

**THE ROLE OF BUCCAL MUCOSAL GRAFT  
SUBSTITUTION URETROPLASTY IN  
STRICTURE URETHRA**

*Dissertation submitted in partial fulfillment of the  
requirement for the degree of*

**M.Ch (UROLOGY) – BRANCH – IV**



**THE TAMILNADU Dr.M.G.R. MEDICAL UNIVERSITY**

**CHENNAI**

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## **DECLARATION**

I solemnly declare that this dissertation **“THE ROLE OF BUCCAL MUCOSAL GRAFT SUBSTITUTION URETHROPLASTY IN STRICTURE URETHRA”** was proposed by me in the Department of Urology, Government Madras Medical College and Hospital, Chennai under the guidance and supervision of **Prof.R.JEYARAMAN, M.S., M.Ch.**, Professor and Head of the Department, Department of Urology, Government Madras Medical College, Chennai.

This Dissertation is submitted to the Tamilnadu Dr. M.G.R. Medical University, Chennai in partial fulfillment of the University requirements for the award of degree of M.Ch Genitourinary Surgery.

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# **CERTIFICATE**

This is to certify that this dissertation entitled **“THE ROLE OF BUCCAL MUCOSAL GRAFT SUBSTITUTION URETHROPLASTY IN STRICTURE URETHRA”** submitted by **Dr.R.BALASUBRAMANIAM**, appearing for **M.Ch (Urology)** degree examination in August 2010 is a bonafide record of work done by him, under my guidance and supervision in partial fulfillment of requirement of the Tamilnadu Dr. M.G.R. Medical University, Chennai. I forward this to the Tamilnadu Dr. M.G.R. Medical University, Chennai, Tamilnadu, India.

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The request for an approval from the Institutional Ethical Committee (IEC) was considered on the IEC meeting which is held on 23<sup>rd</sup> June at 2 P.M in Government General Hospital, Deans, Chamber, Chennai-3.

The members of the Committee, the Secretary and the Chairman are pleased to approve the proposed work mentioned above, submitted by the principal investigator.

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# INTRODUCTION

The long term effects of internal urethrotomies are poor either requiring repeated dilatation or repeated urethrotomies. Conventional urethroplasty including end to end urethroplasty produce consistent result. The use of grafts or flaps is mandatory in patients with longer and complex strictures.

On lay graft is the recent addition to the armamentarium. On lay graft is done either dorsally or ventrally. Various tissues like penile skin, posterior auricular skin, bladder mucosa or buccal mucosa are used.

Since 1995 \_96 Barbagli described a new dorsal on lay urethroplasty, it has been greeted with fair amount of enthusiasm throughout the world. Success rate of the procedure has been 92 – 95 % for a period of 19 to 36 months.

We have attempted to extend the use of the procedure for long anterior urethral strictures including pan urethral strictures using buccal mucosal graft

## **HISTORY**

Suprechko has first described buccal mucosal grafts in 1886. Humby is credited with the first use of buccal mucosa in urethral reconstruction, when in 1941 he reported the series of first stage hypospadias repair. Before widespread antibiotics use the results are poor. The resurgence of the technique occurred in the late 1980s when Duckett reported using buccal mucosal graft in epispadias repair and subsequently, complex hypospadias revisions. Barbagli proposed the dorsal placement of buccal mucosal grafts and noted decreased sacculations and diverticulum formation which marked the revival of free graft urethroplasty.



# REVIEW OF LITERATURE

## ANATOMY

The male urethra is divided into anterior urethra and posterior urethra. The posterior urethra includes prostatic urethra and membranous urethra. The anterior urethra includes penile urethra and bulbar urethra.

The penile urethra is surrounded by corpus spongiosum. The corpus spongiosum lies in the ventral groove between the two corpora cavernosa. The tunica albuginea of the corpus spongiosum is thinner than the corpora cavernosa & contains less erectile tissue. The urethra traverses the length of the penis within the corpus spongiosum. At its distal end the corpus spongiosum expands to form the glans penis, a broad cap of erectile tissue covering the tips of corpora cavernosa.

Buck's fascia is the tough, elastic layer immediately adjacent to the tunica albuginea. On the superior aspect of the corpora cavernosa, deep dorsal vein, paired dorsal arteries & multiple branches of dorsal nerves are contained within the envelope of Buck's fascia. In the midline groove, on the undersurface of corpora cavernosa, Buck's fascia splits to surround

the corpora spongiosum. Consolidations of the fascia, lateral to the corpora spongiosum, attach it to the lateral surface of corpus cavernosa. Attached distally to the undersurface of the glans penis at the corona, Buck's fascia extend into the perineum, enclosing each crus of the corpora cavernosa and bulb of the corpus spongiosum. It firmly fixes these structures to the pubis, ischium and inferior fascia of perineal membrane (urogenital diaphragm).

Anterior urethra extends from the inferior fascia of the urogenital diaphragm to the external meatus of the penis. For better understanding of discussion about reconstruction of urethra it is subdivided into three regions.

Fossa navicularis is contained within the spongy erectile tissue of glans penis & it terminates at the junction of urethral epithelium with the skin of glans. This portion of urethra is lined with stratified squamous epithelium.

The penile or pendular urethra lies distal to the investment of ischiocavernous musculature but it is invested by the corpus spongiosum. The penile urethra is lined with simple squamous epithelium.

The bulbous urethra is covered by the midline fusion of the ischiocavernosus musculature and is invested by the bulbospongiosus & corpus spongiosum. It becomes larger & lies close to the dorsal aspect of corpus spongiosum, exiting at its dorsal aspect, before the posterior attachment of the bulbospongiosus to the perineal body. The bulbous urethra is lined with squamous epithelium which changes to transitional epithelium at the level of membranous urethra.

## **HISTOLOGY**

The wall of urethra is formed in three layers.

### **1. MUSCULAR COAT**

The muscular coat of the prostatic and membranous urethra is the downward continuation of the detrusor muscle of the urinary bladder. Therefore it is innervated by the sympathetic nerve fibres. The sphincter urethra is formed by the striated muscle which surrounds the membranous urethra.

## **2. MUCOSAL COAT**

The mucosal coat is composed proximally of transitional epithelium continuous with the bladder. This cell type terminates in the verumontanum, just distal to the opening of the ejaculatory ducts. Distally a mixture of stratified columnar epithelium and pseudostratified epithelium with mucous glands can be found. The mucous membrane of the penile urethra is characterised by the frequent recesses associated with the tubular mucous glands of Littre, particularly in the dorsal part of the urethra. Distally in the penile urethra, the mucosa becomes stratified squamous epithelium in character.

## **3. SUBMUCOSAL LAYER**

The sub mucosal layer extends throughout the length of urethra. It has rich vascular and erectile network.

## **ARTERIAL SYSTEM**

The blood supply to the deep structures of the anterior urethra is derived from the common penile artery, which is the continuation of the internal pudental artery after it gives off the perineal branch. From that

point the artery is termed the common penile artery and travels along the medial margin of the inferior pubic ramus .As it nears the urethral bulb the artery divides into three terminal branches as follows.

1. The bulbar urethral artery is a short artery or arteries of relatively large caliber that pierce Buck's fascia to enter the bulbospongiosus. These arteries are oriented almost parallel to the path of the membranous urethra.
2. The dorsal artery generally travels along the dorsum of the penis between the deep dorsal vein medially and the dorsal nerves laterally with the coiled rather than the straight configuration. The artery uncoils as the penis elongates with erection, allowing flow to be maintained. Along its course, it gives off 3 to 10 circumflex branches (the circumflex cavernosal arteries) that accompany the circumflex veins around the lateral surface of the corpora cavernosa. Its terminal branches arborize in the glans penis. In many patients the branches penetrate the tunica and connect to the cavernosal arteries. The functional significance of these perforators varies from individual to individual. Proximally the circumflex arteries are also part of the blood supply to the corpus spongiosum.

3. Tiny branches from the deep arteries of penis.

### **SUPERFICIAL PERINEAL SPACE**

In males superficial perineal space contains the continuation of corpora cavernosa, the proximal part of the corpus spongiosum and urethra, the muscles associated with them and the branches of internal pudental vessels and pudental nerves.

The ischiocavernous muscle covers the crura of the corpora cavernosa. They attach to the inner surfaces of the ischium and the ischial tuberosities on each side and insert at the midline into Buck's fascia. They surround the crura at their junction below the arcuate ligament of penis. The bulbospongiosus muscles are located in the midline of the perineum. They are attached to the perineal body posteriorly and to each other in the midline, as they encompass the bulbospongiosus and the crura of the corpora cavernosa at the base of penis .These muscles are confluent with the ischiocavernous muscle laterally, and at their insertion at the Buck's fascia, covering the dorsal vessels and nerves at the base of penis.

# **STRICTURE DISEASE**

## **Etiology**

Basically the strictures caused by the anterior urethra are caused by the

1. Inflammatory diseases of corpus spongiosum like Balanitis Xerotica Obliterans (BXO), post gonococcal strictures,
2. Traumatic scarring after blunt perineal trauma,
3. Hypo spadias repair failure,
4. ischemia after endoscopic procedures,

## **Pathogenesis**

However simple the pathology might appear to be, the etiology of many strictures is unknown. An episode of infection or trauma is not necessarily a direct cause of a stricture. In an interesting review of the anatomy of urethral stricture disease, Chambers et al noted that the first

identifiable change in urethral stricture was the change in the nature of the urethral epithelium from the pseudo stratified columnar epithelium to columnar epithelium that lacks the water proofing ability of the pseudo stratified variant. Consequently they hypothesized that the urine could extravaste and lead to fibrosis.

Partial loss of urethral lining is also important factor predisposing to stricture formation. Since it exposes the spongiosal vascular spaces to the passage of urine and this result in superficial spongi thrombosis, which progresses to a layer of spongiofibrosis. The loss of any portion of circumference of the epithelial lining generally results in narrowing of the lumen during healing because the margins of the residual epithelium are approximated by the natural urethral closure pressure so that unepithelialized defects form clefts that tend to heal by cross adhesion and epithelial over bridging. However intermittent passage of urine opens these clefts and these repeated separation and reexposure of the underlying vascular spongy tissue spaces - combined with relatively slow



uroepithelial proliferation - leads to gradual increase in underlying spongi thrombosis and consequently spongi fibrosis and stricture formation.

