

## Visualization of bladder diverticulum during Tc-99m DTPA renal scintigraphy

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An eight-year-old boy with recurrent urinary infection underwent Tc-99m DTPA renal scintigraphy for the evaluation of renal function. Stasis of the tracer was observed in the pelvocalyceal systems of both kidneys. Intravenous diuretic was administered to evaluate a possible mechanical obstruction.

During the course of the study, a well-defined, round area of activity extended from the bladder which was subsequently confirmed to be a diverticulum on voiding cystourethrogram and at surgery.

**Key words:** bladder, diverticulum, Tc-99m DTPA renal scintigraphy

### INTRODUCTION

BLADDER DIVERTICULA are one of the most important urologic abnormalities in childhood, causing obstruction and stasis of urine flow, leading to reflux, infection, urinary stones, hydronephrosis and in some cases, malignant tumors.<sup>1,2,9</sup>

A diverticulum can be either congenital or acquired and can occur anywhere in the bladder. The ureteral hiatus represents a potential weak spot in the posterolateral wall of the bladder which is the most common site of both congenital and acquired diverticula.<sup>1,3</sup>

A congenital diverticulum, which is encountered more commonly in children, includes all the layers of the bladder wall and is rarely symptomatic. The majority (90-98%) of congenital diverticula occur in males.<sup>2,4,9</sup>

An acquired diverticulum represents herniation of only the mucosa through an area of relatively deficient muscularization in the bladder wall and is usually associated with a reflux, obstructed urethra or neurogenic bladder.<sup>3,5</sup>

A diverticulum rarely produces any specific symptoms that suggest its presence. It is often diagnosed

radiographically during an evaluation for urinary tract infection, incontinence or obstruction.<sup>2,4</sup> Bladder diverticula are best demonstrated on a voiding cystourethrogram, although they may be visible on ultrasound, X-ray computerized tomography or magnetic resonance imaging.<sup>5,6</sup>

### CASE REPORT

An eight-year-old boy, treated several times for recurrent urinary infection, was referred to Nuclear Medicine for the evaluation of renal function. A Tc-99m diethylenetriamine pentaacetic acid (DTPA) renal scintigraphy was performed.

The acquisition was initiated simultaneously with the intravenous injection of 4 mCi (148 MBq) of Tc-99m DTPA. The patient was in the sitting position and the detector was placed posteriorly, over the region of the kidneys. Images were obtained with a circular-field-of-view rotating gamma camera (GE 400 AC/T), equipped with a general purpose, low-energy parallel-hole collimator, centered on the 140 keV photo-peak of Tc-99m with a 20% window.

The blood flow and glomerular (filtration) function of the right kidney were markedly impaired with focal areas of stasis and it was smaller than the left kidney. The blood flow and glomerular (filtration) function of the left kidney appeared normal but there was marked retention of the tracer throughout the pelvocalyceal system. [Fig. 1]

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To differentiate between functional and mechanical obstruction, furosemide was administered intravenously 30 minutes after the DTPA injection. A functional stasis was documented by a normal response of both kidneys to the diuretic.

However, 5 minutes after I.V. diuretic administra-

tion, a well defined, round shaped area of activity protruded from the right upper portion of the bladder and seemed to be continuous with bladder activity. [Fig. 2]

After completion of the test, the images were evaluated for possible patient motion but no motion

