



Original Article

To Study the Role of Magnetic Resonance Imaging in Posterior Urethral Distraction Defects

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Abstract

Objective: To study the role of magnetic resonance imaging in assessment of posterior urethra distraction defects with respect to location, length and depth of scar involved.

Methods: This was a prospective observational study. Patients aged 18-70 years, diagnosed with posterior urethral defect on conventional retrograde and voiding cystourethrography method were included in the study. All the patients planned for surgery had undergone MRI pelvis. All of the patients included in the study got a RGU/MCU done.

Results: Half of patients were below 30 years of age (50%). About one third of patients were between 30-50 years (30%). Road traffic accident was the most common cases of posterior urethral distraction defects (50%). Short Segment Stricture were in 6 (30%) of subjects on conventional retrograde urethrography combined with voiding cystourethrography, 8 (40%) on Magnetic Resonance Urethrography, 9 (45%) were at intraoperatively. Stricture was present at membranous part of urethra in 14 (70%) of subjects on conventional retrograde urethrography combined with voiding cystourethrography, 16 (80%) on Magnetic Resonance Urethrography and Intraoperatively. Periurethral fibrosis did not demonstrated in conventional retrograde urethrography combined with voiding cystourethrography, but Magnetic Resonance Urethrography imaging demonstrated periurethral fibrosis in 4(20%) patients.

Conclusion: MR urethrography is a promising tool for defining posterior male urethral strictures as an alternative to traditional radiographic methods. The future of MR Urethrography in the evaluation of posterior urethral distraction defects is mainly in cases with complex urethral distraction injuries, patients with multiple fistulae and in children.

Keywords: Magnetic resonance imaging, Posterior urethral distraction, Retrogradeurethrography, Voiding cystourethrography.

Introduction

The male urethra is a tubular structure approximately 18-20 cm long and runs from the bladder to the external urethral meatus.

Traditional radiologic exams, such as retrograde urethrography (RUG) and micturition cystourethrography, are considered the standard imaging techniques for the morphologic and

functional study of the urethra. Limitations of these studies include being invasive, poorly defining the accurate length of the stricture, and differing results between the endoscopic and radiographic appearances of the stricture. Moreover, no information is available about the extent of periurethral fibrosis (Osman et al, 2006).

The classic sign of urethral injury in a patient with a pelvic fracture is blood at the urethral meatus, but other symptoms such as bladder distension, inability to void, and perineal hematoma should raise a high index of suspicion as well.

The preoperative evaluation includes- rectal examination with combined RGU/ MCUG to determine the length of the urethral defect. Unfortunately, this evaluation provides limited information on the actual length of the urethral defect, the position of the prostate, and the extent of the fibrosis. The length of membranous urethral stricture is difficult to determine due to 'poor filling of the prostatic urethra with contrast material (Sudarshan et al, 2016).

Magnetic resonance imaging (MRI) has been introduced by McAninch and his group as a non invasive method of assessment of posterior urethral injury. It correctly measures the length of the defect with no problems of spurious estimation and clearly depicts the extent of fibrosis and degree and direction of prostatic displacement (Yoshifumi et al, 1993; Christopher et al, 1992).

The aim of this study was to study the role of magnetic resonance imaging in assessment of posterior urethra distraction defects with respect to location, length and depth of scar involved.

Material and Methods

This was a prospective observational study conducted in a tertiary care hospital in western Uttar Pradesh, India. The study was approved by the Ethical Committee of the Institute and the consent was taken from each participant before including in the study. The study included cases of diagnosed obliterative urethral stricture in patients presenting to the OPD and Emergency Department of the institute. Patients aged 18-70 years, diagnosed with posterior urethral defect on

conventional retrograde and voiding cystourethrography method were included in the study. Patients with concomitant anterior urethral stricture, contraindications for MRI (Pacemaker, orthopaedic implants), poor cardiovascular status and inability to place in lithotomy position (ex. Hip ankylosis) were excluded from the study.

Methods

All the patients planned for surgery had undergone MRI pelvis. The study variables were length of the stricture, extent of the periurethral fibrosis and position of the prostate.

