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Short Term Effects of Direct Vision Internal Urethrotomy on Uroflowmetry Parameters in Male Anterior Urethral Stricture Treatment in Port Harcourt

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Authors' contributions

This work was carried out in collaboration between both authors. Author OCP did study concept, collected the data, analyzed the study and wrote the manuscript; Author EN was involved in study concept. Both authors read and approved the final manuscript.

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Original Research Article

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ABSTRACT

Background: Anterior male urethral stricture is a common pathology which presents to the urologist and cause a lot of morbidity to the patient. Different options of treatment based on different criteria are available. Direct vision internal urethrotomy(DVIU) is a minimal invasive technique applicable in men with short segment urethral strictures with good outcomes. However the length of sustainability of initial success has been out to question

Objectives: To determine the short term effects of DVIU procedure on uroflowmetry parameters in male anterior urethral strictures treatment in Port Harcourt.

Materials and Methods: This is a hospital based prospective non blinded study of patients with short segment anterior urethral stricture ≤20mm. Ethical approval and informed consent were obtained. All patients included in the study had a retrograde urethrogram and a micturating cystourethrogram. They were evaluated using uroflowmetry before, immediate post operatively and six months after DVIU. Data were entered into Microsoft Excel 2010 and analyzed with Data Analysis Tool Pak (version 3.0).

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Results: Twenty six patients were studied. The age group 30 to 39 years had the highest frequency with 11(42.3% of respondents). Bulbar urethral strictures accounted for 76.9% of cases. Inflammatory causes accounted for 50.0% of cases. The mean maximum flow rate before intervention was 10.1ml/sec. There was a marked increase in the maximum flow rate and average flow rate of 20.1ml/sec and 8.03ml/sec respectively in the immediate postoperative period and this was found to be statistically significant. There was however a significant decline in both maximum flow rate and average flow rate six months after intervention. The reoperation rate post DVIU following recurrence was 7.6%. Reconstructive urethroplasty was used in these. There is a negative Pearson's correlation with a 0.16ml/sec reduction in maximum flow rate with every 1mm increase in stricture length.

Conclusion: DVIU as a treatment for short segment anterior urethral stricture causes marked improvement in uroflowmetry parameters in the immediate postoperative period. There is, however, decline in success rates in the long-term period. Increasing length of stricture is associated with reduction in maximum flow rate.

Keywords: Direct Vision Internal Urethrotomy (DVIU); uroflowmetry; anterior male urethral strictures; short segment strictures.

1. INTRODUCTION

Urethral stricture disease is defined as a scarring process involving the spongy erectile tissue of the corpus spongiosum (spongiofibrosis) [1].

It is a global disease that affects both sexes and most age groups [2-4]. It reduces the quality of affected individual's health and causes significant financial and psychological burden on the afflicted and their care givers / family members [5].

Depending on the aetiology, it may be a long or short segment stricture[1] . Infectious causes of urethral stricture are commonly due to Neisseria gonorrhea and less commonly due to Chlamydia, tuberculosis, schistosomiasis and lymphogranuloma venerum [1,6-7]. Strictures arising from these infectious causes usually affect long segments of the urethra in an inflammatory process[6]. Other causes of strictures include post traumatic (fall astride injuries, pelvic fractures), catheter induced/iatrogenic causes from instrumentation and rarely from malignant causes[1,6]. Strictures from trauma or iatrogenic causes are usually short segment because the inflammatory process occurs in a restricted area and the fibrosis occurs in a short period of time [6].

The various treatment options for urethral strictures have been documented in history since the sixth century [2,3,8]. These options include dilatation (bouginage), urethrostomy, direct vision internal urethrotomy (DVIU), placements of stents and reconstructive urethroplasty [2,6,9]. Currently, the commonest techniques used are bouginage and DVIU [6,8,10] . In the USA, 86% of the board certified urologists attest to using DVIU as their intervention of choice in treatment of strictures [7].

The technique of DVIU being used today is as described by Hans Sachse in 197 [11-12] It is a minimally invasive endoscopic treatment for urethral stricture by the transurethral route. Direct vision internal urethrotomy is mainly used for treatment of anterior urethral strictures in males[6,11-13]. Its success rate is varied and reports from different studies show conflicting data [6,11-15]. This research project is therefore intended to evaluate the short term effects of DVIU on uroflowmetry parameters (as a measure of its success rates) in the treatment of male anterior urethral strictures in Port Harcourt.

