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Title: Coexisting sources of false positive reflux on a direct radionuclide cystography scan

Running title: Sources of false positive reflux

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Coexisting sources of false positive reflux on a direct radionuclide cystography scan

Abstract: Direct radionuclide cystography (DRC) is currently a popular method for evaluation of vesicoureteral reflux (VUR), in spite of its pitfalls and drawbacks in producing false positive results. In this article, it is intended to present a case with two sources of false positive reflux on a DRC scan.

Keywords: false positive reflux, direct radionuclide cystography, artifact.

Introduction:

There are a few sources of false positive result on DRC scans, of which some are well described in the literature (*1*). In this article, we intend to present two sources of false positive reflux on DRC in a single patient. One has resulted from systemic absorption of pertechnetate from inflamed bladder mucosa which is previously described in the literature (*2*) and the other is related to an equipment error that we can call it as “picture-in-picture” artifact.

Case report:

A 9-year-old girl with a history of reflux was referred for a DRC scan. Thus, a DRC scan with standard protocol, after obtaining an informed consent, was performed with 20 MBq pertechnetate injected through a Foley catheter placed into the bladder using a single-head GENESYS EPIC ADAC γ-camera. During dynamic imaging, a small spot appeared above the bladder on the right side from the beginning to the end. On closer inspection, synchronous changes in intensity were noted between the spot and the bladder. Later in the filling phase, gradually increasing accumulation of activity in the left renal pelvis and also transient visualization of the upper ureter thereafter were detected (Fig. 1). As we thought that the above patterns are atypical for VUR and to confirm that the activity in the left renal pelvis might be excreted by the kidney following systemic absorption of pertechnetate through inflamed bladder mucosa, a thyroid view was obtained, in which uptake in the salivary glands and thyroid was evident (Fig. 2). On the repeat scan with ^{99m}Tc-Sulfur Colloid (Fig. 3), two days later, no activity was evident in left renal pelvis, but similar to previous scan, the spot above the bladder was persistently present. This time, thyroid showed no uptake. To exclude the possibility of an undiagnosed pelvic kidney with considerable reflux or even a bladder diverticulum, a ^{99m}Tc-DTPA renal scan (Fig. 4) was then conducted, which demonstrated no corresponding abnormality. Because of recent repair of the gamma camera detector, we thought this might be an error resulted from the camera hardware or even software, thus, a point source was placed on the scanning table and a spot view was acquired. Interestingly and unexpectedly, a smaller spot with much less intensity similar to the index source in shape appeared above it on the right (Fig.5).

Discussion:

Despite high sensitivity and favorable dosimetry of DRC scan, careful consideration of its pitfalls and possible sources of false positive reflux is of critical importance (*1*). One of the pitfalls of DRC using pertechnetate is systemic absorption from an inflamed mucosa or in an augmented bladder that may pose a significant confusion to the interpreter. Thereby, the use of pertechnetate is discouraged even in patients who are not in active phase of inflammation (*1,2*). Another problem which is less known to clinicians, is the mentioned artifact in our patient. The camera used for this scan, recently, had an error in count detection as a result of malfunctioning event processor board, so that, it was replaced with another one which had a minor error as well. This hardware item in the gamma camera detectors, in simple terms, processes the events in terms of energy and position. A faulty processor may erroneously localize the events, and as in our patient, can cause distortion in the image as a smaller picture in a fixed location in the main picture or so-called “picture-in-picture” artifact.

References:

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2. Lowe B, Barnes WF, Leonard JC. Absorption of Tc-99m pertechnetate from the augmented bladder during direct nuclear cystography. *Clin Nucl Med.* 1989;14:347-349.

