Original Article

Role of ascending urethrography micturatingcystourethrography (ASU-MCU) in modern medicine in view of 3D cross sectional imaging era: The institutional review study

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Abstract

Aim: To study the usefulness of ASU-MCU in modern medicine in view of 3D cross sectional imaging era. **Materials and Methods**: We retrospectively analysed consecutive 125 patients referred to our department during January 2016 to May 2016 for the ASU-MCU study. There are 100 adults and 25 paediatric patients with 92 male patients and 33 female patients. The age ranging from 1 month to 78 years with majority in 30-50 age groups. Majority of adult patients are referred for ASU-MCU. Majority (80%) paediatric age group patients are referred for MCU. **Results:** The indications in adult male patients were urethral stricture (22%), VUR (18%), diverticulum due to chronic bladder outlet obstruction (12.8 %) urethral injury or perineal trauma (4%), patients of CKD who are prospective renal transplant recipients (4%) and urethrocutaneous fistula (2.4 %). In adult female patients the indications were recurrent urinary tract infections due to VUR (14.4 %), diverticulum (1.6%) and cystocele (0.8 %). In children main indication is VUR (12.5 %), exstrophy of bladder (6.5 %) and neurogenic bladder due to meningomyelocele (1%). **Conclusion:** Our retrospective analysis denotes that ASU-MCU is still a very useful dynamic imaging study .The common indications are stricture urethra and VUR. The Radiology students should be taught about these procedures. All the referring clinicians were satisfied with the imaging outcome.

Keywords: Ascending cystourethrography (ASU), Micturating Cystourethrography (MCU).

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INTRODUCTION

Ascending urethrography (ASU) and Micturating Cystourethrography (MCU) are the routinely asked procedures in the department of radiology in any Medical institute. With advent of 3D Cross sectional imaging the art of doing this procedure and its diagnostic utility may be undermined. The precise radiological findings of normal anatomical features of these procedures are scantily described in modern Textbooks. Our institute is a Government run 2100 bedded multispecialty tertiary care hospital with undergraduate and postgraduate medical teaching facility situated in Mumbai. Patient from all over the State of Maharashtra and neighbouring states are referred. Patients with lower socio-economic strata particularly are the main beneficiaries of this institute. In view of this ASU –MCU is simple, cheap and dynamic imaging modality with good diagnostic utility. Our study will review the usefulness of this procedure and will highlight the precise modern day indication for the procedure.

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MATERIAL AND METHODS

We retrospectively analysed 125 patients referred to our department during January 2016 to May 2016 for the ASU-MCU study.

Procedure 1:

Preparation: Patient is asked to micturate prior to examination.

Equipment: 500 mA Fluoroscopy unit (Allengers-525, India) with computerised radiology system (AGFA CR 35-X)

Contrast medium: Water soluble iodinated contrast 60% (Urografin which contains the active ingredient sodium diatrizoate - megluminediatrizoate).[2] Contraindication for the procedure is acute urinary tract infection. Ascending Urethrography in male. Retract the foreskin and clean the tip of penis with betadine solution. Inject a small amount of topical local anaesthetic (e.g. lignocaine gel) into the urethra with a syringe. Local anaesthetic helps to relax the sphincter as the patient may contract it during the procedure thus leading to a diagnosis of a stricture. The patient is positioned obliquely at 45 degrees with the bottom leg flexed 90 degrees at the knee and the top leg kept straight to visualise full length of urethra. Place the tip of the metallic adaptor into the urethral orifice and attach the contrast loaded syringe to it. Then long axis of penis is stretched parallel to the long axis of femur over the soft tissue of thigh .Avoid crossing over femur. Contrast medium is injected steadily. Images are acquired as soon as 20ml of contrast is injected. Additionally opposite oblique is taken. This is followed by Micturating cystourethrogram. Using aseptic precautions, a Foley's catheter is lubricated with lignocaine gel and inserted into the bladder. In pediatric patients and adult patients with stricture, feeding tube is used. The bladder is filled till patient gets sensation of voiding or maximum bladder capacity is reached. The bladder capacity is estimated by a formula (3) -

Less than one year: Weight (kg) × 7 = capacity (ml)

Less than two years: (2 × age in years + 2) × 30 = capacity (ml)

More than two years: (Age in years/2 + 6) × 30 = capacity (ml)

Patient is asked to void in container. Children are allowed to void on absorbent pad. The following projections are acquired:

1. AP with full bladder for demonstration of the presence or absence of VUR.
2. Both obliques to demonstrate bilateral vesicoureteric junctions and posterior urethra
3. Post void film to check for aureterocele and post void residue.
4. Lateral view if vesicovaginal or Rectovesical fistula is suspected. In female patients only MCU is performed.

