

**A REVIEW ON MANAGEMENT PROCEDURES  
FOR URETHRAL STRICTURE DISEASE AT  
KENYATTA NATIONAL HOSPITAL <sup>1</sup>**

**A dissertation submitted in part fulfillment for the  
Degree of Master of Medicine in Surgery,  
University of Nairobi**

**By**


**DR. KAMANDE LAWRENCE IN JANG A  
MBCHB (NAIROBI)**

**2003**

**DECLARATION**

**CANDIDATE:**


This dissertation is my original work and has not been presented for a degree in any other University or any publication in any journal or institution.

Sign  \_\_\_\_\_ Date

DR. KAMANDE LAWRENCE NJANGA

**SUPERVISOR:**

This dissertation has been submitted for examination with my approval as a University Supervisor.

Signed  \_\_\_\_\_ Date

**DR. OWILLA F.A.**

**MBCHB, MMED (Surg) NRB, Cert. Urology  
LECTURER AND CONSULTANT SURGEON  
UNIVERSITY OF NAIROBI**

## **DEDICATION**

This dissertation is dedicated to my parents Paul Njanga and Esther Njeri whose encouragement, prayers and assistance has made me what I am today.

## **ACKNOWLEDGEMENT**

I wish to express my sincere gratitude to my supervisor Dr. Owilla F.A. for his guidance and assistance during the entire period of study and the preparation of the dissertation. His untiring patience in reading and criticizing the manuscript has been highly appreciated.

My appreciation is also extended to Dr. Michael Johnson for the assistance offered especially in getting some of the journal articles quoted in the references.

I wish to express deep appreciation to my family especially my dear wife Jane and my sons Mark Njanga and Andrew Karimi for the patience and understanding portrayed during my study.

Special thanks to Kenyatta National Hospital Ethical and Research Committee for granting the permission to carry on this study.

Finally I would like to thank every person who in one way or another played a part in writing of this dissertation.

## LIST OF CONTENTS

1.TITLE OF DISSERTATION.....	1
2.DECLARATION	2
3.DEDICATIONS	3
^ACKNOWLEDGEMENT.....	4
5.LIST OF CONTENTS.....	5
6.LIST OF TABLES AND FIGURES.....	6
7.LIST OF ABBREVIATIONS.....	8
8.ABSTRACT	9
^INTRODUCTION.....	10
10.LITERATURE REVIEW.....	11
11.JUSTIFICATION OF THE STUDY.....	27
12.OBJECTIVES.....	28
13.METHODOLOGY	29
14.RESULTS	31
15.DISCUSSION	54
16.CONCLUSION	62
17.RECOMMEDATION S	63
18.REFERENCES	64
19. APPENDIX.....	68

## LIST OF TABLES AND FIGURES :

LIST OF TABLES	page
Table 1 - Age distribution in the study group.....	31
Table 2 - Occupational status in the study group.....	33
Table 3 - Causes of urethral strictures.....	34
Table 4 - Iatrogenic causes of urethral strictures.....	35
Table 5 -Correlation between age group and post traumatic, iatrogenic and post inflammatory urethral strictures.....	37
Table 6 -Presentation of urethral strictures.....	38
Table 7 -Other presentations of urethral strictures.....	39
Table 8 - Preoperative investigation.....	40
Table 9 - Initial management procedures performed during the study period ...	41
Table i0 -Immediate initial management results.....	42
Table 11 -Correlation between initial management procedure and the immediate results.....	43
Table 12 -Correlation between the initial management procedure performed and the recurrence of symptoms.....	45
Table 13 - Outcome of the initial management procedures.....	46
Table 14 - Success rates of the initial management procedures.....	47
Table 15 - Postoperative evaluation.....	49
Table 16 - Total number of procedures performed during the study period.....	50
Table 17 - Complications of anastomotic urethroplasty.....	52
Table 18 - Complications of direct vision urethrotomy.....	52
Table 19 - Complications of passage of sounds.....	53
Table 20 - Complications of other procedures.....	53
LIST OF FIGURES	
Figure 1 - Bar graph on age distribution.....	32
Figure 2 - Pie chart on occupational status.....	33
Figure 3 - Bar graph on causes of urethral strictures.....	34

Figure 4 - Bar graph on iatrogenic causes of urethral strictures.....	35
Figure 5 - Bar graph on a correlation between the age group and post traumatic, iatrogenic and post inflammatory urethral strictures.....	37
Figure 6 - Bar graph on presentation of urethral strictures.....	38
Figure 7 - Bar graph on preoperative investigations.....	40
Figure 8 - Bar graph on the initial management procedures performed.....	41
Figure 9 - Bar graph on the immediate management results.....	42
Figure 10- Bar graph on initial management procedure versus immediate results.....	44
Figure 11- Bar graph on the outcome of the initial management procedures.....	46
Figure 12- Bar graph on the success rate of the initial management procedures.....	48
Figure 13 -Bar graph on postoperative evaluation.....	49
Figure 14 -Bar graph on all the procedures performed during the study period.....	51

## **LIST OF ABBREVIATIONS**

AIDS - Acquired immune deficiency syndrome

BXO - Balanitis xerotica obliterans

CISC - Clean intermittent self catheterization

DVU - Direct visual urethrotomy

FG - French gauge

HIV - Human immunodeficiency virus

KNH - Kenyatta National Hospital

ML - Millilitre

POS - Passage of sounds

RTA - Road traffic accident

TB - Tuberculosis

TURBT-Transurethral resection of bladder tumour

TURP -Transurethral resection of the prostate

UTI -Urinary tract infection



## **ABSTRACT**

This is a 5 year retrospective study that outlines the management procedures for urethral strictures and their outcome from January 1997 - December 2001 at Kenyatta National Hospital. It also highlights the causes, modes of presentation and investigations carried out for evaluation of the strictures.

Data was collected from inpatient files of the patients who were diagnosed and managed during the study period. Files with no records of follow-up were excluded from the study. A total of 179 patients were included and had their details extracted through a proforma questionnaire. Raw data was tabulated and analysed in order to address the objectives of the study.

Post traumatic strictures is found to be the commonest cause in 41.4% of the patients followed by post inflammatory strictures in 21.2%. Contrast urethrogram is found to be the commonest diagnostic tool used in 75.4% of the patients. The commonest modes of presentation is found to be difficulty in passing urine and indwelling suprapubic catheter in 42% and 40.8% of the patients respectively.

A total of 360 procedures were performed during the study period of which 179 were during the initial management and 181 during the follow-up. Overall passage of sounds ( POS) was the commonest procedure performed in 32.2% of the cases followed by direct visual urethrotomy (DVU) in 28.9% and anastomatic urethroplasty in 20.6%. Other procedures accounted for 18.3%.

In the initial management anastomatic urethroplasty was the commonest procedure in 33% of the patients followed closely by DVU in 29.1% and POS in 26.3% of the patients while other procedures accounted for 11.6%.

In the initial management, anastomatic urethroplasty had a better outcome than DVU and POS.

## **INTRODUCTION**

Urethral strictures are difficult to cure. Simple, cheap, rapid and easily available methods of treatment such as dilatation and internal urethrotomy could quickly treat many patients in the first instance, but the recurrence rate is as high as 40% for strictures shorter than 2 cm and 80% for those longer than 4 cm for both procedures after 12 months of followup (1). This results in a population of patients too large to manage easily, in addition to the potential medical and social consequences of repeated instrumentation.

Urethroplasty has a generally low recurrence rate of about 10% after 12 months (2), but it is technically demanding, time consuming and expensive. So it is usually reserved specifically for patients who have failed the above two methods and those with complex strictures at presentation (3).

The apparently high success rate of intraluminal stenting has offered an alternative to urethroplasty (4) but the procedure is also expensive and not readily available in the developing world.

The urology clinic at Kenyatta National Hospital records a high number of patients with urethral strictures every year, so a choice of simple but effective initial procedure could go a long way in reducing the number of patients awaiting operation.

## **BACKGROUND AND LITERATURE REVIEW**

### **Historical background**

Urethral stricture disease dates back to time immemorial with references to the problem and treatment by urethral dilatation appearing in the writing of ancient Indians, Greeks, Egyptians etc.

In ancient India Susruta described use of a reed catheter lubricated with ghee. In Greece Socrates was known to joke about the gleet of others and poor Epicurus committed suicide when he could no longer dilate his own stricture .

Treatment of strictures were essentially by means of intermittent bouginage in early years. Bougies were made of either wax, catgut or silver (5).

The pathology was however not realized until use of microscope to examine human tissues began. Inflammation from any cause was found to lead to granulation tissue formation followed by scarring which led to a stricture in a hollow organ such as urethra. It is not until 1588 that the role of gonorrhoea as a common cause of urethra stricture was described by John Reude. Gonorrhoea to the ancient was hardly more than a common cold in an awkward place (5).

Despite the use of internal urethrotome of maisonneuve and otis in 18th century there was still no cure for urethral strictures. Duplay in 1886 devised the use of full thickness skin in a two stage procedure. The method was perfected by Denis Browne in 1936 for hypospadias repair. Johanson and Swinney adapted Browne's principle for treatment of complicated and difficult urethral strictures of the adult in 1953 and 1954 respectively. Turner-Warwick modified Johanson method by use of scrotal skin in 1960 (6).

The use of internal urethrotomy was revolutionized with the availability of a new endoscopic optical system devised by Harold Hopkins. The system provided a brilliantly clear view of the inside of the urethra (6).

Sachse (1974) introduced a new optical urethrotome which was elegant, easy and safe. Its initial results were so gratifying that the number of urethroplasties being performed in most centres fell dramatically (7).

## **SURGICAL ANATOMY**

In males the urethra is approximately 20 cm long. It extends from bladder neck to the external meatus. Anatomically it is divided into anterior and posterior parts. Anterior parts extend from urogenital diaphragm to external meatus and includes bulbar and penile urethra. Posterior part comprises of membranous and prostatic urethra.

It has two normal narrowing at the level of external meatus and at the junction of bulbar and membranous parts (8).

The urethra consists of a layer of fibroelastic tissue and smooth muscles predominantly lined with stratified columnar epithelium. Superior to prostatic utricle, the epithelium is transitional and stratified squamous in the navicular fossa. Numerous mucous glands open in the urethra. They are more numerous at the membranous and bulbar parts (8).

The urethra shares blood and lymphatic supply of the prostate, urogenital diaphragm and the penis. In the anterior part of the urethra, branches of internal pudendal vessels run distally through corpus spongiosum at 5 and 7 o'clock position (8).

The prostatic part is approximately 3 cm long and it is the widest. The calibre of the most dilatable part averages 45 in French gauge (FG). It pierces the prostate from its base to a point just anterosuperior to its apex. On the posterior wall it has a ridge (urethral crest) with prostatic sinuses on each side where numerous ducts of the prostate glands opens. A rounded eminence on the crest (superior colliculus) has 3 openings on it, the median prostatic utricle with slit ejaculatory ducts on each side (8, 9).

Membranous part is the shortest (approximately 1 cm) and the least dilatable part with a caliber of approximately 27 in FG. It pierces the urogenital diaphragm and is surrounded by the external urethral sphincter hence it is the thickest part (9).

It is also the weakest part, so urethral injury is common at this part during prostatic surgery, instrumentation and due to indwelling catheter. Pelvic fracture urethral injuries are still most common at the junction between membranous and bulbar part (10). Nervi erigentes which innervate erection mechanism of penile corpora lie in close posterolateral

relationship to this part. Injury to them during sphincter relaxing urethrotomy at 8 and 4 o'clock may result in impotence (11).

Spongy part comprises of the bulbar and penile urethra. It is the longest part (approximately 16 cm). Its caliber ranges from 33-36 FG at the bulbar area to 27-30 FG at the penile part. It first bulges backwards forming the intrabulbar fossa and then passes longitudinally through corpus spongiosum. In glans penis it expands to form fossa navicularis, which opens on the surface via the slit like external urethral meatus (8,9). The wall is formed by urothelium applied almost directly to the vascular spaces of erectile tissue. It is the natural thrombotic healing response of this delicate underlying spongy tissue and the extent of consequent spongiofibrosis that largely determines the nature of spongy urethra and its tendency to restenosis after surgery (11). (Spongiofibrosis refers to the fibrosis in the corpus spongiosum which is distributed in the penile and bulbar parts).

Female urethra is equal in length (approximately 4 cm) to prostatic and membranous parts of the male urethra. It is wider and more dilatable. Urethral injuries in female are rare as the urethra is short and mobile with no significant attachment to pelvic bone, thereby rendering it relatively resistant to injury. The reported incidence in females with pelvic fractures is 0-6% (12) as compared to 3-25% in males (10).

A study done at Kenyatta National Hospital (2001) has shown the incidence of urethral injuries in both male and female patients with pelvic fractures to be 12.2% (13).

## **PATHOGENESIS AND AETIOLOGY**

Chambers et al noted that the first identifiable change in urethral stricture disease was a change in the nature of the urethral epithelium from a pseudostratified to a columnar type that lacks the water proofing quality of the pseudostratified variant. Consequently, they hypothesized that urine could extravasate and lead to fibrosis (14). Increased pressure proximal to the narrowed zone leads to further extravasation of urine and subsequent worsening of fibrosis.

In case of partial denudation of urethral lining at the bulbopenile urethra this leads to the exposure of the corpus spongiosum. Margins of urothelium are usually approximated but are intermittently opened by voiding streams and the spongy tissue thus exposed become inflamed with gradual subsequent spongiofibrosis and lumen stenosis (15).

Infected urine, infection of paraurethral glands and hematoma formations exacerbate fibrosis.

Complete urethral disruption with loss of continuity is followed by hematoma formation and subsequent fibrosis. It is worse if the two ends are distracted from each other.

### **Causes of urethral stricture**

These can be categorized as congenital, traumatic, inflammatory, malignant, ischaemic and degenerative.

1. Congenital - These includes posterior urethral valves, mid bulbar stricture and anterior urethral valves otherwise known as double barrelled urethra.
2. Traumatic - Iatrogenic tops the list world wide following passage of urethral sounds, endoscopic instrumentation and catheterization (10). Indwelling catheter causes pressure sores on the most narrow parts of urethra namely the external meatus and penoscrotal junction (6).

Fall astride injury results in bulbar urethral injury whereas pelvic fractures results in membranous urethral injury (16).

