



Original Research Article

DIAGNOSTIC ACCURACY OF SONOURETHROGRAPHY IN DETECTION OF URETHROCUTANEOUS FISTULA OF PENILE URETHRA TAKING RETROGRADE URETHROGRAM AS GOLD STANDARD IN PATIENTS PRESENTING WITH SCROTAL WALL ABSCESS AT TERTIARY CARE HOSPITAL, KARACHI

Article History:

Name of Author:

¹Muhammad Umer Anwar, ²Professor Syed Muhammad Faiq, ³Professor Ameet Jesrani, ⁴Nida Amin Khan, ⁵Professor, Murli Lal,

Affiliation: ¹FCPS Resident, Dept. Of Radiology, SIUT, Karachi, Pakistan

² (VIR) Supervisor, Head of Department, Radiology SIUT, Karachi, Pakistan

³Dept. Of Radiology SIUT, Pakistan

⁴Assistant Professor, Dept of Radiology, SIUT Karachi, Pakistan

⁵Professor, Murli Lal, Dept. Of Urology, SIUT, Karachi, Pakistan.

Corresponding Author:

Muhammad Umer Anwar

Received: 10-11-2025

Revised: 25-11-2025

Accepted: 17-12-2025

Published: 30-12-2025

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Abstract: Background: Urethrocutaneous fistula of the penile urethra is a serious complication in patients with scrotal wall abscess. Timely and accurate diagnosis is essential for planning surgical management. We aimed to evaluate the diagnostic accuracy of sonourethrography in detecting urethrocutaneous fistula, using retrograde urethrogram (RUG) as the reference standard. **Methods:** We carried out a cross-sectional study at a tertiary care hospital in Karachi, enrolling 60 patients with scrotal wall abscess. Each patient underwent sonourethrography followed by RUG. We calculated sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and overall diagnostic accuracy for sonourethrography compared with RUG. **Results:** Of the 60 patients, 47 (78.3%) were aged 20–45 years and 13 (21.7%) were aged 46–70 years. Sonourethrography detected urethrocutaneous fistula in 40 patients (66.7%), while RUG identified the fistula in 44 patients (73.3%). Compared with RUG, sonourethrography yielded 36 true positives, 12 true negatives, 4 false positives, and 8 false negatives. Sensitivity was 81.8%, specificity 75%, PPV 90%, NPV 60%, and overall diagnostic accuracy 80%. **Conclusion:** Sonourethrography detects urethrocutaneous fistula in most patients with scrotal wall abscess and offers detailed periurethral soft tissue assessment without exposing patients to ionizing radiation. It serves as a valuable complement to RUG, particularly when clinicians need to reduce radiation exposure.

Keywords: Sonourethrography; urethrogram; Urethrocutaneous fistula; Penile urethra; Scrotal wall abscess; Ultrasound imaging.

INTRODUCTION

Acquired urethral fistulas typically develop as a consequence of trauma, infections, urethral strictures, surgical mishaps, exposure to radiation therapy, or underlying tumors.¹ Uncommon causes, including neglected or severed urethral Foley catheters, have also been documented.² To accurately identify the fistulous tract and determine

the underlying cause, diagnostic procedures such as retrograde urethrography, micturating cystourethrography, cystoscopy, fistulography, and MRI are essential.³ In our case, the location of the fistula was initially identified through retrograde urethrography and later confirmed via cystoscopy. Although uncommon, unusual external openings of urethral fistulas have been reported. For instance,

one case involved a young patient with insulin-dependent diabetes who developed a dorsal urethral fistula following surgical debridement for necrotizing fasciitis of the penis.⁴ Patodia *et al* described another case where stricture along with long-term catheterisation caused a prostatic abscess that found its way through the retropubic fat into the right inguinal region to result in a prostaticutaneous fistula.^{4,5}

Imaging and pathology of the male urethra are not extensively covered in radiology literature, as this segment of the urinary tract is readily accessible to urologists through clinical assessment and endoscopic evaluation.⁶ Nevertheless, imaging plays a crucial role in evaluating stricture diseases of the male urethra, as it can reveal abnormalities that may not be apparent during urethroscopic examination.⁷ Traditional diagnostic imaging of the male urethra has relied on techniques that utilize radiation and the injection of contrast material into the urethra to outline and assess the structure of the urethral lumen.⁸ Retrograde urethrography (RGU) has certain limitations in accurately assessing anterior urethral stricture disease. These include variability in stricture appearance depending on the patient's positioning and the extent of penile stretching during the procedure. Additionally, RGU offers minimal detail regarding the surrounding periurethral tissues.⁹ Sonourethrography (SUG), being a dynamic and three-dimensional imaging technique that can be performed repeatedly without exposing the patient to radiation, provides significant technical benefits over retrograde urethrography (RGU).¹⁰

