One-stage minimally invasive urethroplasty with buccal mucosa for complex anterior urethral stricture management

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Abstract

Introduction: Long or complex strictures (>2 cm) cannot be managed with excision and anastomosis because they can condition shortening of the penis or spermatic cord, or anastomotic failure. For this type of stricture, numerous techniques have been suggested, including total excision of the strictured segment with free graft or flap application, anastomosis with dorsal or ventral enlargement, and multiple-stage procedures.

Material and methods: Sixty-six urethroplasties were carried out in our hospital from October 2008 to June 2011 (a total of 20 months). Only seventeen patients with complex anterior urethral strictures (strictures encompassing the penile and bulbar urethra that varied from 4 to 15 cm with a mean length of 7 cm) underwent this technique, using a perineal approach with a 4 cm incision. Surgery duration, complications, and short-term and mid-term results were evaluated.

Results: Of the seventeen patients included in the study, thirteen had successful surgical outcomes (76%) and four presented with failure (24%). The main complications were dysesthesia.

Resumen

Introducción: Las estenosis largas o complejas (> 2 cm) no pueden ser manejadas con procedimientos de escisión y anastomosis, ya que pueden condicionar acortamiento del pene, cuerda o falla en la misma. Para este tipo de estenosis se han sugerido numerosas técnicas, incluyendo escisión total del segmento estenótico con aplicación de injertos libres o colgajos, anastomosis con aumento dorsal o ventral y procedimientos en múltiples etapas.

Material y métodos: Se realizaron 66 uretroplastías en nuestro Hospital, del mes de octubre del 2008 a junio del 2011 (20 meses, en total). Se incluyeron sólo 17 pacientes con estenosis complejas de uretra anterior (estenosis que abarcan uretra peneana y bulbar, que variaban de 4 cm hasta 15 cm, promedio longitud de 7 cm), en los cuales utilizamos esta técnica. Se realizó abordaje perineal con incisión de 4 cm. Se evaluaron tiempos quirúrgicos, complicaciones, resultados a corto y mediano plazo.

Resultados: De 17 pacientes incluidos en el estudio, 13 se consideraron exitosos (76%). Cuatro presentaron falla (24%). Las principales complicaciones fueron: disestesia en región perineal (tres pacientes, 17%), hematomas (un...
in the perineal region (three patients, 17%) hematoma (one patient, 5%), and infection (one patient, 5%). Complications associated with taking the buccal mucosa graft were: a certain difficulty in opening the mouth (one patient, 5%), local pain at the site where the graft was taken that lasted more than three weeks (two patients, 11%), and dysesthesia in the mouth (one patient, 5%). Mean surgery duration was 180 minutes and there were no position-related complications.

Conclusions: We believe this technique is a good one-stage management option for complex anterior urethral stricture with mild to moderate spongiofibrosis. It offers very satisfactory functional and cosmetic results and has a low complication rate.

Keywords: Urethral stricture, buccal mucosa, minimal invasion, Mexico.

■ INTRODUCTION

Reconstructive urethral surgery is a great challenge for the urologist that requires training, experience, time, and a considerable capacity to handle frustration.

Despite the tremendous efforts that have been made to improve results, we still have experiences with these patients that are not very satisfying. The use of tissue obtained through tissular engineering in the last few years is the promise of the future in this area, but more time is still needed to perfect the use and to evaluate the results of this new technology.

In the last decade buccal mucosa has been shown to be the best substitution tissue for anterior urethral reconstruction, with more than 1400 published articles upholding this claim at present. However, as with any pathology, choosing the adequate technique and tissue for reconstructing the urethra will depend on the technical support of the surgeon, the integral evaluation of each particular case, and to a large extent, on the intraoperative findings. Based on the abovementioned, in this article we have decided to describe the principles that we consider to be the most important when making decisions about the management of complex strictures in the anterior urethra through what is, in our opinion, a minimally invasive approach.

The objective of this paper is to demonstrate the technique and results of replacement urethroplasty using buccal mucosa for complex anterior urethral strictures with a minimally invasive approach in a single procedure.

■ METHODS

Sixty-six urethroplasties were carried out in our center from October 2008 to June 2011 (20 months). They included 17 patients with complex anterior urethral strictures (strictures that involved the penile and bulbar urethra and varied in length from 4 to 14 cm with a mean length of 7 cm) operated on with this technique. Short-term and long-term results, surgery duration, and associated complications at the surgical and graft sites were evaluated.

■ SURGICAL TECHNIQUE

1. Urethrocystoscopy and transurethral Amplatz guidewire placement up to the bladder (Figure 1).
2. Application of 15 cc of transurethral methylene blue and placement of 14 F nelaton catheter to the stricture site where skin is marked (Figure 2).
3. 4 cm midperineal incision, dissection by planes until bulb urethra is visualized (Figures 3A and 3B).
4. Full-length penile eversion by means of the same perineal incision (Figures 4A and 4B).
5. Dissection of only the left lateral portion of the urethra through which the entire length of the urethra (penile and bulbar) is approached and...
the urethra is partially mobilized in a lateral direction (Figure 5).