3. Inflammatory - These include strictures resulting from gonorrhoea, chlamydia and chemical urethritis. T.B. and schistosomiasis has also been implicated (17).  
Chemical urethritis follows catheterizations due to antioxidants present in latex catheters. Proximal bulbar urethra is the commonest site for gonococcal urethritis due to rich distribution of paraurethral glands (18,19).
4. Malignancy - Is common at prostatic urethra usually from the prostate or bladder. Malignant stricture from penile and urethral tumours are uncommon.
5. Ischaemic - This is common after radiotherapy. Pelvic irradiation may cause ischaemia resulting from endarteritis obliterans to the blood supply to the urethra.
6. Degenerative disorders - The best example of this is balanitis xerotica obliterans. It is a sclerosing fibrotic condition that typically involves the dermal layer of foreskin and glans penis. It may also involve corpus spongiosum resulting in a long urethral stricture (20,21). It usually recurs in the genital skin grafted into the urethra at urethroplasty. So non-genital skin is recommended (22).

In our local set-up, a study by J. A. Adwok in 1984 showed post inflammatory stricture to be more common than posttraumatic stricture (23). These were similar to another study done in Nigeria between 1980 and 1989 (24).

Current figures from the developed world shows the reverse (2,17,25,26).

## **PATHOPHYSIOLOGY OF URETHRAL STRICTURE**

A severe degree of urethral stricture causes changes typical of obstruction. They include the dilatation of proximal urethra. The musculature of the urinary bladder also hypertrophies to overcome the obstruction. These leads to trabeculations, sacculations and even diverticulae. Hydroureteronephrosis secondary to hypertrophy of ureterotrigoal complex and vesicoureteric reflux occurs. These can lead to renal insufficiency (18).

Because of stasis infection occurs which may cause periurethral abscess, prostatitis, cystitis and pyelonephritis which leads to pain.

Acute retention of urine is precipitated by oedema mainly due to urethritis, alcoholic excess and by voluntary retention. In other cases the narrowness of the stricture results in increasing inability to expel residual urine and acute on chronic retention or retention with overflow supervenes (18).

If bacteria in the urine splits urea, calculi may form. Stasis per se is also a predisposing factor to calculi formation (27).

Straining on micturiting may induce hernia, hemorrhoids or rectal prolapse (18).



## CLINICAL FEATURES

Symptoms of the urethral stricture appear after the urethral calibre is reduced to less than 10 FG. It includes difficulty in voiding, chronic retention with dribbling of urine. Acute retention of urine may occur especially after secondary infection due to residual urine. At times the stricture is palpable as a thickening of the urethra (27).

Complications may also lead to varying symptoms. Residual volume may give rise to urinary tract infection and epididymitis. Obstructed ejaculation may lead to infertility. Extravasation of urine each time patient passes urine worsens the spongiofibrosis which can contract longitudinally resulting to a chordee during erection. Abscesses in distended paraurethral glands (paraurethral abscess) may burst in skin resulting into urethrocutaneous fistulae. Calculi commonly form inside these abscesses and in the infected tissues. Infected urine forced into prostatic ducts due to high pressure results in prostatitis. Squamous cell carcinoma after urothelial metaplasia arises in approximately 1% of patients with longstanding urethral stricture (27).

Hernia, hemorrhoids and rectal prolapse may result due to straining. Septicaemia after urethral instrumentation and extravasation of urine can also occur. Backpressure leads to vesicoureteric reflux with subsequent features of obstructive uropathy.

Urethral diverticulae also occurs after the urinary bladder musculature hypertrophies (18).

## INVESTIGATIONS

### 1)Urine flow rate

The flow is proportional to the square of diameter of urethra. It needs a very small reduction of lumen to change a good flow rate into a very bad flow rate, but a normal flow rate does not exclude a stricture of calibre greater than 10 FG.

To obtain reliable results the test must be performed in a private ,stress-free environment when the sensation to void is present. A void of at least 150 ml is required because the maximum flow rate is dependant on the volumes voided (28).

- Normal flow rate >15 ml/sec
- Mild obstruction 10-15 ml/sec
- Moderate obstruction 4-10 ml/sec
- Severe obstruction <4 ml/sec

i

### 2)Contrast urethrogram

Both voiding phase and retrograde phase should be obtained. It gives information about the site, length, number and calibre of the stricture. The length of the strictured segment may be overestimated or underestimated as a result of incomplete filling of prostatic urethra or urinoma cavity connected with the proximal segment respectively (29).

### 3)Urethroscopy

It gives useful information about the appearance of urethral lining immediately distal and proximal to the stricture and so gives a better estimate of the spongiofibrotic length. It is useful also for follow-up of treated strictures (27).

### 4)Others include sonourethrography spongiosonography.

They determine extent of spongiofibrosis otherwise determined at surgery (9).

## MANAGEMENT PROCEDURES FOR URETHRAL STRICTURES

### 1) Urethral dilatation

This procedure depends on the regeneration of epithelium without restenosis (11 ,19). It involves sequential dilatations with metal sounds though filiform dilatations and followers is also used. A skillful dilatation is still an acceptable first choice before embarking upon surgical repair. The goal is to stretch the scar without producing more scarring. However, certain features may render strictures to be unsuitable for dilation. These features include age of the patient, length of the stricture, difficulty and frequency of dilatation, associated local adverse factors, excessive hemorrhage and bacteraemic episodes after dilatation (26).

It is inappropriate to subject children to repeated general anaesthesia for repeated dilatations. Long and multiple strictures are often difficult to dilate and each dilatation further traumatizes the urethra with progressive cicatrization. Difficult dilatations also leads to creation of false passages and are usually associated with hemorrhage. Patients with associated urethral fistulae, periurethral phlegmon and dense periurethral fibrosis are also unsuitable for dilatation (26).

For the patients with an epithelial stricture without spongiofibrosis, dilatation is curative **(19)**.

A new transurethral balloon dilatation catheter has been developed. It is reported to be a safe, well tolerated office based procedure which is superior to sequential rigid dilatations **(30)**.

## **2) Internal urethrotomy**

It also depends on regenerative proliferation of epithelium without restenosis.

It was done originally with otis urethrotome which was blind and therefore had higher risk of false passage. It is now largely done by direct vision urethrotome. It involves making an incision on the stricture which is traditionally done at 12 o'clock. The incision extends up to the normal tissues and this allows the scar to expand. The goal is for the resultant larger luminal caliber to be maintained after healing.

Wound contraction tries to approximate the edges of the scar. If epithelization progresses completely before wound contraction significantly narrows the lumen, then the procedure is said to be successful (19).

In bulbar area the incision at 12 o'clock is questionable because urethral lumen is grossly eccentric within its surrounding spongy tissue. So incision at 4 and 8 o'clock positions is more likely to extend through the layer of spongiofibrosis into the supple layer. Dorsal roofplate is also preserved should urethroplasty be required later (11).

For anterior urethral strictures, urethrotomy is most appropriate for bulbar strictures (31).

Internal urethotomy is unsuitable for the strictures which are located at the external meatus, when the strictures are impassable, when the strictures are complicated by numerous fistulas, calculi and abscesses or when there is gross displacement after severe pelvic trauma (7).

Various methods have been used to improve the result. Examples include use of laser to divide the stricture rather than a cold knife but this has been noted to have no added advantage (32). Other methods include use of a stent to hold the stricture segment and the urethra open, use of clean intermittent self-catheterization to hold the urethra open after an initial urethrotomy (33).

Pansadoro V et al (1996) showed a curative success rate of direct visual urethrotomy to be approximately 35%. The study also showed no increase in success rate with the second urethrotomy (31).

Complications of these procedure includes bleeding, epididymitis, septicaemia, extravasation of urine, incontinence, chordee and impotence (7).

Incontinence is mainly due to injury to the external urethral sphincter following urethrotomy for strictures at the membranous urethra. Urethroplasty for strictures at the same level also led to the same complication, so careful dilatation is still the operation of choice for these strictures (7, 34).

A study done on efficiency of urethral dilatation versus internal urethrotomy as the initial treatment for strictures has shown no significant difference. Both methods becomes less effective with increasing stricture length (1).

### **3) Urethral Stenting**

The procedure is offered as an alternative to repeated urethrotomies, urethral dilatations or urethroplasties.

Intraurethral stenting may be effective. When it is done the fibrotic tissue tends to grow through into the lumen of the stent particularly in traumatic strictures and those with periurethral fibrosis(35).

Moreover, even when successful there is a significant morbidity because the urine pools causing postvoid dribbling and irritative symptoms if not frank infection (36).

There is also pooling of semen after intercourse, interfering with ejaculation and its perception. Some patients have discomfort if not frank pain at the site of a stent (33).

Other complications associated with it includes migration and encrustation.

Even with the above associated problems the failure rate of intraurethral stenting has been quoted to be low in some of the studies (16).

#### **4) Urethroplasty**

It involves urethral reconstruction which can either be done as a one stage or two stage procedure. The former is suitable for most cases. Current one stage procedure encompasses stricture excision and reanastomosis and skin inlay procedure otherwise known as anastomotic and substitution urethroplasty respectively.

**Anastomotic urethroplasty-** It involves stricture excision and spatulated overlap circumferential anastomosis. It provides the only stricture resolving procedures that has potential for 100% success rate in long term (15,37). The best results are achieved when the following technical points are observed. Area of fibrosis is totally excised, urethral anastomosis is widely spatulated creating a large ovoid anastomosis and tension-free anastomosis (19).

It is highly successful and durable but its application is limited by stricture location and length. Short stricture at bulbar and membranous part has best results with up to 93.3% success rate (27). Its only appropriate when the stricture length is up to 2 cm (11,19).

Its immediate complications include bleeding with hematoma formation, urine leak and wound infection while chordee, incontinence, impotence and recurrence are late complications (27).

**Substitution urethroplasty-** No substitute is as good as urethra itself, although some are better than others. It is done in the form of free grafts or pedicle grafts.

Source of free grafts include full thickness skin, bladder mucosa and buccal mucosa.

Full thickness skin graft does not contract, but continues to grow as the patient grows unlike split thickness skin. It is quicker and easier to perform.

The ideal donor site is the penis. Foreskin and penile skin is moisture resistant and almost hairless. It is also soft, pliable, tough, accessible and in most cases abundant. If the patient is circumcised one can use penile skin and covers the penis with split thickness skin graft if a defect is left. Other donor sites include inner surface of the arm, lateral chest, above the iliac crest and other hairless areas. Extragenital skin is much thicker than penile skin and problem with graft contracture have been more

frequent(19).It also has a higher failure rate because of lower take rate except for skin above the jaw line which takes well.The skin above the jaw line also has little subcutaneous fat, is thin and its characteristics are well preserved after transplantation. Unfortunately, only the excision of post auricular skin is cosmetically acceptable and this restricts the amount of graft available (38,39).

The microvasculature of the bladder epithelium is like that of the skin (a deep laminal plexus and a superficial laminal plexus). The contraction characteristic is the same as those of full thickness skin graft.

Bladder mucosal graft is usually used for anterior urethral substitution. It has the following drawback. It is not readily accessible, can be difficult to manipulate the mucosa, tends to form diverticula and to be sticky if it is exposed to the neomeatus (19,40).

The microvasculature of lamina propria in the buccal mucosa exhibits a fairly uniform distribution. This allows it to be harvested at various levels of the lamina with the vascular take characteristics relatively unaffected. The contraction characteristics appear to be similar to those of full thickness skin graft (19).

Buccal mucosa graft is readily available and much more robust. It is associated with prompt donor site healing. It is an excellent substitute for relatively small areas of urethral substitution such as hypospadiac glans meatoplasty corrections (19).

VN Venn and AR Mundy (1998) showed encouraging early results using buccal mucosa for patch urethroplasty with 3% recurrence rate 18 months after surgery as compared to 45.5% recurrence rate for tube graft urethroplasty, all presenting 6 months after surgery (40).

Failure rate of free grafts is high due to failure to take and a significant resticture rate. Failure rate is even higher in case of old age and for penile urethral strictures but better for bulbar urethral strictures (41).

Graft failure to take results mainly from bleeding and hematoma formation beneath the graft, external mechanical factors, necrosis of the graft bed and associated infections (19).

Sources of pedicle graft include scrotal skin, foreskin and penile skin. Scrotal skin has two major drawbacks. It is prone to eczematous and inflammatory reactions when urine soaks resulting in stenosing scrotitis. It is also hair bearing which leads to hairball stone formation (2,11).

Generally the main shortcoming of pedicle grafts is the ballooning of the flap at the site of the patch giving rise to pooling of urine and infection in some. This is partly a consequence of making a ventral stricturotomy, partly because the flap is thinner than the natural urethra (the latter is supported by corpus spongiosum) and partly because of the difficulty in sizing the patch at the time of the procedure.

A recent introduction is the Barbagli procedure which places the stricturotomy and the subsequent graft dorsally. This means the graft is supported by the underlying corporal bodies which virtually eliminates outpouching of the graft as a consequence (42,43).

Foreskin can be mobilized for penile and bulbar urethral substitution in uncircumcised patients (11).

Results of use of penile skin appear excellent for strictures of penile urethra (44).

In-lay patch is the most appropriate procedure for patients with short strictures and surrounding fibrosis (32). Tube interposition is indicated for long strictures. In long-term (>10 years) all skin inlay urethroplasties seem to have a tendency to deteriorate but patch urethroplasty tends to do well in medium term whatever the source of skin with a revision rate of about 5% per year after 4 years follow-up (45).

AR Mundy (1995) reported restrictive rates of 19% and 40% at 5 yrs and 10 yrs respectively for patch urethroplasties while for tube urethroplasties was 36% and 56% at 5 and 10 yrs respectively. Scrotal skin tube urethroplasty does badly than preputial or penile skin tube (45).



Complications of skin inlay urethroplasty include pseudodiverticulum which can lead to terminal dribbling and anaejulatory due to pooling of urine and semen respectively. Others include impotence, recurrent urinary tract infection, urethrocutaneous fistulae, chordee, detachment of the patch, hairball stone, recurrent stricture and squamous cell carcinoma (2, 44).

**Staged urethroplasty** is indicated for long strictures especially full length, after previous unsuccessful repair attempts, strictures due to balanitis xerotica obliterans, in case of multiple perineal fistulae and periurethral abscess (26).

It is done in two stages. First stage involves marsupialization of the strictured urethra while second stage involves reconstruction of the neourethra by tubularization of marsupialized formerly strictured urethra six months later (26).

Complications of first stage include stoma stenosis (24%), bridging (7%) incontinence (7%). Others include orchitis, impotence, deep vein thrombosis (34).

The main complication following second stage is post-micturition dribbling in up to 33% due to a tendency to oversize the neourethra which results in a troublesome urinary pooling after voiding. Others include incontinence (25%), perineal fistula (13%), urinary infection (13%), urethral stone (8%), urethral diverticulum (8%) and recurrence of the stricture (8%) (34).

