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Vesicoureteral Reflux and Other Findings in Micturition Cystography

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排尿時膀胱部撮影で観察した膀胱尿管逆流現象とその他の所見について

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原爆傷害調査委員会広島および長崎国射士院学術会議と厚生省予防衛生研究所との日米共同調査
研究機関米国原子力委員会厚生省国立予防衛生研究所および米国公衆衛生局の研究費による。

要 約

本報告において、泌尿器検査に排尿時膀胱部撮影が重要であることを強調し、併せて膀胱尿管逆流現象に関して文献的考察を行なった。X線所見を示している3症例について報告したが、排尿時

膀胱部撮影が通常静脈性腎盂撮影法を補足する極めて有用な検査であることを述べ、この検査の実施に当って大切な技術的条件についても若干説明した。

Introduction

The cause of vesicoureteral reflux has not been established. Although it is not a sign of a specific disease, it does play an important role in the diagnosis, treatment and prognosis of urinary tract disease. A brief review of the pertinent literature is presented with some case findings to illustrate the usefulness of micturition cystography.

Background

Horio¹⁾ described the phenomenon of retrograde flow from the urinary bladder into the ureters and renal pelves. Such reflux occurs in ascending urinary tract infections, and some reports have related it to intravesical ureter length. Gruber²⁾ and Hutch³⁾ state that it occurs more often in children than in adults because of shorter intravesical ureters. On the basis of Edwards' report,⁴⁾ Rosenheim⁵⁾ classified conditions in which it is found:

1. Abnormalities of ureteral orifice
 - a. Congenital—e.g., ectopic and double ureters
 - b. Acquired
 - (1) Infection
 - (2) Tuberculosis

(3) Trauma (post calculus, post surgical)

2. Infection—cystitis
3. Obstruction of lower urinary tract
4. Neurogenic bladder (congenital or acquired)
5. Megacystic (megaureter syndrome)
6. Unexplained (associated with chronic atrophic pyelonephritis)

Hutch⁶⁾ reported reflux in less than 5% of paraplegics during the first 3 years of their disease with a rising incidence to 17% some 7-1/2 years later. Hutch has stressed contributory anatomical changes in the intravesical ureter. The posterior supporting wall weakens, causing formation of a saccule or diverticulum just below the ureteral orifice, with shortening of the intravesical ureter. Ureteroplasty relieved reflux in the majority of his patients.

Ross et al⁷⁾ noted reflux in 39 of 101 post-traumatic paraplegics more frequently in severe cases, and stressed the role of infection in the development of reflux. Kjellberg et al⁸⁾ detected reflux in 99 (34%) of a series of 290 consecutive examinations of children with urinary tract infection without demonstrable neurogenic lesions. The relation between chronic pyelonephritis and reflux has been stressed since 1960, and in Edwards' report,⁴⁾ 42 of 55 patients with radiological signs of chronic pyelonephritis had vesicoureteral reflux.

After using micturition cystography in 100 children, Jones and Headstream⁹⁾ concluded reflux does not occur in normal children. Pasquier et al¹⁰⁾ found bladder neck obstruction responsible for reflux in children. Leadbetter et al¹¹⁾ could not detect it in normal cases at any age. Horio¹⁾ could not detect it in normal adults, and emphasized inflammation about the ureteral orifice as a major cause. It is generally agreed that the phenomenon does not occur in normal individuals.

As an aid in diagnosing this phenomenon, Winter¹²⁾ instilled 3-7 μ C of rose bengal-I¹³¹ or diodrast-I¹³¹ into the urinary bladder via catheter and measured the gamma ray of the I¹³¹ over the kidneys. Leadbetter et al¹¹⁾ confirmed reflux by urination cystography 15-30 minutes after instillation of 200 cc of 12% sodium iodide and 30 cc of 70% Urokon into the urinary bladder via catheter.

Gross and Sanderson¹³⁾ lists the following signs of vesicoureteral reflux:

1. Minimal dilatation of the lower one-third of the ureter with ureterovesical narrowing
2. A mucosal saccule in either the trabeculated and nontrabeculated urinary bladder
3. The ureteral "notch sign" on the excretory urogram

They list indications for micturition cystography as:

1. Ureteropelvic obstruction, or unexplained caliectasis, pyelectasis or ureterectasis
2. Demonstrable or suspected small or hypoplastic kidney
3. Malposition of the ureteral orifice, duplication of ureters, or ectopic kidney

Present Study

In addition to the above indications, we have used micturition cystography in all cases of chronic urinary tract infection as well. Following routine intravenous pyelography with the patient in a 15-20 degree Trendelenburg position, he was raised to a semi-erect position, and the pressure device released for ureterography, then returned to the horizontal for cystography with a caudad tube angulation. Twenty minutes later water or carbonated beverage was given for diuresis. The patient could usually urinate,

Figure 1. The urinal was bonded to an acrylite plate, and the latter can be attached in position on the Bucky film holder by means of perforations for hanging.