Singh and Blandy explained particular association of inflammatory stricture disease with the midbulbar & distal penile segments of the urethra on the basis that most urethral glands were at these sites. Thus inflammatory strictures were the consequence of fibrosis beginning initially in the corpus spongiosum, caused either directly from the extravasations of urine through the urethral epithelium or indirectly through the involvement of urethral glands at specific sites and subsequent extension into the spongiosum. Once initiated, fibrosis within the corpus spongiosum can cause constriction of the urethral lumen and if there is also infection, this can cause micro abscess formation within the urethral glands. This makes the fibrosis worse and may lead to peri urethral extension of the fibrosis.

Urethra lined by water proof pseudo stratified columnar epithelium



Leaky columnar epithelium



Extravasation of urine and spongiofibrosis



Constriction of urethral lumen



Micro abscess in urethral glands  
Periurethral extension of inflammation



More severe stricture

## **Spongiofibrosis**

The surgical significance of established urethral spongiofibrosis is its high predisposition to progress to stricture formation when it is inappropriately used in surgical repair. Thus it is the overall extent of spongiofibrosis associated with a stricture and not simply the length of stricture that should properly determine both the type and extent of urethral repair required to achieve satisfactory long term resolution. If the longitudinal extent of urethral repair is limited to the length that is actually structured, as opposed to the length of spongiofibrotic abnormality, it commonly results in restenosis.

Severe spongiofibrosis changes are often palpable and they are generally apparent urethrographically by a scarred reduction in the urethral lumen and by the excavation of the ducts of the glands of Littré and Cowper. Endoscopically spongiofibrotic urethra has a whitish colour – quite distinct from the normal urethra that is pink because the underlying vascular spongy tissue is seen through the translucent covering of the urothelium. However preoperative evaluation even by sono urethrogram offers only a guideline – the critical extent of the

surgically significant spongiofibrotic gray urethral abnormality may not be apparent until it can be accurately determined by the direct inspection at the time of operation when the urethra has been opened by an incision extending truly normal pink urethra proximally and distally \_ when it is revealed by a well defined thin layer of sub epithelial fibrosis that is clearly distinguishable.

With progressive constriction of the urethral lumen and if outlet obstruction develops, secondary changes may arise in the lower urinary tract, and even the upper urinary tract. One consequence of obstruction is a predisposition to recurrent urinary infection and secondary prostatitis and epididymitis are also common. Upper tract complications are less common now than they were 50 years ago, but are still common in certain areas of world with less than adequate access to urological care.

The results of dilatation and urethrotomy were recently reviewed by various authors ,who concluded that urethrotomy had no advantage over dilatation in terms of cure rate and that if one urethrotomy or dilatation fails to cure a patient then a second rarely will and third never does(3). Furthermore, the only strictures that regularly respond are single

short strictures of the bulbar urethra and then only in less than 60% of cases. Multiple strictures, stricture > 1 cm long and strictures in penile urethra rarely respond. Various methods have been used to improve the results eg, using laser to divide the stricture rather than cold knife, using stent to hold the stricture segment and the urethra open, or using self urethral dilatation to hold the urethra open after an initial urethrotomy.

The results of laser urethrotomy suggest that it has no advantage over cold knife urethrotomy although theoretically the vaporization of the superficial annular intraluminal ring constriction might work, where the laser urethrotomy performed in the same way may not work. Intraurethral stents may be effective when spongiofibrosis is not too extensive. When stent is placed, the fibrotic tissues tend to grow through into the lumen, particularly traumatic strictures and those with periurethral fibrosis. Moreover, even when successful, there is significant morbidity with intraurethral stents because urine pools, causing post void dribbling and irritative symptoms. There is also pooling of semen after intercourse, interfering with ejaculation and its perception. Some patients have discomfort at the site of stent.

Likewise self urethral dilatation is not accepted by all patients, who like to have their diseases treated by doctors rather than by themselves. Even those who are prepared to try self urethral dilatation tend to discontinue subsequent self urethral dilatation programmes because of difficulties. Thus the only curative treatment for most patients with urethral stricture disease is urethroplasty.

### **Balanitis Xerotica Obliterans**

Of the various causes of stricture urethra, BXO needs special mention. It was first described in 1928. It is a form of lichen sclerosis. It occurs up to 1 in 300 men. The cause is not clear. It commonly occurs in the glans penis and prepuce causing phimosis, with more extensive disease affecting the urethra as far back as the proximal bulbar urethra. The dictum for treatment often taken on major proportions including excision of the entire affected urethra and the use of extra genital tissue (buccal mucosal graft) for reconstruction, to prevent recurrent disease in the repaired area. These are morbid procedures and high failure rates up to 71%.

Surgical procedures recommended for anterior urethral stricture according to the length of stricture is as follows.

- 1 to 2 cm and bulbar urethral stricture \_ End to End urethroplasty
- 2 to 6 cm \_ Augmented dorsal or ventral on lay graft urethroplasty.
- > 6 cm \_ staged urethroplasty.

Substitution urethroplasty involves augmenting or replacing the circumference of urethra with the patch or tube material respectively.

Poor prognostic factors for urethroplasty are

- Periurethral fibrosis
- Poor vascular supply
- Periurethral phlegmon
- Poor tissue availability
- Previous instrumentation
- Long urethral stricture

- Balanitis Xerotica Obliterans(BXO)

In the presence of risk factors staged urethroplasty is advocated.

### **Graft Take**

Graft take occurs in two phases' imbibition and inosculation. It takes 96 hours. During the initial phase of imbibition the graft survives by drinking nutrients from the adjacent host bed and it lasts up to 48 hours. During the phase the graft temperature is less than the body temperature. In response to the growth factors produced by the hypoxic vessels in the graft during inosculation, new vessels are produced as buds from arteries, veins and lymph channels in the vascular bed. These new vessels grow through the fibrin matrix that has formed between the graft and graft bed and penetrate the graft to hook up with the vessels in the sub dermal and intradermal plexus and reperfusing the grafted material. During this space the temperature of the grafted tissue rises to the core body temperature. The process of take is influenced by both the nature of grafted tissue and conditions of the host bed.



Anant kumar et al (3), have reviewed about their management of BXO single stage or multiple stage procedures. They had complications of graft loss, stromal revision and glans cleft narrowing in 5 out of 14 of their staged urethroplasty patients. None of their 25 single stage urethroplasty patients had similar problems. Recurrent stricture was noted in 21.4 % of two stage procedures and 12% of single stage urethroplasty patients.

Jean V. Joseph et al (9) reviewed their 38 staged urethroplasty patients. He concluded that stage two urethroplasty is often converted into multistage procedure. A single patient required three revisions for stage one procedure before he was fit for stage two procedures.

Ezo palminteri et al (10) have concluded that stage two urethroplasty involves considerable patient inconvenience and increased risk of morbidity because of multiple anesthetic procedures.

Revisions are common with staged urethroplasty and approximately 50% of patients two stage procedure is converted into three stage procedure. Penile urethroplasty is particularly susceptible to

revision. It has a recurrence rate of 4 % at 6 month follow up in best of hands (11).

Grafts are placed dorsally in case of anterior urethral stricture disease because

1. Graft is placed over corporal over corporal bodies which provides
  - Good support and prevents sacculation and pouch formation.
  - Good vascular bed potentiating grafts take.
  - Good immobilization of the graft
  - Less chance of graft shrinkage and chordee.
  - A potential for roof strip epithelial regeneration according to the principles of Dupley and Davis (17).
2. Urethro cutaneus fistula can be prevented by adequate duration of indwelling catheter.
3. It preserves residual blood supply of corpus spongiosum (13)
4. In case of bulbar urethra it requires less extensive opening of spongy tissue as urethra is positioned dorsally.

Sherbuny et al (14) conducted study in dogs using buccal mucosal graft urethroplasty and found that BMG shrinkage was less than 10%.when compared to full thickness skin graft and bladder mucosal graft, buccal mucosal graft had less inflammation, less fibrosis and uniform graft thickness at 3 months after grafting.

### **Buccal Mucosal Graft**

The uniqueness of buccal mucosa and its histologic and antibacterial properties make it superior tissue for reconstruction. The unique structure of the buccal mucosa allows it to be an excellent grafting material. It is 500 micrometer thick and is a nonkeratinized, stratified squamous epithelium consisting of four layers. The stratum basale or germinative layer of the epithelium rests against the basement membrane and provides the progenitor cells for cellular division. The basale is two or three cell thick and includes melanocytes, antigen presenting Langerhans cells, sensory Merkel cell and lymphocytes. It has rapid turn over rate and within 25 days all layers of buccal mucosal epithelium are replaced.

The stratum spinosum is the next layer, which provides intercellular bridges that give the buccal mucosa the prickle appearance in light microscopy. The outer two layers (stratum intermedium & superficial) are difficult to delineate from each other. These cells are unique in that they are more firmly attached to each other than other keratinized tissue & provide excellent barrier production.

Beneath the basement membrane, lamina propria lies which contain more collagen and elastic tissue. Elastin fibres are more numerous in the buccal mucosa than in other tissues allowing buccal mucosa to recoil after stretching. The lamina propria further provides long slender papillary invaginations into the epithelia and loose collagen fibres and loops of capillaries from which epithelium gets its blood supply. The web like reticular layer of the lamina propria holds the vasculature and nerves of the buccal mucosa. Collagen, elastin and ground substance depend on fibroblasts that also reside in the area.

The line between the sub mucosa and lamina propria is difficult to delineate. The sub mucosa, which is firmly attached to the underlying buccinator muscle, is also rich in collagen and elastin in addition to minor

salivary glands and sebaceous glands. A major salivary duct (Stenson's duct) from the parotid gland pierces the buccinator muscle opposite the upper second molar bilaterally.

The arterial blood supply to the buccal mucosa originates from the facial artery, the buccal artery and the posterior superior alveolar artery and inferior superior alveolar artery of the external carotid.

Buccal mucosa is ideal substitute for urethra because

1. It has rich epithelium rich in elastin ,which makes it durable and easy to handle.(13)
2. High amount of type 4 collagen content(13),
3. Helps in good graft take,
4. Lamina propria is thin compared to the skin and bladder mucosa, which facilitates inosculation and neovascularisation (13).
5. It has pan laminar plexus – so it can be thinned provided sufficient amount of deep lamina is carried to preserve the physical characteristics (18).

6. It has high capillary density (13).
7. The graft carries a wet epithelial surface (18).
8. Thickness of BMG makes it easy to handle.
9. It is better substitute in case of BXO (19).
10. Harvesting of BMG is easy and easy to apply (13).
11. Large volume is available (13).
12. It heals without much pain.
13. There is no visible scar or deformity (22).
14. It is resistant to infection (22).
15. Graft contracture is less than 10 % (22).
16. Resistant to progression of skin diseases like BXO (21).
17. Donor site is reepithelialized within 2 weeks (24).
18. Of the free grafts used by Mc Aninch, the longest successful grafts were those from the buccal mucosa.