Every surgeon needs to be aware of the low incidence of a significant morbidity associated with lower limb compartment syndrome during urethroplasty surgery (46).

In our local set-up, a study done on one stage repair of urethral strictures by J.S. Oliech at Kenyatta National Hospital between 1978-1984 revealed good results. Only 3 out of 19 patients done one stage urethroplasty and 2 out of 12 patients done two-stage urethroplasty had recurrence after 2 years follow-up (47).

### **5) Proximal diversion**

It includes perineal urethrostomy, suprapubic cystostomy, supratrigonal diversion such as ileal conduit. Perineal urethrostomy or permanent suprapubic cystostomy is sometimes appropriate in patients with significant comorbidity (9).

## **ROLE OF CLEAN INTERMITTENT SELF CATHETERIZATION (CISC)**

It is a method of self dilatation which is easy to teach to the patient, and is safe and effective in preventing stricture recurrence after urethrotomy and urethroplasty. The duration of dilatation is controversial and stoppage of the practice may lead to recurrence of the stricture.

Harris D.R. and others in 1994 showed that the recurrence rate of urethral strictures was significantly reduced when CISC was continued for more than 12 months as compared to 6 months. The conclusion was that catheterization for at least 12 months is required to achieve adequate urethral stabilization (48).

Kassim Abdalla's study (1999) at Kenyatta National Hospital on patients who had undergone passage of sounds, urethrotomy and urethroplasty showed that patients on CISC had a higher urinary flow rates and better quality of life throughout the study period (6 months). Only 25% of them had urinary tract infection at the end of the study as compared to 73.3% on the group which was on repeated urethral dilatations (49).

CISC however is not accepted by all patients, some would like to have their disease treated by the doctor rather than by themselves. Even those who try to do it, some tend to discontinue because of social inconveniences of the technique (33,50).

## **JUSTIFICATION OF THE STUDY**

Urethral stricture disease is a common and an important cause of morbidity especially in young adults in our set-up. Today's procedures for treatment range from urethral dilatations, direct visual urethrotomy, skin inlay procedures, staged urethroplasty, perineal stricture excision and anastomosis to transpubic and abdominoperineal urethroplasty. None of these procedures is a 100% curative.

This study aims at reviewing the outcome of the procedures performed in our set-up, compare it with other studies elsewhere and make recommendations on how to improve it.

Previous local studies had shown that the commonest cause of urethral strictures is post-inflammatory (10,22) whereas the commonest cause in developed world is actually post-traumatic (2, 20, 26, 27).

This study has also looked on to whether there is any change in the causes of strictures bearing in mind the high number of road traffic accidents (RTAs) in our setup today.

## **OBJECTIVES**

### **Main Objective**

To review the management procedures for urethral stricture disease at KNH in a five year period (1997-2001).

### **Specific Objectives**

1. To define demographic features of patients with urethral strictures.
2. To determine the causes, modes of presentation and investigations carried out for diagnosis of urethral strictures.
3. To determine the results of the initial management procedures performed.
4. To determine the complications of all the management procedures performed.
5. To look at the follow-up after the initial management procedure.

## **METHODOLOGY**

### **1. Study Design**

This is a 5 year retrospective study on the management procedures for urethral stricture disease at KNH. It is both descriptive and analytical.

### **2. Study Duration**

It is carried out between January 1997 and December 2001 .The data was collected between 25<sup>th</sup> November 2002 to 7<sup>th</sup> February 2003.

### **3. Study Population**

This study incorporates all patients who were diagnosed to have urethral strictures and had their initial management procedure performed during the study period.

### **4. Exclusion Criteria**

- Patients whose records were not available
- Patients who were not followed up in the urology clinic for at least 6 months after the initial procedure.
- Patients with posterior urethral valves.

## **DATA COLLECTION, ANALYSIS AND PRESENTATION**

The individual data was collected from the medical records of patients who were diagnosed to have urethral strictures and had the initial management procedure performed during the study period. The data was collected through a proforma questionnaire.

All the raw data was entered into an IBM computer utilising SPSS/PC + statistical package version 10. Comparison of values was done using chi-square test to obtain statistical differences. The following variables were compared : Age groups versus causes of strictures, initial management procedures performed versus the results and recurrence of symptoms versus the initial procedure performed.

P-value of less than or equal to 0.05 is statistically significant.

The information is presented in tables, bar graphs and pie charts.

## **OUTCOME OF THE INITIAL MANAGEMENT**

The measures of outcome includes the state of urine stream, urine incontinence ,impotence ,acute urine retention and recurrence of symptoms.

The following criteria is used.

### **Good outcome:**

- Good urine stream with no recurrence of symptoms within 6 months.
- No urine incontinence
- No impotence

### **Fair outcome**

- Good urine stream but with recurrence of symptoms within 6 months.
- No urine incontinence
- No impotence

### **Poor outcome**

- Poor urine stream or
- Urine incontinence or
- Impotence or
- Acute urine retention

### **Ethical considerations**

Before embarking on the study, approval was sought and granted from Kenyatta National Hospital Ethical and Research Committee. Information obtained was handled as private and confidential.

## **RESULTS**

Files of patients with urethral strictures at KNH between January 1<sup>st</sup> 1997 and December 31<sup>st</sup> 2001 were retrieved and reviewed.

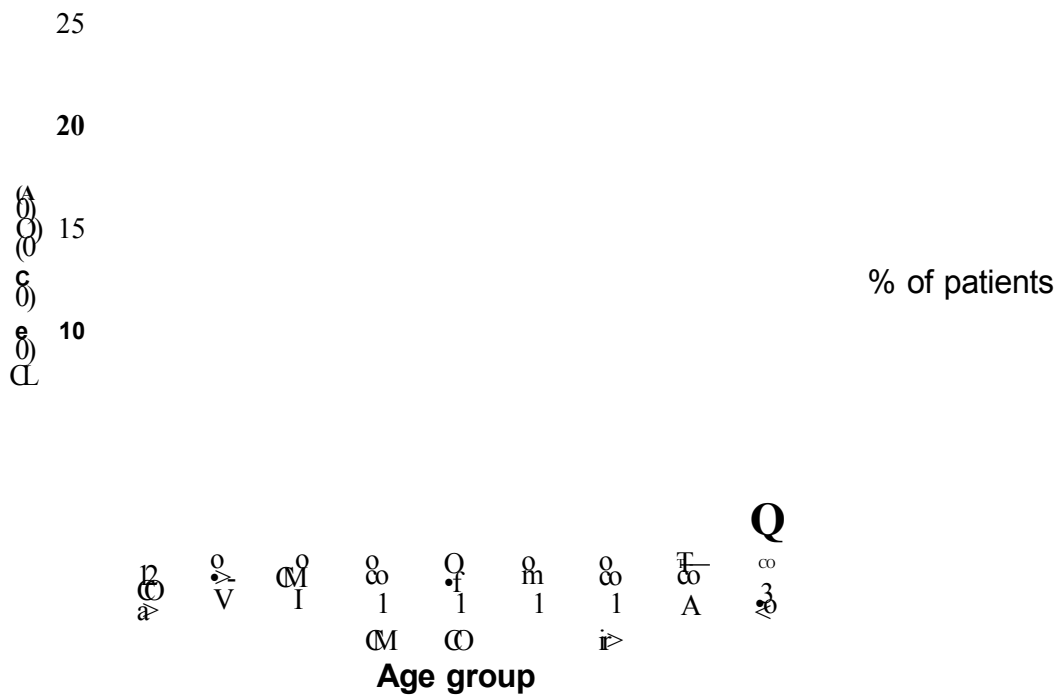
A total of 179 patient files fulfilled the inclusion criteria. Of the 179 patients 6 were females (3.4%) and 173 were males (96.6%). Their age distribution is as shown below.

**TABLE 1**                                **AGE DISTRIBUTION**        **n = 179**

Age group (Years)	No. of patients	% of patients
<10	12	6.7
11-20	21	11.7
21-30	39	21.8
31-40	40	22.3
41-50	33	18.4
51-60	17	9.5
> 61	14	7.8
Adults	3	1.7

**FIGURE 1**

## AGE DISTRIBUTION



The age range is from 4 years to 80 years with a mean age of 35.79 and median age of 35.0.

The incidence is highest in the 31-40 year age group with 22.3% of all the patients followed closely by 21 - 30 years age group with 21.8%.

In 1.7% of the patient the age was simply recorded as adults.



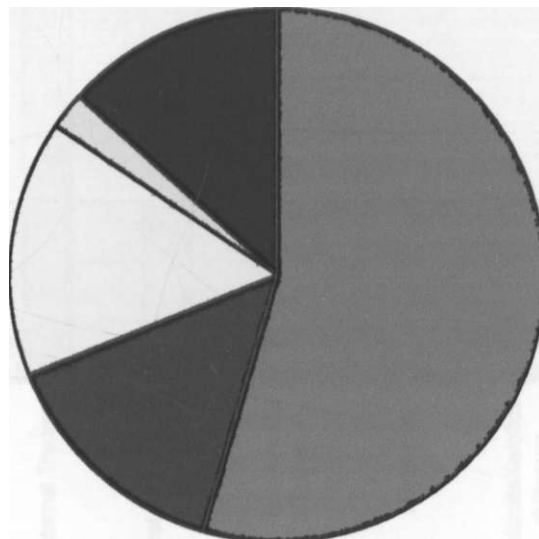
**TABLE 2 : The occupation status of the 179 patients.**

OCCUPATION STATUS	NO. OF PATIENTS	% OF PATIENTS
Employed	98	54.4
Unemployed	26	14.4
Students	28	15.6
Children	4	2.2
Not indicated	23	13.3

Majority of the patients are employed.

**FIGURE 2**

## OCCUPATION STATUS



- **Employed**
- **Unemployed**
- **Students**
- **Children**
- **Not indicated**

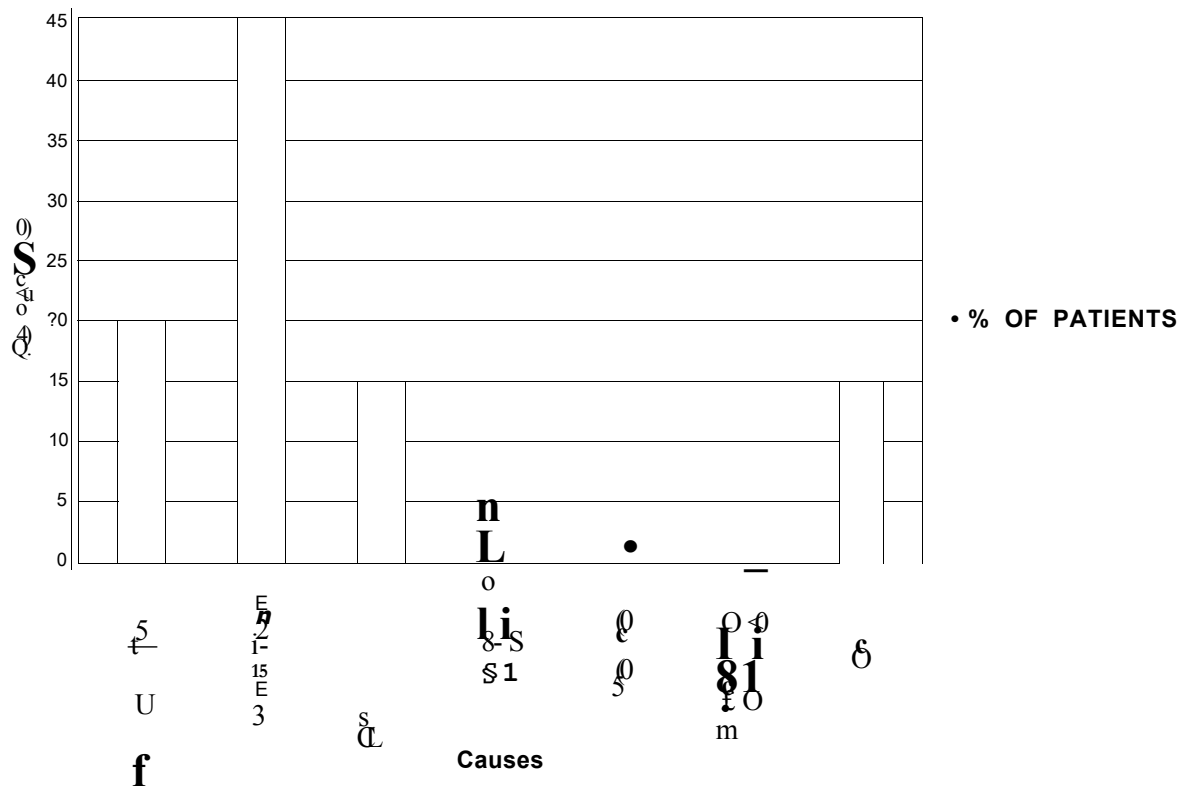
**TABLE 3 rCAUSES OF URETHRAL STRICTURES**

**n = 179**

CAUSE	NO. OF PATIENTS	% OF PATIENTS
Iatrogenic Trauma	34	19
External Trauma	74	41.4
Post gonococcal infection	26	14.5
Non specific infection	12	6.7
Malignancy	5	2.8
Balanitis xerotica obliterans	1	0.6
Unknown	27	15.1

**FIGURE 3**

**CAUSES**



External trauma was the commonest cause in 74 patients (41.4%) of which RTA accounted for 51 patients (28.5%). The remaining 23 patients (12.9%) were due to gunshot in 7 patients, fall from a height in 5 patients, fall astride in 4 patients, hit accidentally by stones and logs of trees in 6 patients and assault in one patient.

