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DORSAL FREE BUCCAL MUCOSAL GRAFT URETHROPLASTY FOR RECURRENT ANTERIOR URETHRAL STRICTURES VIA VENTRAL SAGITTAL URETHROTOMY APPROACH

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ABSTRACT: AIM: To evaluate the results and complications of single stage dorsal free buccal mucosal graft urethroplasty using ventral sagittal urethrotomy approach.

KEYWORDS: Buccal mucosal graft, ventral sagittal urethrotomy, anterior urethral stricture, retrograde urethrogram, cystoscopy.

INTRODUCTION: Urethral stricture disease is a common condition with changing etiology and changing practices in management.⁽¹⁾ Management options were grossly determined by cause, site, and length of stricture and also by other factors like prior attempts at repair and local genital skin condition. Treatment options vary from blind dilatations to perineal urethrostomy, with a wide range of treatments in-between like visual internal urethrotomy, urethroplasty using genital skin flaps or grafts, extra genital skin grafts used as either as patches or tubes.^(2,3,4) Graft materials can be skin, buccal mucosa, bladder mucosa or colonic mucosa. Blind dilatations were no longer practiced and perineal urethrostomy is rarely done in the present day urological practice, only as a salvage procedure. Visual internal urethrotomy is the first line of management for most strictures, but recurrence is as high as 40% (Oosterlinck W). Self-dilatation may prolong the time to recurrence but cannot completely prevent recurrence. Skin grafts and flaps were used since a long time with satisfactory initial results but long term results were poor. Ventral application of grafts and flaps have been shown to produce complications like sacculations with its attendant problems like sequestration of urine and semen causing post void dribbling and difficulty in ejaculation.⁽⁵⁾ To overcome these problems, in 1996 Barbagli has proposed the dorsal application of grafts, which offers a more secure bed with improved chances of neovascularisation and decreased chance of sacculation problems.

Over the past 10-15 years buccal mucosal grafts have been increasingly used in urethral reconstruction because of its advantages in harvesting, graft characteristics and minimal morbidity of donor site.⁽⁶⁾ Humby credited with being the first person to use buccal grafts for urethroplasty. Though buccal grafts were used initially as ventral grafts, now a day they are used dorsally by Barbagli technique.⁽⁷⁾ Buccal mucosa has the advantage of being thin with thicker epithelium and thinner sub mucosa which has rich vascular plexus. It is easily available, easy to harvest and easy to handle during application at recipient site. It is resistant to infections and skin diseases like balanitis xerotica obliterans. Buccal mucosa easily adjusts to the moist environment in the urethra. Buccal mucosa grafts have been used for reconstruction of eye lid, vagina and urethra in hypospadias cripples.

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Barbagli technique involves complete mobilization of the urethra all around the site of stricture.⁽⁸⁾ In long segment strictures, ischemic strictures and strictures associated with prior history of multiple failed procedures complete mobilization of the urethral segment may compromise the vascularity. To overcome this problem in 2001 Asopa Hari S proposed the ventral urethrotomy approach with dorsal application of the grafts.⁽⁹⁾ The technique involves laying open the stricture ventrally and then incising the urethra dorsally without mobilizing it to expose tunica albuginea for the application of free skin or buccal mucosal graft followed by retubularization of urethra in one stage.

MATERIALS AND METHODS: 29 patients were treated by this surgical technique for recurrent anterior urethral strictures, either bulbar or penile or combined or complete, over a period of 28 months, from Dec 2002 to April 2005. The age ranged between 23 to 63 years. The length of the strictures ranged between 2 to 17 cms. One third of the strictures are inflammatory and another one third had clinical evidence of BXO changes.

INCLUSION CRITERIA: Long segment inflammatory strictures i.e. > 2 cm in bulbar urethra and > 1 cm in pendulous urethra, Ischemic strictures, Recurrent anterior urethral stricture following previous visual internal urethrotomy or urethroplasty.

All the patients were evaluated with complete blood picture, complete urine examination, urine C/S, Blood sugar estimation, Renal function tests, Uroflowmetry, Ultrasound evaluation of upper tracts & Bladder and Retrograde urethrogram. All these patients received at least three days of culture sensitive antibiotics before surgery and continued in post-operative period.

General anesthesia with nasotracheal intubation with or without epidural catheter placement for intra and post-operative analgesia. Patient was put in lithotomy position. Buccal mucosal graft was harvested either unilaterally or bilaterally based on the length of the stricture.