Bhargava et al (23) have produced tissue engineered buccal mucosal graft from a small buccal mucosal biopsy to produce 10 cm patches of tissue engineered buccal mucosal graft in 5 to 6 weeks. It closely resembles native oral mucosa and withstands the mechanical stress.

### **BMGS IN STAGED URETHROPLASTY**

There are clear indications for staged urethroplasty particularly where the stricture is complex, lengthy or caused by BXO. While traditional scrotal skin inlay has been used for two stage procedures, as it provides a large quantity of easily accessible tissue. It has significant limitations which include hair bearing area, undergo excoriation and hyperkeratosis & increased risk of diverticulum formation. So flaps and grafts from extra genital skin and penile skin were tried. The penile skin can be limited by the availability of tissue, if the patient has been circumcised. The extra genital skin graft results are poor in some reports and good in some reports.

With this in mind Schreiter & Noll described use of meshed split or full thickness skin grafts for staged urethroplasty. But it leads to graft contraction and excessive growth of granulation tissue through

the interstices of the mesh. Wessels and Mc Aninch in a review described no apparent benefit attributable to the use of flaps over grafts. Long term results were comparable in both the groups. But grafts require less dissection and shorter operating time. Buccal mucosa offers the advantage of being accustomed to a wet environment, hairless, easy to harvest, resilient to infection, a thick epithelium (making it easy handle) and reduced likelihood of pseudo-diverticulum formation even when used ventrally, unlike skin inlay grafts, but it has a thin lamina propria allowing early inosculation. There are two published series where buccal mucosa was used for two-stage urethroplasty in both the groups the graft performed well. About 23% of patients required minor revision after the first stage, with proximal graft stenosis comprising most of these revisions. One patient in each series developed an urethrocutaneous fistula and in contrast to two-staged repairs using skin grafts, none of the patients developed a diverticulum, although the follow-up was short. For circumferential repair of penile urethra two stage repairs using a free graft gives better results than a one stage repair using a flap(26).



## **BMGS AS A VENTRAL/DORSAL FREE GRAFT**

The use of a graft in urethral reconstruction has found renewed interest in the last two decades. Traditionally grafts have been placed on the ventral aspect of the urethra because it allows easier access to the urethra and better visualization of the stricture. Penile and nonhirsute extra genital skins have been used commonly for reconstructing the urethra. Using skin the common problems faced include those caused by contraction of the graft (especially with split-thickness grafts), and increased incidence of diverticulum formation and the risk of potential cosmetic deformity at the donor site. Penile skin has been used with long-term success rates of 50-95%. Ventrally placing a graft is likely to be associated with a higher rate of graft failure because of an inadequate graft bed and poor support, leading to diverticulum's formation, which then leads to post void dribbling and ejaculatory dysfunction. Previous experience using skin grafts for strictures in the penile urethra has not been encouraging, largely attributed to a less abundant corpus spongiosum than in the bulbar urethra, and a poorer blood supply and lower take rates. Barbagli et al., following the concept advocated by Monseur, introduced the dorsally placed graft, and postulated that dorsal

placement is advantageous as it allows better mechanical support for the graft with a richer vascular bed for the graft from the underlying corporal bodies. While there are no randomized controlled trials comparing ventral or dorsal placement of the graft using either skin or buccal mucosa, some authors report good long term stricture free outcomes in ventral on lay technique equivalent to dorsal on lay technique(27,29). The overall success rate for a ventrally placed buccal mucosa graft is 85% at a mean follow-up of 36.9 months. This includes the entire population of strictures irrespective of the site. When bulbar strictures alone are considered the success rate is 89%. There were no reports of the development of urethrocutaneous fistula after a one-stage ventral BMG in the available series, but when skin was used, as a ventral graft fistula formation was common, especially where the graft failed to vascularize. In one of the largest published series, 21% of the patients reported some post void dribbling after surgery but no pseudo-diverticulum formation. The overall success rate with dorsally placed BMGs is 96% with a mean follow-up of 38 months. Dorsal on lay using skin gives success rates of 85% in comparison. None of these patients developed any urethrocutaneous fistulae or pseudo-diverticula.

## **BUCCAL MUCOSA AS A TUBE GRAFT**

Tubularized grafts fail largely because of inadequate graft take, as they are not circumferentially surrounded by vascularized tissue (35, 36). There are three published series where buccal mucosa has been used as tubularized graft. In all of these studies 37 of the 43 tubes constructed were to correct either hypospadias or epispadias. Urethrocutaneous fistula developed in 6 of 43 patients and there were 5 who developed meatal stenosis. Recently Barbagli et al. described on one stage circumferential urethroplasty where, in complex cases, the diseased urethra is excised and replaced with buccal mucosa placed on a circumferential spongioplasty, thereby providing good fixation to a robust well vascularized underlying tissue. With a mean follow-up of 38 months none of the five patients developed a stricture. Therefore a tube graft using the spongioplasty technique may be more applicable to the bulbar than the penile urethra. If there is inadequate surrounding spongy tissue, there will be inadequate graft take, which will inevitably lead to complications.

M T Elsherbiny et al (14), in their study in dogs found that buccal mucosal tube graft had success rate of 33% only even when the tube graft was surrounded by spongiosal tissue all around.

## **COMPLICATIONS**

Although serious complications resulting from harvesting a BMG are infrequent, until recently donor-site complications were not reported. Possible adverse effects of harvesting buccal mucosa include intraoperative hemorrhage, postoperative infection, pain, swelling, and damage to the parotid duct, limitation of oral opening and loss or altered sensation of the cheek or lower lip through nerve damage. Damage to the surrounding structures can be avoided by careful marking of the cheek mucosa before harvesting. It is recommended that the dissection should be at least 1 cm from the opening of the parotid duct. Harvesting mucosa from the cheek carries less morbidity than from the inside of the lips. Paraesthesia after harvesting a BMG is the commonest complication but is transient in most patients. Caldamone et al. reported two patients who developed scar contractures. Dubey et al. reported bleeding in one patient

requiring surgical intervention, and in both these series both the cheek and lower lip were used for harvesting the graft.

Buccal mucosa has proved to be a useful alternative to skin. It is easy to harvest and to handle, is resilient to infections and accustomed to a wet environment. The BMG has been used successfully for treating all types of strictures, in which medium-term outcomes comparable to using skin as a substitute, but with less donor site morbidity and fewer complications. Because of its inherent advantages buccal mucosa has become the recommended source for tissue substitution during urethral reconstruction.

N.P. Gupta et al(37), reviewed their experience in treating 12 patients with a long anterior urethral stricture. They reconstructed the anterior urethra using a one stage urethroplasty with a dorsal on lay buccal mucosal graft through a ventral sagittal urethrotomy. The urethra was approached via a small perineal incision irrespective of the site and length of the stricture. The penis was everted through the perineal wound. No urethral dissection was used on laterally or dorsally, so as not to jeopardize the blood supply. The mean (range) length of the stricture was

5 (3-16) cm and the follow-up 12 (10-16) months. They have used micturating cystourethrogram at 21<sup>st</sup> post operative day, and in the presence of leak, they have retained the catheter for two more weeks for one patient.

The results were good in 11 of the 12 patients. One patient developed a stricture at the proximal anastomotic site and required optical internal urethrotomy. Dorsal buccal mucosal graft urethroplasty via a minimal access perineal approach is a simple technique with a good surgical outcome. It does not require urethral dissection and mobilization and hence preserves the blood supply.

Anant Kumar et al (7), have 39 patients undergone buccal mucosal urethroplasty for BXO related anterior urethral strictures. The 25 patients with a salvageable urethral plate (group 1) were treated with 1stage dorsal on lay urethroplasty using a cosmetic incision. The 14 patients with a severely scarred urethral plate, focally dense segments or active infection (group 2) underwent 2-stage urethroplasty. At a mean follow-up of 32.5 months (range 3 to 52) 3 patients (12%) in group 1 had recurrent stricture, of which 2 and 1 were treated with optical urethrotomy and urethral

dilation, respectively. All patients had a normal slit-like meatus and none had chordee or erectile dysfunction. Four group 2 patients (28.6%) required stomal revision and 2 had glans cleft narrowing after stage 1 urethroplasty. Following stage two, 3 patients had recurrent stricture of whom 2 were treated with optical urethrotomy and 1 underwent repeat urethroplasty. They have concluded that in BXO related strictures with a viable urethral plate one stage dorsal on lay buccal mucosal urethroplasty provides excellent intermediate term results. The cosmetic incision described provides a normal, wide caliber, slit-like glans. Two-stage procedures provide satisfactory outcomes but they are associated with a highest revision rate.

Barbagli et al(38) reviewed a total of 45 patients with an average age of 45 years underwent dorsal on lay skin graft urethroplasty between January 1994 and December 2000. Of the patients 23 had undergone an average of 2.6 prior endoscopic procedures (range 1 to 14). Preoperative evaluation include clinical history, physical examination, retrograde and voiding urethrography, and ultrasonography. In all patients the bulbar urethra was opened along its dorsal surface, the graft was sutured, splayed and quilted to the corpora cavernosa, and the urethra was rotated

to cover the graft. In all patients penile skin was used as substitution material. Mean graft length was 4.7 cm (range 2.5 to 11). Three weeks after surgery voiding cystourethrography was performed. Average follow up was 71 months (range 41 to 110). Clinical outcome was considered a failure when postoperative instrumentation was needed, including dilation. Of 45 cases 33 (73%) were classified as successful and 12 (27%) were failures. The 12 failures were treated with internal urethrotomy (1), end-to-end-anastomosis (1), skin graft urethroplasty (2) and 2 stage urethroplasty (6). Six of the 12 initial failures had a satisfactory final outcome. The remaining 6 patients refused further surgical procedures and received a definitive perineal urethrostomy. They have concluded by saying that penile skin grafts used as a dorsal on lay for bulbar urethral reconstruction in a homogeneous series of patients showed a tendency to deteriorate with time. Longer follow up is required to compare penile skin with buccal mucosa as substitute materials for bulbar urethral reconstruction.