Iatrogenic trauma accounted for 34 patients (19%)

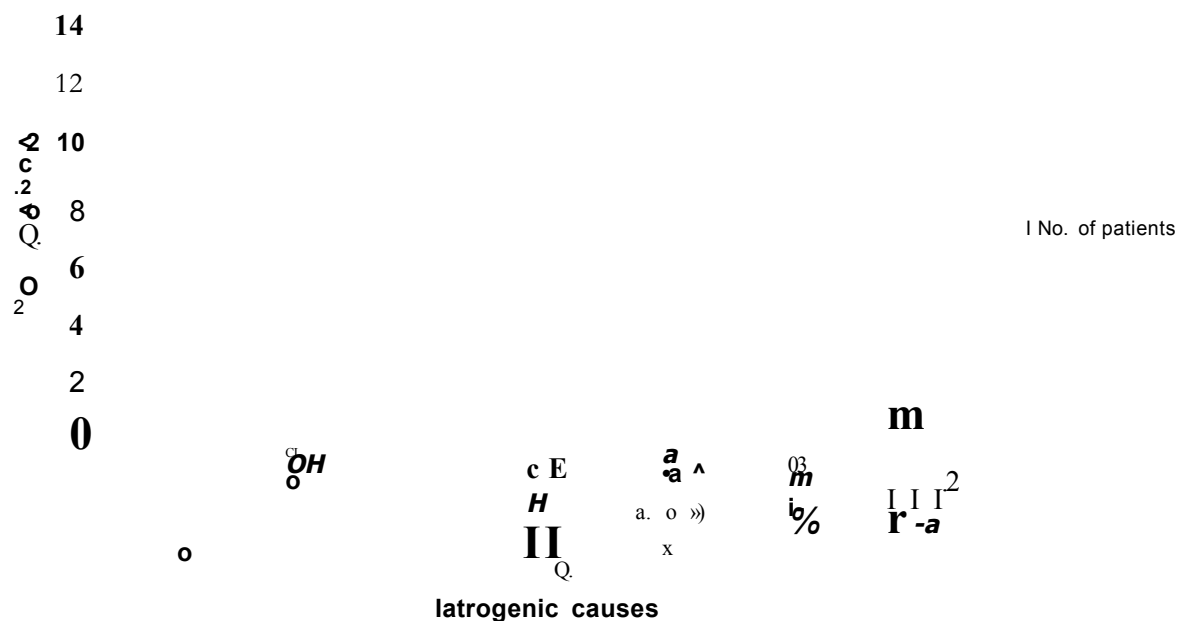
**TABLE 4 IATROGENIC CAUSES**

Iatrogenic Causes	No. of patients	%
Post circumcision	2	1.1
Post TURP	7	3.9
Post catheterization	12	6.7
Post open prostatectomy	7	3.9
Post Hypospadias repair	3	1.7
Post TURBT	2	1.1
Post urethral stone extraction	1	0.6

**FIGURE 4**

MEDICAL LIBRARY  
—IVERSITY OP NAIRQIT

**IATROGENIC CAUSES**



The commonest iatrogenic causes was after catheterization, endoscopic manouvres and open prostatectomy.

Malignancy accounted for 2.8% of the patient. Carcinoma of the prostate was a cause in 3 patients, carcinoma of the urethra in 1 patient and carcinoma of the bladder in 1 patient.

Balanitis xerotica obliterans caused a stricture in one patient.

Radiotherapy and congenital causes were not found in any of the patients.

Of the 6 female patients, 5 of them had external meatus stenosis, the last one the site was not recorded in the file. The cause was known only in one patient and it was due to circumcision.

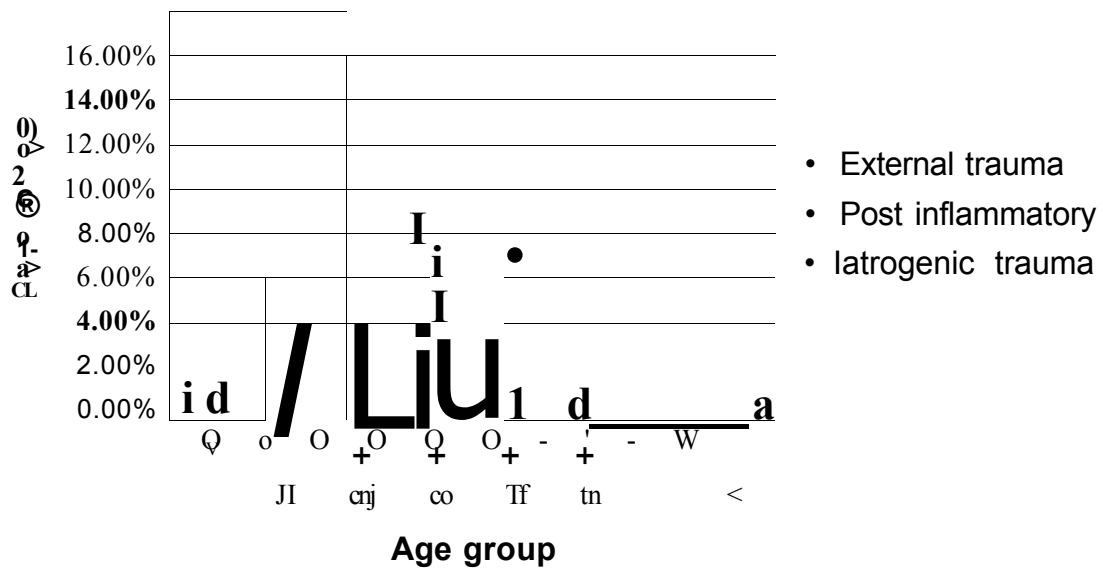
**AGE GROUP VERSUS POST-TRAUMATIC, IATROGENIC AND POST INFLAMMATORY URETHRAL STRICTURES.**

**TABLE 5**

Age Group	External trauma	Post inflammatory	Iatrogenic trauma
<10	4 (2.2%)	0	6 (3.3%)
11-20	10(5.6%)	3 (1.7%)	4 (2.2%)
21-30	29(16.2%)	3(1.7%)	2(1.1%)
31-40	17(9.5%)	16(8.9%)	3 (1.7%)
41-50	12 (6.7%)	13 (7.3%)	0
51-60	2(1.1%)	3(1.7%)	9 (5.0%)
>61	0	0	8 (4.5%)
Adults	0	0	2(1.1%)

**FIGURE 5**

**AGE GROUP VS CAUSES**



External trauma is commonest cause of strictures in the 21-30 years age group and then decreases exponentially with both increasing and decreasing age. Post inflammatory is

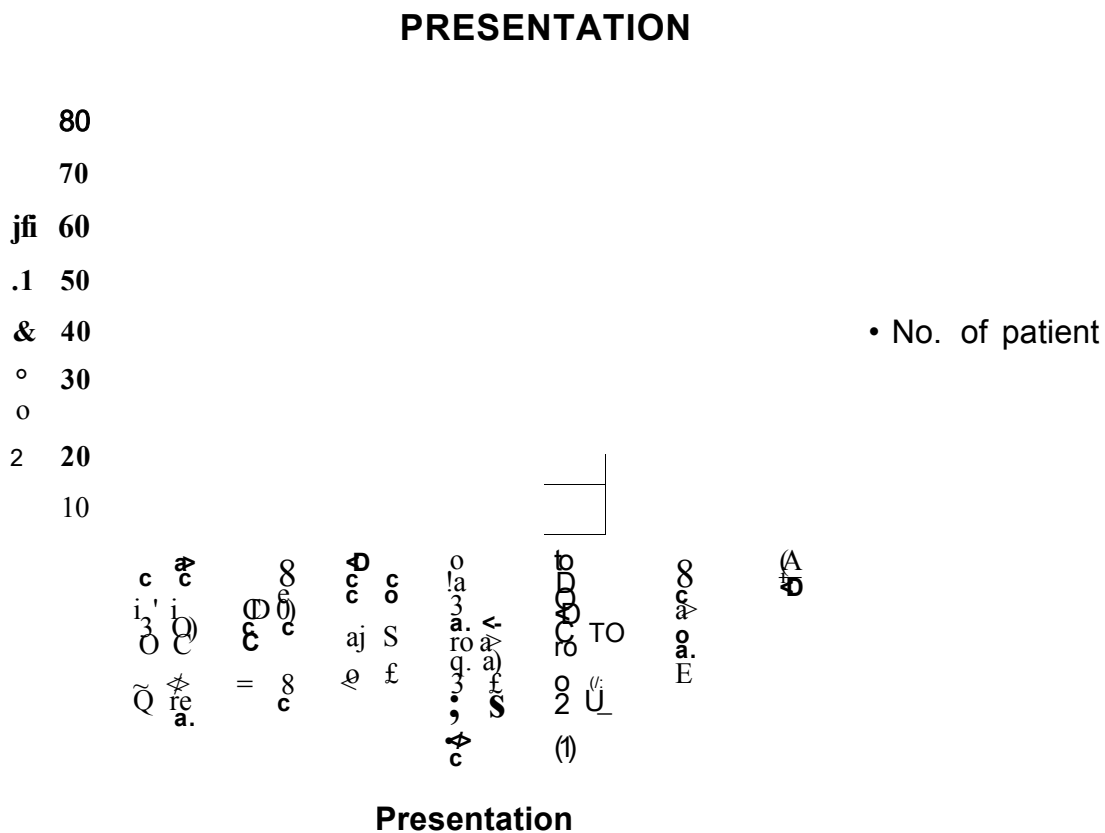
commonest in the 31-40 years age group while iatrogenic is commonest in the over 50 years. P-value is 0.000.

**TABLE 6 : PRESENTATION n= 179**

The range of duration of illness was from 2 weeks to 19 years with a mean of 1.87 and median of 0.67 years. The presentation of the illness were as shown below.

Presentation	No. of patient	% of patient
Difficulty in passing urine	75	42
Urine incontinence	10	5.6
Acute urine retention	22	12.3
In situ suprapubic catheter	73	40.8
Urethrocutaneous Fistula	15	8.4
Impotence	3	1.7
Others	18	10.1

**FIGURE 6**



The commonest presentation is difficult in passing urine which occurred in 42% of the patients followed closely by indwelling suprapubic catheter in 40.8%.

Some of the patients had more than one presenting complain.

**TABLE 7 : Other presentations**

Presentation	No. of patient
Chordee	1
Dysuria	2
Hematuria	4
Left Scrotal pain	1
Loin pain	1
Penile abscess	1
Rectovesical Fistula	1
Rectourethral Fistula	1
Retrograde Ejaculation	1
Scrotal abscess	1
Extravasation of urine	1
Urethral Catheter	2

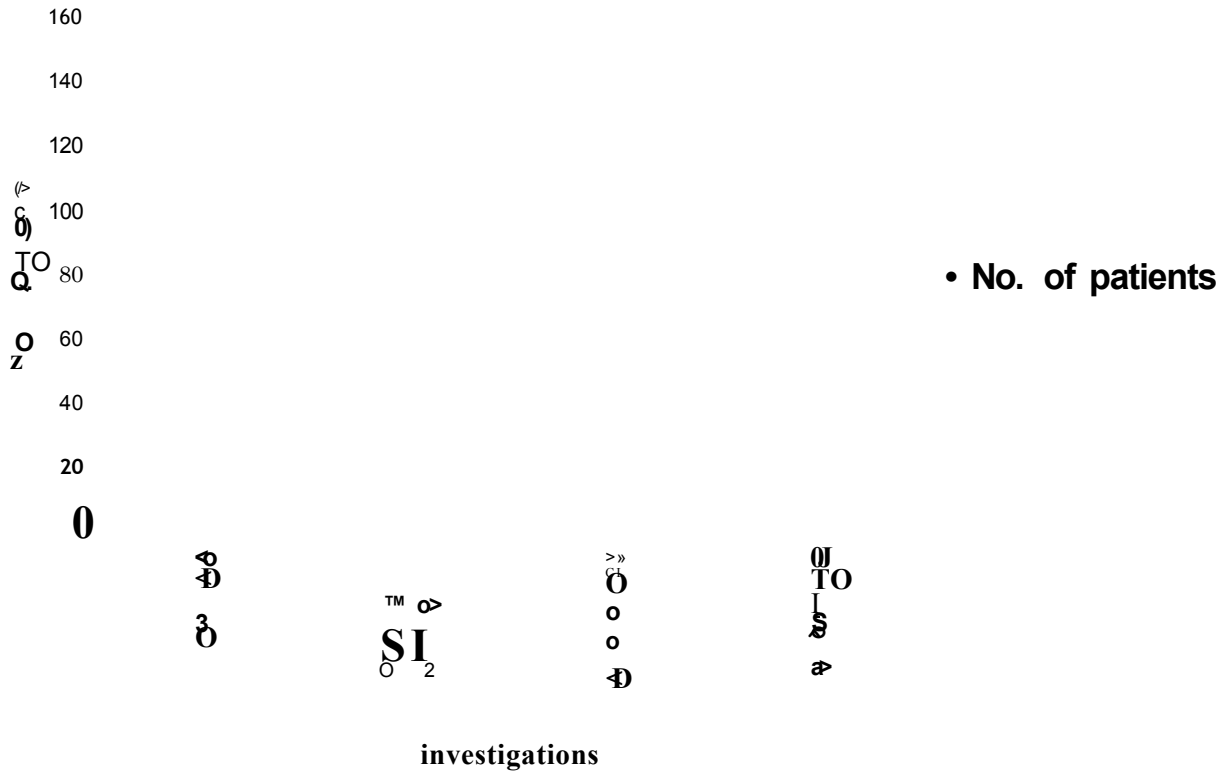
**TABLE 8 : INVESTIGATIONS**

**n=179**

Investigations	No. of patients	% of patients
Urine cultures	36	20
Contrast urethrogram	135	75.4
Urethroscopy	82	45.8
Urine flow rate	0	0

**FIGURE 7**

**PREOPERATIVE EVALUATION**



The commonest investigation performed was contrast urethrogram in 75.4% of the patients. Urine flow rate was not performed in any of the patients.