2. METHODS

This study was conducted on males' age 18 years and above who come to the urology outpatient clinic of the University of Port Harcourt Teaching Hospital with anterior urethral stricture who met the eligibility criteria and were scheduled for DVIU procedure from June 2018 to February 2019. Thirty nine males met the inclusion criteria within the study period, of which twenty seven consented to be included in the study. Follow up period was for six months after undergoing direct vision internal urethrotomy. Study design was prospective observational.

The researchers designed a data collection tool which was pretested and data collection commenced from April 2018 up to August 2019.

Data was entered into Microsoft Excel 2010 and data analyzed using the Data Analysis ToolPak. Tables and figures were used to represent the results. The results were expressed as mean, percentages and standard deviation. Confidence interval was set at 95% and a p-value of 0.05 was considered to be statistically significant. Chi squared tests were used to analyze the location of the stricture according to age group. Two tailed paired T test was used to compare pre-operative and post operative means. Pearson's correlation was used to determine the relationship between stricture length and maximum flow rate. Correlation and regression analysis was used to compare changes of stricture length with age and maximum flow rates.

Data collected and studied include age, presenting symptoms, aetiology of strictures, cystourethrogram features of the stricture (location and length), preoperative and post direct vision internal urethrotomy uroflowmetry parameters. All procedures were carried out by a single urologist. The technique used was cold knife incision of the strictured segment at 12 o,clock position without extending into normal tissue.

Preoperatively, uroflowmetry was carried for every patient and parameters recorded were the maximum flow rate, average flow rate and voiding time. It was reported immediately post removal of catheter three days after DVIU procedure and then at six months.

2.1 Inclusion Criteria

All male patients 18 years old and above with anterior urethral strictures less than or equal to twenty (20) millimetres in length who had a first DVIU.

2.2 Exclusion Criteria

i. Patients with multiple urethral strictures

ii. Patients with complete urethral obstruction on MCUG/ RUG

iii. Patients who have had previous DVIU intervention

iv. Patients whose age is below 18 years

3. RESULTS

Thirty nine (39) patients were seen with anterior male urethral stricture within the study period that fitted the inclusion criteria. Twenty seven (27) patients consented to be included in the study. One patient was excluded from the study due to loss to follow up and inadequate uroflowmetry studies and was not included in the data analysis. Twenty six (26) patients were therefore studied.

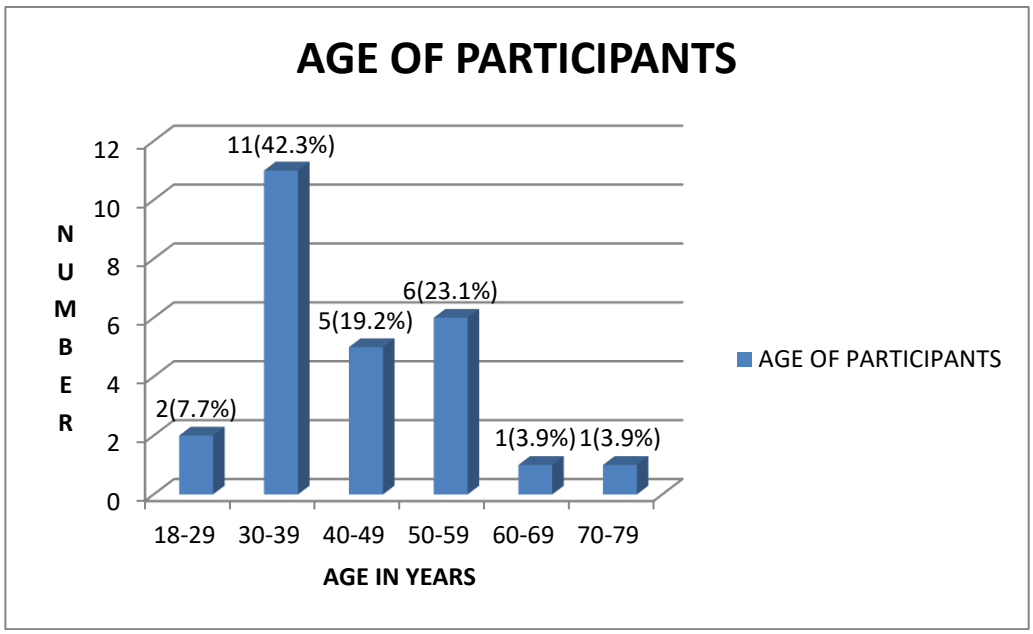

Fig. 1. Percentage age distribution of male patients with urethral stricture in UPTH

