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Comparing the Diagnostic Accuracy of Sonourethrogram and Retrograde Urethrogram in Anterior Urethral Strictures

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ABSTRACT

Introduction: Besides history and physical examination, ascending urethrogram (RGU) remained the Gold Standard for evaluating Male Urethral Stricture. But it underestimates the length of proximal bulbar urethral stricture and it also has the disadvantage of underestimating spongiofibrosis. Since sonography has become the urologist's stethoscope, the present study was aimed to compare the efficacy of sonourethogram (SUG) with respect to RGU in the diagnosis and management of urethral strictures.

Methods: A total of 23 patients meeting the inclusion and exclusion criteria were studied in detail from January 2020 to January 2022 in Department of Urology, Gandhi hospital, Secunderabad. All the patients were first subjected to RGU and those found to have stricture urethra were subjected to SUG. All patients were then subjected to urethroscopy and findings noted. Findings on both these investigations were later correlated with intraoperative findings. Discrepancy in findings of both investigations with those of intraoperative findings were recorded and tabulated. Findings in those patients with change of proposed surgery were also recorded and tabulated. The results were then compared and appropriate statistical tests were applied.

Results: Mean age group of study population in the present study was 44.43 years. In the present study, the most common type of strictures was inflammatory strictures (43.47%). This was followed by idiopathic strictures (26.08%), post catheterization strictures (17.39%) and post TURP strictures (13.04%) in decreasing order of frequency. Most common location of stricture urethra was bulbar urethra constituting about 47.82 % of study population in the present study. Second most common location was penile urethra. 14 out of 23 patients (60.86%) in RGU group had up gradation in length of stricture following SUG. Spongiofibrosis can only be assessed on SUG and cannot be measured by RGU. Mean stricture diameter on RGU was found to be 10.17Fr whereas for SUG was 9.39 Fr. Intraoperative mean stricture diameter was 9.33Fr.

Conclusion: SUG measures exact stricture length and it closely correlates with that of intraoperative findings. So an adequate preoperative planning of surgery can be made based on SUG findings. Stricture diameter on SUG correlates well with intraoperative findings rather than RGU. SUG helps in the identification of spongiofibrosis and periurethral pathology thereby helping in the proper management of patients with stricture thereby minimizing recurrence. False tracts on RGU may be missed if its opening is occluded but these false tracts can be identified on SUG. With accurate information about periurethral pathologies SUG is more useful than RGU when determining the type of operative procedure suitable for patients with strictures localized to the anterior urethra.

Key Words: *Retrograde urethrogram, Antegrade urethrogram, Stricture urethra, VIU, Outcomes*

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INTRODUCTION

Besides history and physical examination, ascending urethrogram remained the Gold Standard for evaluating Male Urethral Stricture Cunningham et al. [1-3]. It has a Sensitivity of 91% and specificity of 72% for diagnosing anterior urethral strictures [4]. It underestimates the length of proximal bulbar urethral stricture and has the disadvantage of underestimating spongiofibrosis. This has been elaborated as this segment of urethra is fixed in the same axis as pelvis. This leads to an 'End-on View' of bulbar strictures radiographically, which reduces their apparent length. Ascending urethrogram leads to radiation exposure of 1-2 msv, equivalent to 6 months of background radiation and 20 chest X-rays [5, 6]. Procedure related infection contributes to 0.6% to 1.6% of all hospital acquired infections [7]. The initial

experience with ultrasound evaluation of the urethra was described separately in the late 1980s by Mc Aninch et al. [2] and Merkle and Wagner [5].

Early studies identified not only the ability of ultrasound to demonstrate the exact length of strictures but also the added ability to define the periurethral tissue, as opposed to contrast urethrography, which only demonstrates the lumen. In particular, the presence and degree of spongiofibrosis helps in deciding the type of surgery so that recurrence can be minimized [8, 9]. Stricture urethra is a very common urological disease. At our institute, we perform on an average 4 Optical Internal Urethrotomies (OIU) and 2 urethroplasties per month, common etiology being inflammatory anterior urethral strictures and post traumatic strictures. The standard diagnostic modality used is retrograde urethrogram (RGU). Since sonography has become the urologist's stethoscope, the present study was aimed to compare the efficacy of sonourethogram with respect to RGU in the diagnosis and management of urethral strictures.

MATERIAL AND METHODS

The present study was a prospective study conducted at our institute in the department of urology, Gandhi hospital, Secunderabad between january 2020 to january 2022. A total of 23 patients meeting inclusion and exclusion criteria were included in the study.

