Bilateral Urinothorax Identified by Technetium-99m DPTA Renal Imaging

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A case of unilateral urinary tract obstruction with extravasation resulting in bilateral pleural effusions is presented. The fluid within the pleural cavities was established to originate from the kidney using [^{99m}Tc]diethylenetriaminepentaacetic acid and scintillation camera imaging.

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Pleural fluid collections have been reported in several cases of urinary tract obstruction or perforation (*1–8*). In some of these cases the pleural fluid was proven to consist of urine. These cases of "urinothorax" are usually ipsilateral, i.e., the pleural effusion forms on the same side as the renal insult. We present a case of unilateral urinary tract obstruction and perforation producing bilateral pleural effusions. A radionuclide renal imaging study demonstrated the presence of extravasation and bilateral pleural fluid collections.

CASE REPORT

A 63-yr-old female with a history of colon carcinoma was admitted for evaluation of left leg pain. Her admission chest radiographs were unremarkable. Her urine and serum creatinine were normal. Abdominal computed tomography revealed evidence of adenopathy in several locations, and the possibility of entrapment of the left ureter in a nodular mass was raised. The left renal pelvis and the proximal left ureter were dilated. Needle biopsy of an external iliac mass was consistent with metastatic colon carcinoma.

In anticipation of possible palliative radiation therapy to the region of the abdominal lymphadenopathy, multiple attempts were made to position a retrograde ureteral stent past an apparent segment of narrowing of the mid left ureter. The stent tip was eventually advanced into the renal pelvis. Renal contrast studies demonstrated extravasation from a dilated left renal collecting system (Fig. 1). The majority of the contrast was confined by Gerota's fascia, although there was some apparent extravasation into the left anterior pararenal space. There was no evidence of pleural fluid on the radiographs obtained during these stent placements. The left ureteral stent failed to drain urine during 2 days following placement and a radionuclide diuretic (furosemide) renal imaging study was requested.

Following the i.v. injection of 16 mCi of technetium-99m diethylenetriaminepentaacetic acid ([^{99m}Tc]DTPA) normal perfusion of both kidneys was demonstrated. Subsequent renal images revealed satisfactory clearance of tracer from the right kidney but extravasation of urine from the region of the left kidney was noted (Fig. 2). At the conclusion of the renal imaging study an ultrasound study was performed in an effort to define the nature of the suspected perirenal urine collection. While an "urinoma" was not identified, there was evidence of new bilateral pleural fluid collections, the left being larger than the right. The patient was then returned to the nuclear medicine section for further imaging. Posterior and left lateral images of the upright patient again demonstrated the diffuse left perirenal urine tracer accumulation (Fig. 3). In addition there was tracer accumulation at the base of both hemithoraces. Supine images showed these collections to layer dependently, confirming that these regions of tracer activity represented fluid in the pleural cavities (Fig. 4). Upright chest radiographs were subsequently obtained which demonstrated discoid atelectasis and new bilateral pleural fluid collection (Fig. 5).

An excretory urogram 3 days later showed persistent extravasation from the left renal collection system. A percutaneous nephrostomy was placed in order to allow adequate drainage of urine. Chest radiographs taken the day after percutaneous nephrostomy demonstrated complete resolution of the pleural effusions. The patient was asymptomatic in regards to the pleural effusions. The serum creatinine remained normal.

DISCUSSION

Pleural effusion associated with urinary tract obstruction or perforation has been reported in 16 pa-

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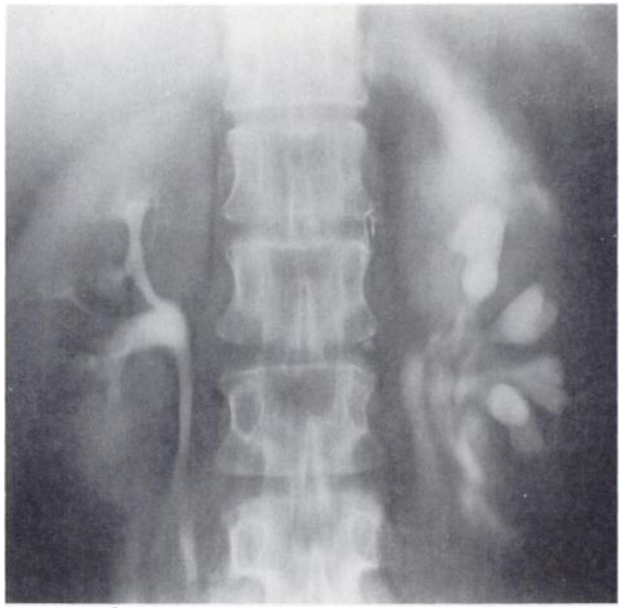