The age range of the participants was 18-79 years with an average age of 42.4 years (SD 12.33). The highest occurrence was in the age group of 30-39 years accounting for 42.3% of the participants (Fig. 1). About 7.7% of patients were below 30 years of age.

The locations of the strictures are represented in Fig. 2 and shows the distribution of location of the urethral strictures. Twenty of the strictures (76.92%) were in the bulbar urethra.

A linear regression analysis done (Fig. 3) shows that the anterior male urethra stricture length increased by 0.08mm (95% CI -0.13 to 0.20) for each additional age in years. This finding was however not statistically significant (p= 0.70).

The causes of anterior male urethra strictures in this study were broadly classified as traumatic, inflammatory and idiopathic (no identifiable cause). Inflammatory causes were identified as the cause of the stricture in 13(50.0%) of all the patients. There was no identifiable cause in 2 of the cases (Table 1).

The uroflowmetry parameters of the were studied before, after and six months after surgery were assessed. The mean maximum flow rate pre DVIU was 10.9ml/sec ± 4.3. There was a tremendous increase in the maximum flow rate in the immediate post DVIU period. The maximum flow rate increased by 20.1ml/sec (95% CI 15.8-24.3), with a statistically significant p value 0.000000000556. The maximum flow rate at 6 months post DVIU increased by 15.0ml/sec (95% CI 11.4-18.9) compared to the pre-intervention period (p=0.0000000321). This is represented in Table 2. There is a decline of 5.1ml/sec between the immediate post DVIU period and six months post DVIU.

Table 1. Aetiology of anterior male urethral strictures in UPTH

Aetiology	Number	Percent
Trauma	11	42.3%
Inflammatory	13	50.0%
Idiopathic	2	7.7%
Total	26	100%

The mean average flow rate pre DVIU was 4.2ml/sec ± 1.21. There was an increase in the average flow rate in the immediate post DVIU period. The average flow rate increased by 8.03ml/sec (95% CI 5.65-10.40), with a statistically significant p value 0.00000027. The average flow rate at 6 months post DVIU increased by 5.96ml/sec (95% CI 4.12-7.80) compared to the pre intervention period (p=0.00000053) (Table 3). This also indicated a decline of 2.07 ml/sec between the immediate post DVIU period and six months post DVIU.