Urethra exposed through a midline perineal incision. In complete anterior urethral strictures the penis is degloved and brought in to the perineal incision. Urethra is exposed at the site of stricture without much lateral dissection and ventral urethrotomy was made. Dorsal urethrotomy is made at the site of stricture extending for about 1-1.5 cm on either ends in to the normal urethra. Mucosal edges were sutured to the tunica albuginea intermittently using 5 0 vicryl or monocryl sutures. The buccal graft is placed in the gap with mucosa facing into the urethral lumen and quilted in position using 5 0 vicryl sutures. A 16F silicone Foley catheter is placed and ventral urethrotomy is closed either intermittently or continuously using vicryl sutures. Throughout the procedure wound is irrigated with antibiotic solution (Amikacin or Gentamicin). Wound is closed after keeping suction drains. Intra venous antibiotics are given for at least 3 days and later converted to oral antibiotics. Drains were removed between 3rd to 5th post-operative days. Pericatheter RGU was done at the end of 3 weeks and catheter is removed, provided there is no contrast leak. In case of any pericatheter leak, catheter removal is postponed for another one to two weeks based on the amount of leak.

FOLLOW UP: After catheter removal patients are followed up at 3 monthly intervals for one year, at 6 monthly intervals during second year and then yearly. Patients are followed with history and uroflowmetry at every visit. Cystoscopy is done at the end of 3 months in all the cases. Retrograde urethrogram is done when patients present with symptoms suggestive of restructure and cystoscopy was done if necessary.

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RESULTS: Five patients developed urethrocutaneous fistulae (17.2%). Four of these patients had post-operative wound infection (13.7%). Of the four, two patients had positive urine culture preoperatively. All infections resulted in urethrocutaneous fistulae. Fistulae involved all the sites i.e. coronal, penile, and perineal with one each and two at penoscrotal junction. All fistulae healed spontaneously but in two cases resulted in resticture. Overall, resticture occurred in 6 patients (20.6%). In 2 cases buccal graft is lost completely. One patient required VIU and VIU followed by periodic visual dilatation in the other patient. Of the other four, two had proximal site narrowing and two had distal site narrowing. Two of the four patients settled with single dilatation. Other two required more than one dilatation and one patient was on self-dilatation. One patient in whom post auricular skin is used along with buccal graft had complete loss of skin graft with neomeatal stenosis, but buccal graft was totally intact and it was not considered as a failure. Blood transfusion was required in one case (3.4%). All patients had pain and cheek swelling lasting for 2-4 days. All patients could tolerate semi solid diet by the end of third post-operative diet. Most patients complained inability to open the mouth completely for 1-2 weeks. No patient complained of numbness, paresthesia or decreased salivation. Mouth opening was normal in all the patients at the time of first follow up i.e. at the end of 3 months.

DISCUSSION: Resection with end to end anastomotic urethroplasty is the gold standard treatment for any stricture of less than 2 cm in bulbar urethra and less than 1 cm in penile urethra, with a high success rate of 95% (Barbagli et al, 1997).⁽⁵⁾ Substitution urethroplasty is required when end to end anastomosis cannot be achieved satisfactorily or when traction on anastomosis and chordee is a possibility. Various materials have been used such as preputial/ penile skin, extra genital skin, buccal mucosa, bladder mucosa, colonic mucosa etc, each with their own advantages and disadvantages. Penile and preputial skin has been used as either grafts or flaps. The substitution urethroplasty can be done as a single stage or two stage procedure. Free full thickness skin grafts have been a main stay of one stage urethral reconstruction for stricture since Devine et al first described their technique in 1963.⁽⁴⁾ Genital skin i.e. preputial or distal penile, is preferred to extra genital skin because it is relatively thin and close to the native tissue.