Christopher J Kane et al (29), has reviewed a retrospective analysis of patients who had undergone buccal on lay urethroplasty at 4 military medical treatment facilities participating in the Uniformed Services



Urology Research Group. The database included demographic data, genito urinary history, preoperative symptoms (American Urological Association Symptoms score), Preoperative Urinary flow rate, stricture length and operative statistics. Postoperative follow-up data included symptoms score, flow rate, retrograde urethrogram results and complications. A total of 53 patients average age has 30 yrs (range 17-64) underwent buccal mucosal graft urethroplasty between January 1996 and March 1998 for refractory strictures. 16 patients had undergone an average of 2.2 prior endoscopic procedures (range 1-7). Average stricture length was  $3.6 \pm$  SD 1.8cm range 2 to 7.5 as measured on preoperative retrograde urethrogram. Follow-up averaged 25 months (range 11-40 months). Average symptom scores decreased from 21.2 (range 14-33) pre-operatively to 5.4 ranges (3-8) post operatively) (P.001). Average peak urinary flow rates increased from 7.9ml/second preoperatively to 30.1ml/ second post operatively (P0.001). Post operative retrograde urethrogram were available for 34 patients and were normal in 34. The overall complication rate was 5.4%. Three patients required endoscopic incisions. One patient has a recurrent narrowing and treatment is considered a failure. There were 4 sacculations (7.5%) and 6 narrowing, 3

of which required further treatment. Of the 53 patients 50 required no additional procedures (94.3%).

Christopher E. Iselin et al (39) has 29 men with a mean age of 43 years (range 10 to 81) who underwent dorsal on lay graft urethroplasty. Follow up included retrograde urethrogram at 3 weeks, 3 months and 12 to 18 months and thereafter when needed. Urinary flow was recorded as subjectively reported by the patients. The technique was used only for bulbar urethral strictures. A total of 23 patients (79%) had undergone previous direct vision urethrotomy and/or open surgery. Dorsal on lay graft urethroplasty was used along in 12 patients (41%), and was performed with partial stricture excision and ventral strip anastomosis in 13 (45%). In another 4 patients (14%) the procedure was combined with an Orandi flap because the stricture extended significantly into the penile urethra. Penile skin graft was used in 27 patients (93%), whereas buccal mucosa was harvested in 2. Mean graft length was 6 cm. (range 3 to 9), and width ranged between 1.5 and 3 cm. Outcome was favourable in 28 patients (97%) for a median follow up of 19 months (range 10 to 37). One patient had symptomatic proximal stricture recurrence and 3 had radiographic evidence of caliber decrease

of the repair but with no impact on urinary flow. They have concluded that dorsal on lay graft urethroplasty is a versatile procedure which may be combined with stricture excision and ventral strip anastomosis or an Orandi flap. Conceptually the technique offers the advantages of spread fixation of the graft on a fixed well vascularized surface, which may improve graft neo vascularization, reduce graft shrinkage and avoid sacculation. Buccal mucosa grafts used as a dorsal on lay for bulbar urethral reconstruction yield excellent results with minimal morbidity and low complication rates. Longer follow up will be required to confirm the durability of our results.

Jack. B. Lewis et al (40), reviewed the records of 78, 1-stage anterior urethroplasties performed via excision with primary anastomosis, buccal mucosal graft or penile fasciocutaneous skin flap techniques from September 1997 to December 2000 by a single surgeon (A. F.M.). All patients had more than 1 year of followup (range 1 to 4.5). Of the graft procedures only those in the bulbar urethra were included in analysis. Outpatient procedures were defined as those in which the patient was discharged to home within 24 hours. Clinical outcome was considered a failure when instrumentation was required postoperatively. Of the 78

anterior urethral repairs 54 (69%) were performed on an outpatient basis, including 50 (93%) in which the outcome was successful compared with 21(88%) of the 24 inpatient procedures. Excision with primary anastomosis had the highest outpatient rate 28 of 31 patients (90%), followed by penile skin flaps 16 of 25 ( 64%) and buccal mucosal grafts (10 of 22 or 45%). Patient characteristics were significantly associated with outpatient procedures, including younger mean age (36 versus 46 years), shorter mean stricture length (3.1 versus 6.6 cm) and shorter mean operative time (3.2 versus 4.66 hours) (p 0.05). Anterior urethral reconstruction can often be completed safely and effectively on an outpatient basis.

M.Bhandari et al (41), have reviewed their experience in managing complex anterior urethral strictures with a dorsally / dorsolaterally placed penile / preputial vascularized flap, and to discuss the advantages of this procedure over a traditional ventrally placed flap. 40 patients (mean age 40.5 years) with recurrent strictures of the pendulous and / or bulbar urethra were treated with longitudinal penile / circum penile flap substitution urethroplasty. Nineteen patients underwent dorsal placement of the flap as an on lay (DO), whereas 21 patients had a ventral only

(VO). Five patients needed inferior pubectomy to facilitate high proximal placement of the flap. Both groups had statistically similar ages, number of previous interventions, stricture site length and follow-up. After a median follow-up of 27.5 months, the stricture recurred in three (24%) of the VO and two (11%) of the DO groups ( $P>0.05$ ). One patient in the VO group required surgical closure of the urethral fistula. Pseudo-diverticulum, sacculation with post void dribble occurred in six patients in the VO and none in the DO group ( $P=0.01$ ). Dorsal placement of the pedicled flap is anatomically and functionally more appropriate than the traditional VO placement. DO preputial / penile flap urethroplasty is a versatile procedure and can be applied even for long anterior urethral strictures, including reconstruction of the meatus and high proximal bulbar strictures.

Mundy et al (36) have concluded that buccal mucosal free grafts appear to be satisfactory material for urethroplasty when applied as a patch. They are tough, resilient, easy to harvest and easy to handle, and leave no visible donor site. They appear to have no particular advantage over genital skin-free grafts or genital skin flaps in terms of cure of the stricture but avoid the cosmetic disadvantages of local genital

skin. As it is not skin, buccal mucosa is resistant to skin diseases such as balanitis xerotica obliterans and is particularly resistant to infection. In short, buccal mucosa may not necessarily give more satisfactory results for the long-term cure of stricture disease; it has many characteristics to make it the material of choice for patch urethroplasty unless a free graft is contraindicated because of poor vascularity or active infection at the site of the stricture.

George D Webster (42) et al has reviewed their experience with 29 patients who underwent augmented roof top anastomotic urethroplasty. The stricture was in the bulbar urethra in all cases. Six patients had a completely obliterative stricture. Mean stricture length was 1.5 cm on retrograde urethrography and the mean excised length was 1.2 cm. In 9 of the 29 patients a roof strip anastomosis was augmented by a ventral on lay and in 20 a floor strip anastomosis was formed with a dorsal on lay. On lays included a pedicled skin flap in 7 cases and a graft in 22. Mean on lay length was 4.5 cm. At a mean follow up of 28 months (range 3 to 126) 27 of the 29 patients (93%) were stricture free and all those surveyed were satisfied with the procedure.

Bergland (44) et al reported on 18 patients with a mean stricture length of 15.1 cm reconstruction using the combination of a penile skin flap and buccal mucosal graft.

Norman Dublin (43) et al had 31 operations. Soon after surgery (that is first 48 h), 22 (73%) of the patients had little or no oral pain; 70% and 90% of the patients were able to eat and drink, respectively. 59% complained of numbness and 75% complained of tightness of the mouth. At discharge 6 days after surgery 90% of patients had little or no oral pain and all were able to eat and drink, but 10% had moderate-to-severe oral pain, 39% had oral numbness, and 52% had tightness of the mouth. At the time of interview, 16% of patients had oral numbness (mean duration 13.6 months) and 32% had tightness of the mouth (mean duration 20.9 months) In answer to the question of whether they would have their cheek mucosa harvested again if required, 74% responded 'yes', 3% 'no' and 23% had mixed feelings. BMG harvesting is a good operation, as most patients were satisfied, but it is not without long-term complications and patients should be adequately informed.

## **AIM**

To evaluate the efficacy of dorsal on lay buccal mucosal graft urethroplasty in treating long anterior urethral strictures.



## **Materials and Methods**

It is a prospective study from August 2007 to May 2010. A total of 34 patients were enrolled in the study.

### **Inclusion Criteria:**

1. Strictures > 2.5cm in length
2. Patients requiring repeated internal urethrotomy or dilatations.

### **Exclusion Criteria:**

1. Periurethral phlegmon,
2. Multiple urethrocutaneous fistula,
3. Associated with chronic renal failure,
4. Scarred perineum.

The preoperative workup included careful general physical examination, palpation of the anterior urethra for any mass; glans penis

inspected for signs of urethral meatal stenosis or balanitis xerotica obliterans. The perineum was inspected and examined for the presence of fistulas or periurethral inflammation. Dental surgeon's opinion was obtained regarding the hygiene of the oral cavity and to rule out any buccal mucosal pathology.

The preoperative variables included in our study are age of the patients, duration and etiology of the stricture disease, preoperative uroflowmetry, history of previous urological intervention, stricture length as per preoperative retrograde urethrogram and intraoperative assessment.

Under nasotracheal intubation, two teams were operating simultaneously in the oral cavity and the perineum. Perineum was explored with midline perineal incision. Bulbar urethra was circumferentially mobilized after separating the bulbospongiosus muscle. Strictured urethra and approximately 1 cm of normal urethra was mobilized proximally and distally. In case of pan urethral stricture penis was invaginated and the urethra was separated from the corpus cavernosum up to the meatus. The urethra is rotated 180 and stricture was incised in the 12'0 clock position commencing at the distal end of the

stricture and proceeding proximally till you get a healthy urethra admitting 24-26 Fr. bougies without difficulty. At this point length of stricture and surrounding spongiofibrosis assessed. If the dense stricture portion is 1-2 cm with extensive spongiofibrosis proximally or distally, that portion is excised. The urethral ends were spatulated dorsally and the ventral ends were anastomosed with 4-0 vicryl, forming the floor strip, leaving a diamond shaped defect dorsally (41). The length of the stricture was measured.

In the same time the oral surgical team harvests the buccal mucosal graft. The parotid duct was identified and desired buccal mucosal graft was outlined and margins infiltrated with sub mucosal injection of 1:100,000 lignocaine in adrenaline. The graft was harvested minimizing fat in the undersurface while avoiding dissection into the muscle and going close to the gums. Donor site was left open. Depending on the length of stricture, buccal mucosal graft was harvested from one or both cheeks. The graft was defatted and fenestrated. The graft was secured to the cavemosa by interrupted vicryl sutures. Quilting sutures were placed through the graft into the underlying corporal surface along the length of the graft until the entire graft was secured.

The right mucosal margin of the opened urethra is sutured to the right side of the patch graft, splaying open the strictured tract to new roof, which is the spread & fixed the graft. The urethra is rotated back to its original position. The left side of the urethra is sutured to the left side of the patch graft and to the corporal bodies. Bulbospongiosus muscle is reapproximated. Corrugated drain kept. An indwelling 16 Fr. Foley catheter is left in place.

