

## An institutional experience on comparison of different Onlay approaches for urethroplasty using buccal mucosal graft

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### Abstract

Urethral stricture is a common disease encountered by urologist. Reconstruction of long and complex urethral strictures is technically demanding. BMG augmentation urethroplasty has become the standard of care for long urethral strictures. It is readily available and easily harvested with minimal donor site morbidity. Buccal mucosa is hairless, has a thin, elastin rich epithelium giving it excellent handling characteristics and a highly vascular lamina propria, which facilitates harvesting and imbibition. Whether to place the graft dorsally, ventrally or laterally is controversial. We conducted this Prospective study, between August 2009 and December 2011. We selected 25 cases of long anterior urethral strictures and were managed by onlay urethroplasty by different approaches. Follow up was done for 8- 20 months. 3 patients lost follow up after first visit. Post operative uroflowmetry was done in all patients after 1 month at the time of first follow up visit. Of 25 cases 21 (84%) were successful and 4 (16%) failed. In terms of success, not much significant difference was found between different approaches

**Key words:** Buccal mucosal graft, strictures, Onlay Procedures.

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### Introduction

Urethral stricture disease is a condition that affects 300 per 100,000 males and its surgical treatment is quite challenging[1]. Several approaches including direct visual internal urethrotomy (DVIU) and anastomotic or augmentation urethroplasties based on the use of flaps and graft have been reported[2]. Barbagli described the dorsal onlay free graft urethroplasty in 1996 and since then graft urethroplasty has gained worldwide application for the treatment of penile and bulbar urethra strictures[3,4].

Different grafts have been described including full thickness skin graft and mucosal graft: buccal mucosa graft (BMG) has found a wide use in the field of substitution urethroplasty offering the advantage of being hairless, accustomed to a wet environment and easy to harvest[5].

Modifications to this technique include dorsal onlay, dorso-lateral and ventral onlay graft urethroplasty; the choice between the different approaches should take into consideration the characteristics of the stricture and the preference of the surgeon performing the procedure[6,7].

The long-term success rate for augmentation anterior urethroplasty using free graft has been demonstrated to range between the 73% and 90% and the chances of recurrence are related to the stricture site, length and etiology[8-11].

BMG augmentation urethroplasty has become the standard of care for long urethral strictures. Whether to place the graft dorsally, ventrally or laterally is controversial. The ideal location for BMG onlay has been debated for quite some time. There is now adequate evidence that dorsal onlay has an edge over the ventral onlay technique, especially in the penile urethra[12,13].

Dorsal placement of graft has advantage of using corporal bodies to provide a secure well vascularized graft bed that helps to prevent

protrusion of the graft with resulting pseudo-diverticulum formation.

In addition, this spread BMG fixation preserves graft width and hence urethral calibre[14] On the other hand ventral location provides the advantage of ease of exposure and good vascular supply by avoiding circumferential rotation of urethra. Ventral urethrotomy allows the lumen to be clearly delineated, thus enabling the surgeon to identify mucosal edges, measure the size of the plate, carry out water tight anastomosis and if necessary, excise a portion of the stricture and perform dorsal re-anastomosis[15]

It is evident that there are various ways and techniques of performing bulbar urethroplasty, additionally the superiority of one over another could not yet been clearly defined. One dealing with reconstruction surgery of the urethral strictures must be very familiar with the use of various surgical techniques to manage any condition of the urethra that might emerge at the time of urethroplasty.

In this study, we have used different approaches of Onlay technique to repair the urethral strictures.

### Materials and methods

This Prospective study, was carried out between August 2009 and December 2011, at Dr D.Y. Patil Medical College, Hospital and Research centre, Pimpri, Pune and it was approved by the ethical committee and consent was taken from all the patients in a detailed consent form.

A total of 25 cases were included and since it is a prospective study comparing different surgical onlay techniques of BMG Urethroplasty, controls were not required.