In conditions where genital skin is not available, like previous circumcision or where it is not suitable for use like scarred tissue from previous multiple surgeries and skin conditions like balanitis xerotica obliterans, an extra genital skin has been used. Various sites have been used for extra genital skin harvestation such as skin over the iliac crest, groin, neck, inner aspect of upper arm and post auricular skin. Disadvantage of extra genital skin is that it is thicker than the genital skin. Extra genital skin has been shown to be unsatisfactory by Webster and Robertson. The practice of one stage urethroplasty has generally developed from the patch procedures described by Turner- Warwick, Blandy, Quarty, Yaxley RP and Mundy AR (1998).^(2,3,10,11)

Although free grafts are used by some, most urologists seem to prefer flaps because of their more predictable survival (Jordan GH). One stage stricturotomy and patch urethroplasty using genital skin flaps has shown a resticture rate of 11% at one year and 19% at five years, rising to 40% at ten years (Mundy AR, 1995). Tube reconstructions were shown to fare less well than patch reconstructions (Mundy AR, 1995). Success rate of free graft urethroplasty for urethral stricture varies from 50-95% (El-kusaby et al; Montfort et al; Devine et al, 1968; Berger et al; Brannan et al; Devine et al, 1976; Webster, 1984).⁽¹²⁾ Roehrborn and McConnell found a history of instrumentation

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and urinary infection to predict a worse outcome after urethroplasty. Ischemic strictures due to instrumentation or prolonged catheterization has shown less satisfactory results inspite the use of pedicled flaps, due to more extensive spongiofibrosis which could compromise the graft bed (Mundy, 1993).⁽¹¹⁾ Hunter Wessells and Jack W Mc Aninch have shown that graft length, graft bed location and patient age differed significantly between the success and failure groups. Free graft placement on the bulbar urethra has shown 93% success rate when compared to 40% on penile urethra. Success rate between the long and short grafts were shown to be statistically significant.

More distal strictures in the pendulous urethra beyond the termination of the bulbo cavernosus muscle can be reconstructed with free grafts, with prior series reporting excellent results (Brannan et al). However more recent procedures argue for flap procedures (Mundy, 1993; Jordan, 1993; Webster et al, 1995). Patient age may be a significant factor due to inferior vascular supply or coexisting disease, both of which compromise quality of graft bed. Bladder mucosa has the obvious disadvantage of requiring laparotomy to obtain it and it can be difficult to handle the mucosa. Mucosal prolapse at the meatus is a unique problem with the bladder mucosa (Montfort et al, 1992; Ozgok et al). BXO, genital lichen sclerosus et atrophicus, is the most common cause of meatal stenosis and is commonly found when circumcision is done beyond the neonatal period (Rickwood et al, 1980; Ledwig and Weigland, 1989; Meuli et al, 1994). Mundy felt that as BXO is a disease of genital skin, a better tissue for reconstruction is the buccal mucosa.

Humby is credited with being the first person to use buccal mucosal free grafts for urethroplasty (Filipas et al; Humby G). It was Burger et al from Mainz who were responsible for generating recent interest in the use of buccal mucosal free grafts, initially for hypospadias repair and subsequently for treatment of urethral strictures. Between 1992 and 1999 there has been 26 reports showing an overall success rate of 87-96% with 18-36 months of follow up. The advantage of buccal mucosa is that it is easily available, easy to harvest and handle, resistant to infections and skin diseases like balanitis xerotica obliterans and donor site can be closed primarily with little or no long term morbidity. And rich and Mundy (2001) proved advantages of buccal mucosa in terms of graft survival and cure rate of bulbar urethral stricture.⁽¹³⁾ But Dublin et al had shown that buccal graft harvestation can result in long term complications like oral numbness (16%) and tightness of mouth (32%).⁽¹⁴⁾ They concluded that buccal mucosa harvestation is a good operation, but it is not without long term complications and patients should be adequately informed.

Using a 5-point analog pain score Wood et al have shown that, the mean pain score for patients with donor site closure was 3.68 and was significantly higher than that for patients without donor site closure (2.26, $p < 0.01$). In an experimental study in dogs, El-Sherbiny et al showed that buccal mucosa grafts were associated with the lowest stricture rate of 12%, followed by 37% for bladder mucosa and 62% for skin ($p < 0.2$). In their study graft shrinkage was less than 10% for buccal mucosa compared with 20% to 40% for skin and bladder mucosa. Shrinkage rate was similar for the onlay and tube techniques. Though the shrinkage rate is similar, Andrich and Mundy in 2001 showed a restructure rate of 11% for patch grafts and 45% for tube grafts. They concluded that 2-stage is more reliable than 1-stage approach for circumferential reconstruction of the urethra. In 2002, Palminteri et al presented their experience with 2-stage buccal mucosal graft urethroplasty for complex bulbar urethral strictures with a success rate of 92.8%. But in 2003, Barbagli et al showed that complete removal and replacement of the urethral mucosa using a circumferential buccal mucosa graft promotes successful one-stage urethral reconstruction.⁽¹⁵⁾ Dubey et al stated that buccal

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mucosa graft appears to be the most versatile urethral substitute, as it can be successfully used for both one- and two-stage reconstruction of the entire anterior urethra.⁽¹⁶⁾ Now a day's buccal mucosa has become the preferred material for complex hypospadias repairs (Baskins et al, Iselin CE et al) and also bulbar urethral stricture (Meneghini et al).

