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Original Research Article

Role of magnetic resonance urethrography in evaluation of male urethral stricture

S. Swain*, Kishore Kumar Behera, S. Panda, Abhilekh Tripathi, Sachin Sharma, Jateen Anshuman, Tilala Yash Manaharlal

Department of Urology and Renal Transplantation, SCB Medical College and Hospital Cuttack Odisha India

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***Correspondence:**
Dr. S. Swain,
E-mail: samirmchindia@gmail.com

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ABSTRACT

Background: Urethral stricture in male is a common urological disease causing lower urinary tract symptoms like thin stream of urine with straining to urinate, may be associated with dysuria or acute urinary retention. RGU is gold standard in male urethral stricture evaluation. In this study we compare magnetic resonance urethrography (MRU) with retrograde urethrography (RGU) in diagnosing male urethral stricture.
Methods: The 40 male patients with the diagnosis of stricture urethra were taken for this study. Evaluation done first by RGU then after 7 days MRU. Final corroboration of above findings with the surgery (endoscopic or open).
Results: Data of 40 male patients with urethral stricture are analysed with computer software SPSS v 25. mean age of stricture diagnosis is 43 years (range is 31-63 years). Mean length of stricture is 1.90 cm (with SD 0.85), 1.89 cm (with SD 0.92) and 1.91 cm (with SD 0.94) in RGU, MRU and Surgery respectively. sensitivity and specificity of RGU is 84.2% and 50% and MRU is 92.1% and 100% respectively. accuracy of RGU and MRU is 82% and 92% respectively. 3 patients out of 16 patients with long segment bulbar urethral stricture (>1.5 cm) without any spongiofibrosis managed with BMG urethroplasty. Two patients out of 24 patients with short segment bulbar urethral stricture (<1.5 cm) with dense spongiofibrosis managed with PEEAU.
Conclusions: Both RGU and MRU can detect stricture lengths accurately but MRU has advantage of detection of spongifibrosis in cases of anterior urethral stricture. MRU detects orientation and alignment of both proximal and distal urethral segments in case of PFUI.

Keywords: Stricture, RGU, MRU

INTRODUCTION

Urethral stricture in male is a common urological disease causing lower urinary tract symptoms like thin stream of urine with straining to urinate. It is divided into anterior urethral stricture and posterior urethral injury.[1]

It is mainly caused by injury, inflammation of urethral mucosa or trauma to urethra. Per urethral catheterization or any instrumentation affects anterior urethra and Perineal trauma (straddle injury) affects both anterior and posterior urethra. Strictures usually present with obstructive voiding symptoms or urinary tract infections and some time leads to acute urinary retention.[2]

Various modalities have been devised to diagnose strictures in male patients. Commonly used methods include RGU, voiding cystourethrography, sonourethrography and MRU.[3-5] Role of imaging in strictures is significant in determining the treatment protocols. The treatment options and approach depend upon the length, location and associated spongiofibrosis with presence and absence of urethrocutaneous fistula.

The gold standard imaging technique is RGU which is readily available, simple and cost effective. Disadvantages include its invasive nature, contrast allergy, inaccurate estimation of stricture length and does not show the spongiofibrosis.[6]

Recent noninvasive tests have been developed to solve problems of RGU, like Sonourethrography and MRU, that do not require injection of contrast media.[7-9] Though noninvasive, each has its own disadvantages. Sonourethrography which is operator dependent and not useful in evaluation of posterior urethra and disadvantage of MR urethrography is its cost and availability.[10,11]

Aims and objectives

Primary

Primary aim and objectives were to compare the validity of MRU in diagnosing male urethral stricture in relation to RGU.

Secondary

Secondary aim and objectives were to correlate the MRU diagnosis with the plan of surgical management and to compare the outcome.

METHODS

Study population

Patients with provisional diagnosis of stricture urethra. Further evaluations done according to our institutional protocol.

Patients were undergoing thorough physical examinations (systemic and local genital examination).