In cases with associated meatal stenosis it was addressed by dorsal on lay buccal mucosal graft with Blandy's type meatoplasty or ventral meatotomy.

The decision of which procedure to perform and length of the buccal mucosal graft needed was partially based on the length and appearance of the stricture on preoperative retrograde urethrography but predominantly on the intraoperative findings of stricture length as well as the appearance of the mucosa and spongy tissue.

Patient was started on oral fluid on 1<sup>st</sup> postoperative day and semisolid diet on day 2 and normal diet from third day. The patient underwent pericatheter study on 21<sup>st</sup> post operative day and catheter was

kept for one more week if it demonstrated leak. Patients asked to have a follow up visit at 3,6,12 months and yearly thereafter. They were evaluated with uroflowmetry and AUG.

Success was defined as patient not needing any form of urethral instrumentation. Satisfactory result was defined as patient who needed urethral manipulation once. Failure was defined as patient who needs regular urethral dilatation by urologist or revision of urethroplasty or self urethral dilatation.

# **REPRESENTATIVE PICTURES**

## Results and Discussion

The patients belonged to the age group of 20 to 60 years. Most of them were in the age group of 20 to 40 years (70%)

**TABLE NO 1**

**AGE GROUP**

<b>Age Group (years)</b>	<b>No. of Patients</b>
20-30	10
31-40	14
41 – 50	8
51 – 60	2

In two patients whose age was more than 50 years, were thoroughly evaluated for systemic diseases like diabetes mellitus, hypertension, cardiac or renal failure, intercurrent illness and benign prostatic hyperplasia.

Majority of the patients, the stricture was caused due to BXO. In 9 patients cause is not known. One patient had post inflammatory stricture.

**TABLE NO 2**

**ETIOLOGY OF STRICTURE**

<b>Etiology of Stricture</b>	<b>No. of Cases</b>
Balanitis xerotica obliterans	23
Idiopathic	9
Post inflammatory	1
Post instrumentation	1

Twelve patients have already undergone visual internal urethrotomy 1-4 times each. Two patients were not able to cope up with self-urethral dilatation program. One patient was undergoing urethral dilatation by the urologist. Eighteen patients have been circumcised. Initially in our study buccal mucosal graft urethroplasty was offered to patients who have failed in traditional form of urethral stricture management like internal urethrotomy and urethral dilatation. As our experience accumulated it was offered to long urethral stricture disease patients in the first instance. Six patients were on urinary diversion for a period of 3 months to 2 years. The patients have been suffering from stricture disease for a period of 1 month to 15 years.



Radiologically stricture was assessed with retrograde urethrogram. They were classified into medium length strictures (2-6 cm) and long segment strictures (>6 cms).

**TABLE NO 3**

**LENGTH OF THE STRICTURE AND METAL STATUS**

<b>Length of Stricture</b>	<b>No. of Patients</b>	<b>External urethral meatus</b>
2 – 6 cms	12	Normal
6 – 10 cms	21	7 meatal stenosis
> 10 cms	1	1 meatal stenosis

Since most of the stricture disease was due to balanitis xerotica obliterans the number of longer strictures was of high proportion. Preoperative stricture length was increased at least by 2 cm from the radiological length assessed by retrograde urethrogram. Eight patients due to balanitis xerotica obliterans were associated with meatal stenosis. The maximum length of stricture encountered was 12cms.

**TABLE NO 4**

**PREOPERATIVE UROFLOWMETRY**

<b>Classification</b>	<b>Peak flow rate</b>	<b>Average flow rate</b>	<b>Voided volume</b>	<b>Not able to void on SPC</b>
Medium length stricture	7.6 to 11.2 ml/sec	3.2 to 6.3 ml/sec	258 to 512 ml	Nil
Long Stricture	5.2ml to 6 ml/sec	2.4 to 3.2 ml/sec	130 to 180 ml	8 patients

The preoperative uroflowmetry was performed in patients who were able to void and not on suprapubic cystostomy.

**TABLE NO 5**

**OPERATIVE PROCEDURE**

<b>Classification</b>	<b>Procedure</b>	<b>No. of grafts used</b>	<b>No. of patients</b>
Medium length Stricture	Dorsal on lay graft Urethroplasty.	12	12
Long Stricture	Ventral meatotomy & Dorsal on lay graft Urethroplasty	2	2
	Blandy's meatoplasty & Dorsal on lay graft Urethroplasty	7	6
	Dorsal on lay graft Urethroplasty	14	14

The medium length strictures had uniform narrowing of the urethra for a fixed length in the bulbar urethra. The long strictures two buccal mucosal grafts of size 6-7 cm/1.5 cm each were harvested from both cheeks. In two patients BMG was first sutured to urethral edges and then fixed to cavernosa in the sides.

The meatus was addressed by dorsal on lay of buccal mucosa on the roof till the tip of the meatus alone in one patient. Blandy's type of urethroplasty and dorsal on lay buccal mucosal graft till the tip of the

meatus in seven patients. Ventral meatotomy and dorsal on lay buccal mucosal graft till the tip of the meatus was done in one patient.

The oral swelling and pain subsided on 3<sup>rd</sup> postoperative day so as to allow normal diet in patients. In three patients the swelling took five days to subside. None of them had parotid duct obstruction.

The pericatheter study was performed in all patients. In one patient with medium length bulbar urethral stricture who had 16Fr. Silicon Foley, Foley got extruded due to balloon failure.

**TABLE NO - 6**

**PERICATHETER STUDY**

<b>Classification</b>	<b>No. of Pericatheter studies</b>	<b>No. of no leaks &amp; Catheter removal on 21<sup>st</sup> POD</b>	<b>No. of leaks &amp; catheter removal on 28<sup>th</sup> POD</b>
Medium length strictures	12	11	1
Long strictures	22	18	4

The above table clearly shows that of four long length stricture patients and one medium length stricture patient had pericatheter leakage. All the five patients had no leak and had their catheter removed on the 28<sup>th</sup> postoperative day.

In the group of patients with long strictures 80%of them had no leak and had their catheter removed on 21<sup>st</sup> postoperative day, 20% of patients had leak and had their catheter removed on 28<sup>th</sup> post operative day. The high incidence of leak in pericatheter study in patients with long

strictures may be due to the extensive dissection or poor vascularity associated with pan urethral strictures.

Immediate uroflowmetry is done on first day of catheter removal. Peak flow rate was in the range of 19ml/ sec to 41ml/ sec with an average peak flow rate of 31.4ml/sec.

The follow up period ranged from 3 months to 33 months. One patient developed urethrocutaneous fistula that healed with prolonged catheter drainage. Two patients developed epididymo orchitis which was managed with good urethral nursing and antibiotics. One patient had transient terminal haematuria settled with conservative line of treatment. One patient had mild restriction in opening the mouth. Two patients had donor site numbness which settled on follow up.

The medium length stricture patients (2, 3, 4, and 6) had sustained good flow rate at 12 months of follow up with average peak flow rate of 19 ml/sec, average mean flow rate of 14ml/second. The patient who underwent substitution for pan urethral stricture had recurrent stricture at

3 months of follow up. Visual dilatation showed recurrent narrowing in the proximal bulbar region. He was advised self urethral dilatation and he is on regular follow up. Of the 6/21 long urethral strictures two had recurrence at sub meatal stenosis and they were advised self meatal dilatation and two others had bulbar urethral narrowing are having durable results with single visual dilatation of urethra.

One bulbar urethral narrowing patient underwent two time visual internal urethrotomy & he is on regular dilatation. One patient had leak in the pericatheter study. The follow up urethrogram of the patient showed evidence of graft loss. The patient underwent visual dilatation of the strictured segment and advised periodic urethral dilatation (once in a month). Patient reviewed after 2 months. He had recurrent stricture and perineal urethrostomy was done.

### Comparison of urethral stricture

<b>Variables</b>	<b>Anant kumar etal.<sup>7</sup></b>	<b>N.P.Gupta etal.<sup>36</sup></b>	<b>Ducket etal.<sup>15</sup></b>	<b>Our study</b>
No. of patients	25	12	2	34
Meatus and penobulbar stricture	4	8	2	33
Pan urethral stricture	21	4	0	1
Failure	3	1	9	7
Follow up period	3-52 months	10-16 months	6-84 months	3-33 months

Ananth Kumar et al., have used circum coronal incision for penile urethral strictures. In N.P. Gupta's group they have used Asopa's technique of ventral urethrotomy and dorsal on lay technique. Since substitution urethroplasty is prone for deterioration over a period of time longer follow up needed before coming to solid conclusions.



### Strictures

<b>Variables</b>	<b>Vito et al</b>	<b>Balbagli et al</b>	<b>Ducket et al.<sup>15</sup></b>	<b>Our study</b>
No. of cases	33	45 skin grafts	25	34
Success	21	11	21	27
Failure	6	12	1	7
Pericathetre leak	5	Not reported	Not reported	5
Follow up months	1-50 months	41-100 Months	10-17 Months	3 -33 Months

In the Bargali series they have used skin as a graft. Of the failed, 50% underwent perineal urethrostomy. In the vito group they have ventral on lay in 7 patients. They had recurrence in one of the patient.

## **Salient Features**

1. Long anterior urethral stricture predominantly occurs in the age group of 30 to 40 years.
2. Balanitis xerotica obliterans is the commonest cause of stricture we have encountered.
3. Meatal stenosis was present in 36% of the long anterior urethral stricture group.
4. Buccal mucosal donor site heals with minimum complications.
5. Leak in pericatheter study and age did not adversely affect the end result.
6. Restricture occurred in the sub meatal and proximal anastamotic site with the intervening graft healthy.
7. Of the 34 graft used one graft loss has occurred.
8. Medium length bulbar urethral strictures had 100% result at the end of 1 year of follow up

9. Urethro cutaneous fistulas requiring surgical correction has not occurred in our series even in pan urethral strictures.

10. Long urethral structure had a successful treatment in 15/22 patients (68%) satisfactory result in 4/22 patients (18%) and failure in patient who needed self urethral dilatation & perineal urethrostomy (13.6%)

## **CONCLUSION**

1. Buccal mucosal graft has good graft properties for graft survival with minimal donor site morbidity.
2. Dorsal onlay graft is the preferred form of graft placement.
3. Buccal mucosal graft is an ideal substitute for urethra in treating medium length bulbar urethral stricture.
4. Because of less failure rate 20% it can be offered as an alternative to staged urethroplasty in case of long urethral stricture.