INCLUSION CRITERIA

1. Patients with anterior urethral stricture between the age group of 25-75 years
2. Etiology of the stricture being inflammatory or idiopathic or Post-TURP or post catheterization
3. Patients willing to be a part of study

EXCLUSION CRITERIA

1. Posterior urethral strictures
2. Patients with perineal trauma, PFUDD
3. Recurrent urethral strictures
4. Patients with concurrent prostatomegaly
5. Patients not willing to be a part of the study

Method of collection of data:

Patients presenting with narrowed urinary stream and other lower urinary tract symptoms like burning micturition, increased frequency of micturition, straining while voiding were evaluated with thorough history and physical examination. Other causes of narrowed urinary stream other than stricture were ruled out after performing various investigations like USG KUB for prostate size, uroflowmetry to know the pattern of voiding, complete urinary examination and urine for culture and sensitivity to rule out urinary tract infection prior to performing RGU. Suspected patients with stricture urethra were subjected to RGU. Those with stricture urethra meeting inclusion and exclusion criteria were then included in the present study. These patients were then subjected to sonourethrogram (SUG). All the sonourethrograms were done by the same Radiologist. The findings of sonourethrogram & ascending urethrogram were compared with the findings of cystoscopy and later on correlated with intra-operative findings.

Statistical analysis:

Descriptive statistics were used to analyze the data obtained. Measures of central tendency calculated in terms of mean and measures of varibility calculated in terms of standard deviation.

RESULTS

In the present study, a total of 23 patients with stricture urethra were studied ranging from 21-70 years with a mean age of 44.43 years. Majority of study population were in the age group of 31-40 years contributing to 43.47% of study population.

1. Etiology of stricture:

Inflammatory etiology (43.47% of study population) was the most common cause for stricture urethra, Patients with history of sexually transmitted disease, recurrent urinary tract infections or presence of Lichen sclerosus were considered to have inflammation of urethral mucosa which may even extend to coepus spongiosum due to high pressure voiding against narrowed urethral lumen.

Table 1: Etiology of stricture urethra in the present study

Etiology of stricture	No of cases
Inflammatory	10
Post TURP	3
Catheterization	4
Idiopathic	6

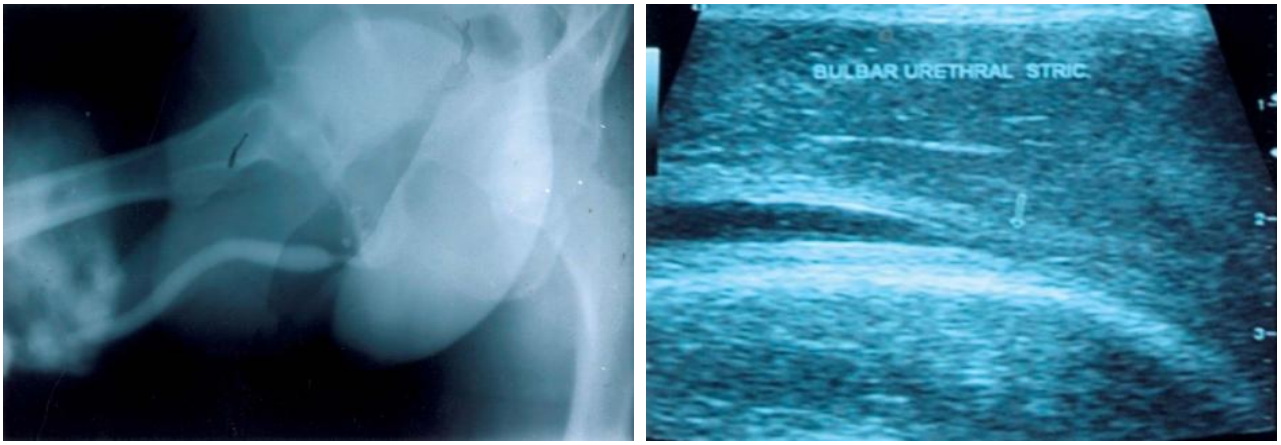
2. Location of Stricture:

Table 2 depicts the location of stricture urethra in our study with bulbar urethra constituting about 47.82 % followed

by penile urethra and panurethra.

Table 2: Location of stricture urethra in the present study

Location of stricture	No. of patients
Bulbar	11 (47.82%)
Penile	7 (30.43%)
Panurethral	5 (12.95%)



A. RGU showing bulbar urethral stricture B. SUG showing bulbar urethral stricture

Fig 1: RGU and SUG in a case of bulbar urethral stricture

A. RGU showing penile urethra stricture with dilated proximal bulbar urethra

B: SUG showing penile urethra stricture with dilated proximal bulbar urethra

FIG 2: RGU and SUG in a case of penile urethral stricture

3. LENGTH OF STRICTURE ON VARIOUS MODALITIES

Based on length of stricture on RGU or SUG, strictures were classified into 3 categories in the present study. Stricture length less than 1.5 cm was considered as category I, between 1.5 to 3cm were considered as Category II and any stricture more than 3 cm were considered as Category III.