FIGURE 1
Excretory urogram demonstrating extravasation of contrast material from left kidney

tients. In 15 of these cases there has been convincing chemical or circumstantial evidence that these pleural fluid collections represented urine. In one case the pleural fluid collection was chemically proven not to be urine (*9*). In all but one of these cases, the pleural fluid collections were ipsilateral to the renal insult. Proof of the nature of the pleural urine was based on BUN or creatinine in six of these cases. One case was further confirmed by recovery of indigocarmine dye from the pleural space following i.v. injection of the dye (*6*). In one case "the radionuclide" tracer was recovered from the pleural space by thoracentesis after an "iodine-131 renogram" was performed (*7*).

In the present case there were both obstruction and perforation of the left renal collecting system. The urine collected primarily within the perirenal space but there was some extension into the anterior pararenal space. The contrast studies showed no obvious connection between the retroperitoneum and the pleural space. There was no pleural fluid evident on the radiographs performed prior to the radionuclide renal imaging study. The renal imaging study demonstrated extravasation of the radionuclide tracer into the left retroperitoneum and within both pleural cavities.

The mechanism of transit of urine from the retroperitoneum to the pleural space has been the subject of some debate. One theory has proposed that retroperitoneal urine may travel by way of lymphatic drainage into the pleural space (*1*). Another possibility would be that the retroperitoneal urine first enters the peritoneal cavity and then migrates into the pleural cavity by way of the lymphatics. The basis for the theoretical lymphatic

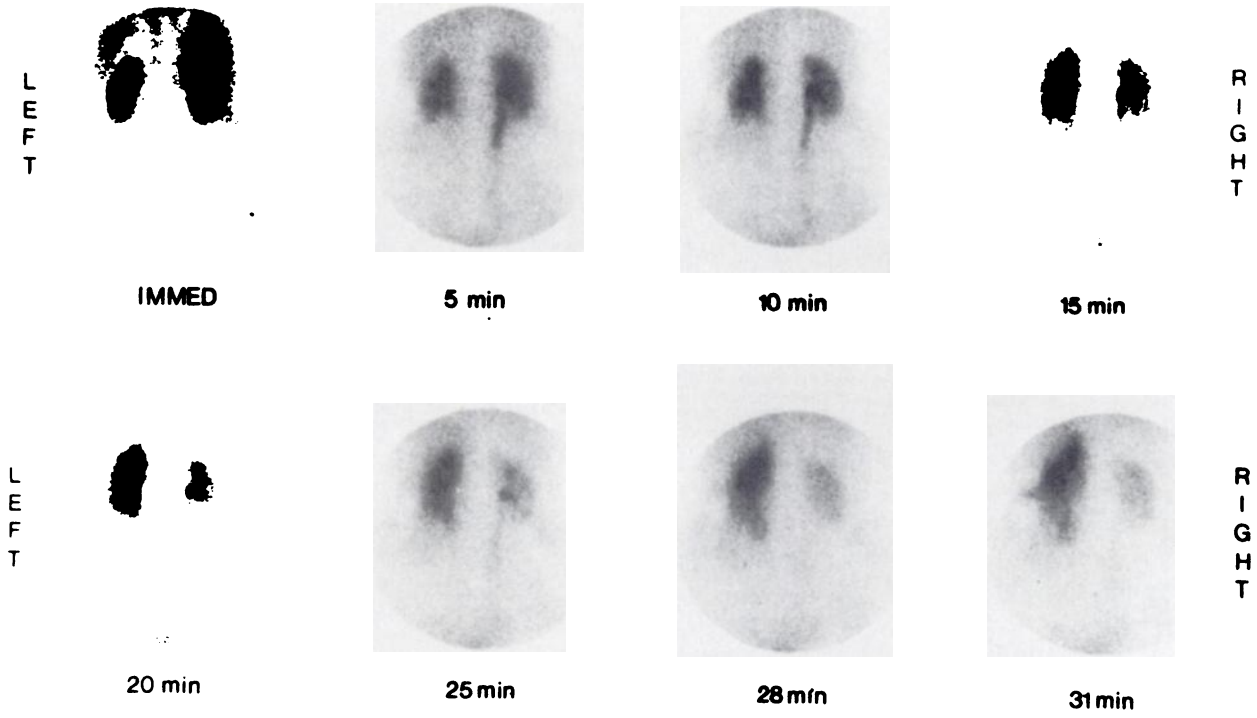

FIGURE 2
Sequential [^{99m}Tc]DTPA renal images demonstrating extravasation of urine tracer from left kidney