Selection criteria for cases were, a) Adult male patients with long anterior urethral strictures which were not amenable to or suitable for dilatation, OIU or end to end anastomosis

b) Adult male patients with recurrent anterior urethral strictures.

Patients with following conditions were excluded from the study group.

a) Anterior urethral stricture which extended to membranous urethra and posterior urethral strictures b) Patients who had unhealthy or diseased buccal mucosa such as submucosal fibrosis, ulcers etc.

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A detailed history was taken including patient's age, complaints and duration, possible aetiology and previous treatments taken if any. A thorough physical, systemic and local examination including per rectal examination was done to reach a provisional diagnosis.

Preoperative workup was done including the following investigations, complete Haemogram, Blood grouping and Rh typing, BT, CT, blood urea, serum Creatinine, HIV, HBSAg, Urine routine and microscopy. ECG and Chest X ray if indicated were done.

Special investigations were also done in all the patients like, a) Ultrasonography of abdomen and pelvis to know the prevoid and postvoid urinary residue, b) Uroflowmetry to determine the urinary stream and also to know the level of obstruction, c) RGU and MCU to know the stricture characteristics like location, length and number, d) Urethroscopy intra operatively to visualize the stricture and to pass a small feeding tube across the stricture. Pre anaesthetic evaluation of the patient was done by the anaesthetist. The 4 patients who had come with retention of urine, an emergency trocar SPC was done in them. If patient's oral hygiene was poor, then he was advised to start povidone iodine mouth gurgles 7 to 10 days before surgery. Patients were prepared in the usual manner the previous night. One hour before surgery an antibiotic dose, a 3<sup>rd</sup> generation cephalosporin was given. The procedure was performed under spinal plus epidural regional anaesthesia.

#### Procedure

The buccal substitution urethroplasty was performed with a two team approach as one team harvested the buccal mucosal graft, the other team performed the perineal dissection.

Buccal graft harvest was begun with painting and draping the face and cheek in the usual sterile fashion. Two 3-O silk sutures were placed through the lip to provide traction. The graft was outlined 2.5 cm wide and as long as is required. Local anaesthetic infiltration of lidocaine with adrenaline was injected underneath the graft for good pre-emptive analgesia and intraoperative hemostasis. The graft was then incised and dissected off of the buccinator muscle, while avoiding Stensen's duct. The defect was closed with an absorbable suture. The graft was spread and defatted. It was kept in saline until the time of implantation.

Urethroscopy was done intraoperatively to visualize the stricture and the lumen of the stricture was intubated with either an 8 French feeding tube or with a 0.035 inch guide wire. The urethroplasty was performed in the high lithotomy position. Great care was taken to ensure the patient is properly padded and secured. Subsequently, the patient's perineum was prepped and draped in normal sterile fashion. A 14 Fr nelaton catheter was used to delineate the urethral contour, and to determine the exact location of the distal portion of the stricture. After urethral exposure, a No.15 blade scalpel was used to incise the urethra over a 8 French feeding tube or a 0.035 inch guide wire and the urethral stricture was opened completely. The stricture was incised until normal urethra was identified. Both proximal and distal urethral stumps were bougied to ensure they are wide open to 30 French.

The buccal mucosa was then sewn dorsally, laterally or ventrally onto the defect using a running 4-O polydioxanone suture, locking every third stitch for a watertight seal.

#### Technical details of different onlay procedures

A) Ventral onlay – This seems to be of advantage only if one contemplates the use of the spongioplasty maneuver. The spongioplasty procedure requires that the corpus spongiosum adjacent to the area of the stricture be relatively normal and free of fibrosis.

B) Lateral onlay – This allows one to expose the urethra while cutting through the corpus spongiosum, where it is relatively thinner, thus limiting bleeding and maximizing exposure. In addition, in the bulbous urethra, the graft can be sutured to the underlying muscle bed in the hope of improving graft host bed immobilization and approximation.

C) Dorsal onlay – The urethrostomy is through the stricture on the dorsal wall. In the area of the urethrostomy, a graft is then applied, spread fixed to the triangular ligament or corpora cavernosa, or both.