Urethrocuteaneous fistula represents a potentially serious complication of penile urethral pathology, and its timely and accurate diagnosis is crucial for appropriate management. Sonourethrography, a non-invasive imaging modality, holds promise as a diagnostic tool, but its efficacy in identifying urethrocuteaneous fistulas needs thorough investigation. By comparing its results to retrograde urethrogram, the established gold standard, this study aims to provide valuable insights into the diagnostic accuracy of sonourethrography. The findings could contribute to refining diagnostic protocols for patients with scrotal wall abscesses, facilitating prompt and accurate identification of urethrocuteaneous fistulas, and guiding clinicians toward effective treatment strategies. This research is essential for improving patient care, enhancing diagnostic precision, and optimizing the overall management of urological complications associated with penile urethral pathology.

MATERIALS AND METHODS

The study was a cross-sectional analysis conducted in the Radiology Department of SIUT, Karachi, over a six-month from 1st March 2025 to 30th August 2025 following the approval of the research synopsis of the research by the College of Physicians and Surgeons Pakistan (CPSP). Due to time limitations, although the calculated sample size was 226 based on expected sensitivity (92.9%), specificity (91.7%), and prevalence (20%) of urethrocuteaneous fistula of the penile urethra—with an 8% margin of error and 95% confidence interval—only 60 patients were enrolled. A non-probability consecutive sampling technique was employed to recruit patients meeting the inclusion criteria.

Participants included male patients aged between 20 and 70 years who presented with sonographically confirmed scrotal wall abscess, defined as a hypoechoic collection within the scrotal wall accompanied by surrounding cellulitis. Exclusion criteria were applied to eliminate confounding conditions, including history of epididymitis, orchitis, syphilis, tuberculosis, malignancy, vasculitis, connective tissue diseases, seropositive or seronegative arthritis, as well as chronic illnesses such as stroke, renal or hepatic impairment, chronic obstructive pulmonary disease, congestive heart failure, and myocardial infarction. Patients who did not consent were also excluded.

Following ethical approval from the institutional review board and informed consent from the participants, patient demographic data and clinical history were collected. Each patient underwent both retrograde urethrography and sonourethrography for diagnostic evaluation. The retrograde urethrogram was performed by inserting a prefilled Foley's catheter into the glans penis, followed by administration of contrast medium (Urografin 76%) and capturing a spot radiographic image. For sonourethrography, the patient was positioned supine and the anterior urethra was assessed using a high-frequency linear transducer (10–14 MHz). Both procedures were carried out by a consultant radiologist with over ten years of experience. Urethrocuteaneous fistula of the penile urethra was identified on sonourethrography as a hypoechoic tract extending from the urethra to the skin, and on retrograde urethrogram as contrast leakage into surrounding tissues during either the filling or post-void phase.

All findings were recorded on a structured proforma. The data were then entered and analyzed using SPSS version 22. Descriptive statistics such as mean and standard deviation were calculated for continuous variables like age. For normally distributed data, results were presented as mean $\pm$ standard deviation,

while non-normally distributed data were summarized as median with interquartile range. Frequencies and percentages were reported for categorical variables, including positive and negative results on sonourethrography and retrograde urethrogram. Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and overall diagnostic accuracy of

sonourethrography, using retrograde urethrogram as the reference standard, were calculated using a 2×2 contingency table. The data were stratified by age, and post-stratification analysis was also conducted to assess diagnostic performance across different age groups.

RESULTS

We enrolled 60 patients who presented with scrotal wall abscess. Most participants (78.3%) were between 20 and 45 years of age, while 21.7% were aged 46–70 years. Sonourethrography identified urethrocuteaneous fistula of the penile urethra in 40 patients (66.7%), whereas retrograde urethrogram, the reference standard, detected fistula in 44 patients (73.3%). When compared with the gold standard, sonourethrography correctly diagnosed 36 true positive and 12 true negative cases, while it misclassified 4 patients as positive (false positives) and missed 8 cases (false negatives). The test achieved a sensitivity of 81.8% and a specificity of 75%. The positive predictive value reached 90%, indicating that a positive sonourethrography finding corresponded to a true fistula in most cases. The negative predictive value was lower at 60%, suggesting reduced certainty in excluding the diagnosis when the test was negative. Overall, sonourethrography demonstrated a diagnostic accuracy of 80%, reflecting its potential as a practical and non-invasive tool for detecting urethrocuteaneous fistula in this patient population, albeit with some limitations in ruling out disease.