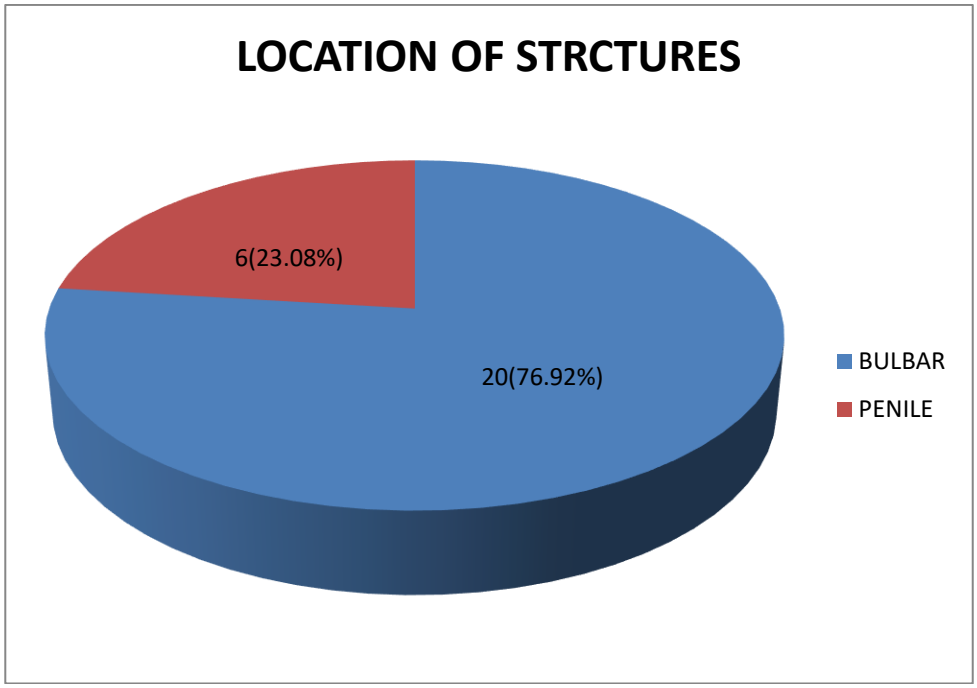

Fig. 2. Distribution of location of male urethra strictures in UPTH

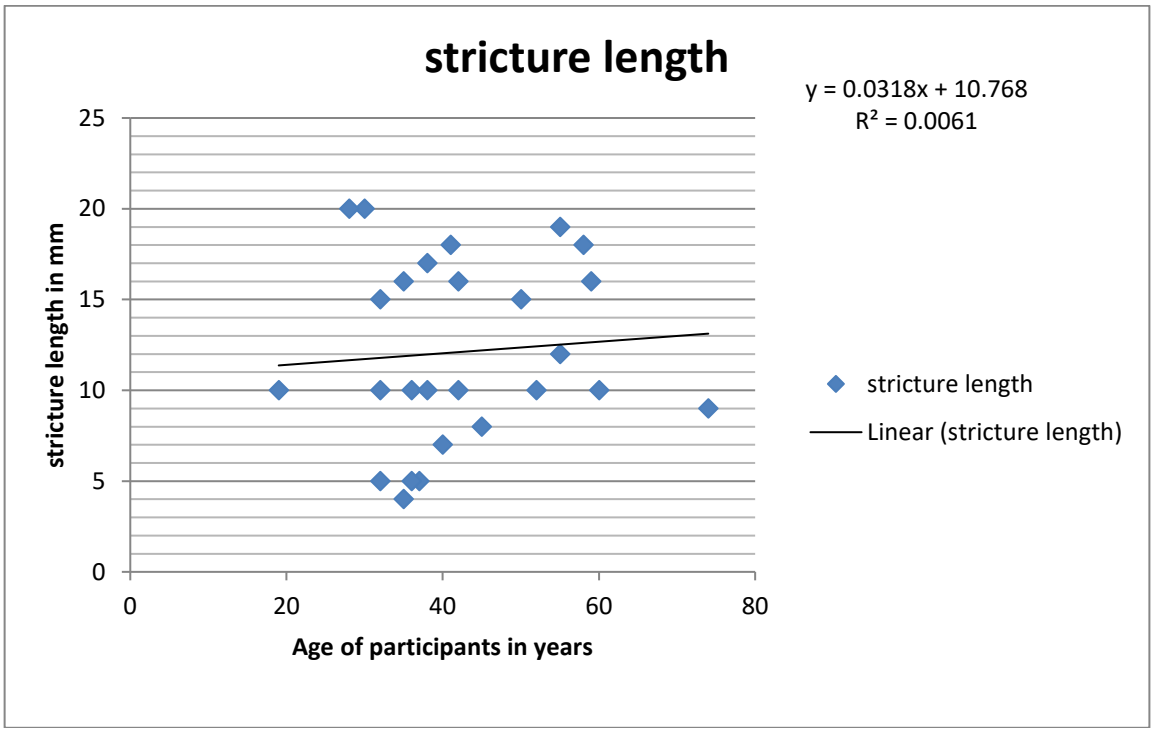

Fig. 3. Linear regression analysis of relationship between stricture length (mm) and age of patient in years

Table 2. Analysis of maximum flow rate measurements gotten during the study

	Pre intervention mean ± SD	Immediate post intervention mean ± SD	Six months post intervention mean ± SD
Maximum flow rate	10.9±4.3	31.0±13.4	25.9±11.8
Mean difference		20.1(95% ci 15.8-24.3)	15.0(95% ci 11.4-18.9)
P value		0.000000000556	0.0000000321