Images are then interpreted immediately by the performing radiology student and confirmed by senior teaching staff. If any further study is required, then it is immediately done .The VUR is graded as per the International Classification of Vesico-ureteral Reflux[4]

Grade I: Reflux into non-dilated ureter.

Grade II: Reflux into the renal pelvis and calyces without dilatation.

Grade III: Mild/moderate dilatation of the ureter, renal pelvis and calyces with minimal blunting of the fornices.

Grade IV: Dilation of the renal pelvis and calyces with moderate ureteric tortuosity.

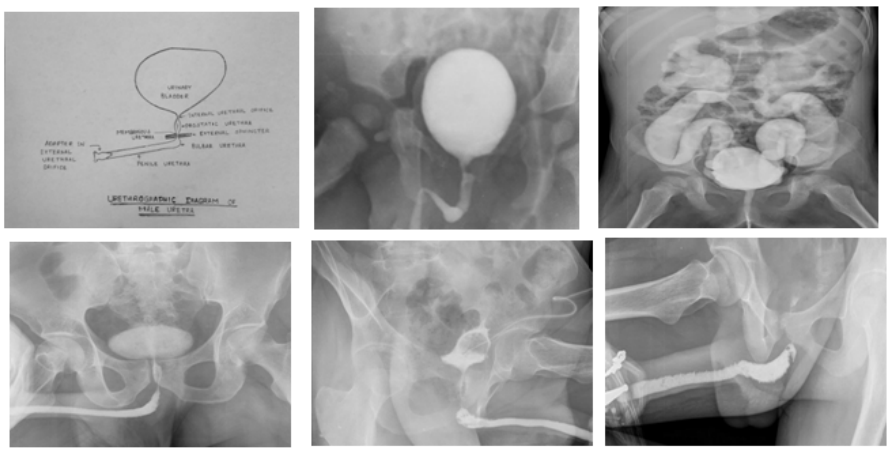
Grade V: Gross dilatation of the ureter, pelvis and calyces; ureteric tortuosity; loss of papillary impressions.

All the referring clinicians were telephonically asked about whether they are satisfied or not about the imaging outcome.

RESULTS

Table 1:

	Urethral stricture	36%
Male (n=79)	VUR	28%
	Diverticulum due to chronic bladder outlet obstruction	20 %
	Urethral injury or perineal trauma	6%
	Patients of CKD who are prospective renal transplant recipients	6%
	Urethrocutaneous fistula	4%
Female (n=21)	Recurrent urinary tract infections due to VUR	85.5 %
	Diverticulum	9.5%
	Cystocele	5%
Paediatric(n=25)	VUR	64%
	Exstrophy of bladder	32 %
	Neurogenic bladder due to meningomyelocele	4 %



Our study proves that urethral stricture and VUR are the two most important indications to do ASU-MCU study. These two indications cannot be deduced on any of the current higher end 3D cross sectional imaging like USG, CT scan or MRI. ASU-MCU is currently the only modality to reasonably prove or disprove urethral stricture and VUR. This procedure also yields diagnostic information to the satisfaction of referring clinicians. VUR grades were noted between Grade I to V as mentioned above. Different bladder shapes were noted as Christmas tree, trabeculated and Spherical. This procedure does not require any patient preparation or premedication. The duration of the procedure is not more than 10 minutes. The patients were walked in and went back immediately after the procedure.

COMPLICATIONS

The complications can be divided into two groups. One regarding the technique of the procedure, two due to contrast media. Due to the technique of the procedure complications that can occur are dysuria, acute infection, trauma resulting in transient hematuria and intravasation of contrast media. No acute infection seen in our series. Dysuria was noted in6.4% patients, hematuria in 3.2 % and intravasation of contrast was seen in 2 patients (1.6 %). Dysuria and hematuriae solved over a period of time with adequate hydration without requiring any specific treatment. No adverse reaction noted due to contrast media. All the clinicians were satisfied about the imaging outcome of the procedure except one who wanted additional view to demonstrate urethral stricture better.