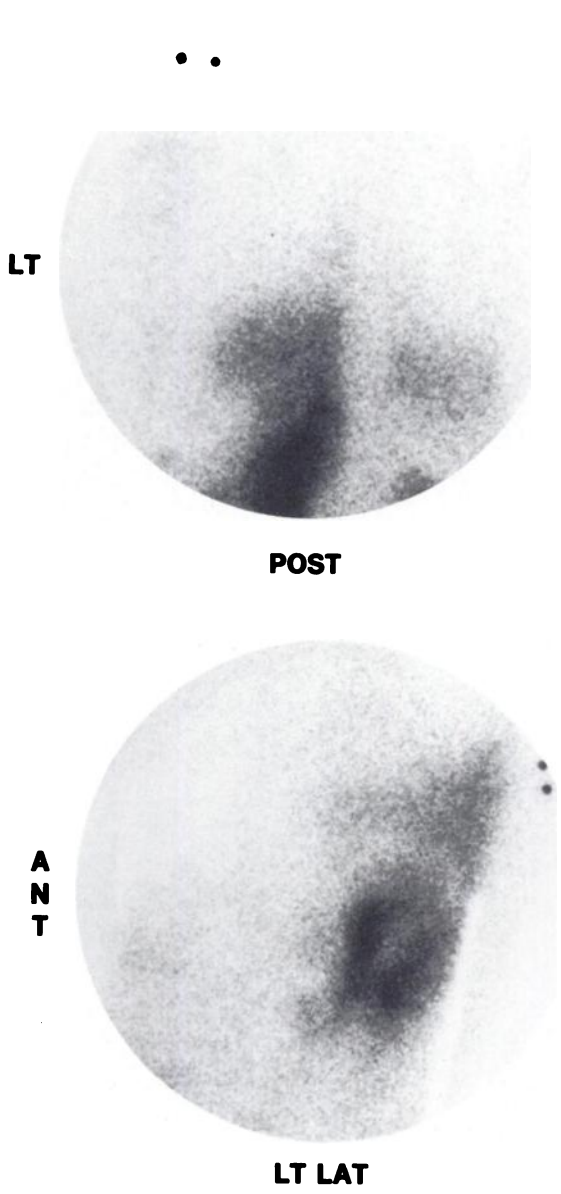

FIGURE 3
Upright images of thorax and upper abdomen in posterior and left lateral projections demonstrate [^{99m}Tc]DTPA within pleural cavities bilaterally

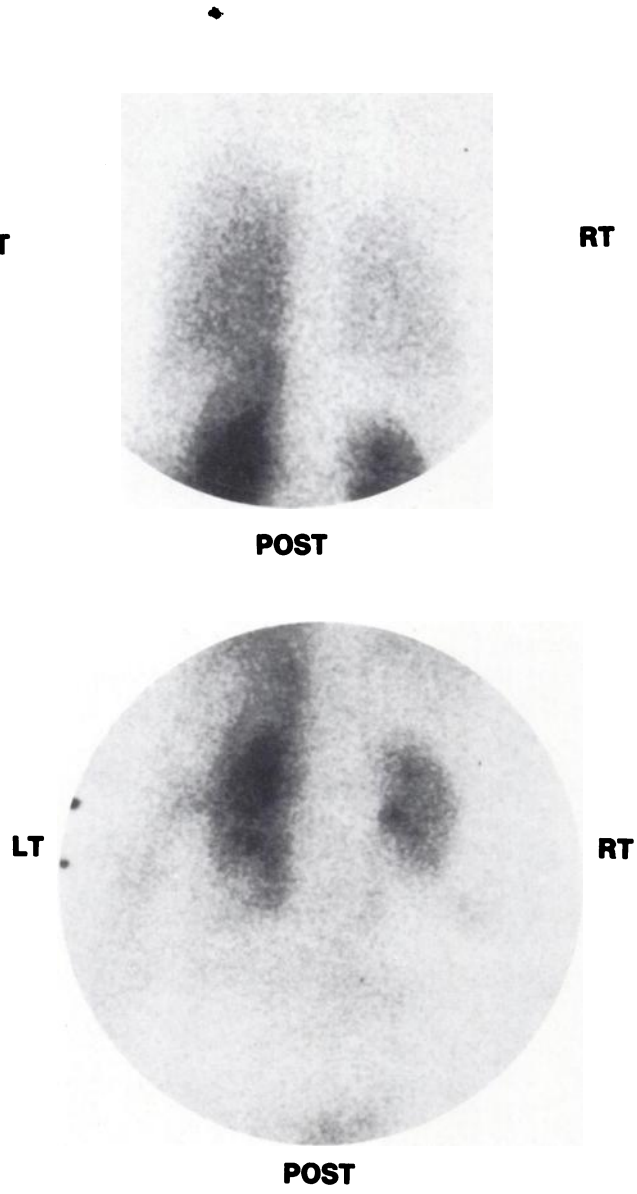

FIGURE 4
Posterior images of thorax and upper abdomen in supine position illustrating bilateral urinothorax and urine extravasation from left kidney

connection between the peritoneum and the pleural space is founded upon work done by Lemon and Higgins in 1929 using dogs (*10*). However, a lymphatic pathway between the abdominal cavity and the pleural space has not been demonstrated in man.