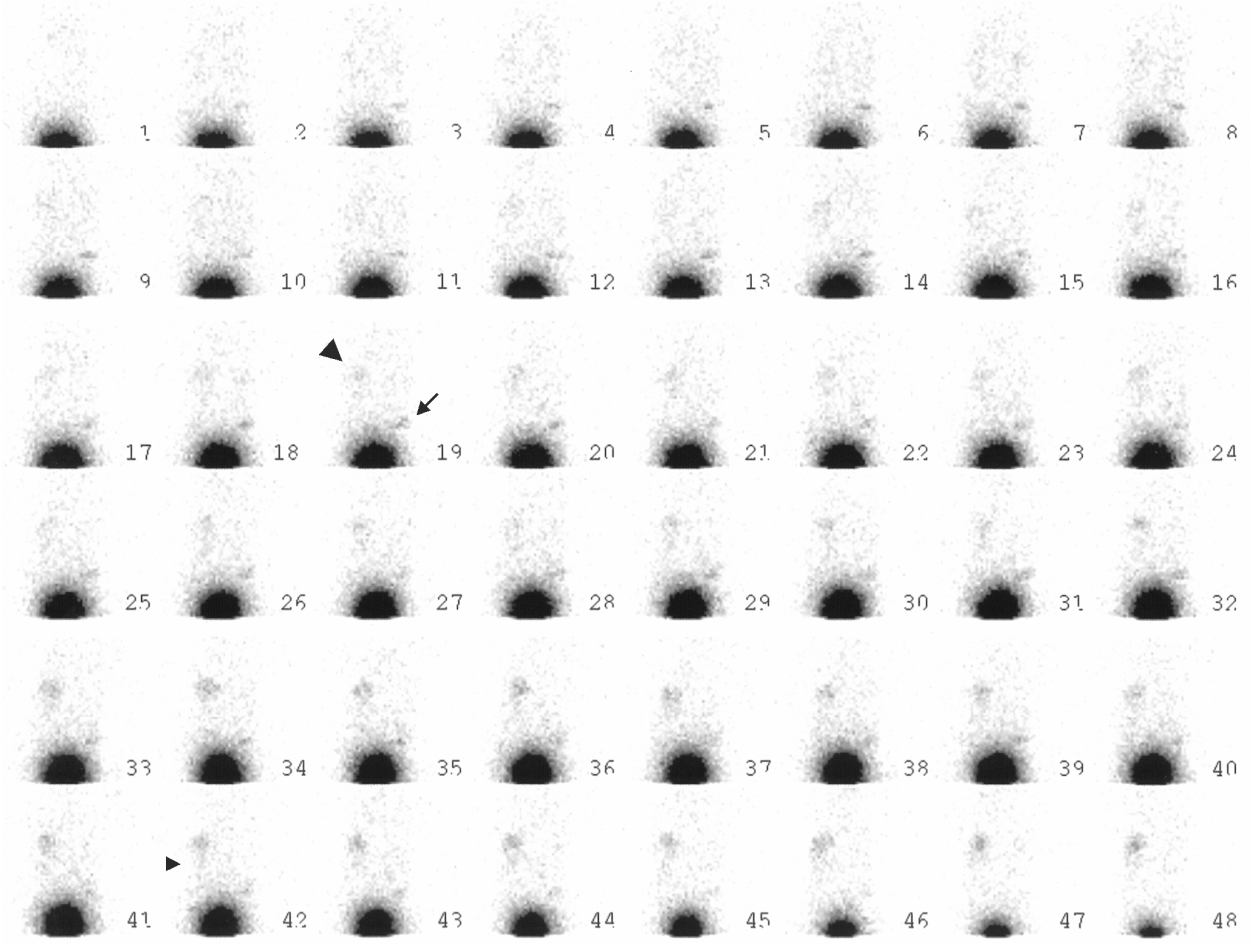

FIGURE 1. Filling and voiding phases of DRC scan from posterior view. The spot (shown by small arrow) appeared from the beginning to the end of the study. On the left side, activity in the renal pelvis and ureter are shown by large and small arrowheads respectively.

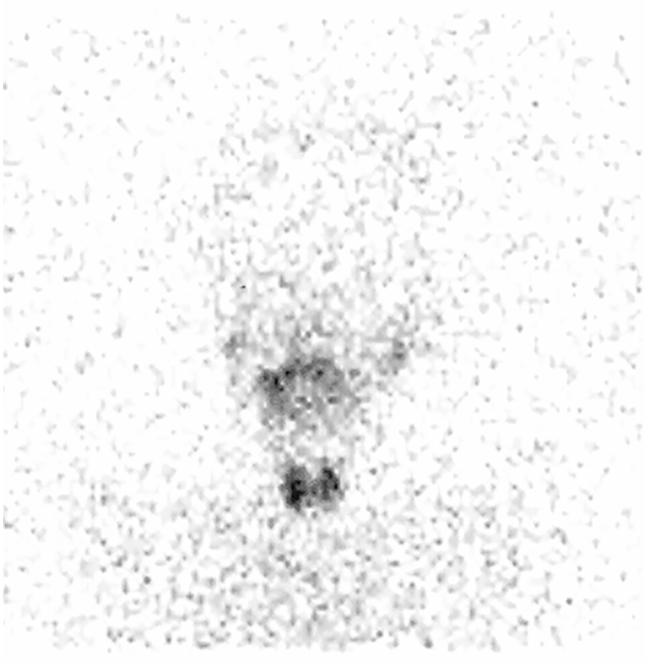

FIGURE 2. Anterior view of the head and neck. Uptake in salivary glands and thyroid implies presence of the pertechnetate in the circulation following absorption through the inflamed bladder mucosa.