DISCUSSION

ASU-MCU is a commonly requested fluoroscopic procedure in any institute. The procedure is easy to perform and has a short learning curve. The diagnostic yield of these procedures depends on the technique of performing the procedure. Most of the findings are to be observed real-time under fluoroscopy. The timing of capturing the images should also be perfect. Our intention of doing this analysis was to find the current diagnostic utility of these procedures in view of the current cross-sectional imaging era. We would also like to emphasise on the technique of doing the procedure as the information provided by these examinations cannot be obtained by any other currently available higher end imaging modality. The anatomy of the urogenital system and it's radiological appearance should be known prior to the procedure. Anatomy of male urethra[5,6]: It is about 18-20 cm long. It is divided in three parts as follows

- Prostatic Urethra: It runs within the prostate eccentrically. It is about 3 cm in length. It is widest and most dilatable part of urethra. It is widest in the middle and gets narrowed at it proximal end called internal urethral orifice and distal end where it joins membranous urethra. It is semilunar shaped in cross section with convexity directed anteriorly.
- Membranous part: It runs through the external sphincter. With exception of urethral orifice it is the narrowest part of the urethra. It is shorted and least dilatable art of urethra. It is star shaped in cross section. The Bulbourethral glands of Cowper are placed one on each side of the membranous urethra, although their ducts open into the spongy part of the urethra after piercing the perineal membrane. Numerous urethral glands also open into the membranous urethra. Prostatic and membranous urethra together referred as posterior urethra.
- Spongy (Penile) urethra: The spongy urethra is the region that spans the corpus spongiosum of the penis. It is divided into the pendulous urethra and the bulbous (or bulbar) urethra. The pendulous urethra is invested in the corpus spongiosum of the penis in the pendulous portion of the penis. The urethra is located concentrically within the corpus spongiosum.

The penile urethra is the narrow with a uniform diameter of about 6 mm in the body of penis except at two locations. One at its commencement, to form intrabulbar fossa and two within glans penis to form fossa navicularis. The External urethral orifice is the narrowest part of male urethra. It forms a sagittal slit about 6mm long and is bound on each side by a small labium. In the distal urethra lies the fossa navicularis, a small dilation of the urethra just proximal to the urethral meatus. The meatus is a slit like orifice with its long axis in a midline sagittal plane. The urethral meatus is slightly ventral to the tip of the penis. The bulbous urethra is invested in the bulb of the penis, the portion of corpus spongiosum that lies between the split corpora cavernosa in the superficial perineal space. Bulbourethral (Cowper) glands, a male homologue of the greater vestibular (Bartholin) glands, originate in the external urethral sphincter muscle but terminate in ducts that empty into the bulbous urethra. The spongy urethra lies closer to the dorsum of the penis in the bulb. Radiological appearance of the male urethra on ASU: The prostatic urethra though widest and most dilatable but is not fully distended on ASU. It looks like a thin smooth strip but should not be mistaken for a stricture. Hence at times we have to do MCU with descending urethrogram for the prostatic urethra. The membranous urethra is narrowest except external urethral orifice, the contrast jet is seen going into the bladder rather than fully distending it and not fully outlining it. Ideallyprostatic urethra is seen as widest in middle part and narrowed at its proximal and distal end as seen in line diagram and radiographical image (fig.1).The penile urethra is seen as uniform tube from the point of adaptor till narrowed membranous urethra. Here care must be taken to adequately stretching the penis otherwise it will have corrugated appearance. The membranous urethra is seen as narrowest short segment between penile and prostatic urethra. Just distal to membranous urethra the penile urethra shows slight bulbous appearance. The fully distended normalurinary bladder is Ovoid in shape. Its apex is directed towards umbilicus and neck directed downwards. The empty bladder is tetrahedral having four surfaces, apex pointing forwards, Neck downwards and base backwards. Shape of the bladder can suggest the disease process affecting it. Christmas tree appearance is typical of neurogenic bladder, small spherical suggests chronic cystitis, trabeculated bladder suggests cystitis, pear shaped suggests bilateral external compression.[7,8]

CONCLUSION

Our retrospective analysis denotes that ASU-MCU are still very useful dynamic imaging studies. The most common indications arestricture urethra and VUR. The Radiology students should be taught about these procedures to have a good diagnostic yield. All the referring clinicians were satisfied with the imaging outcome.

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