Table 3: Category wise distribution of patients in the present study

Category	RGU	SUG	Intra operative
I(<1.5cm)	14	4	4
II(1.5-3cm)	4	10	10
III(>3cm)	5	9	9

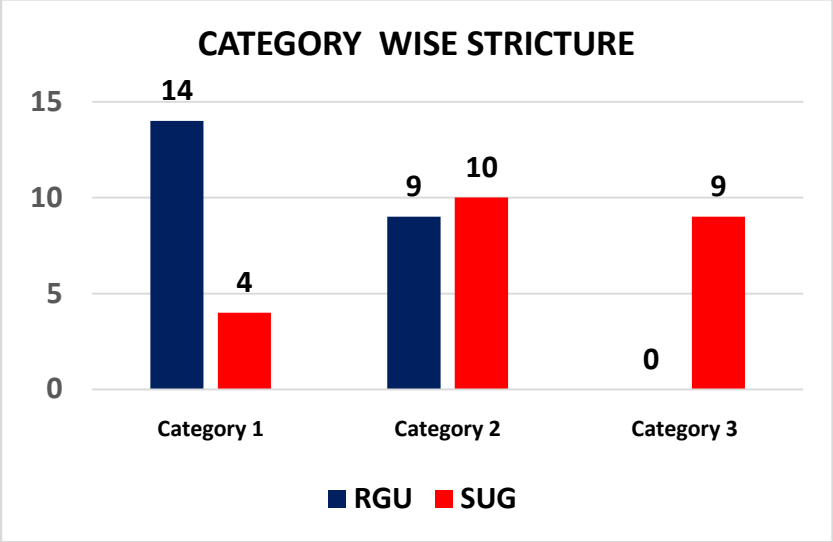


Fig 3: Bar diagram depicting category wise distribution on various modalities in the present study

Table 4: Mean stricture length on various modalities in the present study

Category	Mean stricture length (cms)		
	RGU	SUG	Intraoperative
I (<1.5 cms)	1.1	1.3	1.3
II (1.5 to 3 cms)	2.4	2.5	2.6
III (>3 cms)	7.3	8.4	8.3

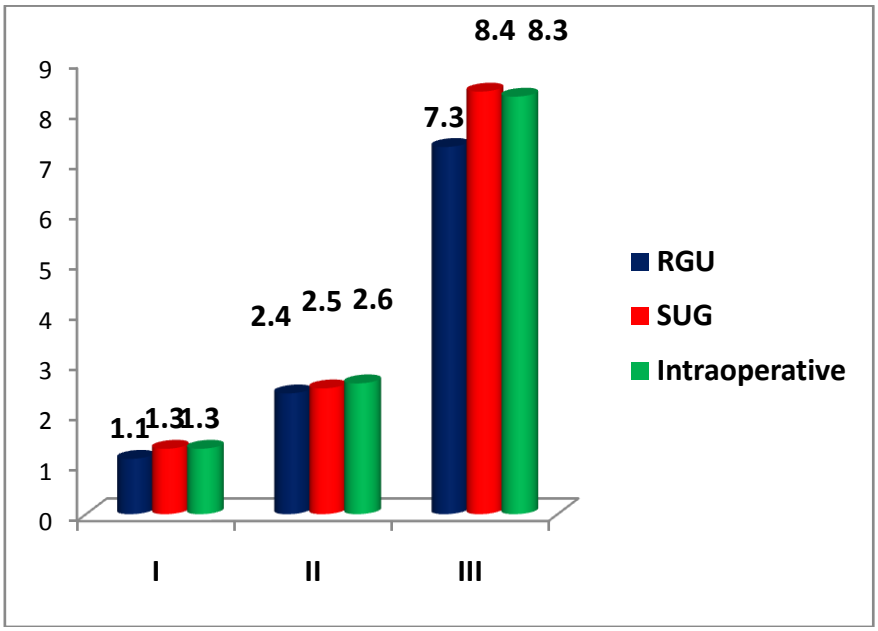


Fig 4: Bar diagram representing mean stricture length (cms) on RGU, SUG and intra operative findings in the present study

SUG had better sensitivity to measure exact stricture length when compared to RGU. Sensitivity of SUG and RGU was 100% in the diagnosis of stricture urethra. Only 4 patients had category I strictures in the present study. SUG was able to correctly identify categorize these strictures with a specificity of 100% whereas RGU had a sensitivity of only 28.57% in categorizing category I strictures. All category 2 strictures were correctly identified on SUG with a sensitivity of 100% whereas sensitivity of RGU was 0% as all these category II strictures were later upgraded to Category II. Sensitivity of SUG in predicting category III strictures was 100% whereas RGU had a sensitivity of only 55.55%. This plays an important role in choosing the type of surgery.