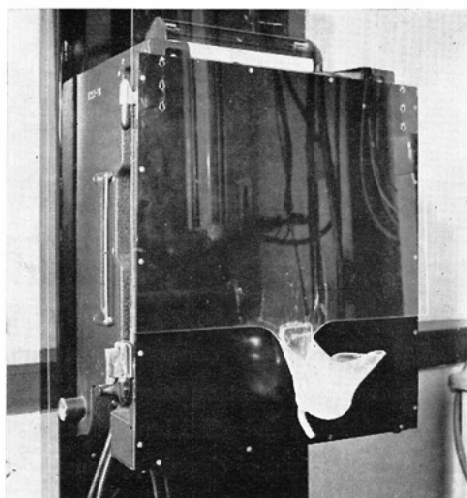
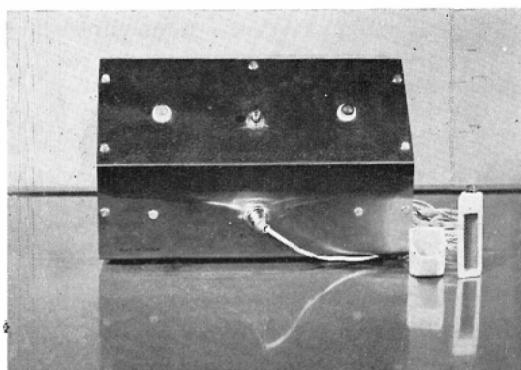


Figure 2. Picker Company "P-O-Mat" urinal.



and one preliminary AP cystogram identified any residual urine in the ureters or renal pelves. The two types of urinals used were both satisfactory. The specially designed urinal shown in Figure 1, attached to a plain low density plastic plate, was suspended from a Bucky film holder. At micturition the patient signaled the technician to make the exposure. The "P-O-Mat" (Picker Company), Figure 2, includes special electrodes in its urinal which, on contact with solution, cause a current flow. Stereoscopic exposures were used for close sequence films. One post-micturition film identified any residual urine in the ureters.

Figure 3. Roentgenogram showing marked visicoureteral reflux of media (Case 1).



CASE 1 (M.F. No. 324808)

This 44-year-old housewife was healthy until 1963, when she had a hysterectomy for uterine myoma. Persistent pyuria was subsequently found on urinalysis. Physical findings were within normal limits. A small number of red and white blood cells, epithelial cells and mucus per high power field were noted microscopically. Urine culture showed staphylococcus epidermidis and diphtheroids, but no acid-fast bacilli. All other laboratory studies were normal.

Intravenous pyelogram showed a bifid right renal pelvis and minimal deformity and dilatation of the right renal pelvis and calyces, compatible with chronic inflammatory disease. The left collecting system was normal. Marked reflux of contrast material into the ureters was seen on the micturition films with dilatation of the proximal portion of the urethra.

CASE 2 (M.F. No. 267223)

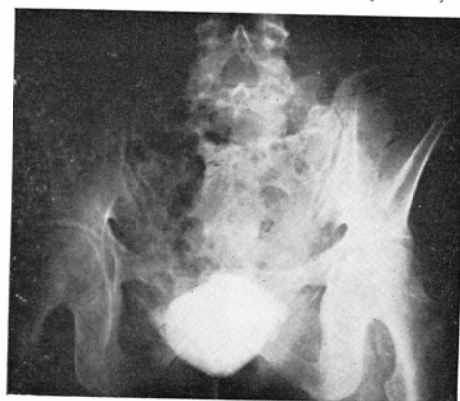
This patient was symptom free and normal on physical examination. A small number of red and white blood cells was noted per high power field on routine urinalysis. Urine culture was negative for acid-fast bacilli, but showed gram-positive staphylococcus epidermidis. All other laboratory findings were within normal limits.

Intravenous pyelogram showed some lack of definition of superior and middle calyces of the left kidney, and the right lowermost minor calyx, compatible with an inflammatory process. Slight deformities were seen in both sides of the urinary bladder, which were accentuated during urination, and identified as trabeculation and diverticula.

Figure 4a. Roentgenograms showing accentuation of diverticula during micturition (Case 2).



Figure 4b. Roentgenograms showing accentuation of diverticula during micturition (Case 2).

**CASE 3 (M.F. No. 466212)**

This 32-year-old female with slight right hypochondrium tenderness had no abnormal findings on physical examination. A small number of red and white blood cells, epithelial cells, mucus and a few calcium oxalate crystals per high power field were found on urinalysis. Urine culture showed staphylococcus epidermidis, Escherichia coli and diphtheroids. All other laboratory studies were within normal limits.

Intravenous pyelogram showed a bifid left renal pelvis. Trabeculation and a diverticulum of the right side of the urinary bladder was clearly demonstrated on the films made during micturition.

Figure 5a. Roentgenograms showing bladder diverticulum during micturition (Case 3).



Figure 5b. Roentgenograms showing bladder diverticulum during micturition (Case 3).



Discussion

Using this technique, vesicoureteral reflux, diverticula, and trabeculation of the urinary bladder were well demonstrated, since the latter findings were accentuated during micturition. The two types of urinals facilitated radiography during micturition, and stereo exposures provided two films in close sequence. The procedure was simple, and no special skill was required.

The assurance and relaxation of the patient for urination constituted a problem. A special enclosure or curtain is recommended to avoid distraction and embarrassment of the patient.

While X-ray cinematography is more advantageous with constant observation and a continuous recording of findings during micturition, the method described here is simple, and a conventional radiographic unit is a good substitute for cinematography when it is not available.

Conclusion

This report stresses the importance of micturition cystography in the study of the urinary tract, and includes a review of the literature concerning vesicoureteral reflux. Three case reports with roentgenographic findings to illustrate how micturition cystography can provide a most useful supplement to routine intravenous pyelography are presented. Some technical points useful in conducting such examinations are described, to facilitate demonstration of abnormalities with ordinary radiographic equipment.

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