## INITIAL MANAGEMENT

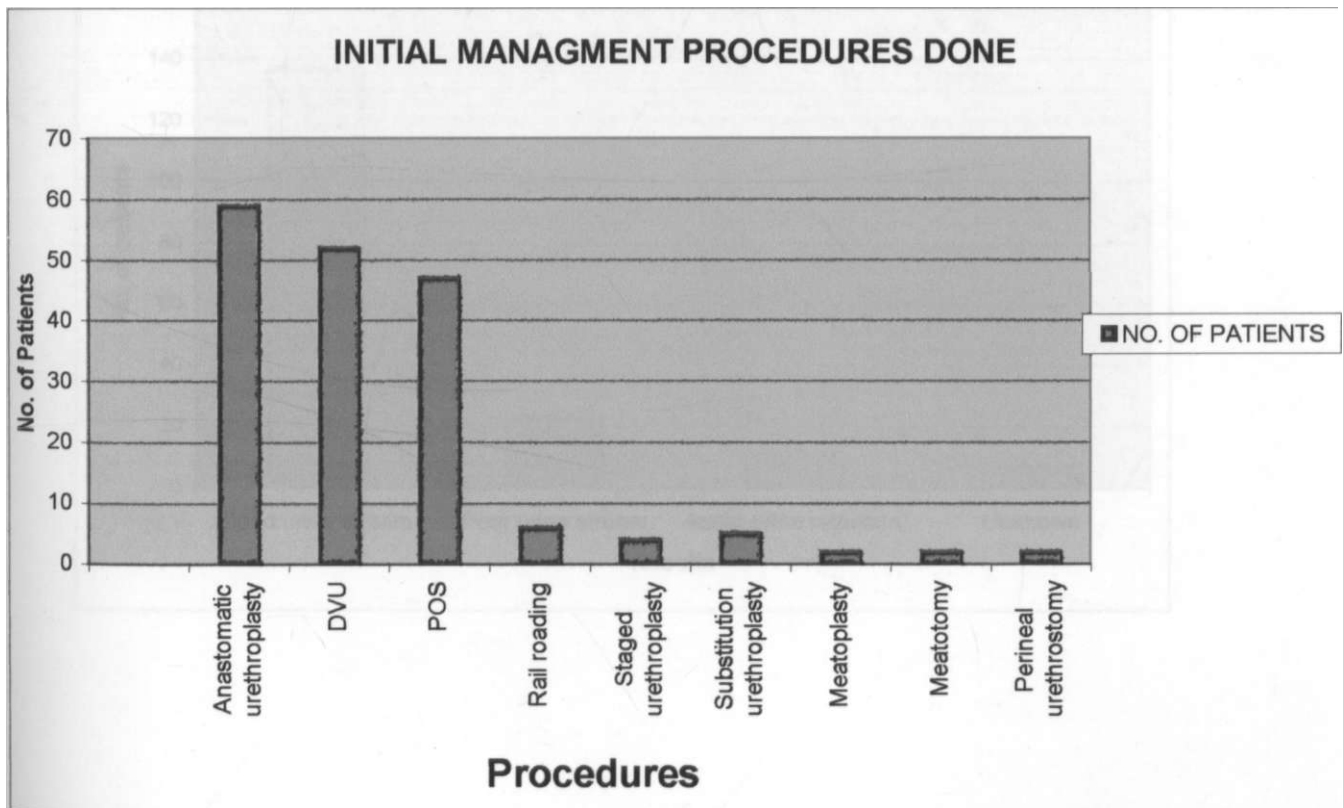
The initial management was carried out in all 179 patients. Anastomatic urethroplasty was the commonest procedure performed in 59 patients (33%).

Details are as shown in the table below:

**TABLE 9:** n=179

PROCEDURE	NO. OF PATIENTS	% OF PATIENTS
Anastomatic urethroplasty	59	33
DVU	52	29.1
POS	47	26.3
Rail roading	6	3.4
Staged urethroplasty	4	2.2
Substitution urethroplasty	5	2.8
Meatoplasty	2	1.1
Meatotomy	2	1.1
Perineal urethrostomy	2	1.1

**FIGURE 8**



**TABLE 10: IMMEDIATE INITIAL MANAGEMENT RESULTS**

n= 179

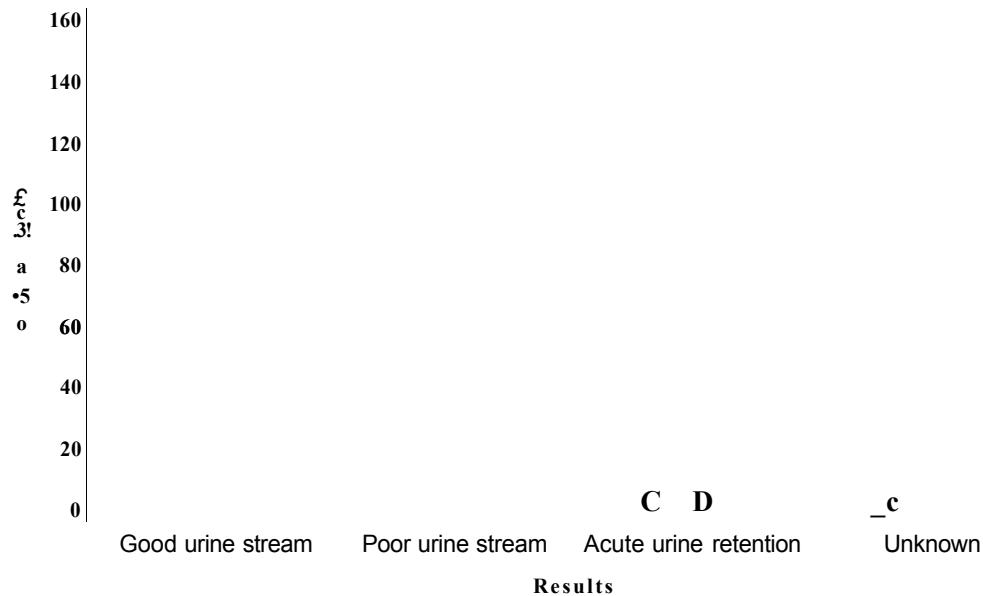
Results	No. of Patients	% of Total
Good urine stream	137	76.5%
Poor urine stream	23	12.9%
Acute urine retention	12	6.7%
Unknown	7	3.9%

In seven patients the results was difficult to assess from the records available. Those patients seemed to have stayed with the urethral catheter all along during the follow-up period.

Majority of the patients achieved a good urine stream immediately after the procedure. Eight patients had urine incontinence while 4 had impotence after the initial procedure.

**FIGURE 9**

**IMMEDIATE INITIAL MANAGMENT RESULTS**



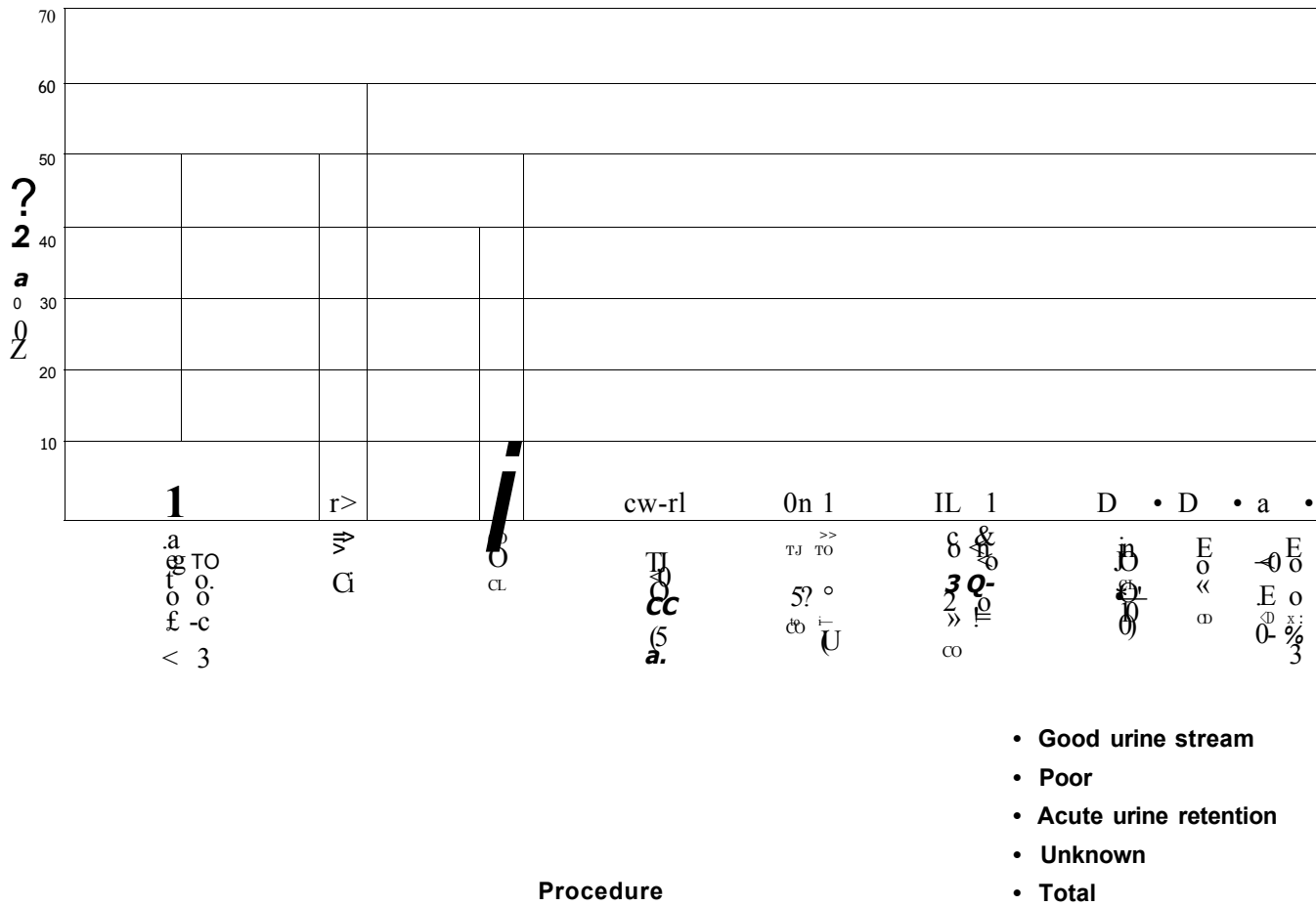
**TABLE 11: INITIAL PROCEDURE VS IMMEDIATE RESULTS****n = 179**

Procedure	Good urine stream	Poor Urine stream	Acute urine retention	Unknown	Total
Anastomatic urethroplasty	44 (74.6%)	9 (15.3%)	5 (8.5%)	1 (1.7%)	59 (100%)
D.V.U	47 (90.4%)	2 (3.8%)	2 (3.8%)	1 (1.9%)	52 (100%)
P.O.S	31 (66%)	10 (21.3%)	3 (6.4%)	3 (6.4%)	47 (100%)
Rail Roading	2 (33.3%)	1 (16.7%)	1 (16.7%)	2 (33.3%)	6 (100%)
Staged urethroplasty	3 (75%)	0	1 (25%)	0	4(100%)
Substitution urethroplasty	4 (80%)	1 (20%)	0	0	5 (100%)
Meatoplasty	2(100%)	0	0	0	2(100%)
Meatotomy	2(100%)	0	0	0	2(100%)
Perineal urethrostomy	2(100%)	0	0	0	2(100%)

Direct visual urethrotomy has better immediate results with 90.4% of the patients having a good urine stream as compared to 74.6% and 66% in case of anastomotic urethroplasty and passage of sounds respectively. P-value is 0.020. The number of patients whose results was a poor urine stream was not dependent on the initial procedure performed as confirmed by a P-value of 0.372.

FIGURE 10

INITIAL MANAGEMENT PROCEDURE VS IMMEDIATE RESULTS



## RECURRENCE OF SYMPTOMS

Of the 137 patients who had a good urine stream, 72 of them had recurrence of symptoms. The mean follow-up duration was 18.7 months with a median of 13.5 months. Range of follow-up was from 6 months to 60 months

**TABLE 12** n=137

Procedures	6 months	>6 months-1 year	>1 - 2years	>2-4 years	Total
Anastomotic Urethroplasty n=44	12 (27.3%)	0	2 (4.5%)	3 (6.8%)	17(38.6%)
DVU n=47	12(25.5%)	6(12.6%)	5 (10.6%)	2 (4.3%)	25 (53.2%)
POS n=31	16(51.6%)	3 (9.7%)	2 (6.5%)	1 (3.2%)	22 (71%)
Rail roading n=2	2 (100%)	0	0	0	2 (100%)
Staged Urethroplasty n=3	1 (33.3%)	0	0	0	1 (33.3%)
Substitution Urethroplasty n=4	1 (25%)	0	2 (50%)	0	3 (75%)
Meatotomy n=2	2(100%)	0	0	0	2(100%)
Total	46 (33.8%)	9 (6.6%)	11 (8%)	6 (4.4%)	72 (52.9%)

Overall the recurrence rate was 52.9%. Anastomotic urethroplasty had a lower recurrence rate (38.6%) as compared with Direct visual urethroplasty and Passage of sounds with 53.2% and 71% respectively. P-value is 0.020.

Note: In meatoplasty and perineal urethrostomy patients urine stream remained good during follow-up. They were performed in only four patients.

**TABLE 13: OUTCOME OF THE INITIAL MANAGEMENT**

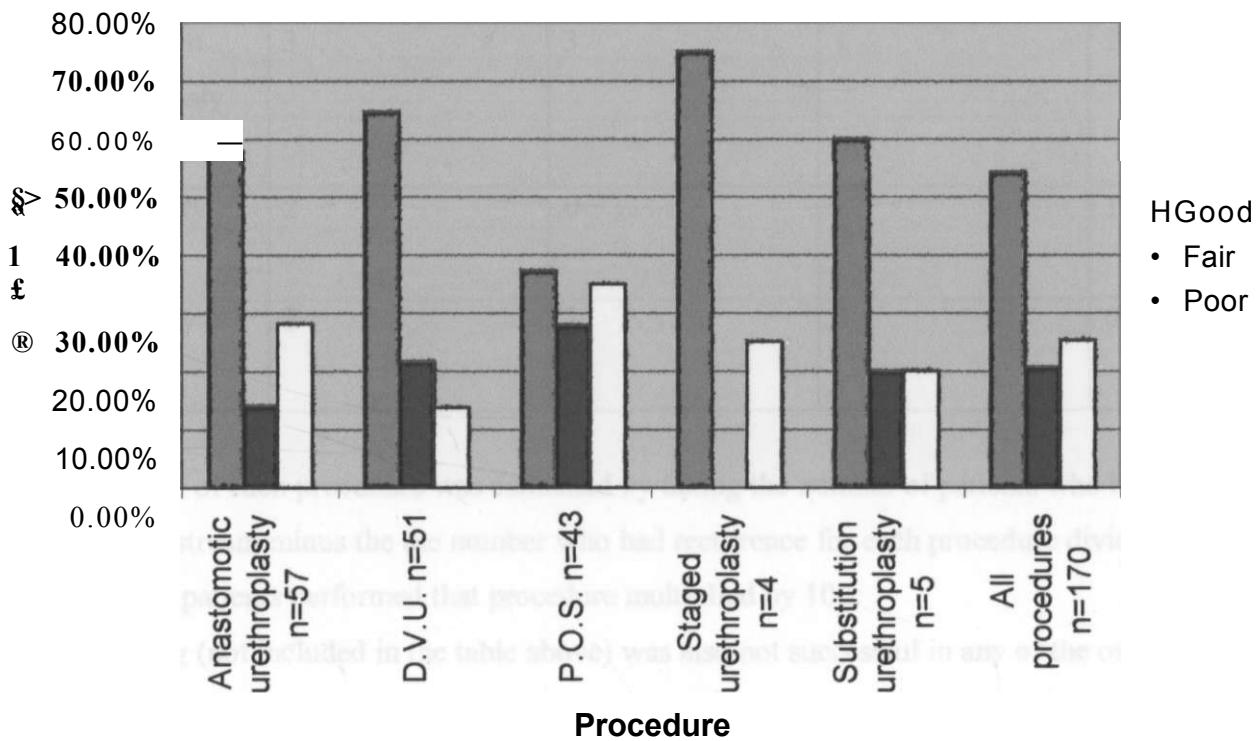
Among the 172 patients whose outcome was assessed, it was good in 92 patients (54.4%), fair in 35 patients (20.6%) and poor in 43 patients (25.3%).