To summarise, 14 out of 23 patients were upgraded in category after re-categorization by SUG (60.86 %). Surgical technique was changed for 10 patients in whom initially OIU was planned and was then changed to urethroplasty due to the difference in stricture length on SUG.

4. DEGREE OF SPONGIOFIBROSIS

Degree of spongiofibrosis cannot be emphasised by means of RGU as it represents only the narrowing of urethral lumen, whereas SUG has the additional benefit of evaluating spongiofibrosis. Spongiofibrosis is evident with respect to compressibility of corpus spongiosum and classified accordingly into mild, moderate and severe spongiofibrosis based on Devine et al classification.

In the present study, spongiofibrosis was seen in 15 patients out of the 23 patients. Out of these 15 patients, about 8 individuals had mild spongiofibrosis. About 3 patients had moderate spongiofibrosis and 4 patients had severe spongiofibrosis.

Table 5: Degree of spongiofibrosisin the present study

Degree of spongiofibrosis	Frequency	Percentage
Mild	8	53.33%
Moderate	3	20 %
Severe	4	26.67%
Total	15	100%

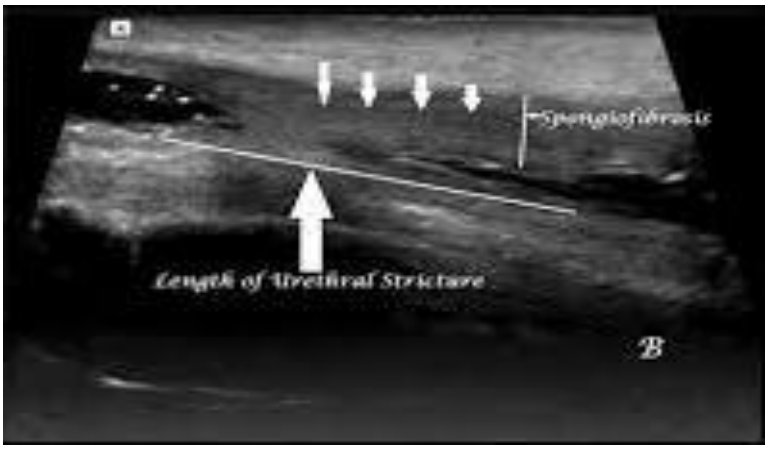


Fig 5: SUG showing spongiofibrosis and length of stricture. Note extension of spongiofibrosis beyond length of actual stricture urethra

5. STRICTURE DIAMETER

Diameter of urethral lumen was measured on both RGU and SUG. Diameter was measured in terms of millimeters and was then converted into French (Fr) units. Mean stricture diameter on RGU was found to be 10.17Fr whereas for SUG was 9.39 Fr. Intra operative mean stricture diameter was 9.33Fr.

Table 6: Mean stricture diameter (Fr) in the present study

Modality	Mean stricture diameter (Fr)
RGU	10.17
SUG	9.39
Intra operative assessment	9.33

6. SURGERY DONE

In the present study, 4 patients underwent OIU as they had a stricture length of less than 1.5cms on both RGU and SUG. Two patients with penile urethral stricture underwent Orandi flap repair, 2 patients underwent Asopa dorsal inlay buccal mucosal graft urethroplasty and 3 patients underwent Barbagli dorsal onlay buccal mucosa graft urethroplasty. Two Patients with pan urethral strictures underwent Asopa dorsal inlay buccal mucosal graft urethroplasty. Three Patients with pan urethral strictures underwent Barbagli dorsal onlay buccal mucosa graft urethroplasty. Four patients out of eleven bulbar urethral strictures had stricture length less than 1.5 cms and underwent OIU. Seven patients with bulbar urethral strictures underwent Barbagli dorsal onlay buccal mucosal graft urethroplasty in the present study.