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# **APPENDIX**

## CONSENT FORM

### சுய ஒப்புதல் படிவம்

ஆய்வு செய்யப்படும் தலைப்பு  
ரோல் ஆப் பி.எம்.ஜி யுரித்ரோபிலாஸ்டி இன் ஸ்ட்ரிச்சர் யூர்த்ரா

சிறுநீரக அறுவை சிகிச்சை பகுதி : அரசு பொது மருத்துவமனை,  
பங்கு பெறுபவரின் பெயர்  
பங்கு பெறுபவரின் எண்  
பங்கு பெறுபவர் இதனை (✓) குறிக்கவும்

மேலே குறிப்பிட்டுள்ள மருத்தவ ஆய்வின் விவரங்கள் எனக்கு விளக்கப்பட்டது. என்னுடைய சந்தேகங்களை கேட்கவும், அதற்கான தகுந்த விளக்கங்களை பெறவும் வாய்ப்பளிக்கப்பட்டுள்ளது என அறிந்து கொண்டேன். ( )

நான் இவ்வாய்வில் தன்னிச்சையாக தான் பங்கேற்கிறேன். எந்த காரணத்தினாலோ எந்த சட்ட சிக்கலுக்கும் உட்படாமல் நான் இவ்வாய்வில் இருந்து விலகி கொள்ளலாம் என்றும் அறிந்தும் கொண்டேன். ( )

இந்த ஆய்வு சம்பந்தமாகவோ, இதை சார்ந்த மேலும் ஆய்வு மேற்கொள்ளும் போதும் இந்த ஆய்வில் பங்குபெறும் மருத்துவர் என்னுடைய மருத்துவ அறிக்கைகளை பார்பதற்கு என் அனுமதி தேவையில்லை என அறிந்து கொள்கிறேன். ( )

இந்த ஆய்வின் மூலம் கிடைக்கும் தகவலையோ, முடிவையோ பயன்படுத்திக் கொள்ள மறுக்கமாட்டேன். ( )

இந்த ஆய்வில் பங்குகொள்ள ஒப்புக்கொள்கிறேன். எனக்கு கொடுக்கப்பட்ட அறிவுரைகளின்படி நடந்து கொள்வதுடன் இந்த ஆய்வை மேற்கொள்ளும் மருத்துவ அணிக்கு உண்மையுடன் இருப்பேன் என்றும் உறுதியளிக்கிறேன். என் உடல் நலம் பாதிக்கப்பட்டாலோ அல்லது எதிர்பாராத வழக்கத்திற்கு மாறான நோய்குறி தென்பட்டாலோ உடனே இதை மருத்துவ அணியிடம் தெரிவிப்பேன் என உறுதி அளிக்கிறேன். ( )

பங்கேற்பவரின் கையொப்பம் இடம் தேதி  
கட்டைவிரல் ரேகை

பங்கேற்பவரின் பெயர் மற்றும் விலாசம்

ஆய்வாளரின் கையொப்பம் இடம் ..... தேதி  
ஆய்வாளரின் பெயர்

**PROFORMA**  
**ROLE OF BUCCAL MUCOSAL GRAFT**  
**IN STRICTURE URETHRA**

Sl.No.

Name:

Age:

Address:

Ph No. :

Presenting complaints:

Duration of stricture:

Etiology:

H/O previous urethral instrumentation:

OIU

Self urethral dilatation

urethral dilatation (urologist)

AUG:

Uroflow:

Operative Notes:

Donor site complications:

Urethroplasty complication:

Intervention:

Uroflowmetry	Peak flow	Avg. flow	Voided vol.

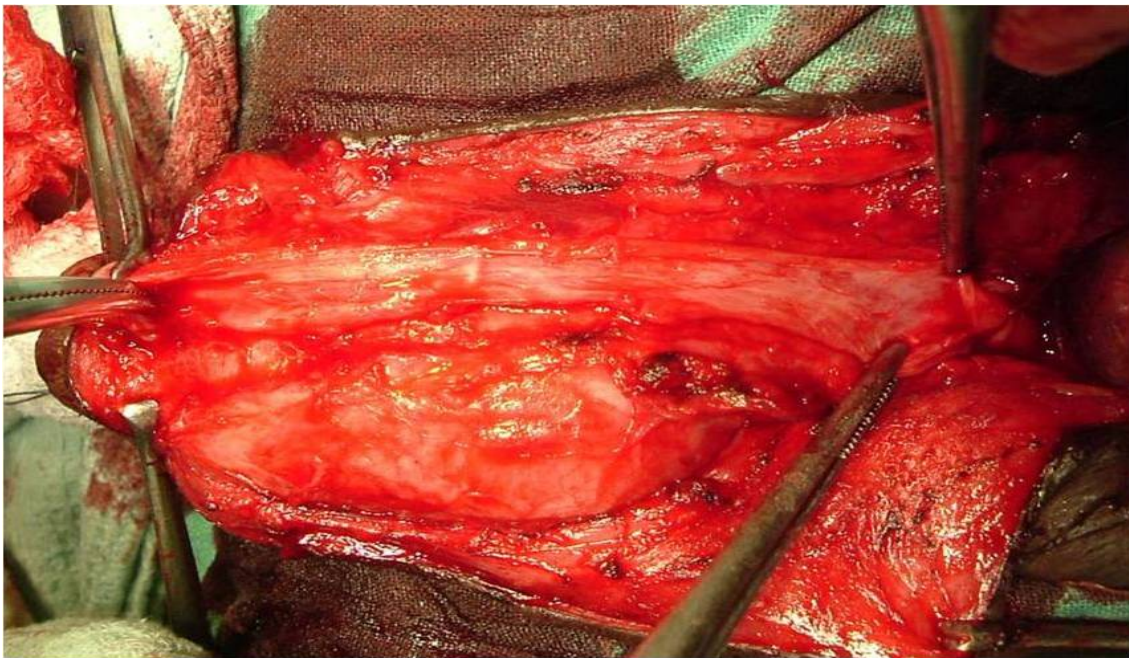
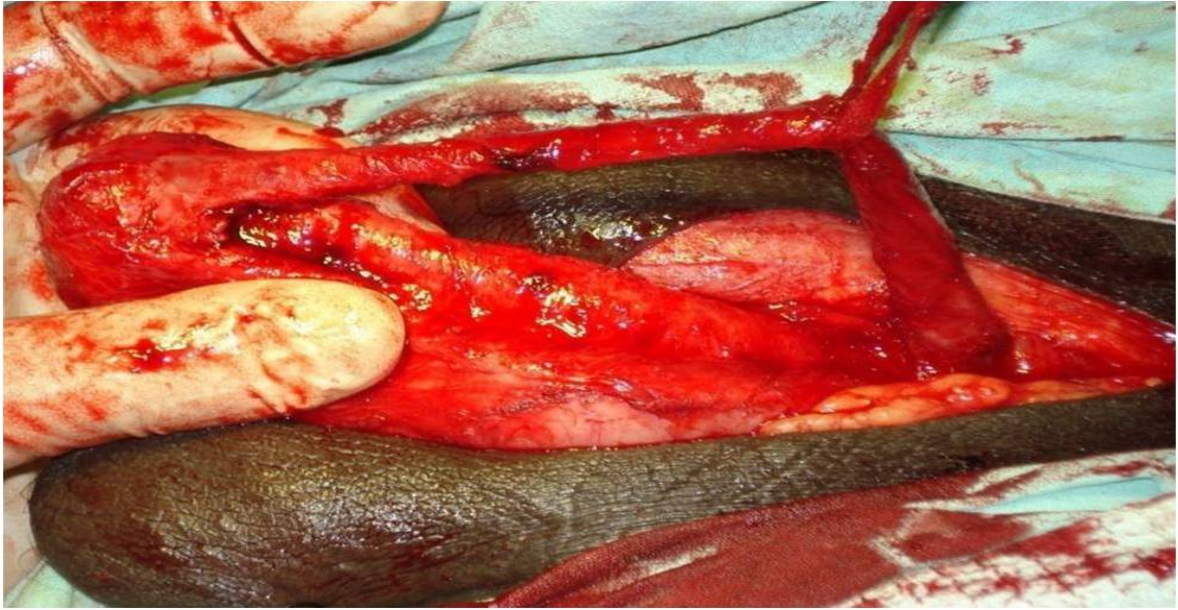
AUG:

