

COMPARISON OF SONOURETHEROGRAPHY AND RETROGRADE URETHROGRAPHY IN ANTERIOR URETHRAL STRICTURES TAKING SURGICAL FINDINGS AS GOLD STANDARD

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ABSTRACT

BACKGROUND: Previously retrograde urethrogram and micturating cystourethrogram were used for the evaluation of urethral strictures. Lack of radiation, ability to assess mucosal and periurethral abnormality and more precise measurement of stricture length makes the sonourethrogram an alternative to conventional urethrogram in evaluation of anterior urethral strictures. **OBJECTIVE:** To compare the difference between sonourethrogram and fluoroscopic guided urethrogram in characterization of anterior urethral strictures taking surgical findings as gold standard. **METHODS:** Total 50 male patients having lower urinary tract symptoms (thin streak of micturation or interrupted micturation) for 1 week or longer were included in this cross sectional study from September 2019 to February 2020. Patient's history and demographic details like patient's age was noted. Sonourethrographic studies were performed using high frequency probe while injecting saline solution through 12 Fr Foley's catheter with bulb inflated in fossa navicularis. Anterior urethra was visualized up to the penoscrotal junction with multiple longitudinal and transverse scans by placing the transducer on the ventral surface of penis. The findings of sonourethrogram were compared with retrograde urethrogram and surgical findings and recorded on proforma. **RESULTS:** The average age of the patients was 37.22 – 11.09 years. The sensitivity, specificity, PPV and NPV and diagnostic accuracy of sonourethrogram for detection of anterior urethral stricture was 77.7%, 96.8%, 93.3% and 88.57% and diagnostic accuracy was 90% respectively. **CONCLUSION:** Sonourethrogram can be used as an alternative to retrograde urethrogram in the diagnosis and characterization of anterior urethral strictures without hazards of ionization radiation.

Key words: Sonourethrogram, Retrograde Urethrogram, Surgical findings, Urethral strictures

Introduction

Urethral stricture involves narrowing of urethra and is one of the commonest public health concerns and is widely reported in literature. Earliest management of urethral strictures was carried out by using reeds for dilatation of urethra as reported in Greek and Egyptian literature as old as >600BC by Shusruta.¹ Urethral stricture had 15-20% prevalence in past century.² The causes responsible for structural narrowing of urethra are many including Idiopathic (33%), iatrogenic (33%), traumatic (19%) and inflammatory (15%).^{3,4}

Idiopathic, iatrogenic causes such as traumatic insertion or removal of urinary catheter, chronic indwelling catheter or blunt perineal trauma such as straddle injury were various aetiologies commonly involved in anterior urethral strictures.⁵ Of inflammatory causes of urethral stricture development Chlamydia and gonococcal urethritis are often reported. The patients suffering from anterior urethral strictures usually present with symptoms of weak urinary stream, straining while urination, urinary

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hesitancy, unable to complete empty bladder, urinary retention and post void dribbling. Later in disease process anterior urethral strictures are complicated by high rates of urinary tract infections (41%) and urinary incontinence (11%).⁶ Retrograde urethrography (RUG) is although the investigation of choice in diagnosis of anterior urethral strictures but has certain limitations⁷ due to expertise required to carry out the procedure, inadequate penile traction during contrast injection and patient position in inexperienced hands usually yield altered appearances and length of strictures.^{8,9,10} Apart from these technical difficulties of carry out the procedure retrograde urethrography poses risk of radiation exposure to patient's testes,¹⁰ extravasation of contrast in other penile tissues and intravasation of contrast in venous system and lymphatics.¹¹

On the contrary sonourethrography (SUG) is breakthrough in investigation of urethral strictures. Its three dimensional visualization⁸ of anterior urethra with normal saline and high frequency ultrasound eliminates risk of radiation exposure⁷ and contrast instillation associated with two dimensional retrograde urethrography.

According to one study retrograde urethrography and sonourethrography have same diagnostic efficacy in detection of anterior urethral strictures.¹¹ Recent researches have shown sensitivity and specificity of sonourethrography in detection of anterior urethral strictures to be 81% and 92%¹² respectively. Rationale of our study was to derive comparison between traditional retrograde urethrography and sonourethrography in the diagnosis of anterior urethral stricture and encourage usage of sonourethrogram over retrograde urethrographic in usual practice as that will be a cost effective technique offering comparable diagnostic advantage over retrograde urethrography without radiation hazards and added advantage of visualization of periurethral soft tissues.