Evaluation of anastomotic urethroplasty, DVU, POS, staged and substitution urethroplasty separately is also shown below.

Evaluation	Anastomotic Urethroplasty n=57	D.V.U n = 51	P.O.S. n = 43	Staged Urethroplasty n = 4	Substitution urethroplasty n= 5	All procedures n= 172
Good	33(57.9%)	33(64.7%)	16(37.2%)	3(75%)	3(60%)	92(54.1%)
Fair	8(14.0%)	11(21.6%)	12(27.9%)	0	1(20%)	35(20.6%)
Poor	16(28.1%)	7(13.7%)	15(34.9%)	1(25%)	1(20%)	43(25.3%)

**FIGURE 11**

**INITIAL MANAGEMENT PROCEDURES OUTCOME**



**TABLE 14:INITIAL PROCEDURES SUCCESS RATE**

The success of a procedure in this study is defined by the number of patients whose immediate result was a good urine stream and had no recurrence during follow-up.

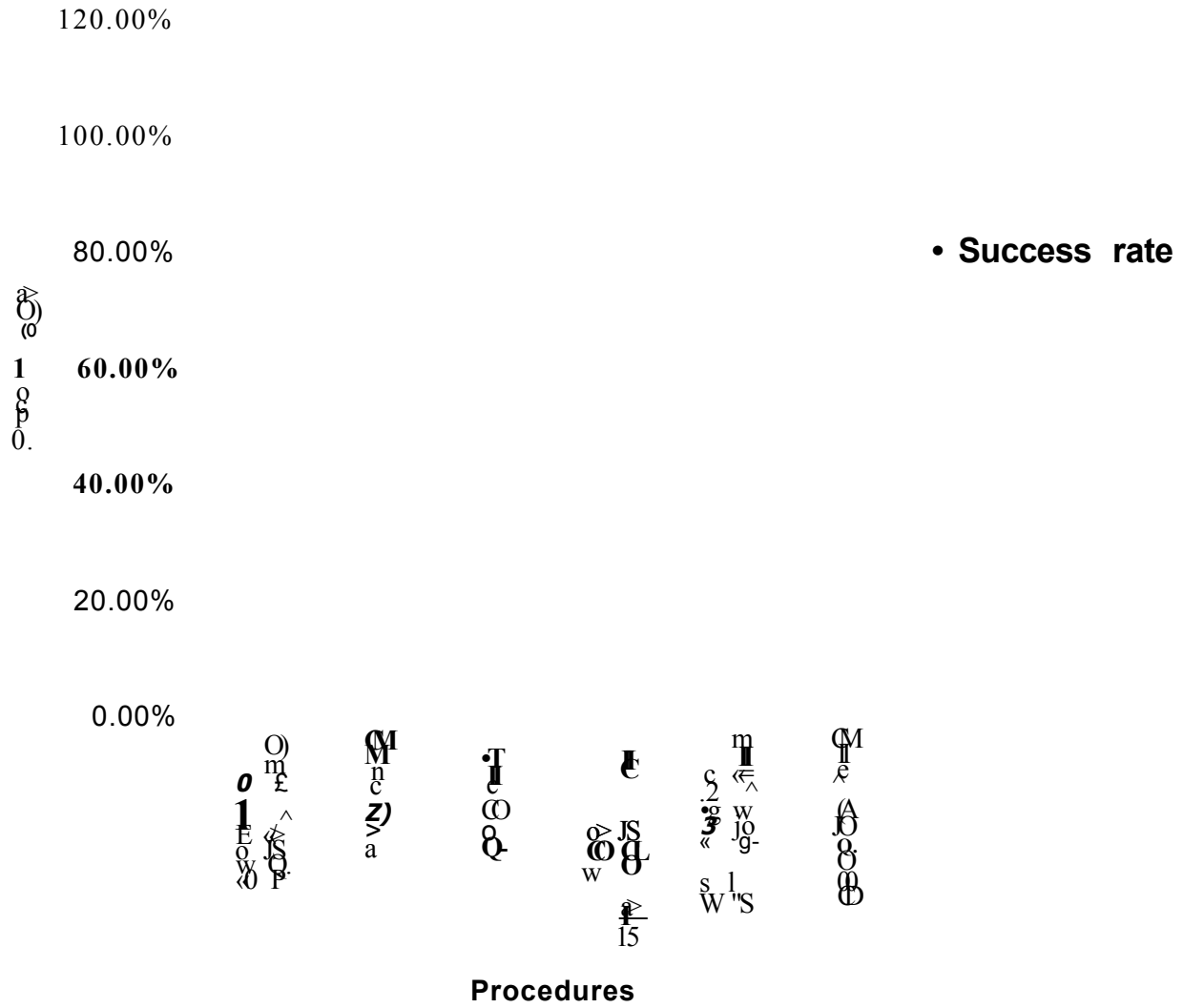
Procedures	No. patients with a good urine stream	No. of patients With recurrence	No. of patients with Successful procedures	Success rate
Anastomotic Urethroplasty n=59	44	17	27	45.8%
DVU n=52	47	25	22	42.3%
POS n=47	31	22	9	19.1%
Staged Urethroplasty n=4	3	1	2	50%
Substitution Urethroplasty n=5	3	3	1	20%
Meatoplasty n=2	2	0	2	100%
Meatotomy n=2	2	2	0	0

Success rate of each procedure was estimated by taking the number of patients who had a good urine stream minus the the number who had recurrence for each procedure divided by the total patients performed that procedure multiplied by 100.

Rail roading (not included in the table above) was also not successful in any of the of the patients

FIGURE 12

### PROCEDURES SUCCESS RATE



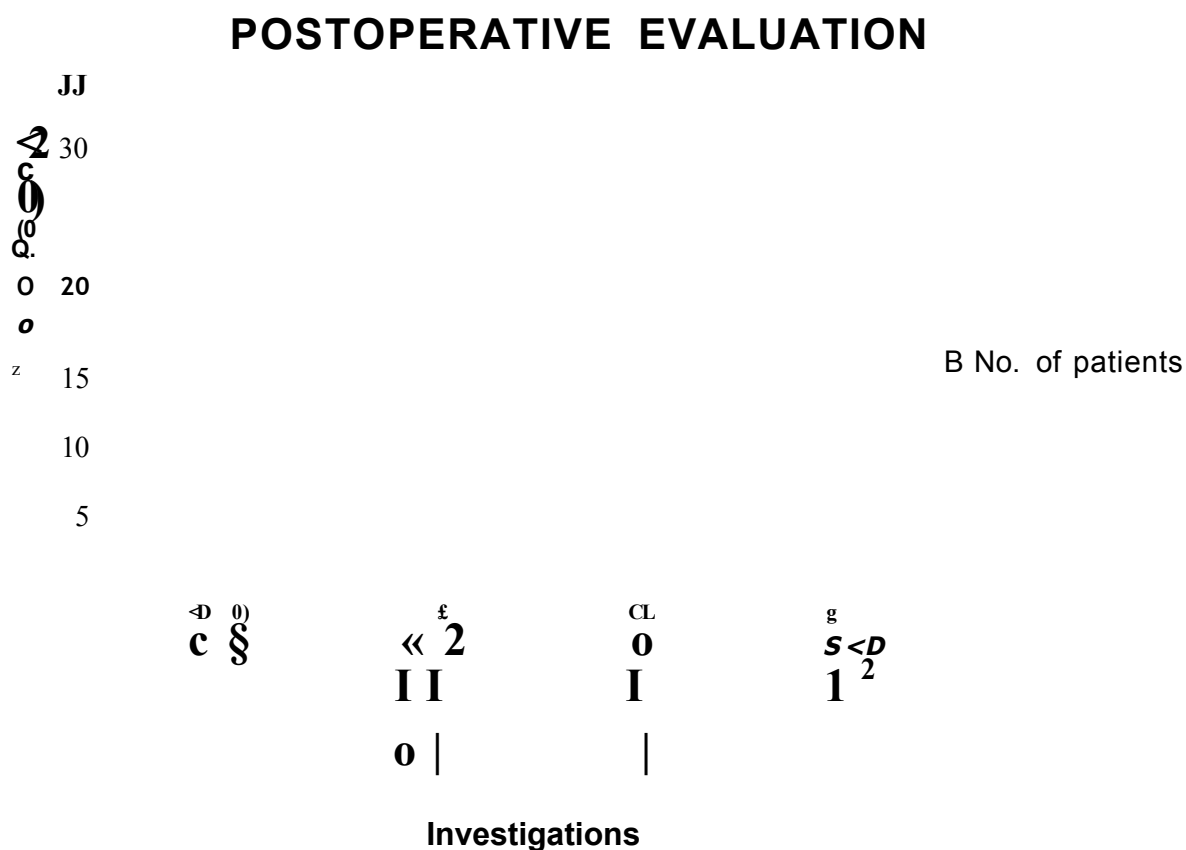


**TABLE 15: POST OPERATIVE EVALUATION**

**n=179**

Investigations	No. of patients	% of patients
Urine cultures	21	11.7
Contrast urethrogram	12	6.7
Urethroscopy	31	17.3
Urine flow rate	0	0

**FIGURE 13**



Contrast urethrogram and urethroscopy were actually performed after the recurrence of symptoms while urine cultures were performed after features of UTI.

No uroflowmetry studies were performed.

**TABLE 16:THE TOTAL NUMBER OF PROCEDURES DONE DURING THE STUDY PERIOD**

No.	Procedure	No. in the initial management	No. during follow-up	Total
1.	Anastomotic Urethroplasty	59	15	74
2.	DVU	52	52	104
3.	POS	47	69	116
4.	Staged Urethroplasty	4	5	9
5.	Substitution Urethroplasty	5	6	11
6.	Rail roading	6	2	8
7.	Meatoplasty	2	2	4
8.	Meatotomy	2	0	2
9.	Perineal urethrostomy	2	2	4
10.	Suprapubic Cystostomy	N/A	28	28
	Total	179	181	360

Substitution urethroplasty was performed in 11 patients. In two patients it was by use of buccal mucosa graft, two patients by use of preputial skin. Three patients by use of tubularized penile skin graft and one patient by use of a patch penile skin graft. In three of the patients it was not clearly stated in the files.

# PROCEDURES DONE

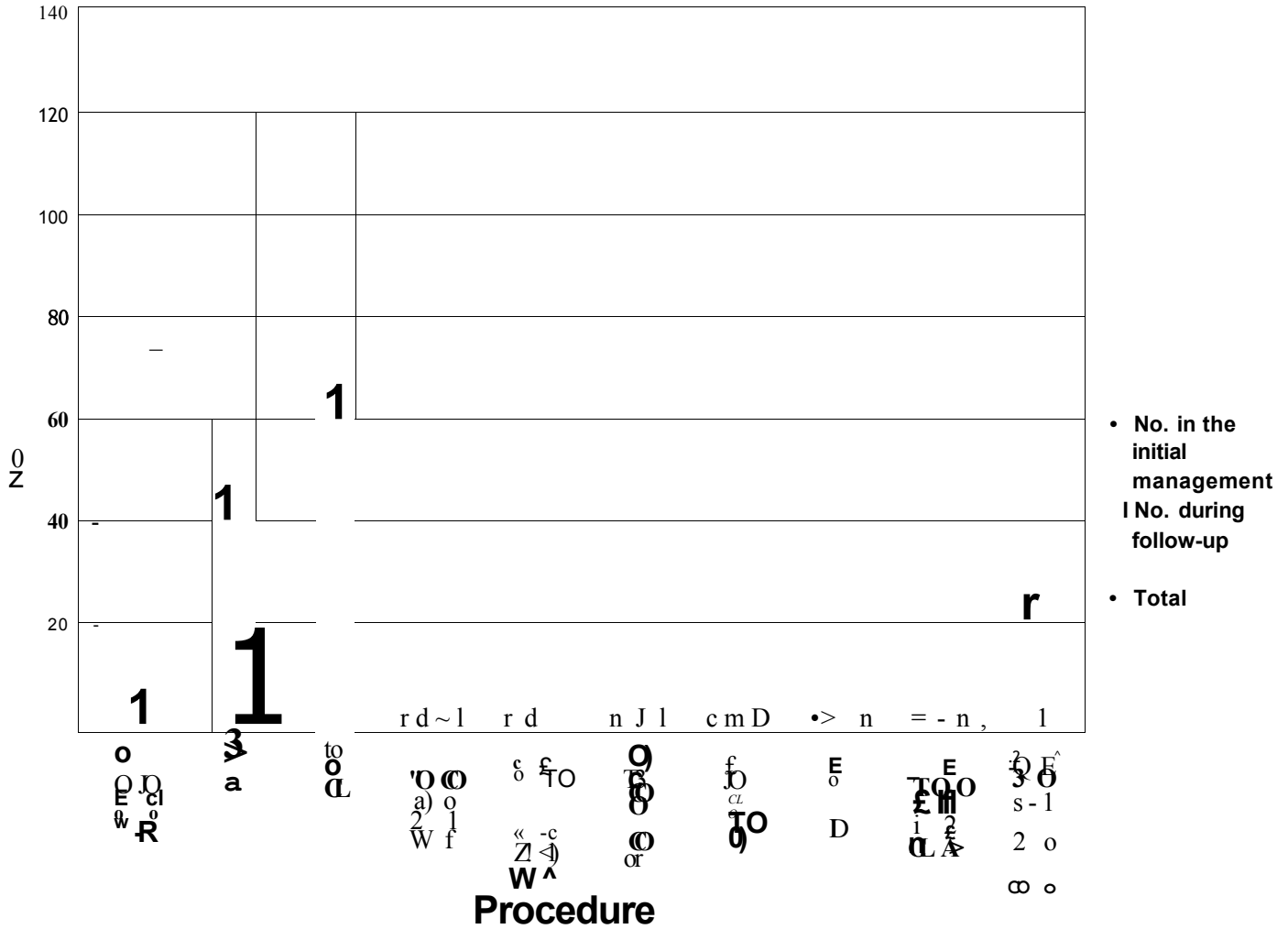


FIGURE 14

CISC was taught and practiced by 40 patients some after initial and other after follow-up procedures.