# PRE-OPERATIVE AUG



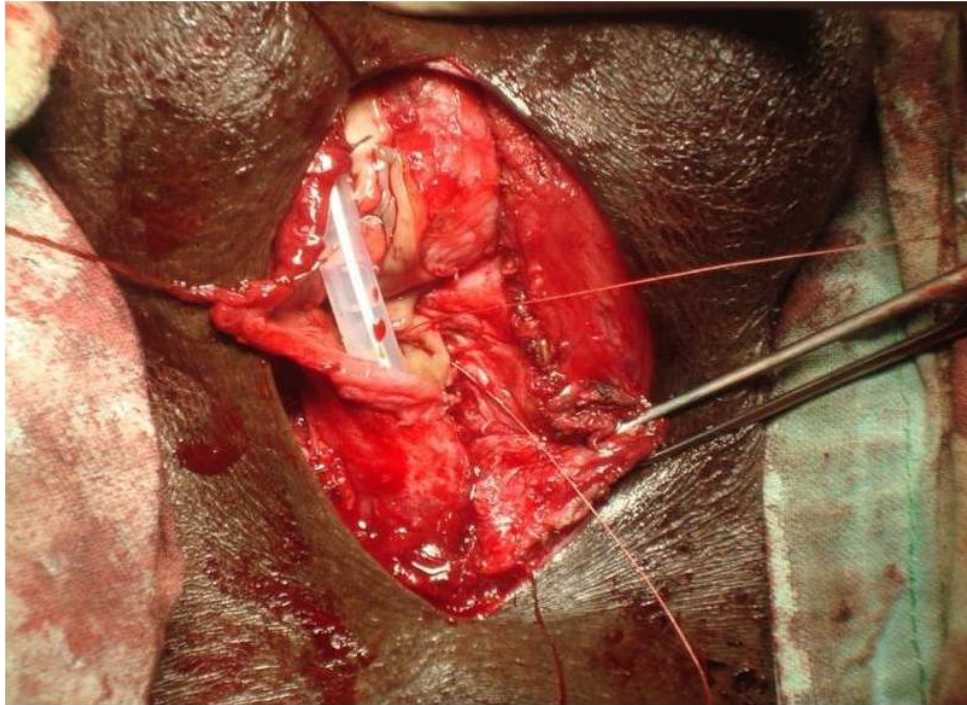


# OPERATIVE PICTURES

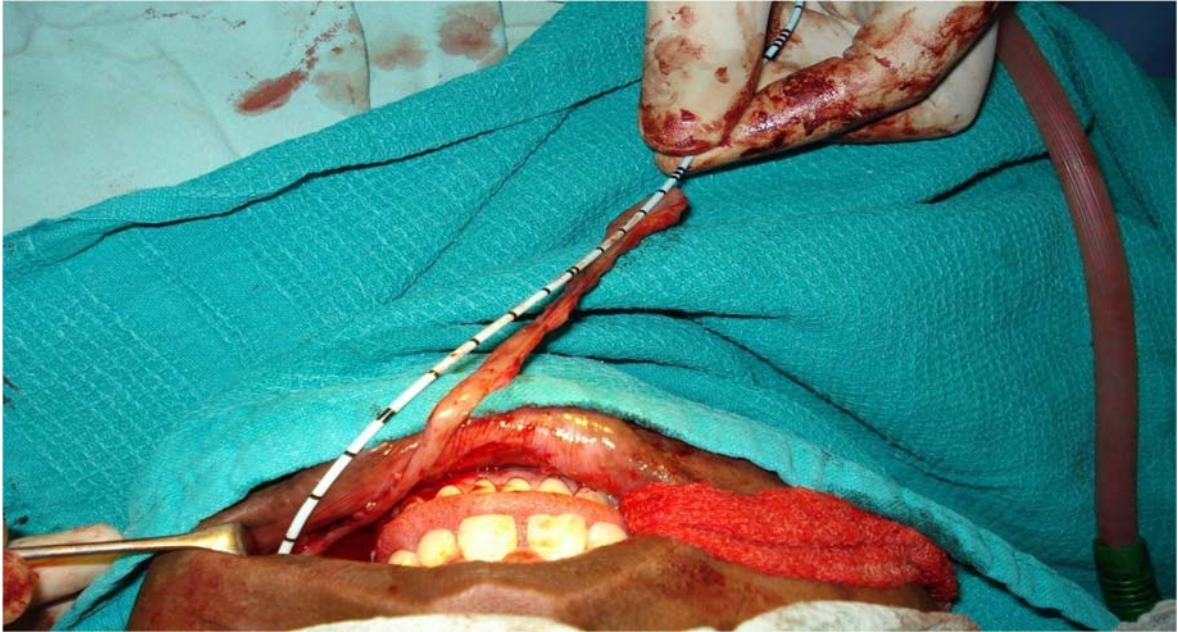




## OPERATIVE PICTURES

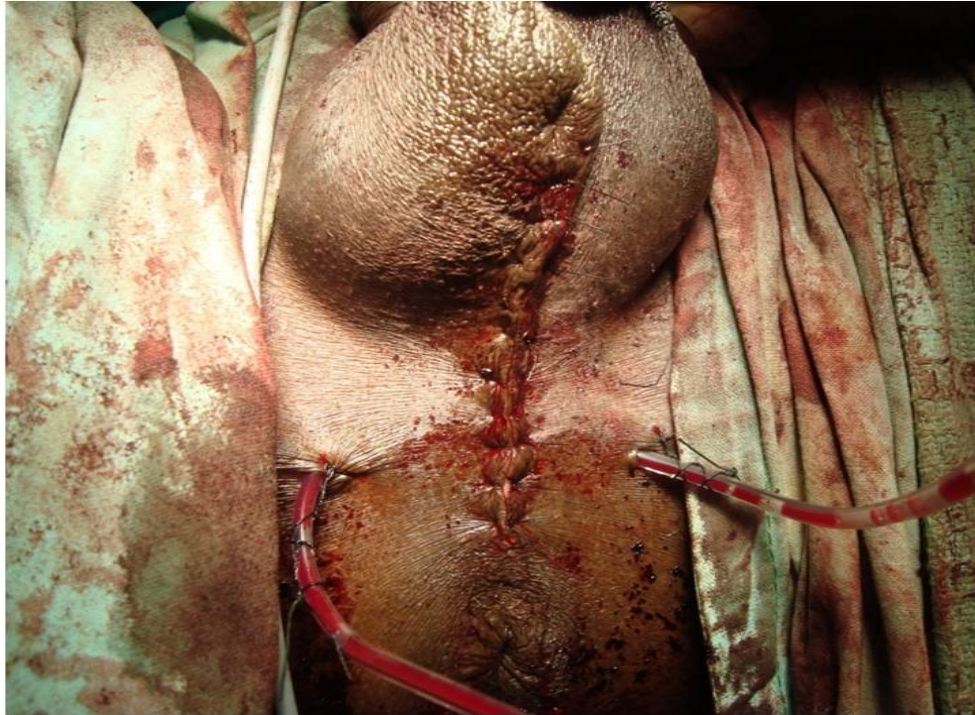


# BUCCAL MUCOSAL GRAFT





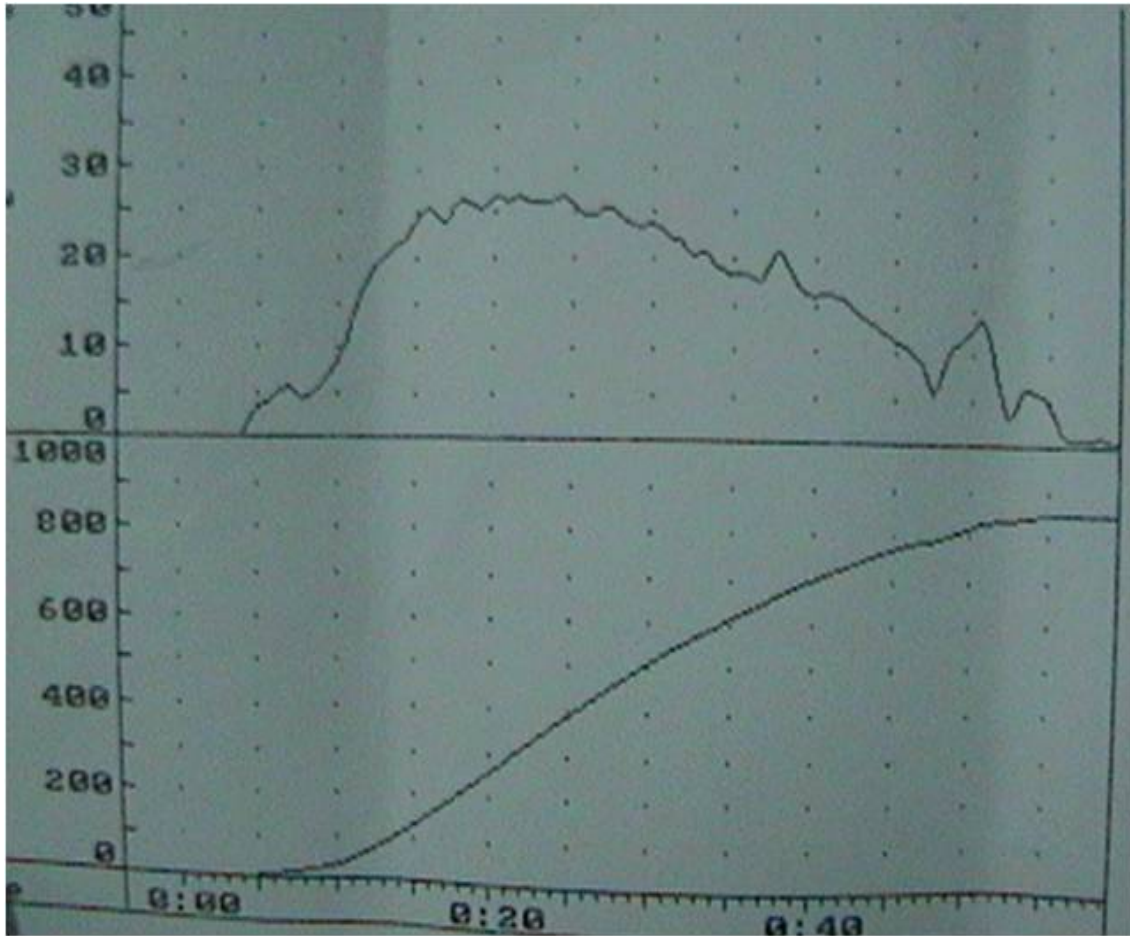
# WOUND CLOSURE



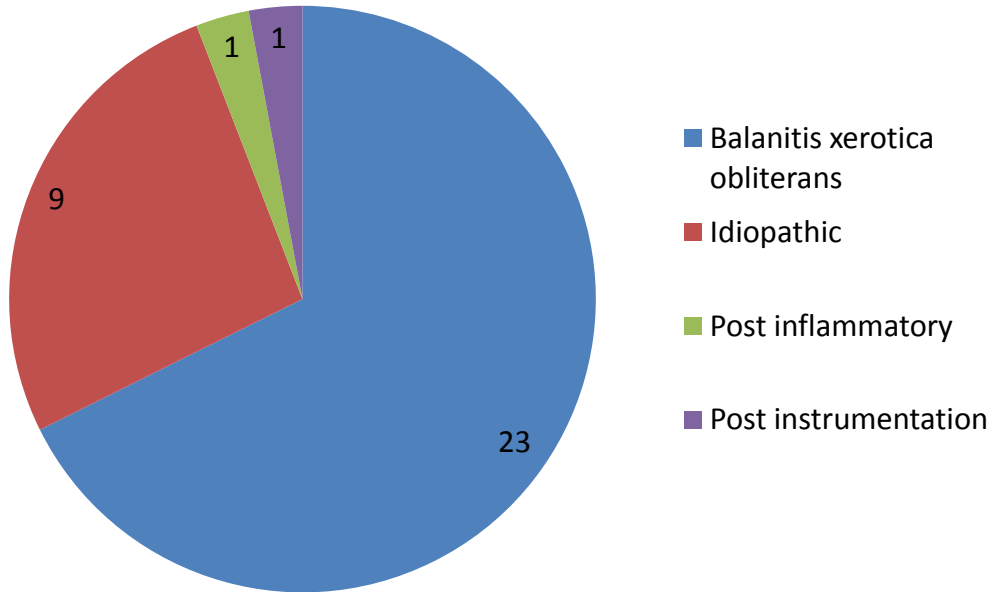
# POST OP AUG



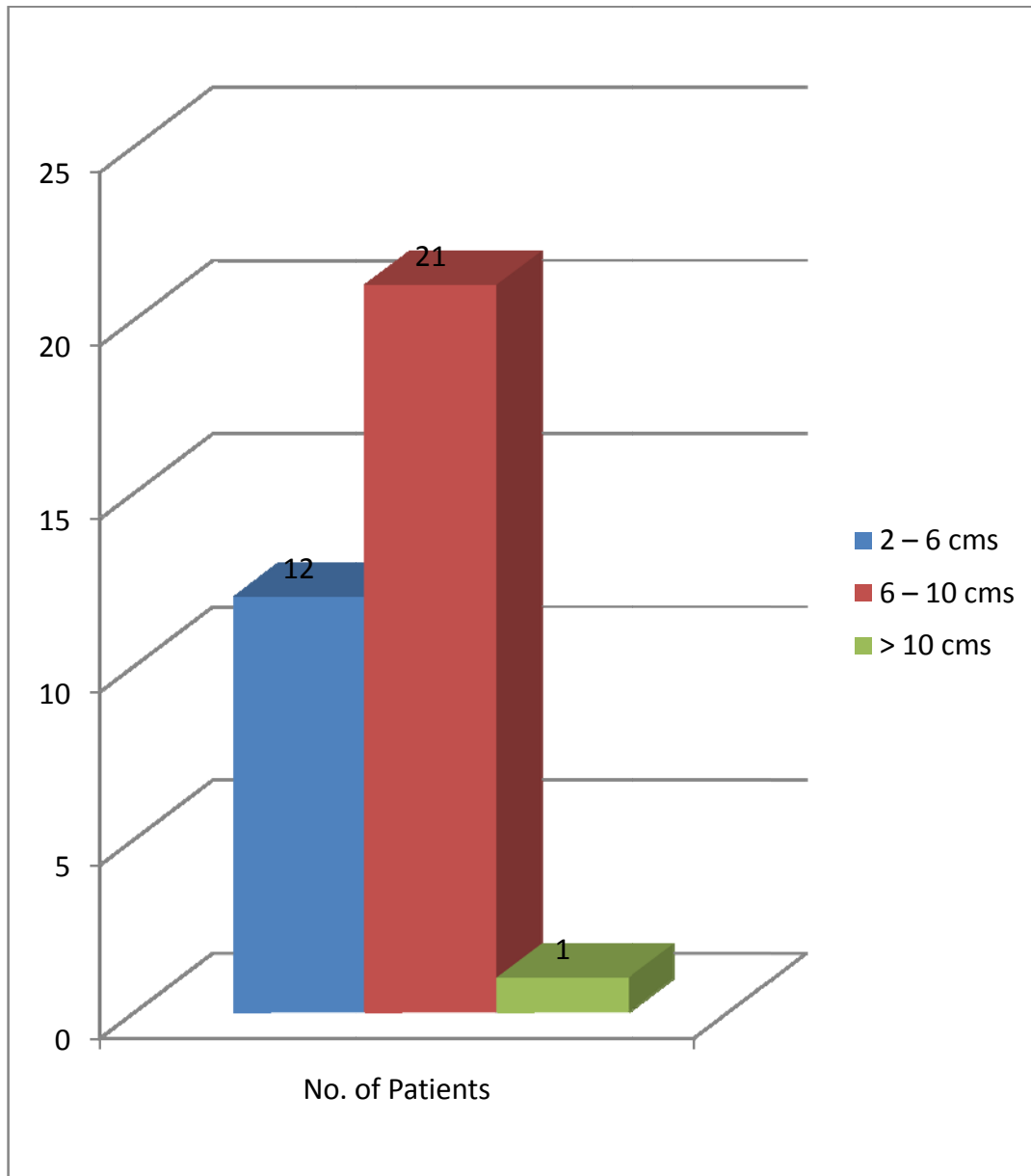
# POST OP UROFLOW



# ETIOLOGY

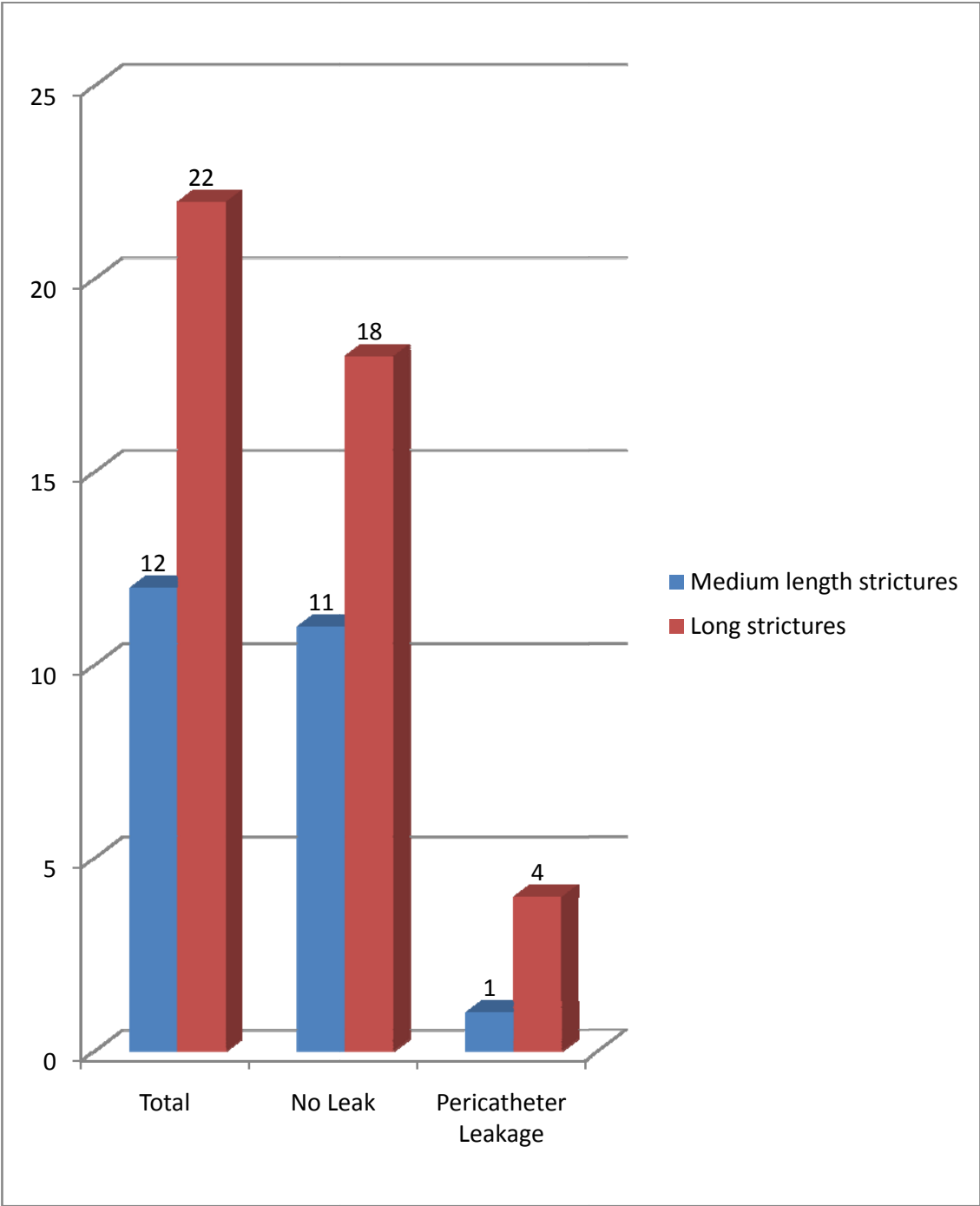


# STRICTURE LENGTH





# PERICATHETER STUDY





## MASTER CHART

Sl. No.	Name	Age	Length Cms	Cause	Pre-operative			Post-operative		
					Peak Flow ml/sec	Mean flow ml/sec	Voided volume ml	Peak Flow ml/sec	Mean flow ml/sec	Voided volume ml
1.	Muniyandi	43	3.5	BXO	7.8	6	260	22	18	350
2.	Joseph	23	7	Idiopathic	5	3	150	28	21	400
3.	Bharath	21	12	BXO with Meatal Stenosis	SPC			22	18	350
4.	Sarangapani	46	8	BXO	5.5	2	160	26	20	350
5.	Pandi	26	5	Idiopathi	10	6	300	32	19	400
6.	Ismail Basha	31	8	BXO with Meatal Stenosis	6	3	200	30	20	350
7.	Asaithambi	47	6.5	BXO	SPC			37	19	300
8.	Thirupathi	36	4.5	BXO	8	4	270	28	18	400
9.	Sudalai Madan	34	9.4	BXO	4	3	130	24	18	350
10.	Thangapandi	39	9	BXO with Meatal Stenosis	SPC			26	17	300