Table 3. Analysis of average flow rate measurements gotten during the study

	Pre intervention mean ± sd	Immediate Post Intervention Mean ± SD	6 Months Post Intervention Mean ± SD
Average flow rate	4.21±1.24	12.24±6.16	10.17±5.05
Mean difference		8.03(95% CI 5.65-10.40)	5.96(95% CI 4.12-7.80)
P value		0.00000027	0.00000053

Table 4. Reoperation rate following DVIU for anterior male urethra stricture

	Repeat Surgery	
	Yes	**No**
Stricture aetiology		
Traumatic	1	10
Inflammatory	1	12
Idiopathic	0	2
Stricture location		
Bulbar	1	19
Penile	1	5

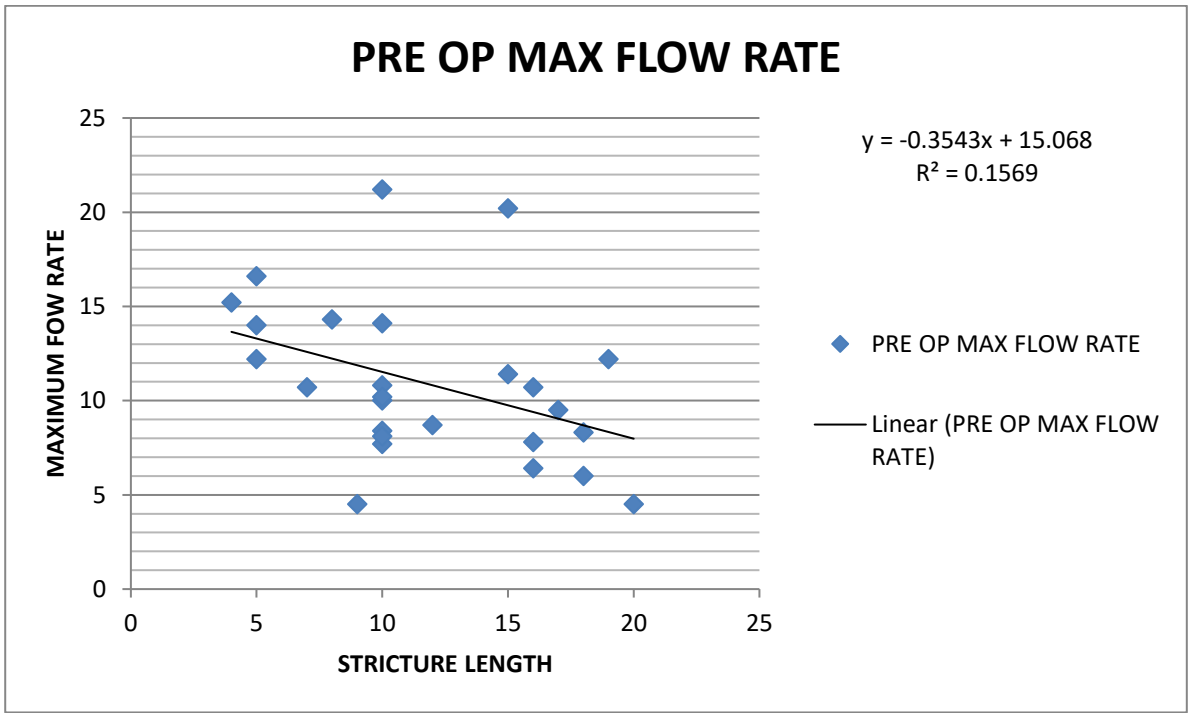

Fig. 4. Correlation between stricture length and maximum flow rate

A scatter plot was done analyzing the association between male urethra stricture length and maximum flow rate uroflowmetry measurements. There is a negative Pearson's correlation of 0.396 showing that there is a 0.16ml/sec reduction in maximum flow rate with every 1mm increase in stricture length and this was statically significant (p value 0.04).

Two patients out of 26(7.6%) had open Urethroplasty after failed DVIU (Table 4). One patient had anastomotic urethroplasty, while the other had buccal mucosa substitution urethroplasty.