In turn, the edges of the stricturotomy are then sutured to the edges of the graft as well as to the adjacent structures

A 16 French silicone catheter was placed through the urethra and secured to the glans with a suture. The tunica of the spongiosum was closed over the graft for a well vascularized bed. The bulbospongiosus muscle was closed with a running 3-O polyglactin suture. A corrugated rubber drain was placed before closing the dartos fascia with a running 2-O polyglactin and the skin was closed with multiple vertical mattress stitches using 2-O nylon.

Postoperatively chlorhexidine mouthwash was used four times daily after meals. Diet was reinstated on the same evening with clear liquids, followed by full liquid, the next day and then resuming regular diet. The patients were on antibiotics, usually third generation cephalosporin until the Foley catheter was removed after two weeks.

#### Follow Up

During 1<sup>st</sup> follow up of the patient after one month, uroflowmetry was repeated to document the improvement in the urine stream and relief of obstruction. RGU was repeated at 3 months. Thereafter, follow up was done every 3 months for a year.

The clinical outcome was considered a failure, if a patient required any additional procedures including simple urethral dilation, within one year of the procedure.

The data was analyzed statistically by applying Chi-square test with Yate's correction.

#### Results

A total of 25 male patients with age ranging from 19- 65 yrs with anterior urethral (penile or bulbar) stricture longer than 2.5 cm underwent BMG urethroplasty between August 2009 and December 2011. The distribution of cases in different age groups is shown in table 1.

The etiologies of the strictures were trauma in 4(16%), infection in 2(8%), iatrogenic in 3(12%), BXO 5(20%) and idiopathic in 11(44%) patients( table 2).

The most common complaints were poor stream in 22 patients, frequency in 20 patients, straining in 18 patients and burning micturition in 4 patients. Four patients had come with retention and underwent emergency trocar SPC. The duration of symptoms ranged from 2- 12 months (table 3).

Uroflowmetry was performed in 21 patients excluding 4 patients who were on SPC. The maximum flow rate of urine (Q Max) ranged from 6- 15 ml/sec, demonstrating poor flow and obstruction. Prevoid and postvoid urine residue was determined in all patients except 4 patients who were on SPC. Postvoid residue ranged from 15- 200 ml. RGU and MCU was performed in all 25 patients. The site of stricture was penile in 5 pts, bulbar in 13 pts, penobulbar in 6 pts and pan anterior urethral in 1 pt. The stricture length ranged from 2.5- 10.5 cms, a mean length of 4 cms. The mean stricture length in ventral, dorsal and lateral onlay was 3.9, 4.4 and 4.3 cms respectively (table and graph 4).

All of the operations were done by the same surgical team. Out of 5(20%) pts with penile urethral strictures, 4 underwent dorsal onlay and 1 underwent lateral onlay. In 13(52%) bulbar urethral strictures, 3 underwent dorsal onlay, 4 underwent ventral onlay and 6 underwent lateral onlay. Among 6(24%) pts with penobulbar strictures, 4 pts underwent dorsal onlay and 2 pts underwent lateral onlay. One (4%) patient with pan anterior urethral stricture underwent dorsal onlay (Table 5). In 5(20%) patients buccal mucosa was harvested from inside of both the cheeks as the stricture length was more than 6 cms.

In the immediate postoperative period, 8(32%) patients had minor complications. These included discharge of pus and urine leak in 3 pts and 1 pt respectively, from the perineal wound (16%). The pus was sent for culture and sensitivity and appropriate antibiotics were started and wound healed well in all 3 pts. In patient with urine leak, the per urethral catheter was left in situ for a month, after which urine leak subsided. In all other patients, catheter was removed after 2 weeks. 3 patients experienced pain and one patient had swelling at the donor site (16%). In all these patients the pain subsided after a day and the swelling resolved after a week without any intervention (table 6).