Place of study

Department urology, SCB medical college and hospital, Cuttack, Odisha

Study population

The 40 male patients with the final diagnosis of urethral stricture were taken up for study after satisfying inclusion and exclusion criteria.

Study period

The study carried out on April 2021 to March 2023.

Study design

It is a hospital based prospective observational study.

Ethical clearance taken from institutional ethical committee.

Inclusion criteria

Male patients with diagnosis of urethral stricture and patient selection were according to the study criteria.

Exclusion criteria

Active infections in urinary tract, previous optical internal urethrotomy, previous urethroplasty, cardiac pacemaker and implants *in-situ* were excluded.

Sampling procedure

Consecutive sampling method was used.

Statistical analysis

All the collected data are analysed by computer software: Microsoft excel, SPSS v 25.

Methods

All the patients were explained about the procedure and the study. After enrollment for the study with signing of consent form. The patients were investigated by RGU and MR urethrography. These patients were subjected to definitive procedure like endoscopic or open surgical intervention under anesthesia. The radiological data were compared by endoscopic (or) open operative findings in all these patients.

Factors analysed

Length and location of stricture segment. Extent of spongiofibrosis. Associated pathology.

RESULTS

Urethral stricture disease is more common in age of 31-63 years. Mean age of stricture diagnosis is 43 years.

Table 1: Age distribution in stricture patients.

Age group (In years)	N
11-20	1
21-30	7
31-40	12
41-50	8
51-60	9
61-70	3

The 14 cases were idiopathic, 12 cases are iatrogenic, 8 cases are post traumatic, 5 case were inflammatory. One case due to PFUI (straddle injury) was seen Table 2.

Table 2: Causes of stricture urethra.

N	Cause of stricture	Percentages (%)
14	Idiopathic	35
12	Iatrogenic	30
8	Post traumatic	20
5	Inflammatory	12.5
1	PFUI	2.5
Total	40	100

RGU

All patients having anterior urethral stricture. Length of stricture in RGU showed 26 patients (65%) had long segment anterior urethral stricture (> 1.5 cm), 14 patients (35%) had short segment anterior urethral stricture (<1.5 cm) (Table 3).

In all cases it showed single stricture and in one case only penile urethra Narrowing and no definite stricture seen.

Table 3: Length of stricture in RGU.

Length of stricture	N	Percentages (%)
<1.5 cm	26	65
>1.5 cm	14	35
Total	40	100

Most common location of stricture is mid bulbar urethra i.e., 50% (20 patients) followed by proximal bulbar and distal bulbar, 2 patients were bulbomembranous junction stricture.

MRU

In MRU 60% (24) patients had stricture length <1.5 cm but in 2 patients dense spongiofibrosis seen. i.e., in 9% cases. 40% (16) patients had stricture length >1.5 cm long segment stricture without spongiofibrosis seen in 3 patient i.e., in 18% cases (Table 4).

Table 4: Length of stricture in MRU.

Length of stricture	N	Percentages (%)
<1.5 cm	24	60
>1.5 cm	16	40
Total	40	100

Most common location of stricture is mid bulbar urethra i.e., 52.5% (21 patients) followed by proximal bulbar, distal bulbar and bulbomembranous urethra.

Surgery

All stricture patients were undergoing treatment, either by open surgery or by endoscopic methods.12 patients with stricture length <1.5 cm and 3 patients with stricture length >1.5 cm without songiofibrosis underwent CPE with optical internal urethrotomy. Eight patients with stricture length >1.5 cm with spongiofibrosis and 2 patients with stricture length <1.5 cm but with dense spongiofibrosis underwent BMG urethroplasty.6 patients with stricture length >1.5 cm with spongiofibrosis and 2 patients with stricture length <1.5 cm with spongifibrosis underwent perineal end to end anastomotic urethroplasty (PEEAU). PEEAU was done with perineal bulb sepation and b/l crural separation. Five patients underwent segmental lay open and they are followed up for further planning of stage 2 urethroplasty. Two patients had no definite stricture so CPE with endodialation done and PUC placed (Table 5).