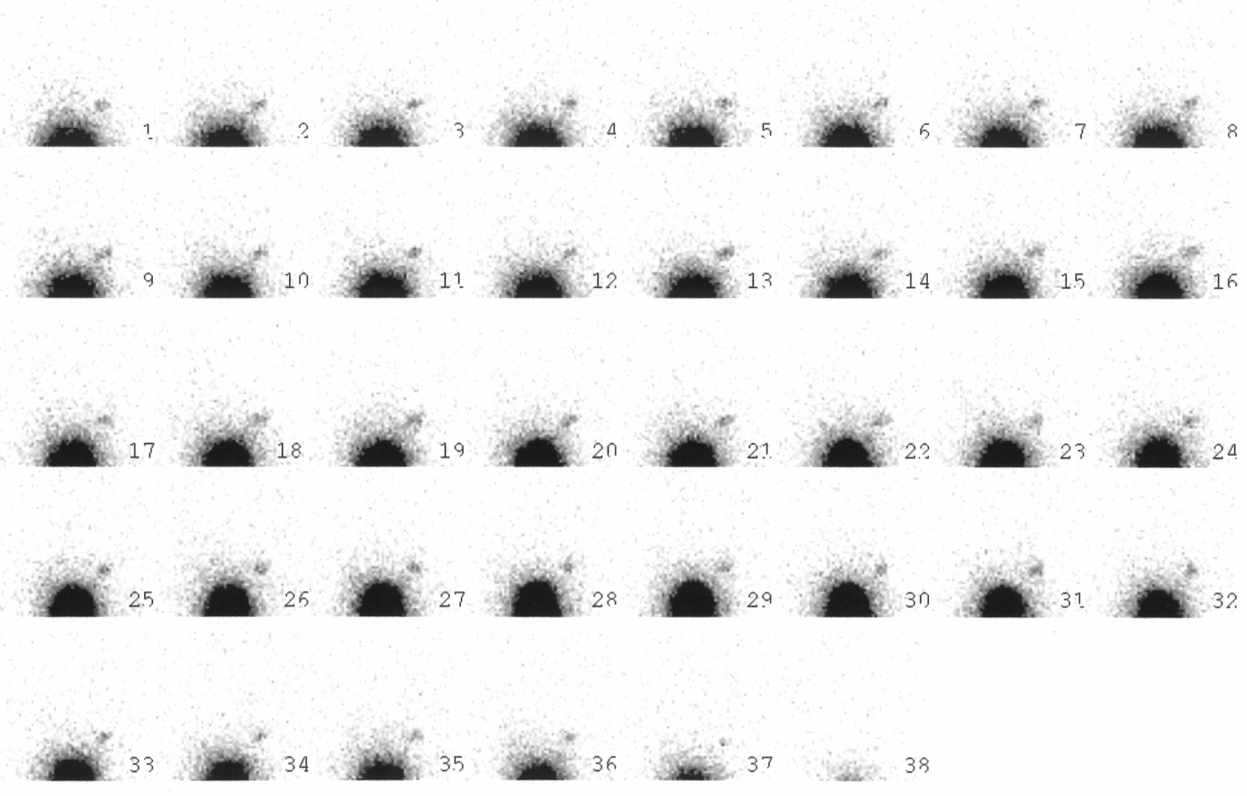

FIGURE 3. Filling and voiding phases of repeat DRC scan showed no activity in left renal pelvis but persistent focal activity in pelvis above the bladder.