4. DISCUSSION

The management of anterior urethral stricture disease in men can pose challenge for the urologist. Different therapeutic options exist ranging from simple dilatation, direct vision internal urethrotomy (DVIU), stents and reconstructive urethroplasty [2,6,9,16]. DVIU as a treatment option has its advantages and disadvantages. Reconstructive urethroplasty is said to have the best success rates, however DVIU has the advantage absence of a skin incision, faster healing time and return to work, shorter time to carry a catheter as a stent, minimal blood loss and has a shorter learning curve than urethroplasty [6,9,16]. This makes DVIU a preferred option for physicians and patients alike.

The mean age of occurrence of anterior male urethral stricture was 42.4 years in this study, with a distribution of 18 -79 years (Figure 1).Nwofor et al [17], Musau et al. [18] and Zehri et al. [19] reported mean ages of 43.2years, 49.4 years and 48 years. These are similar to findings in this study and the populations have similar demographics. Ramyil et al reported a mean age of 30.6 years [14]. This is the active working age group, with increase vehicular and industrial accidents. This age group would also be more sexually active and hence inflammatory causes will also dominate. Nwofor et al[17], Tritschler et al. [20] and Fenton [21] all recorded an age range of 18-79 years similar to what was seen in this study.

The commonest site of male urethral stricture in this study was in the bulbar urethra accounting for 76.9% of cases (Fig. 2). Ekeke et al in their study in Port Harcourt reported bulbar strictures accounting for 40.2% of the 188 men studied [22]. Ramyil et al in a study between 2002 and 2006 which revealed that bulbar urethra stricture accounted for 88.6% of all urethra stricture cases seen [13]. Other studies in Nigeria and outside

Nigeria indicate the bulbar urethra as the most frequently involved segment with percentage rates of 50 to 80%,[23-26]. The bulbar urethra is relatively immobile and is injured in blunt abdominal trauma [27]. It is also more commonly injured in endourology procedures [1,27].

Mandhani et al in their study in Lucknow, UP, India reported a mean stricture length of 8.6mm [28]. This study reported mean length of 12.1mm (SD 5.0). The stricture length is influenced by many factors including aetiology, immune response of the patient, repeat procedures etc[1]. Stricture length and degree of fibrosis have been identified as predictors of good response [20, 29,30]. Dubey in 2011 reported that the best outcomes occurred when the stricture length was less than 10mm with minimal spongiofibrosis [27].

There was a positive correlation between increasing age and longer stricture length with 0.08mm added for each additional age in years. This may be supported by the fact that with increasing age, there are increasing co-morbidities, progressive dysfunction of the immune system and ongoing poorly treated infections [31].

The causes of urethral stricture were broadly divided into traumatic, inflammatory and iatrogenic in this study (Table 2). Inflammatory causes accounted for 52.4% of strictures, with traumatic causes closely following with a percentage of 42.6%. Shittu et al [12] in the study of optical urethrotomy in Ibadan, reported post infective causes to account for 80% of aetiological factors. A percentage distribution of 79% inflammatory and 21% traumatic was documented by Mandhani and his associates [28]. Different findings were reported by Nwofor et al and Tritschler et al, with traumatic causes dominating [17,25]. The contrasting reports may be explained by increased use of endoscopy in some centres, antibiotic use and antibiotic resistance. The classification of aetiology may also be a factor as some studies separate iatrogenic from traumatic causes. This study combined them in one class. A systemic review is needed to clarify these variations.

Uroflowmetry studies were used to assess the treatment outcomes of DVIU in this study. Different studies have used different methods to assess outcome including: subjective patient assessment [1], international prostate symptom score (IPSS) [13], maximum flow rate [32], repeated retrograde urethrogram[20] and flexible urethroscopy [33]. This has caused varying findings of success. Uroflowmetry has the advantage of being non invasive, inexpensive and provides quantitative and objective analysis of the patients micturition [32].

The pre DVIU mean maximum flow rate was 10.9ml/sec in this study. Pansandaro reported a slight lower mean maximum flow rate of 6.6ml/sec pre operatively before DVIU [33]. The preoperative maximum flow rates may be related to the degree of luminal narrowing, degree of spongiofibrosis and presence of obstruction by a prominent median lobe [20].