Table 7: Surgeries done in the present study

Stricture location	Surgery	No of patients
Penile urethra	Orandi flap repair	2
	Asopa dorsal inlay Buccal mucosal graft	2
	Barbagli dorsal onlay Buccal mucosal graft	3
Pan urethral	Asopa dorsal inlay Buccal mucosal graft	2
	Barbagli dorsal onlay Buccal mucosal graft	3
Bulbar	OIU	4
	Barbagli dorsal onlay Buccal mucosal graft	7

DISCUSSION

Stricture urethra is a common urological problem among males. It causes severe morbidity and affects quality of life. Traditionally RGU was used in the diagnosis of stricture urethra. Limitations of RGU in the accurate evaluation of anterior urethral stricture disease include variation in the appearance of strictures with position of the patient and the degree of stretch of the penis during the study. It also provides limited information about periurethral structures.

In 1988 McAninch et al[10]. reported a new technique for imaging the male anterior urethra with high- resolution ultrasound (sonourethrography). The initial technique involved the use of a 5 MHz linear array transducer applied to the dorsal surface of the penis. Images were obtained during retrograde instillation of normal saline. As the normal urethral wall and spongiosum are elastic they were compressible on saline injection as is a blood-filled vein. When altered by stricture disease the corpus spongiosum loses its elasticity due to a higher collagen content and is not compressible, causing a reduction in the inner diameter of the urethra. As a dynamic, three-dimensional study, which can be repeated without radiation exposure, sonourethrography offers important technical advantages compared with RGU. This study was undertaken to explore the uses of high-resolution ultrasound in evaluating abnormalities of the male anterior urethra and comparing it with RGU.

In the present study, a total of 23 patients with stricture urethra were evaluated. Results were compiled, tabulated and compared. Appropriate statistical tests were applied.

AGE DISTRIBUTION

Mean age group of study population in the present study was 44.43 years. The age group of the study population had no effect on management of these patients. Majority of the patients were in the age group of 32-43 years.

In a study by Dola et al [11], mean age of the patients presented for the study was 56.21±15.65. In a study by Josey Varghese et al [12], mean age of the study population was 55 years. In a study by Srinivas Kalabhavi et al [13], mean age of the study population was 39 years. The mean age of study group in the present study is similar to mean age of study group in the study done by Srinivas Kalabhavi et al [13].

Table 8: Mean age of study population in various studies

Study	Mean age
Dola et al [11]	56.21
Josey Varghese [12]	55
Srinivas kalabhavi et al [13]	39
Present study	44.43

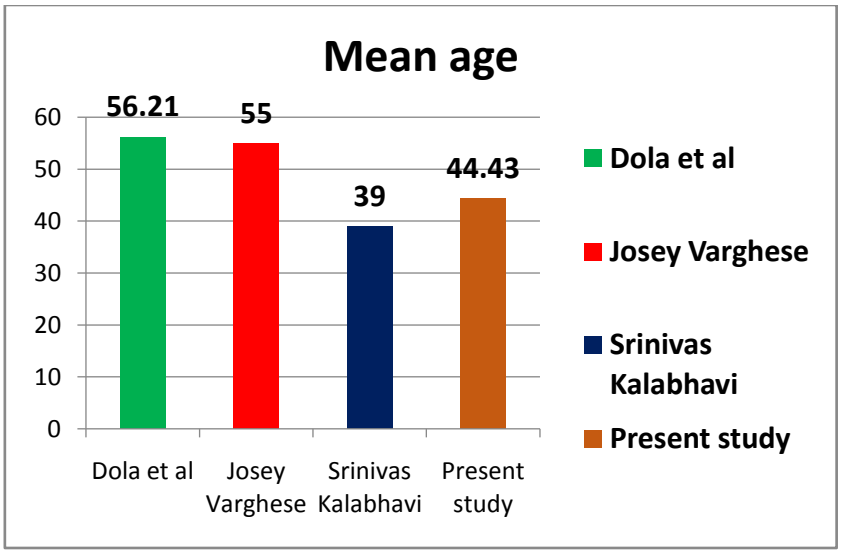


Fig 6: Bar diagram depicting mean age of study population in various studies

2. ETIOLOGY OF STRICTURE

In the present study, the most common type of strictures was inflammatory strictures (43.47%). This was followed by idiopathic strictures (26.08%), post catheterization strictures (17.39%) and post TURP strictures (13.04%) in decreasing order of frequency.

Inflammatory strictures constituted to about 33.33% of study population in a study by Sinivaskalabhavi et al [13]. Trauma, catheter related strictures and idiopathic etiology constituted around 23.33%, 23.33% and 20% of study population respectively.

In a study by BR Ravi kumar et al [14], inflammatory strictures were seen in 12 out of 35 patients, BXO was seen in 9 patients, trauma in 13 patients and Post TURP in 1 patient. In the present study, strictures due to BXO were also included under inflammatory causes.