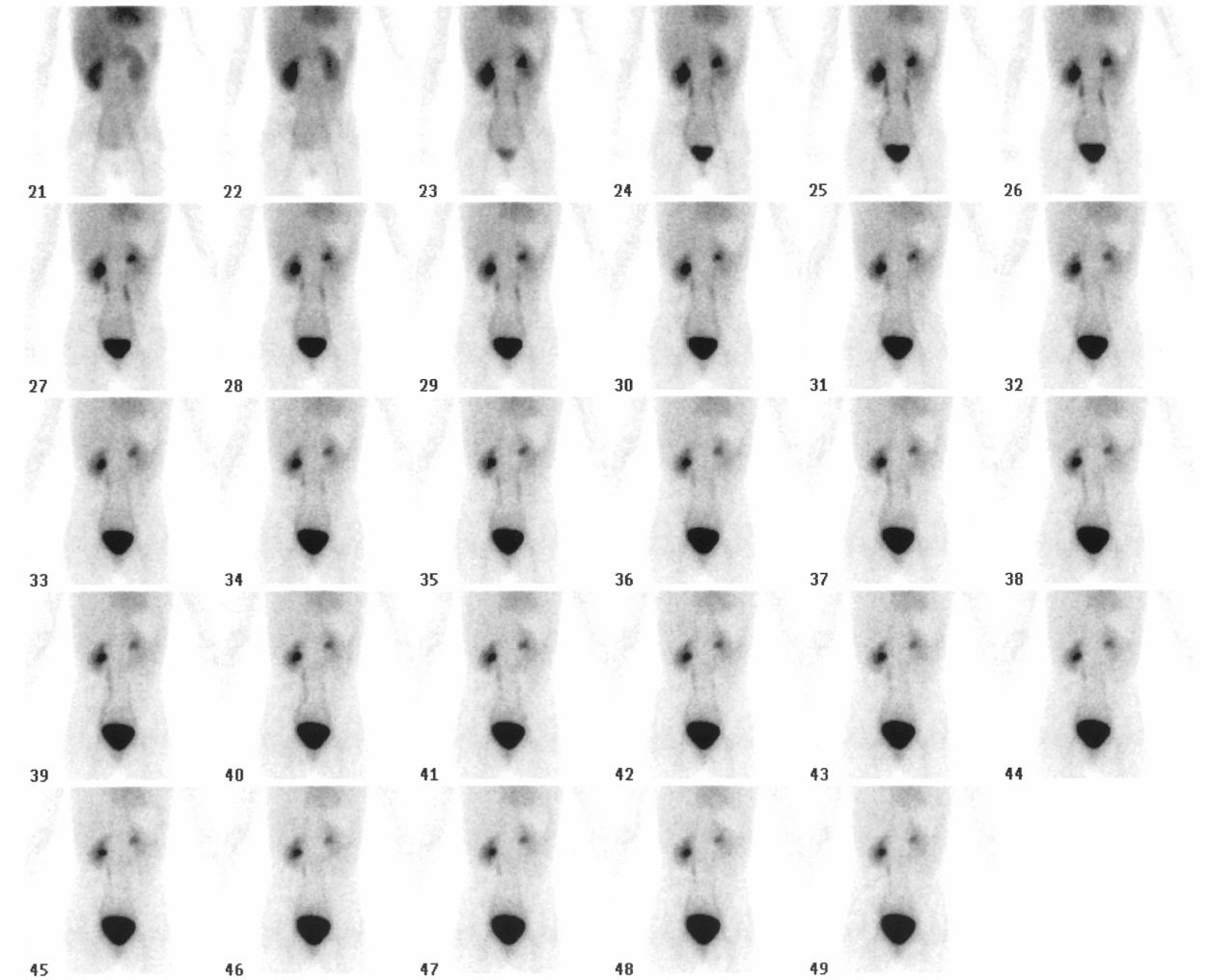

FIGURE 4. Dynamic posterior ^{99m}Tc-DTPA renal scan with standard protocol did not show any corresponding abnormality in the pelvis.

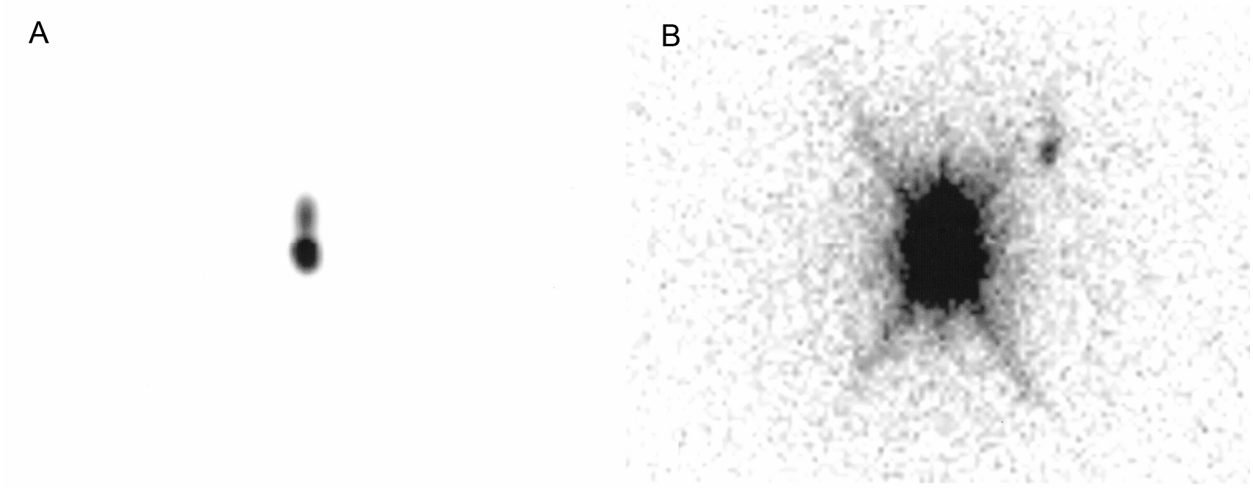

FIGURE 5. Spot view of a point source without (A) and with brightness enhancement (B). In B, with increase in brightness, another smaller spot became visible above and on the right side of the point source, in the location of the image similar to the patient scan.