Of 25 cases 21 (84%) were successful and 4 (16%) failed. The 4 ventral grafts provided success in 3 cases (75%) and failure in 1 (25%). The 12 dorsal grafts provided success in 10 cases (83.33) and failure in 2 (16.67%). The 9 lateral grafts provided success in 8 cases (88.89%) and failure in 1 (11.11%). No surgical complications were observed. Failures involved the anastomotic site narrowing in all the 4

cases requiring OIU with dilatation in 1 case and simple urethral dilatation in other 3 cases (Table 7).

In terms of success rate between dorsal (83.33%) and lateral (89.89%) onlay techniques, statistically there was no significant difference. The  $P = > 0.5$  with degree of freedom 1, when Chi-square test was applied with Yate's correction.



Fig 1:Related images

Table 1: Age distribution of cases

| Age group | No. of Patients | Incidence |
|-----------|-----------------|-----------|
| 21-30     | 5               | 20%       |
| 31-40     | 5               | 20%       |
| 41-50     | 3               | 12%       |
| 51-60     | 8               | 32%       |
| 61-70     | 4               | 16%       |

Table 2- Distribution of etiology

| Etiology   | No. of cases | Incidence |
|------------|--------------|-----------|
| Infection  | 2            | 8%        |
| Iatrogenic | 3            | 12%       |
| Trauma     | 4            | 16%       |
| BXO        | 5            | 20%       |
| Idiopathic | 11           | 44%       |

Table 3 – Symptomatology

| Complaints          | No. of patients | Incidence |
|---------------------|-----------------|-----------|
| Poor stream         | 22              | 88%       |
| Frequency           | 20              | 80%       |
| Straining           | 18              | 72%       |
| Burning micturition | 4               | 16%       |
| Retention           | 4               | 16%       |

**Table 4-Distribution of site stricture.**

| Site of stricture     | NO. of cases | Incidence |
|-----------------------|--------------|-----------|
| Penile                | 5            | 20%       |
| Bulbar                | 13           | 52%       |
| Penobulbar            | 6            | 24%       |
| Pan anterior urethral | 1            | 4%        |

**Table 5- Distribution of different onlay techniques.**

| Technique | No. Of cases | Percentage |
|-----------|--------------|------------|
| Ventral   | 4            | 16%        |
| Dorsal    | 12           | 48%        |
| Lateral   | 9            | 36%        |

**Table 6- Donor site morbidity.**

| Donor site morbidity | No. of cases       | Incidence |
|----------------------|--------------------|-----------|
| Immediate            | 4(3pain,1swelling) | 16%       |
| Delayed              | 2(cyst)            | 8%        |

**Table 7- Failures in different Onlay techniques.**

| Technique | No of patients | Failure |
|-----------|----------------|---------|
| Dorsal    | 12             | 2       |
| Lateral   | 9              | 1       |
| Ventral   | 4              | 1       |

## Discussion

Treatment of urethral stricture disease includes numerous reconstructive surgical techniques. The urologist must be familiar with all of these different techniques to be able to deal with any type of urethral stricture. The choice of reconstructive technique depends on the stricture length, degree of spongiofibrosis, and surgeon's preference and experience.

Over the years, the use of free graft materials like pre auricular skin, bladder mucosa, small intestinal mucosa and penile skin has seen a decreasing trend partly because of the complications associated with them, both at donor site and at the recipient site and partly because of the technical difficulty in harvesting such grafts.

Buccal mucosa graft (BMG) was first described for urethral reconstruction by Humby in 1941[16]. It has become an ideal urethral substitute because of ease of harvest, surgical handling characteristics, hairlessness, compatibility in a wet environment, and its early ingrowth and graft survival. Because of these unique characteristics, buccal mucosa has endeared itself to the realm of reconstructive urology. Standard bulbar urethroplasties using buccal grafts should have a lifetime success rate approaching 92% [17,18].