Either the free grafts or flaps can be used ventrally or dorsally. Initially flaps and grafts were used as ventral onlay, with unique post-operative problems like sacculation with sequestration of urine and semen resulting in post void dribbling and difficulty in ejaculation (Pressman and Greenfield; Barbagli et al, 1996). In 1996 Barbagli published the results of dorsal augmentation, where in urethra is completely mobilized at the site of stricture and rotated 180 degrees and stricturotomy done dorsally.⁽⁵⁾ Graft is fixed to the corporal bed using quilting sutures and urethra is sutured to the graft edges. **Not only the technique of graft procurement but also placing the graft is crucial, as the blood supply of the recipient area and the graft support are both vital in take up and subsequent loosening of the graft (Barbagli et al, 1996; Kane et al; Morey et al; Asopa et al; Orandi A, 1968).** Later a number of studies have shown high success rate of dorsal onlay graft urethroplasty (Barbagli et al, 1998; Iselin and Webster, 1999; Guralnick and Webster, 2001; Andrich et al, 2001). The initial success rate was as high as 97% but Barbagli et al in 2001 showed that long term follow up of their patients from 21.5 to 48 months resulted in a decline of success rate from 92% to 85%, emphasizing the need for long term follow up before any conclusions can be made. In a comparative study of dorsal and ventral onlay techniques using grafts and flaps, Dubey et al from SGPGI, Lucknow showed that complications were more common with ventral onlay than dorsal onlay, which include fistulas (21% to 13%), ejaculatory dysfunction (20% to 5%), Urethral pseudodiverticulum (26% to 3%), post void dribbling (39% to 23%). Penile angulation/ torsion deformity and diminution of penile sensation were higher for dorsal onlay than ventral onlay. Stricture recurrence was not significantly different among the four groups.⁽¹⁶⁾

We had a fistula rate of 17.2% when compared to 8.3% in Asopa series. Relatively high incidence of fistula in our study was due to post-operative infection. Five Patients (17.2%) had post void dribbling. All these patients had long segment strictures. No patient with stricture less than 5 cm and no patient with pure penile stricture had post void dribbling or ejaculatory dysfunction. We had a restructure rate of 20.6%, which was higher than that in Asopa series (8.3%) and in Gupta et al series (8.3%). Four out of six restructures in our series were secondary to under estimation of stricture resulting in restructure at the proximal or distal augmentation site. None of our patients had post-operative hematoma or chordee, which were seen in Asopa study with a frequency of 8.3% each. The complication and restructure rate were not significantly different from the Barbagli technique, and the success rates were also comparable i.e. 85- 95% in Barbagli technique (Barbagli et al, 85%; Dubey et al, 88%; Barbagli et al, 92%; Shailesh A. Shah, 95%) Vs 79.4- 91.7% in Asopa technique (Our series, 79.4%; Asopa et al and Gupta et al, 91.7%).¹⁷

CONCLUSIONS: Asopa technique of augmentation urethroplasty i.e. dorsal augmentation via ventral sagittal urethrotomy approach is relatively easy to do and as it preserves urethral vascularity through circumflex vessels, this technique is particularly useful in long segment strictures and ischemic strictures. Blood loss is not significant and graft can be placed dorsally with all its advantages as described in Barbagli technique. It is relatively easy to do because it does not require complete mobilization and also rotation of urethra as in Barbagli technique. Ventral urethrotomy does not seem to have any additional risk for fistula formation, provided there was no post-operative

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wound infection. Sizing of the graft is accurate and hence pooling of urine and semen is minimized. Use of buccal mucosal graft in Asopa technique have the additional advantages of the graft itself. As with any other urethroplasty technique, Asopa technique also needs long term follow up to consolidate the results and to score over the Barbagli technique.

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