Following DVIU, there was a significant improvement in the maximum flow rate by 20.1ml/sec in this study and this finding was strongly statistically significant (Table 3). Shittu in his report from University College Hospital, Ibadan in 2001 reported a mean maximum flow rate of 23ml/sec, which is similar to the finding of this study [12]. Majority of studies in Nigeria [13], the Middle east [34], Asia [35] and Europe [36,37] report high initial success rates ranging from 50% to 93%. Some of these studies have slightly differing inclusion criteria and used different instruments or methods to monitor outcome. These account for the different success rates. No study was identified that indicated immediate high failure rates.

Despite these initial success rates, most urologists are skeptical about long term success [30,35]. This study showed that there was a significant decline in maximum flow rate at six months compared to rate achieved postoperatively (Table 3). There was a decline of 5.1ml/sec representing an average of 20.3% reduction. This decline was noted in 25 out of the 26 patients studied. One patient had acute retention of urine which had to be relieved by suprapubic cystostomy. Studies with long term follow up have submitted that the success rate of DVIU declines with time. Santucci et al in their study of seventy patients, who had DVIU, reported an 8% long term success rate after 5 years of follow up [14]. Pansadoro noted a recurrence rate of 68% over 98 months [34]. A 29.99% stricture free rate two years post DVIU was reported by Pal and his associates [35]. There is paucity of research regarding factors associated with recurrence following DVIU [33]. Dubey noted that there was no standardized definition of failure [29].

Identified independent predictors of recurrence after DVIU in literature include older age, obesity, severe spongiofibrosis, long segment strictures greater than two centimetres, urethral caliber greater than 15 French gauge, disorders of wound healing and idiopathic aetiology [20,31,33,34]. Andre M et al in 2005 reported that male urethral strictures could recur as early as twelve weeks post DVIU with declining maximum flow rate [11]. Their finding was in agreement with this study with two cases requiring a repeat intervention within twelve weeks of the DVIU procedure.

The mean average flow rate before DVIU in this study was 4.2ml/sec. This is lower than accepted value of 5ml/sec used to predict retention in uroflowmetry assessment[32]. The average flow rate increased in the immediate post operative period by a value of 8.03 ml/sec ($p<0.01$). There was then a similar decline noted with the maximum flow rates by 2.07ml/sec. The average flow rate has been noted to be a strong predictor of acute retention of urine, whilst the maximum flow rate is ideal for assessment of bladder emptying function [38-40].

This study showed a reduction in maximum flow rate with increasing stricture length. There was a 0.16ml/sec reduction in flow rate with every millimetre increase in urethral stricture length. This was inferred by Erickson et al, who used maximum flow rate as a means of predicting stricture recurrence[33]. Heyns and his associates showed a significant positive correlation between urethral diameter and maximum flow rate [41]. The urethral diameter will further reduce with increasing stricture. The agreed cut off for a short segment urethral stricture is 20millimetres or less [1,27]. This was the value used in this study. Other studies however have shown better success rates when stricture length is 10millimetres or less [20,28,30]. These findings could be considered in redefining the limit for short segment strictures and may help in better patient selection for the DVIU procedure. This study showed improved maximum flow rates with reducing stricture length further supporting the argument above.

The reoperation rate in our study was 7.6%. This is similar to findings in a study by Bodker [41]. The early recurrence (within 3 months) of stricture in this series is backed by the study of Andre et al [11]. Reoperation rate post DVIU increases with longer follow up. All cases of recurrence in this study were treated with reconstructive urethroplasty. This is in line with the report of Greenwell et al who submitted that repeat urethrotomy is not cost effective and did not have any clinical benefit [21].

5. CONCLUSION

Direct vision internal urethrotomy is a viable treatment option for short segment anterior male urethral strictures as it produces marked improvement in the immediate post operative period. Its longterm success is however poor, with evidence of recurrence and reducing urine flow rates. There is reduction in maximum flow rate with increasing stricture length.

CONSENT

All participating clients gave consent to participate in the study

ETHICAL APPROVAL

Ethical approval was gotten from the ethical review committee of UPTH with number UPTH/ADM/ 90/S.II/VOL.X/799 before the study was commenced. Data confidentiality was maintained throughout study duration and the procedures were done under the guidelines of the Declaration of Helsinki

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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