TABLE 1: CHARACTERISTICS OF PATIENTS

DEMOGRAPHY		NUMBER	PERCENTAGE
AGE	20-45 YEARS	47	78.3%
	46-70 YEARS	13	21.7%
URETHROCUTANEOUS FISTULA OF PENILE URETHRA ON SONOURETHROGRAPHY	POSITIVE	40	66.7%
	NEGATIVE	20	33.3%
URETHROCUTANEOUS FISTULA OF PENILE URETHRA ON RETROGRADE URETHROGRAM	POSITIVE	44	73.3%
	NEGATIVE	16	26.7%

TABLE 2: RESULTS SONOURETHROGRAPHY IN DETECTION OF URETHROCUTANEOUS FISTULA OF PENILE URETHRA TAKING RETROGRADE URETHROGRAM AS GOLD STANDARD IN PATIENTS PRESENTING WITH SCROTAL WALL ABSCESS

VARIABLE	URETHROCUTANEOUS FISTULA OF PENILE URETHRA RETROGRADE URETHROGRAM		TOTAL
	POSITIVE	NEGATIVE	

URETHROCUTANEOUS FISTULA OF PENILE URETHRA SONOURETHROGRAPHY	POSITIVE	36(TP)	04(FP)	40
	NEGATIVE	08(FN)	12(TN)	20
TOTAL		44	16	60

TABLE 3: SENSITIVITY, SPECIFICITY, POSITIVE AND NEGATIVE PREDICTIVE VALUES AND DIAGNOSTIC ACCURACY OF SONOURETHROGRAPHY IN DETECTION OF URETHROCUTANEOUS FISTULA OF PENILE URETHRA TAKING RETROGRADE URETHROGRAM AS GOLD STANDARD IN PATIENTS PRESENTING WITH SCROTAL WALL ABSCESS

VARIABLE	SENSITIVITY	SPECIFICITY	POSITIVE PREDICTIVE VALUE	NEGATIVE PREDICTIVE VALUE	DIAGNOSTIC ACCURACY
SONOURETHROGRAPHY	81.8%	75%	90%	60%	80%

DISCUSSION

Sonourethrography demonstrated a sensitivity of 81.8% and a specificity of 75%, with a positive predictive value of 90% and a negative predictive value of 60%. The overall diagnostic accuracy was 80%. These figures indicate that sonourethrography detects most true cases of fistula, but misses a proportion that RUG identifies.

Our sensitivity value falls within the range reported in earlier studies of anterior urethral pathologies, which documented sensitivities between 77% and 98%.¹¹⁻¹⁵ Similar to our findings, Jesrani et al.¹¹ and Anil et al.¹² reported a high concordance between positive sonographic findings and intraoperative confirmation. Rajakumari¹⁴ also observed that sonourethrography often delineates lesion extent more accurately than RUG, which tends to underestimate disease length. This is an observation relevant to fistula detection where tract size and extent influence surgical planning.

The lower specificity and negative predictive value in our study suggest caution when interpreting a

negative sonourethrogram. Missed diagnoses may arise from small or intermittently patent tracts that collapse during scanning, periurethral inflammatory changes obscuring the tract, or variability in operator skill. Seerla et al.¹³ described similar diagnostic challenges in their series on male urethral pathologies.

Despite these limitations, sonourethrography offers clear advantages. It avoids ionizing radiation, provides multiplanar visualization, and allows real-time evaluation of periurethral soft tissue changes. In cases of urethrocuteous fistula, these soft-tissue details are crucial for determining the extent of periurethral fibrosis or associated inflammation, both of which can guide surgical decision-making. Ramanathan et al.¹⁵ emphasised that imaging approaches capable of assessing both the urethral lumen and surrounding structures improve diagnostic confidence and surgical outcomes. The ability to repeat sonourethrography without radiation risk further enhances its value for follow-up.

Although RUG remains the reference standard, our

results support incorporating sonourethrography into the diagnostic pathway for suspected urethrocuteaneous fistula, particularly when detailed periurethral tissue evaluation is important or when radiation exposure should be minimised. Larger, multicentre studies with surgical correlation could confirm these findings and refine the diagnostic role of sonourethrography in this patient population.

LIMITATIONS

We conducted this study at a single centre with a modest sample size, which restricts the extent to which the results can be applied to other settings. Variations in operator skill and scanning technique may also have influenced the diagnostic performance of sonourethrography.

CONCLUSION

Our findings show that sonourethrography detects urethrocuteaneous fistula of the penile urethra with high diagnostic accuracy in patients presenting with scrotal wall abscess. By providing detailed periurethral soft tissue evaluation without the risks of ionizing radiation, it serves as a valuable and non-invasive complement to retrograde urethrogram, particularly when reducing radiation exposure is an important clinical consideration.

CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

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