11.	Munusamy	31	8.8	BXO	9	6	350	28	19	350

12.	Ravichandran	35	4	Idiopathic	8	6	400	32	22	400
13.	Kanagaraj	44	9	BXO	4	3.2	160	34	18	400
14.	Subburaj	24	5.6	Idiopathic	11	5	300	22	18	400
15.	Sivaprakasam	51	7	BXO	5	3	200	20	16	350
16.	Kali Rathnam	44	6.5	BXO with Meatal Stenosis	SPC			22	16	300
17.	Prabhakaran	37	7	BXO	4	3	150	32	22	400
18.	Rajkumar	38	6	Idiopathic	6	3	200	28	20	300
19.	Sabapathi	28	9	BXO with Meatal Stenosis	SPC			29	23	300
20.	Vasudevan	33	8	Post inflammatory	4	2	170	28	20	400
21.	Tamilselvan	32	5	BXO	8	6	270	40	24	350
22.	Kuppusamy	36	9	Idiopathic	5	3	180	26	20	300
23.	Manoharan	27	4	Post Instrumentation	9	4	300	24	18	350
24.	Ravichandran	25	4.5	Idiopathic	8	5	300	20	16	350
25.	Shanmugam	42	8	BXO with Meatal Stenosis	5	2	150	18	14	300
26.	Murugan	29	9	BXO	6	3	180	28	20	400

27.	Sampath	31	4	Idiopathic	SPC			26	19	400
28.	Rathinaraj	53	8.4	BXO with Meatal Stenosis	5	3	190	20	18	400
29.	Chandran	21	5	BXO	6	4	270	24	20	400
30.	Venkatachalam	46	9.2	BXO	4	2	180	26	24	350
31.	Adhikesavan	36	4.8	Idiopathic	7	4	300	24	28	400
32.	Manojkumar	22	9	BXO	5	3	150	32	26	350
33.	Ramamurthy	39	9	BXO with Meatal Stenosis	SPC			20	16	300
34.	Marimuthu	45	7	BXO	4	2	220	20	14	350