Radiographic Recognition of Chest Tube Malposition in the Major Fissure*

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Twelve patients with a chest tube positioned in the major fissure of either lung were collected prospectively in a two-year period. In eight of these 12, there was evidence of chest tube malfunction, with poor drainage of pleural air or fluid collections; in six of these eight, placement of additional tubes or tube repositioning resulted in improved pleural drainage. In all 12, the tube had been placed through the lateral chest wall. Although tube placement in the major fissure can sometimes be suspected on the anteroposterior portable chest roentgenogram because of the tube's characteristic course, in such cases a lateral roentgenogram is not usually obtained for confirmation of location unless there is evidence of tube malfunction.

Chest tubes are commonly used in the treatment of pneumothorax or abnormal collections of pleural fluid; however, when placed in an ectopic location, chest tubes may function poorly. This report reviews the radiographic appearance of ectopic tube position within the major fissure, a cause of chest tube malfunction only briefly discussed in the clinical literature.1

**Materials and Methods**

Twelve patients with a chest tube inadvertently placed in the major fissure were collected prospectively at the University of California, San Francisco, over a two-year period. Tube placement within the major fissure was proven using simultaneous posteroanterior and lateral chest roentgenograms (ten patients) or computerized tomograms (two patients). Medical records and chest roentgenograms were reviewed; and, when possible, an assessment of the chest tube function was obtained from the patient's physician at the time when the radiographic diagnosis of tube malposition was made. All 12 patients were adults, ranging in age from 31 to 68 years. In these patients, chest tubes had been placed for evacuation of pneumothorax (seven patients), treatment of empyema (three patients), or drainage of pleural effusion prior to pleurodesis (two patients).

**Results**

In eight of 12 patients with tube placement in the major fissure, there was clinical evidence of chest tube malfunction. Figures 1A and 1B show anteroposterior chest roentgenograms of a 35-year-old woman with spontaneous pneumothorax. The tube was positioned in the left major fissure and drained air and fluid from the pleural space. In Figure 1A, the tip of the tube was not seen in the left hilum, as it should be. The tube was repositioned, and the patient was placed on a portable chest roentgenogram (Figure 1B). A chest wall view shows the tube in the fissure. Figure 1C shows the tube repositioned through the left fissure at the time of discharge. A chest roentgenogram taken several hours later demonstrates that the tube had remained in the fissure and was not repositioned by the patient.

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**Figure 1.** A (left), Portable anteroposterior chest roentgenogram following chest tube placement in 35-year-old woman with spontaneous pneumothorax shows tube to have course typical of placement within major fissure. Large pneumothorax (arrows) persists. Because of apparent tube malfunction, portable lateral roentgenogram (B, center) was obtained, showing tube to be within major fissure, with its tip near left hilum. Arrows again outline pneumothorax. C (right), Several hours later, placement of second chest tube resulted in evacuation of pneumothorax.
malfunction. These eight included four of the seven patients with pneumothorax, who had persisting or increasing air collections (Fig 1), all three patients with empyema (Fig 2), and one patient with a pleural effusion in whom adequate drainage of the pleural fluid collection was not achieved. In six of the eight patients with an ectopic tube location and poor tube function (three with empyema, one with pleural effusion, and two with pneumothorax), placement of additional chest tubes or repositioning of the ectopic tube resulted in improved drainage of the pleural space (Fig 1C). The two additional patients with tube malfunction had a small (less than 10 percent) persistent pneumothorax, but their chest tubes were removed without placement of additional tubes or tube repositioning.

In all 12 patients, the malpositioned chest tube was placed through the lateral chest wall, in or near the axillary line. On frontal chest roentgenograms, the tube typically followed a straight (Fig 1) or gently curved (Fig 2) course medially and superiorly from its point of entry, as it followed the upper posterior portion of the major fissure. This appearance was seen in ten of our 12 patients. In contrast, in many patients with a normally positioned chest tube introduced through the lateral chest wall, the tube will show a curve at the point where it enters the pleural space and is deflected anteriorly or posteriorly around the lung (Fig 3); however, this “normal” appearance was seen in two of our patients.

In three of the 12 patients, an ectopic tube placement in the major fissure was suspected on the basis of the initial portable anteroposterior roentgenogram because of the tube position and course (Fig 1A). In one patient, posteroanterior and lateral roentgenograms were the initial examination, leading to the diagnosis of an ectopic position. In three of the eight patients in whom tube malposition was not suspected on the initial portable anteroposterior roentgenogram, the diagnosis was suggested on subsequent portable roentgenograms when a history of tube malfunction was obtained; in the remaining five patients the diagnosis was made only when posteroanterior and lateral x-ray films were obtained.

**Discussion**

Malfunction of a pleural drainage tube can result from a variety of causes, including poor tube position within the pleural space. In our study, eight of 12 patients with a chest tube positioned in the major fissure had clinical evidence of tube malfunction, and six of these eight who had subsequent repositioning of the tube or an additional tube placed had improved pleural drainage. Although several authors have emphasized that a chest tube directed into the posterior or lateral costophrenic angle can be obstructed by the closely opposed pleural surfaces investing the diaphragm and chest wall, only one study has suggested the possibility that a tube may be obstructed when positioned in the major fissure by the closely opposed pleura of the upper (or middle) and lower lobes. Of nine patients studied by Maurer et al with a tube positioned in the major fissure, six had poor drainage or no drainage of the pleural space as determined by serial roentgenograms. Tubes positioned in the minor...
obliquely downward from posterior to anterior, roughly paralleling the sixth rib. Thus, a chest tube placed laterally in the fifth, sixth, or seventh intercostal space will enter the chest near the major fissure and, if directed centrally, can enter the fissure.

Radiographically, an ectopic tube in the major fissure can sometimes be suspected on the initial anteroposterior roentgenogram by its characteristic course. From its point of entry, the tube extends centrally and superiorly in a straight line or follows a gentle curve. Often, a tube passed through the midaxillary line and positioned normally in the anterior or posterior pleural space will be angulated or will show a sharp curve at its point of entry; however, some normally positioned tubes will have a course on frontal roentgenograms identical to that of a tube positioned in the major fissure. Also, a tube positioned in the major fissure may have a normal “curve” near the chest wall.

It is difficult to infer from our data how commonly a fissural location results in poor tube function. In three of our cases, an ectopic tube position was suspected only when a history of tube malfunction was obtained. We do not mean to suggest that all chest tubes positioned in the major fissure will function poorly; in some patients, adequate pleural drainage will be obtained; however, when tube malfunction occurs in a patient with a chest tube having a course typical of fissural placement, a lateral x-ray film can easily be obtained to confirm its location. If the tube is found to be in the major fissure, replacing the tube will likely result in improved pleural drainage.

REFERENCES