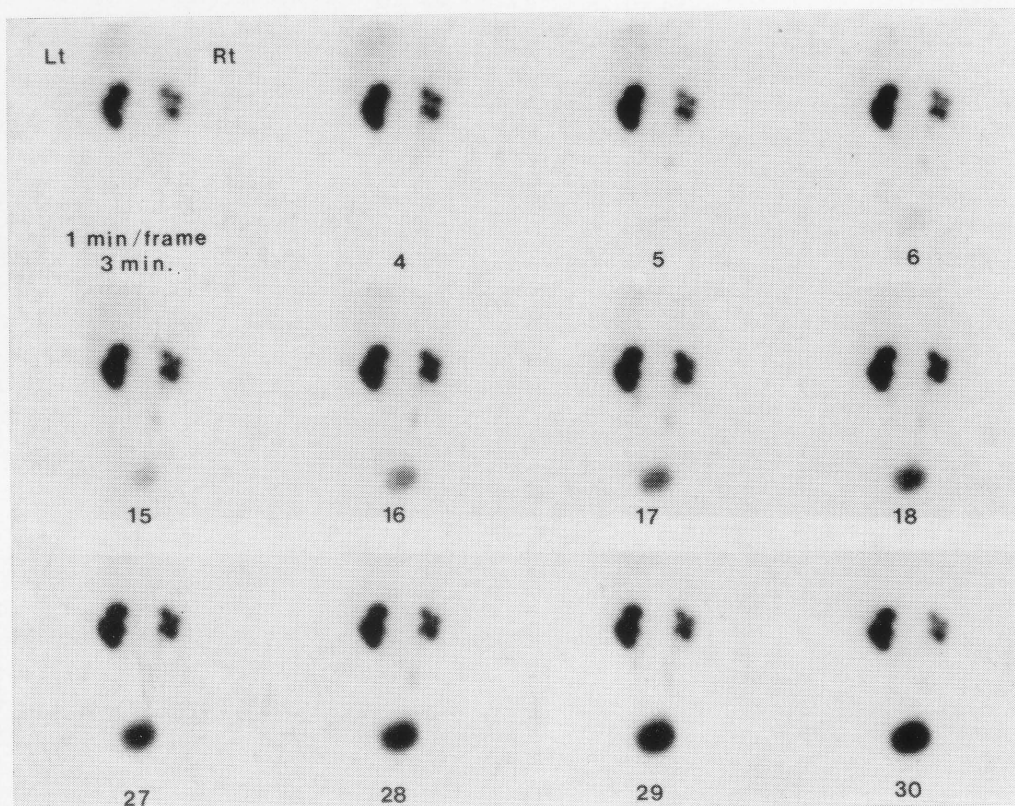


Fig. 1 Selected sequential one-minute Tc-99m DTPA functional images up to 30 minutes after radionuclide administration.

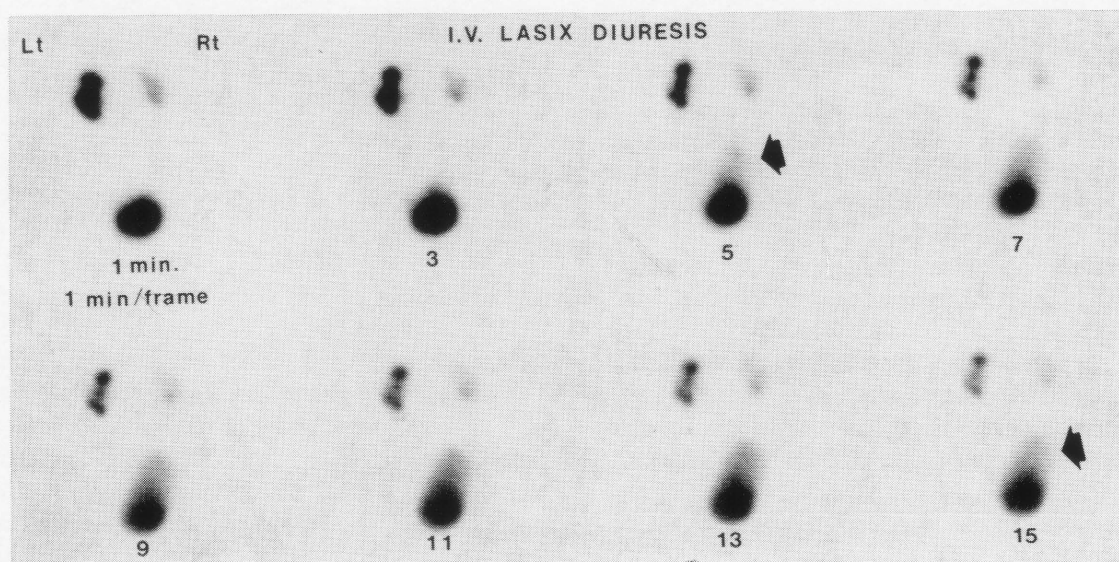
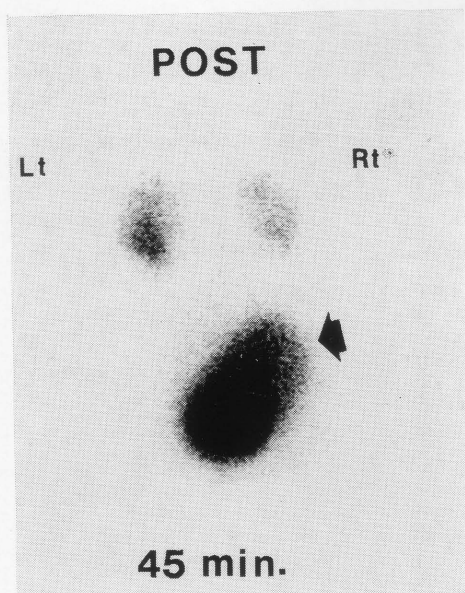
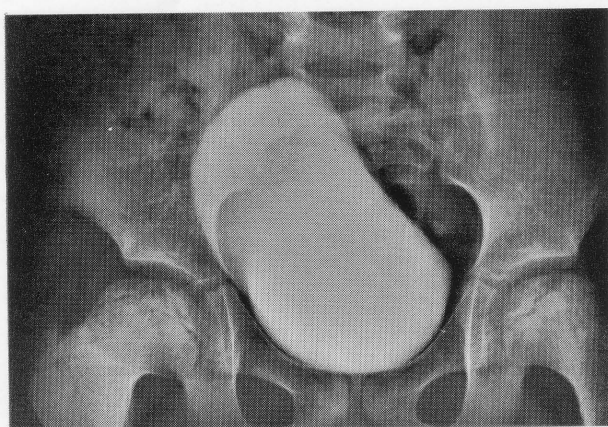