## COMPLICATIONS OF EACH PROCEDURE

**TABLE 17: Anastomotic urethroplasty n=74**

Complications	No. of patients	% of patients
Anastomotic stricture	4	5.4
Erectile dysfunction	3	4.1
Bleeding post operatively	3	4.1
Urine leakage	4	5.4
Urethral fistulae	2	2.7
Wound sepsis	5	6.8
Urine incontinence	4	5.4
Injury to the rectum	1	1.4
Urethral diverticulae	1	1.4

**TABLE 18 : DVU**

Complications	No. of patients	% of patients
Extravasation of urine	5	4.8
Erectile dysfunction	1	0.96
Bleeding post operatively	1	0.96
Urine incontinence	1	0.96
UTI	1	0.96

**TABLE 19: POS n=116**

Complications	No. of patients	% of patients
False passage	12	10.4
Bleeding post operatively	4	3.5
Extravasation of urine	1	0.9
Urine incontinence	2	1.8
Acute urine retention	3	2.6
UTI	2	1.8

**TABLE 20: Other procedures**

Complications	Staged urethroplasty	Substitution urethroplasty	CISC	Meatotomy	Perineal urethrostomy
Stenosis of the stoma	2	N/A	N/A	N/A	1
Wound sepsis	1	3	N/A	0	0
Urethral fistula	1	1	N/A	0	0
Incontinence of urine	0	1	0	0	0
Bleeding	0	0	2	0	0
UTI	0	0	4	0	0
Extravasation of urine	0	0	1	0	0
Meatal restenosis	N/A	N/A	0	2	N/A

## **DISCUSSION**

Urethral strictures is mainly a disease of the males. Among the 179 patients who were included in the study, 173 or 96.6% of them were males while 6 or 3.4% were females. This is because the incidence of urethral injuries in females especially after pelvic fractures is rare as the urethra is short and mobile with no significant attachment to the pelvic bone (10).

Inflammatory causes has also not been incriminated in stenosis of female urethra, although it has innumerable glands and one would expect them to rupture in case of infection into the spongy tissue causing a scar similar to the one in male's corpus spongiosum, but this does not seem to happen (6). The role of extravasation of urine in the formation of the stricture is thought to explain this phenomenon. In females the urethra is more wide and short, there is nothing to cause retention and no reason for urine to build up pressures upstream of the inflamed glands leading to extravasation of urine and subsequent fibrosis (6,14).

In this study all the females had external urethral meatus stenosis except in one patient whose records were not clear. Causes of the stenosis were not known except in one patient, which was after circumcision.

The overall incidence of urethral strictures is found to be highest in the 31-40 years age group accounting for 22.3% of all the patients followed closely by 21-30 years age group with 21.8%. The incidence of posttraumatic stricture is highest at the 21-30 years age group with 16.2% while post inflammatory is highest at 30-40 years age group with 8.9%. This is in keeping with previous studies done by J.A Adwok at Kenyatta National Hospital (KNH) in 1982-83 and A.Ahmed et al in Nigeria in 1980-89 (23,24).

This can be explained by the fact that this is the most active phase of life when most people are in their prime in physical and social activities.

The lowest incidence is in the under 10 years age group with 6.7% of the total cases. This can be explained by the fact that children are less exposed to traumatic and inflammatory

causes. The commonest cause in the under 10 years is actually iatrogenic with 6 patients as compared to post-traumatic with 4 patients. Iatrogenic cause was mainly after hypospadias repair and circumcision.

External trauma is found to be the commonest cause of urethral strictures in our set up, accounting for 41.4% of all the causes of which 28.5% was due to RTA related urethral injuries. It was followed by inflammatory causes accounting for 21.2% of the causes. This is in keeping with the current general trend worldwide (2,17,25,26). Previous studies in Africa had shown post-inflammatory strictures to be commoner due to the high incidence of gonococcal infections (23,24,47,49).

This change can be explained in the following ways. There is an improvement of medical services in our set up resulting in early treatment of the patients suffering from urethritis. Also public awareness of sexually transmitted infections in this era of HIV and AIDS has improved with better health education programmes. Development especially in the urban areas has also resulted in an increase in movements of people from rural areas to urban areas and within the urban areas resulting in use of more vehicles with subsequent increase in RTAs.

Iatrogenic causes are also on the increase, they accounted for 19% of all the causes in this study. A previous study by J.S Oliech at Kenyatta National Hospital showed catheterization and endoscopic manoeuvres to be the commonest cause of iatrogenic strictures (51). In this study the commonest cause were also found to be catheterization in 12 patients and endoscopic manoeuvres in 9 patients. Strictures after open prostatectomy were also common and accounted for 7 patients. TURP has been quoted in some studies to account for up to 6% of the strictures (52). In this study it accounted for 3.9%.

The mean duration before presentation at KNH was 1.9 years with a median of 0.7 of a year. The commonest presentation was difficulty in passing urine in 42% of the patients. Some of the patients had earlier presented with acute retention of urine in the peripheral hospitals where temporary urine diversion (suprapubic cystostomy) was performed and were later referred to KNH. They accounted for 40.8% of the patients. A few of the

patients (12.3%) presented at KNH with acute retention of urine, some due to blocked suprapubic catheters. The retention of urine was relieved by suprapubic cystostomy and change of catheters in cases of blocked catheters. They were later discharged via the urology clinic to await definitive management. These presentation results is comparable to a previous study in Nigeria by B.C Ogbonna (1998) where difficulty in passing urine accounted for 42% of the patients while indwelling suprapubic catheter and acute retention of urine accounted for 28% and 19% respectively (3).

Impotence was a presentation in 3 patients and was associated with pelvic fractures. This was most likely due to injury of nervi erigentes which lies posterolaterally to membranous part, which is the weakest part of the urethra and so prone to injuries (10,11).

Urine incontinence is mainly due to chronic urine retention with overflow incontinence and in some is due to external urethral sphincter injury after pelvic fractures.

Some patients presented with the complications of the strictures such as urethra fistula, extravasation of urine, chronic urine retention, features of urinary tract infection, retrograde ejaculation and inguinal hernia. They accounted for 15% of the patients.

Contrast urethrogram is necessary because it defines the length, extent and severity of the stricture. In this study it was not available in evaluation of 24.6% of the patients while in another study in Nigeria it was unavailable in 68% of the patients (3). This is mainly due to financial constraints in those patients. In some of the patients urethroscopy was the first mode of evaluation performed. Urethroscopy was performed in 45.8% of the patients whereas uroflowmetry was not performed in any of the patients. Uroflowmetry machine is available in the hospital's surgical outpatient minor theatre. Urine cultures were done in 20% of the patients to rule out urinary tract infections preoperatively.

The commonest initial procedure performed was anastomotic urethroplasty in 33% of the patients. This consistent with the current trend world wide since its results are currently the best with success rate of over 90% which is sustained(25,33).It was followed closely



by DVU in 29.1% and POS in 26.3% of the patients. Substitution urethroplasty is technically difficult and its results seem to deteriorate in the long term (33,34,45). This could explain one of the reasons why it was performed in only 5 patients.

Staged urethroplasty is usually reserved for long strictures especially full length, after previous unsuccessful repair attempts, strictures due to balanitis xerotica obliterans and in cases associated with perineal fistula and periurethral abscesses (2,26). This could explain why it was performed as an initial procedure in only 4 patients.

Rail reading was performed in 6 patients, they all had a completely obliterated urethral lumen.

Meatoplasty and meatotomy were done in 4 patients who had external meatus stenosis. Perineal urethrostomy is usually performed as a form of permanent urine diversion procedure in patients with other co-morbidities (9). It was performed in 2 patients who had a disfigured perineal anatomy after a severe perineal injury.

Post operatively the patients' results were mainly assessed on the basis of the urine stream. Only 6.7% and 17.3% of the patients had contrast urethrogram and urethroscopy performed respectively post operatively. They were actually performed after recurrence of symptoms. This is in contrast to most of the other studies world wide where post operative assessment is on the basis of symptomatology, urine flow rates and contrast urethrogram (2,17,44,45). This could be explained by the fact that routine post-operative contrast urethrogram is not possible due to financial constraints with most of our patients and also uroflowmetry is not popular and so is never performed in our set-up.

The immediate results of the initial procedures was good with 137 patients (76.5%) having a good urine stream while 23 patients (12.2%) had a poor stream. Acute retention of urine after removal of catheter occurred in 12 patients (6.7%).

The goal of treatment of a urethral stricture is a patent, continent urethra without jeopardizing any sexual function present. Accordingly, the results were classified as good, fair and poor. Good was when the urine stream was good, no incontinence, no

impotence and no recurrence of symptoms within 6 months. Fair was when there was a good urine stream, no incontinence, no impotence but there was recurrence of symptoms within 6 months. Poor was when there was a poor urine stream after the procedure or incontinence of urine or impotence or acute retention of urine.

The overall outcome after evaluation was good in 54.1% , fair in 20.6% and poor in 25.3%. DVU seemed to have had a better immediate outcome than anastomotic urethroplasty (good in 64.7% as compared to 57.9% in the latter) but the former had a higher recurrence rate of 53.2% as compared with 38.6% in the latter during the 4 years follow-up. Actually the success rate for anastomotic urethroplasty was 45.3% as compared to 42.3% in DVU. This is consistent with other previous studies (24,25). This is due to the fact that in DVU the wound contraction tries to approximate the edges before epithelization is complete while in anastomotic urethroplasty the area of fibrosis is totally excised and anastomosis is widely spatulated creating a large ovoid anastomosis. POS had a poor outcome as expected (24). Its outcome is usually improved by serial dilatations but in this study many of the patients came back for a repeat dilatations only after the recurrence of the symptoms just like shown in some other studies (3).

The overall recurrence rate on the 137 patients who had a good urine stream after the initial procedure was 52.2%. Anastomotic urethroplasty had a recurrence rate of 38.6% while for DVU and POS was 53.2% and 71% respectively. This was higher than shown in a previous local study(22). The mean follow-up duration was 18.7 months. Anastomotic urethroplasty had less recurrence rate than DVU and POS due to the fact as stated above. The highest recurrence occurred in the first 6 months. This was consistent with another study done in South Africa (1). This could have been due to bad selection of the initial procedures viz a vis the stricture characteristics since each procedure has its indications as well as its limitations (17).

Recurrence rate for DVU and POS after 1 year was 38.1% and 61.3% respectively. This is comparable to another study, which quoted 40-80% recurrence rate in 1 year (1). This is because both of these procedures depends on the regenerative proliferation of the

epithelium without stenosis and in most cases it is usually not possible. However, their results are usually improved by use of clean intermittent self catheterization.

Anastomotic urethroplasty has a potential of a 100% success rate in long term (15,37) and actually most of the studies quote over 90% success rate (25,33). In these study the recurrence rate in the first one-year was 27.3% which was quite high as compared with upto 10% which has been quoted in many studies (2,25,34) while the success rate was way below the other studies at 45.8%. The possible reasons for these scenario are beyond the scope of these study.

More procedures were performed on the patients who had recurrence during the follow-up. Some of the procedures were repeated several times in the same patients. POS was the commonest follow-up procedure done at 69 times followed by DVU at 52 times. There was no increase in the number of staged urethroplasties performed during follow-up as one would have expected. Urine diversion procedures included suprapubic cystostomy in 28 patients and perineal urethrostomy in 2 more patients.

In total POS was the commonest procedure performed in 116 times followed by DVU in 104 times and anastomotic urethroplasty in 74 times. This is consistent with other previous studies.(24,47) This could be due to the fact that POS and DVU are simple, cheap, rapid and easily available while urethroplasty is technically demanding, time consuming and expensive (3).

Substitution was performed in a total of 11 patients. In two patients it was by use of buccal mucosa free graft, two patients by use of preputial pedicle skin graft, three patients by use of tubularized penile skin graft, one by use of patch penile skin graft. In three of the patients it was not clearly recorded in the operation notes. In most studies pedicled skin grafts are strongly favoured against free grafts and less strongly in favour of preputial or penile to scrotal skin. Buccal mucosa or urothelial free grafts are less commonly utilized and tend to be used for patients in whom pedicled preputial or penile skin is unavailable (2,45). CISC was noted to have been undertaken by 40 patients in some after the initial and others after the follow-up procedures.

Complications rates of all the procedures performed were lower or comparable to other studies. Anastomotic urethroplasty had the bulk of the complications. Wound sepsis was the commonest in 5 patients (6.8%). Anastomotic strictures occurred in 4 patients (5.4%) and its incidence is reduced by excision of the area of fibrosis totally followed by spatulated overlap circumferential anastomosis which is tension free (19). Urine incontinence also occurred in 4 patients (5.4%). It is usually associated with loss of urethral sphincter mechanism and an inability to retain urine once the bladder has reached capacity. Impotence was also noted in 3 patients (4.1%) although its degree is difficult to quantify objectively especially in post traumatic strictures where trauma could also have caused some degree of impotence and from the records preoperative potency was not evaluated.

Other complications included bleeding post operatively in 4.1%, urine leak at the anastomotic site in 5.4%, urethral fistulae in 2.7%, injury to the rectum and urethral diverticulae in 1.4% of the patients.

In a study by Martinez-Pineiro et al excision and anastomotic repair for urethral stricture disease was performed in 150 patients and their post operative complications consisted of 2 wound infection (1.3%), 2 hematomas (1.3%), 1 chordee (0.65%), 2 incontinence (1.3%) and 7 erectile dysfunction (4.7%) (in previously potent patients) (25).

Complications of DVU consisted of extravasation of urine in 5 patients (4.8%), erectile dysfunction, bleeding post operatively, incontinence of urine and urinary tract infections in one patient (0.96%) each.

In a study by JP Blandy et al between 1978 and 1983, 151 patients underwent 265 internal optical urethrotomies and their complications were as follows: bleeding in 16 patients (6%), septicaemia in 17 patients (6.4%), extravasation of urine in 5 patients (1.9%), fever in 24 patients (9.1%), epididymitis, incontinence and impotence in 2 patients (0.75%) each (7).

Complication of POS included false passage in 12 patients (10.35%), bleeding in 3.5%, extravasation of urine in 0.9%, acute retention of urine in 2.6%, urinary tract infections in

1.8% and incontinence in 1.8%.The complication rate is lower than the one quoted by JP Blandy in a study of 141 strictures treated by dilatation which was as follows : extravasation in 2.1%, acute retention in 14.2%, abscess in 3.5%, false passage in 9.2%, epididymitis in 7.8%, pyelonephritis in 0.7%, bacteraemia in 4.3% and endocarditis in 0.7% (6).