In our study, we found that buccal mucosa was safe to use in long anterior urethral strictures. It was very efficient in terms of less graft shrinkage or contracture as it is a full thickness graft. It is very versatile tissue because of thick epithelium of thin dermis with a dense subdermal vascular plexus, which facilitated the early imbibition of nutrients from the would bed as well as early inosulation that allowed early ingrowth of blood vessels. There was least donor site morbidity with few minor complications which subsided without any interventions. Only few limitations to its use were diseased buccal cavity as in cases of submucosal fibrosis and ulcers and in cases were adequate urethral plate was absent.

Coming to the onlay technique of urethroplasty, there is still controversy as to which technique is superior. Various onlay techniques have been advocated by different researchers which includes ventral, dorsal and lateral onlay. In our study we have included 25 patients, 4 of them underwent ventral onlay, 12 underwent dorsal onlay and 9 cases underwent lateral onlay. Only 4 cases were suitable for ventral onlay as they had lesser degree of spongiofibrosis, rest of the cases were divided into dorsal and lateral onlay group.

Dubey et al. 2003, in their study have shown a success rate of 87.5% to 100% for dorsal onlay BMG urethroplasty with a follow up ranging from 22 to 44 months. They compared these results with various studies on ventral onlay BMG urethroplasty whose success rate was in the range of 57% to 100% with their follow up ranging from 20 to 60 months. They concluded that dorsal onlay technique is more efficient[19]. In our study, the success rate of dorsal onlay urethroplasty was 83.33% and ventral onlay was 75%. Followup ranged from 8 – 20 months. The only advantage of ventral onlay was easy dissection but this has to be weighted against the relatively higher complication rates in terms of sacculations and fistula formation at the graft site, especially in cases of dense spongiofibrosis due to compromised blood supply. In our series, the immediate post operative morbidity was minimal in both dorsal and ventral group. Failures were One out of 4 and 2 out of 12 cases in ventral and dorsal group respectively. Probably, because of relatively small sample size in ventral group, comparison between the two group was of less significance.

Barbagli et al. 2005, published a retrospective study of 50 cases with bulbar urethral strictures where buccal mucosal graft urethroplasty was done. In their study, grafts were placed as ventral, dorsal and lateral onlay in 17, 27 and 6 patients respectively. After a mean follow up of 42 months, placement of graft into ventral, dorsal and lateral surface of bulbar urethra showed similar success rates, 83% in both ventral and lateral group and 85% in dorsal group, without any significant difference in the out come[20]. In our study dorsal and lateral onlay proved to be having better success rate with 83.67% and 88.11% respectively. The advantage we found with these techniques is that the corpus spongiosum is relatively thin dorsally and laterally, minimizing bleeding after urethotomy. Lateral onlay has an added advantage, in that the urethra need not be mobilized completely which makes it more easier to perform and also maintains an intact blood supply to that part of the urethral segment.

A graft such as oral mucosa carries no blood supply of its own. Its survival depends on the absorption of nutrients from a well vascularized recipient bed (imbibition phase) and later, on the ingrowth of capillaries from the recipient bed to the graft (inosulation phase). Early failure of a free graft can result from inadequacy of either phase and frequently reflects a poorly-vascularized recipient bed, infection, or hematoma. Late recurrence may owe to progression of the original disease.

On the basis of medium term results our study found that, buccal mucosa is an ideal graft for substitution urethroplasty in all long anterior urethral strictures including cases with BXO and very efficient in terms of less graft shrinkage or contracture as it is a full thickness graft. Both dorsal and lateral onlay are comparable in terms of the success rate of the procedure. The ventral onlay procedure cannot be commented upon in terms of success rates because of the relatively small sample size. Short term and medium term results were encouraging in our study. In our study, the immediate post operative morbidity was minimal in all the three onlay techniques. Failures were One out of 4, 1 out of 9 and 2 out of 12 cases in ventral, lateral and dorsal groups respectively. In our study dorsal and lateral onlay proved to be having better success rate with 83.67% and 88.11% respectively compared to ventral group in which success rate was 75%. Probably, because of relatively small sample size in ventral group, comparison with the other two groups was of less significance.

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