Inflammatory strictures were more common in the present study in contrast to other studies mentioned above. It was the most common cause for stricture in the present study. Iatrogenic strictures were second most cause for stricture urethra in the present study.

Table 9: Etiology of stricture urethra in various studies

Study	Etiology			
	Inflammatory	Trauma	Idiopathic	Iatrogenic (Post TURP+catheter induced)
Srinivas kalabhavi et al [13]	33.33%	23.33%	20%	23.33%,
BR Ravi kumar et al [14]	34.29%	37.14%	-	2.86%
Present study	43.47%	-	26.08%	30.43%

3. LOCATION OF STRICTURE

Most common location of stricture urethra was bulbar urethra constituting about 47.82 % of study population in the present study. Second most common location was penile urethra.

Most common location of stricture urethra was bulbar urethra in the study by Josey Varghese et al comprising about 40.91% of study population. A similar finding was seen in a study by Dola et al [11]. Bullbar urethral strictures were seen in 47.37% of study population. In contrast to these findings, Gupta et al [15] reported higher incidence of penile urethral strictures in his study comprising about 48.27% of study population. Bulbar urethral strictures were seen in only 20.7% of study population.

Table 10: Incidence of bulbar urethral strictures in various studies

Study	Bulbar urethral strictures (percentage)
Gupta et al [15]	20.7%
Dola et al [11]	47.37%
Josey Varghese et al [12]	40.91%
Present study	47.82%

4. LENGTH OF STRICTURE ON VARIOUS MODALITIES

RGU depicted 14 cases of Category I strictures whereas SUG confirmed these findings in only 4 patients. When these findings were correlated with intraoperative findings, SUG had a positive predictive value of 100% in the exact diagnosis of category I strictures which was proven to be statistically significant (P=0.02).

RGU detected 4 cases of category II strictures which were later upgraded to category III and thereby had a positive predictive value of 0%, whereas SUG findings correlated with intraoperative findings. Thus SUG has a positive predictive value of 100 % if correlated with SUG findings.

Only 5 out of 9 category III strictures were identified on RGU with a sensitivity of 55.55% and specificity of 100%. SUG was able to detect all the cases of category III strictures on correlation with intraoperative findings with a sensitivity and specificity of 100%.

In the present study, 10 patients with category I and 4 patients with category II on RGU were upgraded to Category II and category III strictures after SUG and correlating them with intraoperative findings. Thus 14 out of 23 patients (60.86%) in RGU group had up gradation in category following SUG.

E Gong et al [14] in his study stratified the patients according to category wise strata. Only 2 patients (8.7%) with category II on RGU were upgraded to category III.

Thus from the findings of the present study, inadequate stretch while performing RGU and End on view on RGU can affect exact measurement of length of stricture. These factors are nullified on SUG as there is need of application of stretch while performing the test.

Mean average stricture length on RGU was found to be 33.2 mm in the present study. Mean average stricture length o SUG and intraoperative findings were 37.3 mm and 36.7 mm respectively. Average stricture length during intraoperative period was correlated well with SUG than RGU (r=0.6) thereby suggesting SUG has better outcomes with

respect to measurement of exact length of stricture thereby helping in planning of appropriate surgery based on these findings. This will minimize intraoperative change in decisions, help in proper patient counseling prior to surgery and minimize recurrence rate by choosing appropriate surgery.

Similar findings were seen in a study by BR Ravi kumar et al [14]. Average stricture length was 9.3 mm on RGU and 14.1 mm on SUG in his study. SUG was closely correlating with intraoperative findings in his study. He proposed SUG ahs better sensitivity in diagnosing exact length of stricture.

Srinivas kalabhavi et al [13] reported mean stricture length of 21 mm, 30.5 mm and 32 mm on RGU, SUG and intraoperatively in their study. They concluded that SUG is more effective than RGU in diagnosing exact stricture length.

Table 11: Mean average stricture length in various studies

Study	**Average stricture length**		
	RGU	**SUG**	**Intraoperative findings**
Srinivas kalabhavi et al [13]	21mm	30.5 mm	32 mm
BR Ravi kumar et al [14]	9.3 mm	14.1 mm	14.5 mm
Present study	33.2 mm	37.3 mm	36.7 mm

5. DEGREE OF SPONGIOFIBROSIS

Devine et al., classified urethral strictures into categories on the basis of depth of invasion into the surrounding spongiosum. This classification includes:

Stage A. mucosal fold,
Stage B. small iris constriction not involving the spongiosum,
Stage C. full-thickness involvement of the urethra without any underlying spongiosum inflammation,
Stage D. full thickness stricture with spongiofibrosis
Stage E. involves inflammation and fibrosis outside of the spongiosum itself and
Stage F. Complex stricture complicated by a fistula.