The work of Baron et al. has shown that the creatinine level within pleural effusions should almost always be equal to or less than the serum level except in cases of urinothorax (*8*). In those cases the pleural fluid creatinine is consistently higher than the serum level. The chemical nature of the pleural fluid was not determined in the present case. A thoracentesis was not clinically warranted since there was prompt resolution of the pleural fluid following nephrostomy placement. One cannot totally exclude the possiblity that there was direct excretion of [^{99m}Tc]DTPA into the pleural space by way of the blood. However, this is not believed to be likely in this case.

While retroperitoneal urine extravasation is a much more common phenomenon than transit of urine into the pleural cavities, the possibility of urinothorax should be considered in the appropriate situation when

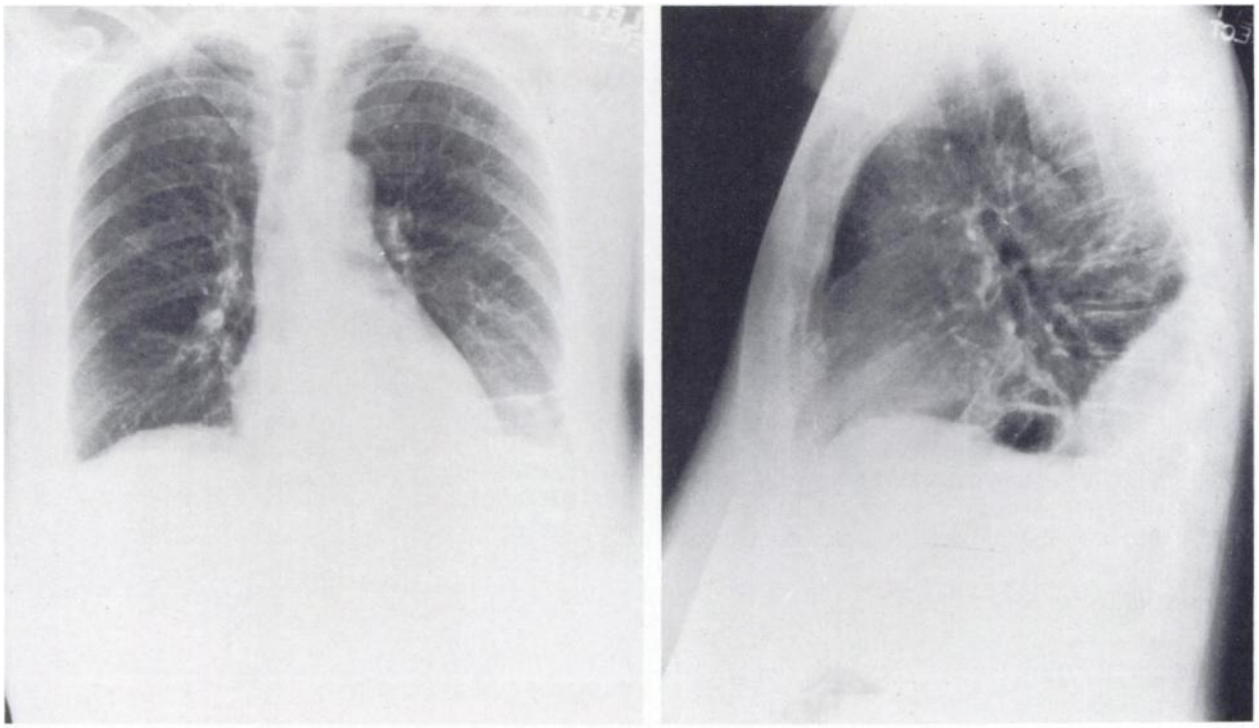

FIGURE 5
Chest radiographs reflecting presence of discoid atelectasis and bilateral pleural fluid

other causes for pleural effusion have been excluded. One means of confirming urinothorax entails chemical characterization of the pleural fluid. The present case indicates that radionuclide renal imaging may also be suitable in cases in which a thoracentesis is not warranted.

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