Material and Methods

The cross-sectional study was conducted from September 2019 to February 2020 in department of radiology, (SIUT), Karachi. Study was approved by ethical review committee of the institute. 50 patients with age 18 to 65 years were selected which were

presented with lower urinary tract symptoms for 1 week or longer and clinically suspected of having urethral stricture (thin stream of urine and with difficulty in micturation) referred from urology outpatient department and urology ward. Patients who have per-urethral pussy discharge or pain on physical examination were excluded from the study. Patients having meatal stenosis, hypospadias or epispadias on physical examination were also excluded from the study. The approval of institutional research & ethical committee and informed consent was taken prior to commencement of the study. The sample size was calculated by using sensitivity and specificity of sonourethrography for diagnosis of urethral strictures. The sample was collected through nonprobability consecutive sampling technique. Patients were subjected to Toshiba (Xario 200) real time ultrasound Doppler scanner for sonourethrography using the 7.5 MHz linear array transducer with the patients in supine position, glans penis was cleansed with antiseptic solution and 2% lignocaine jelly was introduced through anterior urethra to provide adequate local anesthesia. A 12 Fr Foley's catheter was then introduced such that the bulb of the catheter is laid in the navicular fossa. The bulb was distended gently using 2 ml normal saline. Then the penis was cranially extended over the lower abdomen and ultrasonic gel was applied to the ventral surface of the penis. 20 ml to 100 ml of sterile normal saline was infused after taking care to exclude air bubbles. The penile urethra was visualized to the penoscrotal junction with multiple longitudinal and transverse scan by placing the transducer on the ventral surface of penis. Subsequently, the transducer was repositioned to visualize the proximal penile and distal bulbar urethra transscrotally. Transperineal scans were performed to visualize the proximal bulbar urethra. The findings of sonourethrography were compared with retrograde urethrogram and surgical findings when stricture was preoperatively detected.

The whole study was statistically evaluated to determine the sensitivity and specificity of sonourethrography in diagnosing anterior urethral strictures taking surgical findings as gold standard.

Patients data was entered and analyzed by using statistical package for social sciences (SPSS 21.0). Frequency and percentage was computed for qualitative variables i.e presenting complains, history of

presenting illness, sonourethrography findings and surgical findings. Mean – SD was calculated for quantitative variable i.e. age. With surgical findings as gold standard; the sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy of sonourethrography findings was calculated.

Results

In our study 50 male patients with lower urinary tract symptoms for 1 week or longer were included. 37.22 – 11.09 years and 5.36 – 1.81 respectively, is the average age and duration of symptoms of the patients. Regarding lower urinary tract symptoms, 42 (28.97%) had painful urination in form of severe spasmodic pain during micturation, 84 (57.93%) urinary hesitancy as they unable to micturate often, 81 (55.86%) urinary retention as some patients after passing urine does not completely able to empty bladder and 75 (51.72%) had post urination dribbling as even after passing urine they continue to dribble urine and again try to pass but it continues to dribble.

Postsurgical confirmation of anterior urethral stricture was 36% while sonourethrography was diagnosed in 30% cases as shown in table 1. 77.7%, 96.8%, 93.3% and 88.57% respectively were the sensitivity, specificity, PPV and NPV of sonourethrography for detection of anterior urethral stricture. 90% was the diagnostic accuracy of sonourethrography for detection of anterior urethral as shown in (Tab. 1).