Spongiofibrosis can only be assessed on SUG and cannot be measured by RGU. Elasticity of the corpus spongiosum is assessed during SUG and thereby graded according to thickness of corpus spongiosum involved based on echogenicity. Corpus spongiosum loses its elasticity as the inflammation process increases in severity. This is because of replacement of type I collagen in normal tissue with type III collagen.

In the present study, degree of spongiofibrosis was graded into 3 categories – mild, moderate, severe. Mild spongiofibrosis includes less than involvement of 1/3 rd thickness of corpus spongiosum. Moderate spongiofibrosis includes involvement of 1/3 rd to 1/2 of thickness of corpus spongiosum, severe spongiofibrosis includes more than involvement of 1/2 thickness of corpus spongiosum.

Spongiofibrosis was seen in 15 patients out of the 23 patients (60.86 %). Out of these 15 patients, about 8 individuals had mild spongiofibrosis. About 3 patients had moderate spongiofibrosis and 4 patients had severe spongiofibrosis.

Gupta et al [21] reported spongiofibrosis rate of 59.25% in study population. Dola et al [25] reported spongiofibrosis in 52.6% of stud population. About 77% of bulbar urethral strictures had spongiofibrosis. Srinivas kalabhavi et al [27] studied 30 patients with stricture urethra and spongiofibrosis was seen in all the patients (100%). BR Ravi kumar et al [28] in their study had a spongiofibrosis rate of 68.57% within the study population. In all these studies it was found that SUG plays a vital role in identifying spongiofibrosis rate which has a bearing in the management of anterior urethral strictures. SUG has no role in the diagnosis of posterior urethral strictures.

Table 12: Spongiofibrosis rate in various studies

Study	**Spongiofibrosis rate**
Gupta et al [15]	77%
Dola et al [11]	52.6%
Srinivas kalabhavi et al [13]	100%
BR Ravi kumar et al [14]	68.57%
Present study	60.86%%

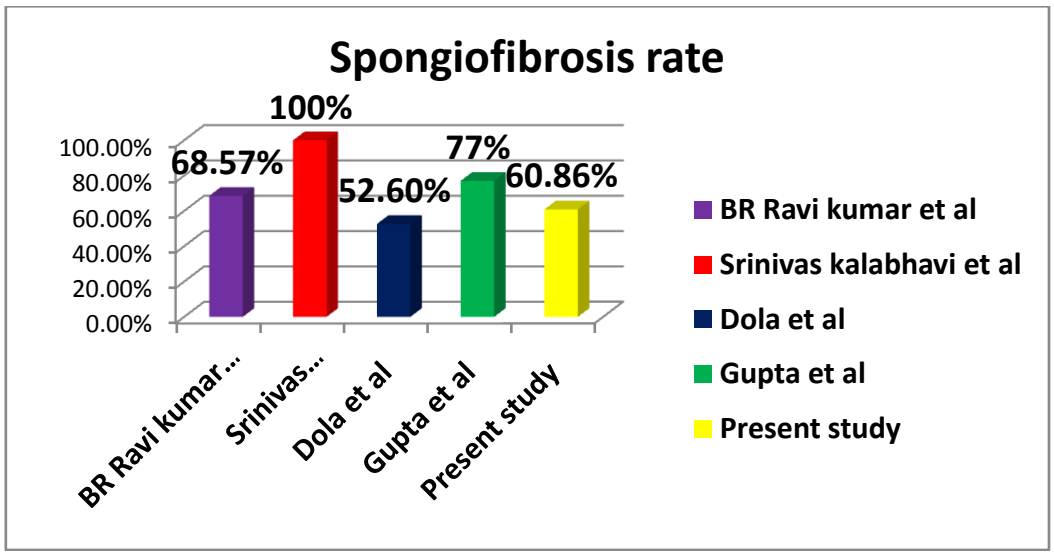


Fig 7: Bar diagram depicting spongiofibrosis rate on SUG in various studies

6. STRICTURE DIAMETER

Mean stricture diameter on RGU was found to be 10.17Fr whereas for SUG was 9.39 Fr. Intraoperative mean stricture diameter was 9.33Fr. There are not many studies in the literature to compare stricture diameter in various modalities. BR Ravi kumar et al [14] in his study studied stricture diameter on various modalities. Mean stricture diameter on RGU was 0.9 mm and SUG was 1.1 mm. Mean stricture diameter on SUG had strong correlation with intraoperative findings and was statistically significant. Even in the present study, mean stricture diameter on SUG was closely correlating with intraoperative findings and was statistically significant (P = 0.02 on chi square test).