Fig. 2 Sequential one-minute Tc-99m DTPA images after I.V. diuretic administration. Filling in of the bladder diverticulum is shown in the 5 minute image (arrow).



**Fig. 3** Posterior static image at 45 minutes demonstrating the presence of the bladder diverticulum (arrow).



**Fig. 4** Anterior view of the voiding cystourethrogram demonstrating the bladder diverticulum.

artifact could be detected. An additional posterior static image confirmed this bladder configuration. [Fig. 3]

Since the patient had recurrent urinary infection, a bladder diverticulum had to be included in the differential diagnosis. Subsequently, a paraureteric bladder diverticulum was demonstrated on a voiding cystourethrogram [Fig. 4], and the patient underwent surgery confirming the same diagnosis.

### DISCUSSION

Tc-99m DTPA renal scintigraphy is a valuable diagnostic tool for the functional and gross anatomical evaluation of the entire urinary system. Usually less attention is paid to the bladder unless there is an abnormality directly related to it. But the technique

can provide valuable information about vesico-ureteral reflux, bladder configuration and capacity, and displacement of the bladder due to intra-pelvic masses.

Schutte and Silberstein have demonstrated bladder diverticula on bone scans, mimicking pelvic lesions, during the excretion of methylene diphosphonate (MDP) via the urinary system.<sup>7,8</sup>

Of course, Tc-99m DTPA renal scintigraphy is not the first test to apply for the diagnosis of bladder diverticula and the diverticula may not be as prominent as in this particular case. Since most of them are found incidentally and are usually related to recurrent urinary infection in childhood, any suspicion that may come out of a carefully interpreted renal scan can save time and change patient management.

It is important to mention that the incidence of malignant tumor associated with bladder diverticula is 10.6% and that 80% of diverticula surgically treated for benign disease have abnormal histopathology including chronic inflammation and squamous metaplasia.<sup>9-11</sup>

In the early stages, paraureteric diverticula are usually intermittent, filling only when bladder pressure is high, thus making early diagnosis unlikely.<sup>4</sup> Such bladder diverticula can only be diagnosed by imaging the bladder under increased vesical pressure, such as voiding cystourethrogram, direct/indirect radionuclide cystography or as an indirect finding in I.V. pyelography or renal scintigraphy. Diuretic renal scintigraphy is advantageous because it increases bladder pressure for the diagnosis of bladder diverticula in its routinely applied form.

In this case, the recurrent urinary infection and the prominent impairment of the right kidney was due to the presence and to some extent to the mechanical obstruction of the paraureteric diverticulum.

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