All of the patients included in the study got a RGU/MCU done. Around 300ml to 500 ml of iodinated contrast material (30 ml of ioxitalamate mixed with 1 L of normal saline) was instilled into the bladder through the suprapubiccystostomy catheter to the patient's tolerance. During fluoroscopic observation, the patient was asked to void and then approximately 20 ml of diluted (50%) ioxitalamate infused simultaneously into the urethra with a syringe and a urethral catheter. Images obtained with the patient in the oblique position during maximum urethral distention. All the patients planned for surgery was additionally undergone MRI imaging. MR imaging examinations performed after RGU combined with VCUG examinations and the time between performance of MR imaging and RGU combined with VCUG imaging ranged from 4 to 10 days. Before MR imaging, the penis was positioned anteriorly in the supine position and taped to the abdominal wall beneath the surface coil. MR images were obtained by using a 1.5-T MR imaging device and a pelvic phased-array coil. Immediately after completion of the MR imaging examination and while the patient was on the table of the MR imager, 150-300 ml of normal saline was injected slowly into the emptied bladder through the suprapubiccystostomy catheter until the patient felt the need to void. Before repeating imaging, the tip of a 10-mL syringe was filled with 8-10 ml of sterile lubricating jelly which was inserted into the urethral meatus. The sterile lubricating jelly infused in the anterior urethra

until resistance is felt and some of the lubricating jelly overflowed from the urethral meatus. The glans sulcus of the penis then gently tied by using long gauze in order to avoid escape of the lubricating jelly. The penile shaft was secured in the midsagittal plane of the pelvis by using an upward traction and taping the edges of the tying gauze to the abdomen. MR imaging was performed again with the same imaging protocols and additional sagittal T1-weighted spin-echo (473/20) sequences before and 3 minutes after the administration of 0.1 mmol/kg of dopedtetate dimeglumine (Magnevist).

Statistical analysis

Descriptive statistics are presented in form of frequencies and percentages.

Results

Half of patients were below 30 years of age (50%). About one third of patients were between 30-50 years (30%). Road traffic accident was the most common cases of posterior urethral distraction defects (50%) (Table-1).

Short Segment Stricture were in 6 (30%) of subjects on conventional retrograde urethrography combined with voiding cystourethrography, 8 (40%) on Magnetic Resonance Urethrography, 9 (45%) were at intraoperatively. Stricture was present at membranous part of urethra in 14 (70%) of subjects on conventional retrograde urethrography combined with voiding cystourethrography, 16 (80%) on Magnetic Resonance Urethrography and Intraoperatively. Periurethral fibrosis did not demonstrated in conventional retrograde urethrography combined with voiding cystourethrography, but Magnetic Resonance Urethrography imaging demonstrated periurethral fibrosis in 4(20%) patients (Table-2).

Prostatic displacement was seen in 8 (40%) of total subjects on conventional retrograde urethrography combined with voiding cystourethrography, 12 (60%) of total subjects on Magnetic Resonance Urethrography. In Conventional retrograde urethrography combined with voiding cystourethrography findings, 6

(30%) patients were planned for Internal Urethrotomy or Perineal approach and 14 (70%) patients were planned for combined perineo abdominal transpubic approach. In Magnetic Resonance Urethrography findings, 8 (40%) patients were planned for Internal Urethrotomy or Perineal approach and 12 (60%) of total subjects planned for combined perineo abdominal transpubic approach. But during intraoperative period, planned surgical management was changed. 9 (45%) patients were decided for Internal Urethrotomy or Perineal approach and 11 (55%) were decided for combined perineo abdominal transpubic approach. False tracks were identified in 2 (10%) patients in conventional retrograde urethrography combined with voiding cystourethrography and in 4 (20%) patients in Magnetic Resonance Urethrography. Corpus cavernosum injury did not demonstrated in conventional retrograde urethrography combined with voiding cystourethrography, but Magnetic Resonance Urethrography imaging demonstrated corpus cavernosum injury in 3 (15%) patients (Table-3).

Table-1: Basic profile of patients

Basic profile	No. (n=20)	%
Age in years		
< 30	10	50.0
30 – 50	6	30.0
51 – 75	4	20.0
Causes of posterior urethral distraction defects		
Road Traffic Accident	10	50.0
Fall from height	8	40.0
Fire arm injuries	2	10.0

Table-2: Distribution of cases according to study parameters

Study parameters	RGU/MCU (n=20)		MRI (n=20)		Intraoperative (n=20)	
	No.	%	No.	%	No.	%
Measured Length						
Short Segment Stricture (<25 mm)	6	30.0	8	40.0	9	45.0
Long Segment Stricture (>25 mm)	14	70.0	12	60.0	11	55.0
Location of prostate						
Membranous	14	70.0	16	80.0	16	80.0
Prostatomembraneous	6	30.0	4	20.0	4	20.0
Periurethral fibrosis						
Seen	0	0.0	4	20.0	-	-
Not Seen	20	100.0	16	80.0	-	-