Sonourethrography Finding	Surgical Finding		Total
	Positive	Negative	
Positive	14(TP)	1(FP)	15(30%)
Negative	4(FN)	31(TN)	35(70%)
Total	18(36%)	32(64%)	50

Sensitivity	=14/18	77.7%
Specificity	=31/32	96.8%
PPV	=14/15	93.33%
NPV	=31/35	88.57%
Diagnostic Accuracy	=14+31/50	90%

Table 1: Diagnostic accuracy of sonourethrography finding in detecting of male anterior urethral stricture

(Fig. 1) shows stricture in bulbous and bulbomembranous junction of urethra with pre and poststenotic

dilatation on sonourethrogram and fluoroscopic guided urethrogram, however length of stricture can be accurately measured on sonourethrogram which in this case is 3.2 cm and additionally sonourethrogram shows spongiofibrosis due to visualization of periurethral soft tissues in this modality. Length of stricture cannot be measured accurately on fluoroscopic urethrography due to magnification factor and spongiofibrosis cannot be seen due to non visualization of periurethral soft tissues on fluoroscopy. (Fig. 2) shows stricture in bulbomembranous junction of urethra on both modalities, however here not only accurate length of stricture measured on sonourethrogram which in this case is 2.0 cm but additionally spongiofibrosis noted as well as calculus with posterior acoustic shadowing was noted at bulbomembranous junction. Calculus was not noted on fluoroscopy due to radiolucent nature of calculus.

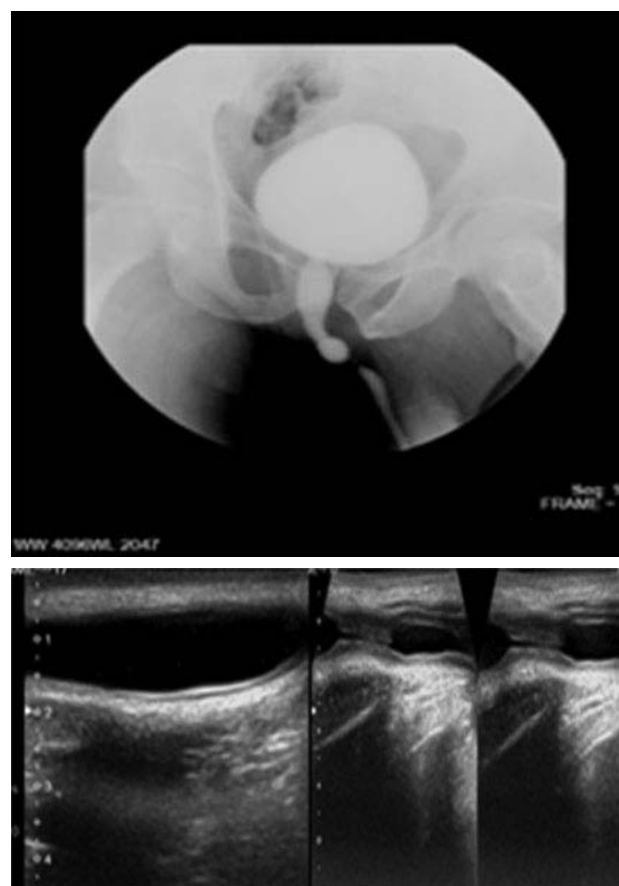


Figure 1: Stricture in bulbous and bulbomembranous part of urethra on sonourethrogram and corresponding fluoroscopic guided urethrogram. Length measures 3.2 cm on sonourethrogram and additionally showing spongiofibrosis.