Table 13: Mean stricture diameter on various modalities in various studies

Study	Mean stricture diameter	
	RGU	SUG
BR Ravi kumar et al [14]	0.9 mm	1.1 mm
Present study	3.39 mm (10.17 Fr)	3.13 mm (9.39 Fr)

7. SURGERY DONE

In the present study, two patients with penile urethral stricture underwent Orandi flap repair, 2 patients underwent Asopa dorsal inlay buccal mucosal graft urethroplasty and 3 patients underwent Barbagli dorsal onlay buccal mucosa graft urethroplasty.

Two Patients with pan urethral strictures underwent Asopa dorsal inlay buccal mucosal graft urethroplasty. Three Patients with pan urethral strictures underwent Barbagli dorsal onlay buccal mucosa graft urethroplasty.

Four patients out of eleven bulbar urethral strictures had stricture length less than 1.5 cms and underwent OIU. Seven patients with bulbar urethral strictures underwent Barbagli dorsal onlay buccal mucosal graft urethroplasty in the present study.

From all the data of the present study, SUG had better sensitivity in measuring exact length of stricture than RGU. Exact stricture length plays an important role in the selection of stricture length. Various studies has proven that the outcomes for stricture length less than 1 cms with VIU were better and any strictures more than 1 cms had recurrence. So they proposed end to end anastomosis for patients with stricture length between 1-2 cms and substitution urethroplasty for stricture length more than 2 cms.

In the present study, even though RGU and SUG were able to correctly identify the presence of stricture in all the individuals, there was a considerable difference when it comes to categorizing the patients according to stricture length. About 10 out of 14 patients with category I and 4 out of 4 category strictures were later up graded to category II and category III respectively on SUG. This considerable difference in the present study can be attributed to inadequate stretch while performing RGU and also because of end of view appearance on RGU which makes it difficult to correctly estimate the distance between 2 tapering ends. SUG nullifies these limitations as there is no need to apply penile stretch while performing the test and also the entire urethra can be distended with lignocaine jelly injection through urethra. An additional benefit of SUG is that it can estimate spongiofibrosis which should also be taken into consideration when patient is planned for surgery. Majority of recurrences following initial surgery are due to incomplete assessment of spongiofibrosis part in the corpus spongiosum. This was proven in other studies too.

In the present study, a decision of OIU was made for 14 patients on the basis of RGU. But this decision was changed to substitution urethroplasty after re categorizing the patients after SUG and there was a change in decision in about 10 patients. In the present study, stricture length less than 1.5 cms were managed with OIU and more than 1.5 cms underwent substitution urethroplasty.

Anastomotic urethroplasty alone was not done in any of the patients in the present study. However in the present study, stricture length less than 1 cm on RGU had similar findings on SUG and intraoperatively. Thereby any stricture length less than 1 cm correlates well with SUG and intraoperative findings. They are also less likely to have moderate or severe spongiofibrosis. So whenever a stricture length of less than 1 cm is made on RGU, OIU can be planned without correlating with SUG findings.

LIMITATIONS

The present study carries its own limitations, as the principal investigator is not blinded and small sample size. Other limitations being, long term follow up of patients to look for recurrence and factors responsible for recurrence. Another limitation found in the present study was that the long penile and bulbar strictures was unable to be distended adequately, restricting proper visualization of actual stricture length on both modalities. There is a need for double blinded studies with large sample size and long term follow up of those patients undergoing urethral surgeries based on the findings of RGU and SUG based on the findings of the present study.

CONCLUSION

- Both SUG and RGU are modalities of choice for diagnosis of stricture urethra
- Even though RGU can identify a stricture, length of the stricture identified may be less than actual length and may lead to change in intraoperative decision if proposed stricture length is more than stricture length on RGU
- SUG measures exact stricture length and it closely correlates with that of intraoperative findings. So an adequate preoperative planning of surgery can be made based on SUG findings.
- Stricture diameter on SUG correlates well with intraoperative findings rather than RGU.
- Spongiofibrosis and other periurethral pathology cannot be determined by RGU alone. SUG helps in the identification of spongiofibrosis and periurethral pathology thereby helping in the proper management of patients with stricture thereby minimizing recurrence.
- False tracts on RGU may be missed if its opening is occluded but these false tracts can be identified on SUG
- With accurate information about periurethral pathologies SUG is more useful than RGU when determining the type of operative procedure suitable for patients with strictures localized to the anterior urethra.

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