In the treatment of urethral stricture the key to good result lies in the selection of the proper management procedure and any poor result is not the fault of the procedure but it reflects a bad selection of cases (17).From the study this is actually supported by the fact that there is no significant relationship between the initial management procedure performed and the immediate result of poor urine stream.The p-value is 0.372. Actually the management procedures should be considered as different complementary means available for 'cure' of different types of strictures, each with its indications as well as limitations (17).

## CONCLUSIONS

- 1 . The highest incidence of urethral strictures is among the 21-40 years age group in 44.1% of all the patients during the study period.
- 2 . The commonest cause of urethral strictures is external trauma in 41.4%, of which 28.5% is due to RTA related urethral injuries.
- 3 . The commonest form of iatrogenic trauma in urethral stricture patients is still catheterization and endoscopic manouvres in 6.7% and 5% respectively.
- 4 . Post traumatic strictures are commonest among the 21-30 age group while post inflammatory ones are commonest among the 31 -40 age group.
- 5 . The commonest diagnostic tool is a contrast urethrogram.
- 6 . Overall the commonest procedure performed was POS.  
Anastomotic urethroplasty was the commonest initial management procedure performed.
- 7 . Overall the initial management procedures outcome was good in 54.1%, fair in 20.6% and poor in 25.3%.

## **RECOMMENDATIONS**

1. For proper assessment of the outcome of management procedures uroflowmetry studies should be introduced and a routine post operative contrast urethrogram for those patients who can afford.
2. CISC should be popularized so as to reduce the already high recurrence rate in our set up.
3. A prospective study on this subject will shed more light especially on the factors affecting the results so as to recommend a criteria for each procedure selection in our set up.

## REFERENCES

1. Steenkamp JW, Heyns CF, De Kock ML. Internal urethrotomy Vs dilatation as a treatment for male urethral strictures (A prospective randomized comparison). *J. Urol.* Jan. 1997, 157: 98-101.
2. AR Mundy. Results and complications of urethroplasty and its future. *B.J.Urol.* 1993,71 :322-325.
3. BC Ogbonna. Managing many patients with urethral stricture. A cost benefit analysis of treatment options. *B.J. Urol.* 1998, 81 : 741-744.
4. Milroy EJG, Chappie CR , Eldin A. A new stent for the treatment of urethral strictures. *B.J.Urol.* 1989, 63 :392-396.
5. Attwater HL. The history of urethral stricture *B.J. Urol.* 1943, 15:31
6. John P Blandy. Urethral stricture. *Postgraduate Medical Journal.* June 1980, 56: 383-416
7. JP Blandy, P Chilton, JR Shah . The impact of optical urethrotomy on the management of urethral strictures *B.J.Urol.* 1983, 55: 705-710.
8. GJ Romanes. *Cunningham's manual of practical anatomy 15<sup>th</sup> Ed. Vol. 2 Oxford Medical Publications, 1996 : 201, 223-224.*
9. Henry Woo, C Chappie. Urethral strictures. *Surgery International Edition 1995 ,28 : 37-43*
10. Chappie CR. Urethral injury. *B.J. Urol.* 2000 , 86 : 318-326.
11. Turner- Warwick, Christopher Chappie. Urethral strictures. In *Re- operative urology 1<sup>st</sup> edition. New york: Little Brown and company, 1995 : 135- 170.*
12. Perry MO, Husmann DA. Urethral injuries in female subjects following pelvic fractures. *J.Urol.* 1992, 147 : 139-43.
13. Kadhaya D Muballe. The pattern of Urethral injuries in Pelvic fractures at Kenyatta National Hospital. *M.Med dissertation university of Nairobi (U.O.N) 2001*
14. Chambers RM, Baitera B. The anatomy of the urethral stricture, *Br. J. Urol.* 1977, 49: 545-51
15. Turner- Warwick R. Urethral stricture surgery. In *Current Operative Surgery ; Urology, ed. Mundy AR 7<sup>th</sup> Ed. New York: Churchill Livingstone, 1989 : 215-8*



16. Morgia G, Saita A, Morana F . Endoprosthesis implantation in the treatment of recurrent urethral stricture: a multicentre study. Calabrian Urology Society. J.Endourology (US) Oct 1999, 13 (8): 587-90.
17. M Koraitim. Experience with 170 cases of posterior urethral strictures during 7years. J.Urol. 1985, 133 : 408-10.
18. Bailey and Love. Urethral strictures. Short Practice of Surgery 23<sup>rd</sup> Ed. London: Chapman and Hall,2000 : 1261-1264.
19. Gerald HJ, Steven MS, CJ Devine. Surgery of the penis and urethra.. Campbell Urology 7<sup>th</sup> ed. Vol. 3 W.B. Saunders Company,1998 : 3341-3361.
20. Schinella RA, Miranda D. Posthitis xerotica obliterans in circumcision specimens. Urology 1974, 3 : 348.
21. Herchorn S. Colapinto V. Balanitis xerotica obliterans involving anterior urethra Urology 1979, 14 : 592-6.
22. SN Venn, AR Mundy. Urethroplasty for balantis xerotica obliterans. B.J.Urol. 1998, 81: 735-737.
23. Adwok JA. Urethral strictures at Kenyatta National Hospital. E.Afri. Med.J. March 1986, 63: 175-81.
24. A Ahmed, GD Kalayi. Urethral stricture at Ahmadu Bello University Teaching Hosptial, Zaria. E. Afri. Med. J, Oct. 1998, 75(10): 582-5.
25. Martinez-Pineiro JA, Carcamo P. Excision and anastomotic repair for urethral stricture diseases. Experience with 150 cases. European Urol. (Switzerland) 1997, 32(4) : 433-41.
26. GD Webster, RB Koefoot, SA Sihelnik. Urethroplasty management in 100 cases of urethral stricture: A rationale for procedures selection. J.Urol. 1985, 134 : 892-97.
27. John Blandy. Urethral strictures. Lecture Notes on Urology 4<sup>th</sup> edition. Oxford: Blackwell 1991: 261.
28. CR Chappie, NP Bryan. Benign prostatic hyperplasia. Surgery international 2000 ,48: 17-21.
29. Koraitim MM. Posttraumatic posterior urethral strictures in children: A 20-years experience. J. Urol. Feb. 1997, 157(2): 641-5.

- 30 MacDiarmid SA, Harrigan CT , Cottone JL . Assessment of a new transurethral balloon dilatation catheter in treatment of urethral strictures. Johnson De Urol.(USA) Mar. 2000, 55(3): 408-13.
- 31 Pansadoro V, Emiliozzi P. Internal urethrotomy in management of anterior urethral strictures. Long-term follow-up. J.Urol. 1996, 156(1): 73-5.
- 32 Becker JC, Miller J, Noske HD, Klask JP, Weidner W. Transurethral laser urethrotomy with argon laser: experience with 900 urethrotomies in 450 patients from 1978 to 1993. Urol. Int 1995, 55: 150-3.
- 33 DE Andrich, AR Mundy. Urethral strictures and their surgical treatment .B.J.Urol. 2000, 86: 571-580.
- 34 JJF Somerville, OA Adeyemi, PB Clark. Long term results of two staged urethroplasty. B.J.Urol. 1985, 57: 742-745.
- 35 Baert L, Verhamme L, Van Peppel H, Vandeursen H, Baert J. Long term consequences of urethral stents. J. Urol. 1993, 150: 853-5.
- 36 Jordan GH. Urolome endoprosthesis for the treatment of recurrent bulbous urethral stricture. AUA update series 2000, 19: 18-23.
- 37 Turner-Warwick R. Observation on the treatment of traumatic urethral injuries and the values of the fenestrated urethral catheter B.J. Surgery 1973, 60 : 775.
38. Webster GD, Brown MW, Koefoot RB Jr, Sihelnik KS. Suboptimal results of lull thickness skin graft urethroplasty using extrapenile skin donor sites. J. Urol. 1984, 131: 1082-3.
39. Greenwell TJ, Venn SN, Mundy AR. Changing practice in anterior urethroplasty. B.J.Urol. 1999, 83:631 -5.
40. SN Venn, AR Mundy. Early experience with use of buccal mucosa for substitution urethroplasty. B.J.Urol. 1998,81: 737-740.
41. Wessells H, McAnimch JW. Use of free grafts in urethral stricture reconstruction J. Urol. 1996, 155(6): 1912-5.
42. Barbagli G, Selli C, Tosto A, Palminteri E. Dorsal free graft urethroplasty. J. Urol. 1996, 155:123 -6.
43. Iselin CE, Webster GD. Dorsal onlay graft urethroplasty for repair of bulbar urethral strictures. J. Urol. 1999, 161: 815-8.

44. GD Webster, Cary N. Robertson. The vascularized skin island urethroplasty. Its role and results in urethral stricture management. *J.Urol.* 1985, 133 : 31-33.
45. AR Mundy. The long-term results of skin in lay urethroplasty. *B.J.Urol.* 1995, 75 : 59-61.
46. Tuncer R, Zorlundemir U. Lower limb compartment syndrome following urethroplasty. *Br. J. Urol.*, 1997, 80(4): 646.
47. JS Oliech. One stage repair of urethral strictures at Kenyatta National Hospital (1978-84). *E. Afri. Med. J.* Jan 1988, 65 : 39-47.
48. Harris DR, Beckingham IJ, Lamberger RJ, Lawrence WT. Long term results of intermittent low friction selfcatheterization in patients with recurrent urethral strictures *B.J.Urol.* 1994,74(6): 790-2.
49. Kassim Abdalla. The use of clean intermittent self catheterization in the management of urethral strictures at Kenyatta National Hospital. *MMed dissertation, University of Nairobi*, 1999.
50. Matanhelia SS, Slaman R, John A. Mathew PN. A prospective randomized study of self dilatation in the management of urethral strictures. *J.R. Coll Surg.* 1995, 40: 295-7
51. Oliech JS. Indwelling catheters and catheter induced infections. *Proc. Ass. Surg. E.Afri.* 1982, 5:237.
52. Smiddy FG. *Tutorials in Surgery 2.* Pitman Medical, England 1979.

**APPENDIX**

**QUESTIONNAIRE**

1. Name \_\_\_\_\_ Age \_\_\_\_\_  
IP. No. \_\_\_\_\_  
Occupation \_\_\_\_\_ Employed/Unemployed/Student/Not indicated  
Duration of illness \_\_\_\_\_
- II. Presentation (Tick the appropriate)
- Difficulty in passing urine
  - Urine incontinence
  - Acute retention of urine
  - Indwelling suprapubic catheter
  - Urethrocutaneous fistula
  - Extravasation of urine
  - Impotence
  - Others: specify \_\_\_\_\_
- III. Cause (Tick the appropriate)
- Iatrogenic trauma (State the real cause)
  - External trauma (State the real cause)
  - Postgonococcal infection
  - Non-specific infection
  - Malignancy (State the type)
  - Radiotherapy
  - Congenital
  - Unknown

IV. Investigations done (Indicate the results where applicable)

	Yes	No
(a) Urine cultures	<input checked="" type="radio"/>	<input checked="" type="radio"/>
(b) Urine flow rate	<input checked="" type="radio"/>	<input checked="" type="radio"/>
(c) Contrast urethrogram	<input checked="" type="radio"/>	<input checked="" type="radio"/>
(d) Urethroscopy	<input checked="" type="radio"/>	<input checked="" type="radio"/>

V. Stricture characteristics

Patent (Yes/No)

Site: \_

Length:

Number:

Presence of disruption (Yes/No)

VII. Results (Tick the appropriate answers/s)

(a) Urine stream good	<input checked="" type="radio"/>
(b) Urine stream poor	<input checked="" type="radio"/>
(c) Urine incontinence	<input checked="" type="radio"/>
(d) Impotence	<input checked="" type="radio"/>
(e) Acute retention of urine	<input checked="" type="radio"/>
(f) Unknown	<input checked="" type="radio"/>

State the follow-up duration \_\_\_\_\_

Recurrence of symptoms	Yes	No
(a) Within 6 months	<input checked="" type="radio"/>	<input checked="" type="radio"/>
(b) 6 months - 1 year	<input checked="" type="radio"/>	<input checked="" type="radio"/>
(c) 1 year - 2 years	<input checked="" type="radio"/>	<input checked="" type="radio"/>
(d) 2-4 years	<input checked="" type="radio"/>	<input checked="" type="radio"/>
(e) >4 years	<input checked="" type="radio"/>	<input checked="" type="radio"/>

Follow-up investigations (Indicate the results and the duration after the initial procedure where applicable).

- (a) Urine cultures
- (b) Contrast urethrogram
- (c) Urethroscopy
- (d) Urine flow rate

#### **DIVERSITY OF NA1ROW**

XI. Indicate the procedures done during the followup and at what duration after the initial procedure.

XII. Complications of the procedures done. Specify

Tel.: 726300/726450/726550  
Fax: 725272  
Telegrams: "MEDSUP", Nairobi



**KENYATTA NATIONAL HOSPITAL**  
P.O. Box 20723, Nairobi

Ref.....MH-ERg/Q.1./1573

Date..U...Npyember..2.QP.2.

Dr. Lawrence Kamande Njanga  
Dept. of Surgery  
Faculty of Medicine  
University of Nairobi

Dear Dr. Njanga,

**RESEARCH PROPOSAL** "A REVIEW OF MANAGEMENT PROCEDURES FOR URETHRAL STRICTURE DISEASE AT KENYATTA NATIONAL HOSPITAL"\_ (P68/6/2002)

This is to inform you that the Kenyatta National Hospital Ethical and Research Committee has reviewed and **approved** the revised version of your above cited research proposal.

On behalf of the Committee I wish you fruitful research and look forward to receiving a summary of the research findings upon completion of the study.

This information will form part of data base that will be consulted in future when processing related research study so as to minimize chances of study duplication.

Thank you.

Yours faithfully,

PROF. A.N. GUANTAI  
**SECRETARY, KNH-ERC**

c. c. Prof. K.M. Bhatt,  
Chairman, KNH-ERC,  
Dept. of Medicine, UON.  
  
Deputy Director (CS),  
Kenyatta N. Hospital.  
Supervisor: Mr. Owilla F.A., Dept. of Surgery, UON  
The Chairman, Dept. of Surgery, UON  
The Dean, Faculty of Medicine, UON  
CMRO