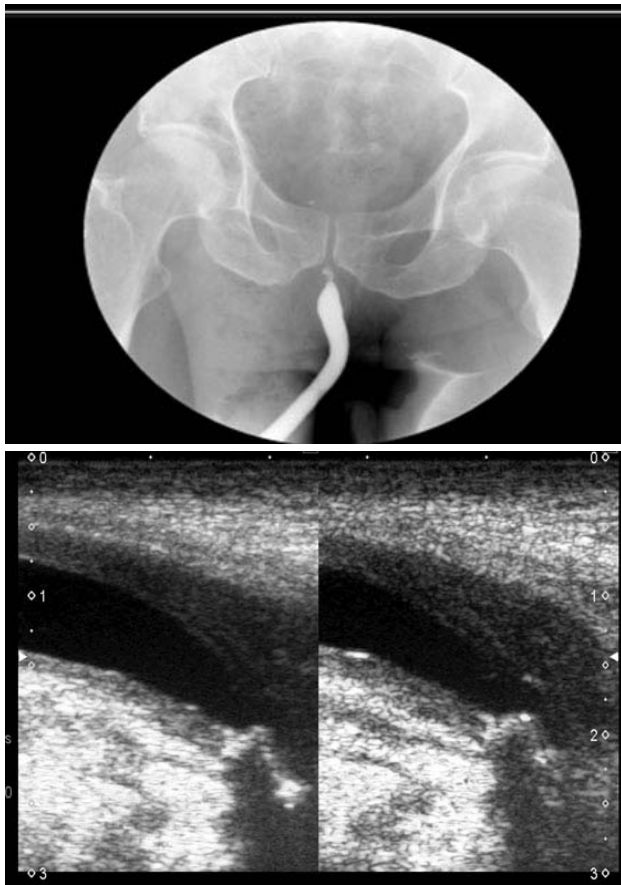


Figure 2: Stricture in bulbomembranous junction of urethra showing length of 2.0 cms on sonourethrograph and corresponding fluoroscopic guided urethrogram. Sonourethrograph also shows calculus and spongiofibrosis.

Discussion

Urethral stricture occurs due to fibrous scarring of urethra which leads to obstruction in flow of urine.¹³ Urethral strictures top the list for which surgical interventions are carried out in developing countries across world.¹⁰ An important insight in stricture management is complete information about length of stricture before opting for any surgical intervention because length of stricture will determine the type and technique of surgery to be carried out in particular patient.^{14,15} Historically retrograde urethrography has been gold standard in diagnosing urethral strictures but this comes with certain limitations.⁹ In mid 1980s McAninch et al did sonographic evaluation of complex urethral strictures at San Francisco General Hospital.¹⁶ Since then this technique is frequently used to evaluate strictures in anterior urethra.

In our study there were 50 male patients having lower urinary tract symptoms with age ranging from 15 to 65 years. The average age of the patients were 37.22 – 11.09 years showing most patients were in their 3rd decade. Mean age of patients around 3rd decade was in Chiou R.K. et al., Bearcroft P.W.P. et al., Gluck C.D. et al., Gupta S. et al., Samaiyer S.S. et al.^{17,18,19,20} Regarding lower urinary tract symptoms, 20 (40%) had painful urination, 30 (60%) urinary hesitancy, 33 (66%) urinary retention and 29 (58%) had post urination dribbling. Singh et al³ and Peter A. Nash et al²¹ study also included the same number of patient with such symptoms.

For this study, normal saline is used as a negative contrast agent to distend the urethra to perform the Sonourethrographic imaging. Radiographic contrast medium was used immediately after the contrast study in Bearcroft P.W.P. and Berman L.H.⁸ Normal saline is used If no contrast imaging is to be performed it. In our study dorsal scanning approach is described to the penile urethra moving ventrally for subscrotal and perineal views of the bulbar urethra which was also reported in few other studies.^{22,23}

77.7%, 96.8%, 93.3% and 88.57% % respectively, are the sensitivity, specificity, PPV and NPV of sonourethrography for diagnosis of anterior urethral stricture, diagnostic accuracy and efficacy of sonourethrography was 90%. The diagnostic accuracy of sonourethrography for detection of anterior urethral stricture was 80% to 91% was performed and observed by stratification analysis for all factors. In a study by Alam et al.¹¹ Sensitivity of SUG to diagnose urethral stricture length at cut off level 10 mm was 94.1%, specificity 97.7%, positive predictive value 94.1%, negative predictive value 97.7% and accuracy 96.7%.¹¹ Heidenreich A et al,²² reported 98% sensitivity and 96% specificity of using sonourethrography in the detection of urethral stricture. Gupta S et al¹⁹ showed that the urethral ultrasound detected 91.3% anterior urethra strictures and x-ray urethrography detected 88.5% strictures of anterior urethra. In Samaiyer SS et al²⁰ study the diagnostic accuracy by SUG in 96.44%.

Conclusion


Sonourethrography is a multi planner, easily available and cost effective technique for evaluating the male

anterior urethra without causing radiation hazards. It is an effective combination of high-resolution imaging and normal saline as a negative contrast agent. Lack of radiation exposure makes this investigation easy for attempting it frequently. Hence, we recommend pre interventional Sonourethrographic assessment with greater frequency of anterior urethral strictures in men.

Conflict of Interest: None

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