Table 5: Name of surgery done.

Surgical procedure	N	Percentages (%)
CPE with OIU	15	37.5
BMG urethroplasty	10	25
PEEAU	8	20
Segmental lay open	5	12.5
Only endodilation	2	5
Total	40	100

Endoscopic procedure like cystopanendoscopy done in 17 patients, no definitive stricture seen in 2 patients. Out of which 15 patients: with short segment stricturelength <1.5 cm underwent OIU, 13 patients underwent open procedure (Table 6).

Table 6: Types of surgery done.

Type of surgery	N	Percentages (%)
Endoscopic	17	57.5
Open	23	42.5
Total	40	100

Most common location of stricture is mid bulbar urethra i.e., 52.5% (21) followed by proximal bulbar, distal bulbar and bulbomembranous urethra (Table 7).

Table 7: Location of stricture in surgery.

Location of stricture	N	Percentages (%)
Distal bulbar	6	15
Mid bulbar	21	52.5
Proximal bulbar	11	27.5
Bulbo membranous junction	2	5
Total	40	100

Out of 40 patients, length of stricture varies from 1 cm to 3.5 cm. So mean stricture length is 1.9 cm with standard deviation of 0.85. Length of stricture in MRU varies from 1 cm to 3.8 cm.so mean stricture length is 1.89 cm with standard deviation is 0.92.

Table 8: Paired samples statistics.

Paired samples statistics		Mean	N	SD	Std. error mean
Pair 1	RGU lengh	1.9050	40	0.85514	0.13521
	MRU length	1.8975	40	0.92362	0.14604

P=0.898

On definitive management of these patients the length of stricture segment varies from 1 cm to 4 cm, with a mean length of 1.91 cm and standard deviation of 0.94.

Table 9: Paired samples statistics.

Paired samples statistics		Mean	N	SD	Std. error mean
Pair 1	RGU length	1.9050	40	0.85514	0.13521
	Surgery length	1.9150	40	0.94937	0.15011

P=0.858.

Mean length of stricture in MRU is 1.89 cm and mean stricture length confirmed on surgical intervention is 1.91 cm with standard deviation of 0.92 and the 0.94 respectively.

Table 10: Paired samples statistics.

Paired samples statistics		Mean	N	SD	Std. error mean
Pair 1	MRU length	1.8975	40	0.92362	0.14604
	Surgery length	1.9150	40	0.94937	0.15011

P=0.303

Sensitivity of RGU is how often it is capable of finding true positive.

Formula is: true positive/true positive+ false negative. Sensitivity of RGU=32/38*100=84.2%

Sensitivity of MRU is true positive/true positive+false negative of RGU is its ability to found true negative.

Formula is: true negative/true negative+false positive.

Sensitivity of MRU 35/38×100=92.1%

Specificity

Specificity of RGU=1/2×100=50%.

Specificity of MRU is true negative/true negative+false positive.

Specificity of MRU=2/2×100=100

How many cases RGU is able to correctly diagnose the stricture.

Accuracy of RGU=33/40=82.5%

How many cases MRU is able to correctly diagnose the stricture.

Accuracy of MRU=37/40×100=92.5%.

Figure 1: RGU of mid and proximal bulbar urethral stricture (solid arrow).

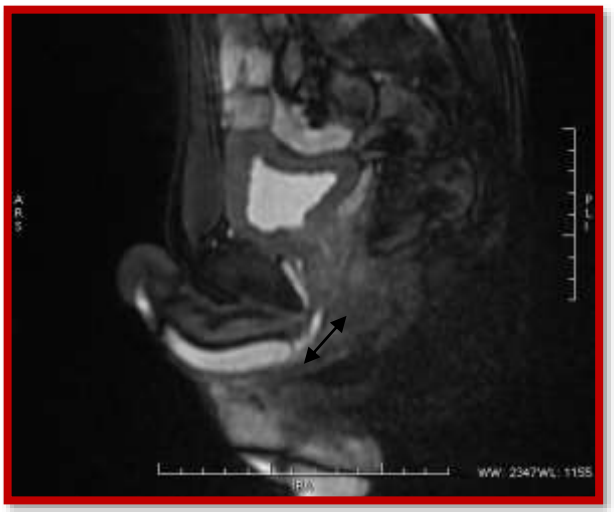

Figure 2: MRU showing proximal bulbar urethral stricture with spongiofibrosis (solid arrow).