Table-3: Distribution of cases according to other parameters

Other parameters	RGU/MCU (n=20)		MRI (n=20)		Intraoperative (n=20)	
	No.	%	No.	%	No.	%
Prostatic displacement						
Seen	8	40.0	12	60.0	-	-
Not seen	12	60.0	8	40.0	-	-
Planned Surgery						
Internal Urethrotomy or Perineal	6	30.0	9	45.0	8	40.0
Perineoabdominal	14	70.0	11	55.0	12	60.0
Identification of false track						
Seen	2	10.0	4	20.0	-	-
Not seen	18	90.0	16	80.0	-	-
Identification of corpus cavernosum injuries						
Seen	0	0.0	3	15.0	-	-
Not Seen	20	100.0	17	85.0	-	-

Discussion

Obstructive conditions of the urethra are generally defined as urethral strictures. Anterior urethral strictures result from trauma or inflammation and are usually associated with scarring in the surrounding corpus spongiosum (spongiofibrosis). In contrast, the mechanism of posterior urethral strictures is complete or partial disruption of the lumen continuity secondary to pelvic trauma resulting in displacement of the urethral axis and urethral obliteration from intervening fibrosis. Urethral strictures rarely involve both anterior and posterior segments simultaneously (Gallentine and Morey, 2002). Being popularized in 1910 by Cunningham (1910), RUG remained as the gold standard imaging study for diagnosing urethral strictures for nearly a century.

MRI is an evolving radiographic modality and is widely replacing the conventional radiographic modalities despite its relative high cost. In our institute, MRI was used as a single radiographic modality in evaluating potential kidney donors,

replacing the conventional modalities (El-Diasty et al, 2005).

Yoshifumi et al (1993) reported that the length of the urethral injury was measured correctly within 5 mm in 85% of patients by using MR imaging. Stricture length measured by Narumi et al on sagittal MR images, was not the true length of a fibrotic segment but the distance between the prostatic apex and the bulb of the penis. In the present study, short segment Stricture were in 6 (30%) of subjects on conventional retrograde urethrography combined with voiding cystourethrography, 8 (40%) on Magnetic Resonance Urethrography, 9 (45%) were at intraoperatively.

Results in this study showed that MR urethrography demonstrated lower error in the measurement of stricture length than did combined RGU / MCUG and was useful for selecting the most appropriate surgical procedure. This finding is consistent with the study by Sudarshan et al (2016).

In the present study, stricture was present at membranous part of urethra in 14 (70%) of subjects on conventional retrograde urethrography combined with voiding cystourethrography, 16 (80%) on Magnetic Resonance Urethrography and Intraoperatively. Periurethral fibrosis did not demonstrated in conventional retrograde urethrography combined with voiding cystourethrography, but Magnetic Resonance Urethrography imaging demonstrated periurethral fibrosis in 4(20%) patients.

Yoshifumi et al (1993) performed the MR imaging study in 27 patients who requiring definitive urethroplasty procedure. The study results revealed the length of urethral stricture in 23 out of 27 patients (85%) and displacement of the prostatic apex in 19 of 21 (90%) are correlated with the surgical findings.

In this study, prostatic displacement was seen in 8 (40%) of total subjects on conventional retrograde urethrography combined with voiding cystourethrography, 12 (60%) of total subjects on Magnetic Resonance Urethrography. In Conventional retrograde urethrography combined with voiding cystourethrography findings, 6 (30%) patients were planned for Internal Urethrotomy or Perineal approach and 14 (70%) patients were planned for combined perineo abdominal transpubic approach.

Christopher et al (1992) conducted a study on 18 patients who underwent MRI imaging before open urethroplasty, the surgical results were correlated with the MRI findings.

This study agrees with the experiences of others that the degree of dislocation can be clearly identified by combined MRI views, particularly with coronal and sagittal reconstruction (Yoshifumi et al, 1993).

Conclusion

MR urethrography is a promising tool for defining posterior male urethral strictures as an alternative to traditional radiographic methods. The future of MR Urethrography in the evaluation of posterior urethral distraction defects is mainly in cases with

complex urethral distraction injuries, patients with multiple fistulae and in children.

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