Antibiotics were begun after a chest roentgenogram showed bilateral infiltrates consistent with aspiration pneumonia. The infiltrates began to clear but soon worsened in association with low pulmonary capillary wedge pressures and negative cultures and stains from bronchoscopic specimens and blood. The patient was diagnosed as having adult respiratory distress syndrome.

Oxygenation became more difficult as pulmonary compliance dropped. The patient had to be sedated and paralyzed while inverse-ratio ventilation was initiated. Oxygenation and ventilation continued to worsen on high levels of positive end-expiratory pressure and a prolonged toxic fraction of inspired oxygen. On the 26th day in the ICU, failing hemodynamics and persistent bilateral bronchopulmonary fistulas prompted the initiation of high-frequency jet ventilation (Fig 1). On the 36th day in the ICU, the patient died.

Permission was granted for a complete autopsy. The lungs, which weighed 2,180 g together, were diffusely firm with patchy hard tan regions that were scattered throughout all lobes and measured up to 5 cm. Microscopically, the lung architecture was severely distorted by organizing interstitial fibrosis overlaid with large regions of partially calcified woven (immature) bone. The bone had numerous osteocytes and was associated with osteoelastic and prominent osteoblastic activity (Fig 2). No separate calcification was found. Additional findings at autopsy included acute pancreatitis, adrenal cortical necrosis, nonbacterial thrombotic endocarditis, multiple visceral infarcts, and tracheal stenosis.

DISCUSSION

Metaplastic pulmonary ossification is usually discovered at autopsy in the setting of other pulmonary injury. Two types of diffuse or disseminated ossification are described: (1) dendriform, with its characteristic branching along terminal airways and occasional islands of marrow; and (2) nodular, which tends to be more circumscribed and situated

*From the Departments of Medicine and Pathology, Cornell University Medical College—the New York Hospital, New York.
†American Lung Association Research Fellow.
‡Associate Professor of Pathology.

Reprint requests: Dr. Fried, Division of Pulmonary/Critical Care, New York Hospital, Starr 505, 520 East 70th Street, New York 10021

Figure 1. Chest roentgenogram taken with portable technique, illustrating diffuse bilateral alveolar infiltrates, bilateral pneumothoraces with thoracostomy tubes, and right heart catheter in place.

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