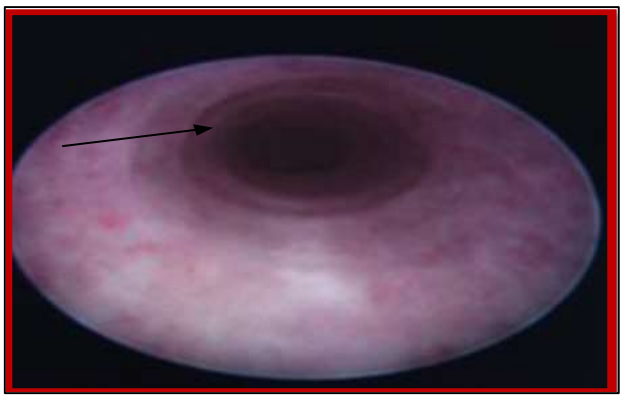

Figure 3: Endoscopic view of stricture segment (solid arrow).

DISCUSSION

RGU was set as gold standard imaging modality for the diagnosis of stricture urethra in 1910, by Cunningham because it is easily available and a simple technique. But it has certain disadvantages like over or under estimation, radiation effect and does not provide information about periurethral spongiofibrosis.[3,4]

To overcome this limitation, MRI was suggested, according to Garcia-Valtuille the treatment choice and route of approach depends upon the site, length, spongiofibrosis and associated pathology.[8,9] Endoscopic repair can be effective for stricture <1.5 cm without spongiofibrosis. The long stricture >1.5 cm with spongiofibrosis can be treated by open repair either anastomoticor augmentation urethroplasty through perineal route, but complex stricture needs trans pubic approach.[12,13]

In this study for diagnosing anterior urethral stricture: RGU has sensitivity of 84.2% and specificity of 50%. MRU has sensitivity of 92.1% and specificity of 100%.

Whereas the study by Syed al the sensitivity and specificity of RGU for the diagnosis of urethral stricture was 91% and 72%andby MRU it was 100%.[6]

The other study by Mohamed et al showed the sensitivity, specificity for diagnosing anterior urethral stricture by RGU was 91% and 90% and 89% and 91.7% for posterior urethra, by MRU it was 91.7% (ant and post). In sono-urethrography the accuracy was 100% in ant urethra, 60% in posturethra.[13]

In this study the accuracy showed by RGU for planning surgery was 82.5% and by MR urethrogram was 92.5%. But the study by Osman for both RUG and MR urethrogram the accuracy was 85%.[14]

In this study MR urethrogram diagnosed all the cases of anterior and posterior stricture with exact delineation of its length with 100% sensitivity, 93.4% specificity and 90.1% overall accuracy, which was well correlated the study by Mohamed et al.[13]

In this study in 2 cases of normal urethra, RGU can detect only one case, but MRU diagnosed both cases, so specificity of MRU is 100% over RGU is 50%.

Similar to the study conducted by Sung et al.[16] In this small series of patients MR urethrography proved to be a promising technique for evaluating male urethral stricture. It combined the advantages of RGU and Sono urethrography with its few disadvantages of cost effectiveness and its availability.

Limitation

This is a single center study with limited sample size.

CONCLUSION

Both RGU and MRU can detect stricture lengths accurately but MRU has advantage of detection of spongifibrosis in cases of anterior urethral stricture. MRU detects orientation and alignment of both proximal and distal urethral segments in case of PFUI.

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Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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