6. 45° medial rotation of the urethra at its left lateral surface and exposure of the dorsolateral portion of the urethra (Figure 6).

7. Dorsal incision of the urethra along the entire length of the stricture (Figure 7).

8. Taking of the buccal graft with the usual technique from one or both cheeks, depending on the length of the stricture (Figure 8).

9. Dorsolateral placement of the buccal mucosa graft, attachment to the albuginea, 5-0 vicryl suture of the lateral edge of the buccal mucosa with the lateral end of the urethra (Figure 9).

10. Placement of 14 F silicon Foley catheter and later total closure of the other lateral portion of the urethra with 5-0 vicryl (Figure 10).

11. Penis is reestablished in its original site and then closure by planes is done with absorbable 4-0 suture (Figure 11).

And finally, the catheter was removed three weeks after the surgery and control cystourethrography was done to evaluate whether there was contrast medium leakage at the surgical site and also to evaluate the postoperative outcome (Figure 12). The patient used to demonstrate this approach was a 54-year-old man with an approximately 12 cm-long complex stricture that required double buccal mucosa.

■ RESULTS

Seventeen patients with strictures that involved the penile and bulbar urethra and that varied in length from 4 to 14 cm, with a mean length of 7 cm, were included in the study. Failure was considered when a patient required a second procedure, urethral calibration, or if there was a complication that conditioned urinary obstruction. The patients were evaluated at 3, 6, 9, and 12 months after surgery through a questionnaire using the International Prostate Symptom Score (IPSS), as well as patient satisfaction with the surgical outcome. Success was considered when the patient had an IPSS that was under 7 points and when he characterized his quality of life as good to excellent. Of the 17 patients, 13 had successful outcomes (76%) and 4 patients presented with failed results (24%). Three of those patients required subsequent calibrations, while one required reoperation. The main complications were: dysesthesia in the perineal region (3 patients, 17%), hematoma (1 patient, 5%), and infection (1 patient, 5%). Complications associated with obtaining the buccal mucosa graft were: a certain difficulty in opening the mouth (1 patient, 5%), local pain at the site where the graft was taken that lasted more than three weeks (2 patients, 11%), and dysesthesia in the mouth (1 patient, 5%). One of the most important points
to mention is that the local conditions were essential for surgical success. We found that the patients with a greater degree of spongiofibrosis associated with a higher number of urethrotomy procedures or previous dilations were the patients that presented with failure.

**DISCUSSION**

Complex anterior urethral stricture approach is usually aggressive and the majority of the time two or more stages of surgery are necessary. Recovery time and the time between one procedure and the next are generally long. Morbidity and psychological and functional consequences should be taken into consideration in these cases. The current tendency is to use the new techniques that are meant to be less invasive and whose principle is to have an adequate functional and esthetic outcome, as well as to reduce the morbidity associated with these types of procedures as much as possible.

However, in order for there to be a satisfactory outcome in anterior urethral stricture management, it is essential to maintain the principles of regeneration, substitution, excision, and anastomosis.

Numerous surgical techniques have been developed. Long-term results of urethroplasty are determined by various conditions that include patient characteristics, adequate surgical technique selection, the type of stricture, its location, length, and cause, and the associated local conditions.

Preservation of the urethral vasculature and adjacent tissues is extremely important for the success of the surgery. Knowledge of urethral vascular anatomy and of the genital skin is fundamental in reconstructive procedures. The urethra can be moved extensively because it has bi-directional arterial irrigation, in other words, anterograde and retrograde irrigation (Figures 13A and 13B).

Figure 3. Step 3. 4 cm perineal incision A). Dissection until visualizing the bulbar portion of the anterior urethra B).

Figure 4. Step 4. Penile inversion maneuver through perineal incision A). Completely everted penis by means of 4 cm perineal incision B).
The circumflex bulbar and cavernous arteries are the initial branches of the common penile artery, a branch of the internal pudendal artery, and they irrigate the proximal corpus spongiosum in an antegrade manner (Figure 14).

They bifurcate into two central cavernous arteries and into the dorsal artery of the penis. The dorsal artery of the penis is divided into multiple branches that will penetrate the glans penis and then carry the arterial flow over the distal corpus spongiosum in a retrograde manner (Figure 15).

There are also perforating arteries that emerge from the corpora cavernosa that dorsally irrigate the corpus spongiosum (Figure 16).

Two to three urethral arteries located the majority of the time at the 3 and 9 o’clock positions regularly flow within the corpus spongiosum. However, current studies have shown that the location of the arteries within the corpus spongiosum is more varied (Figures 17A and 17B).

Vascular disease of the urethra is an important factor in the failure of anastomotic procedures. In these cases, either replacement procedures, the use of vascularized flaps, or two-stage surgery are recommended, depending on the individual case.

According to the abovementioned references, we partially mobilized the lateral surface of the urethra in order to maintain the greatest vascular flow provided by...
the perforating arteries emerging from the crura at the contralateral side of the dissection. Likewise, we made the dorsal incision exactly at the site where there was less chance of injuring a urethral artery (Figure 18), thus sparing the vasculature of the corpus spongiosum.

We also took into consideration the fact that unilateral dissection reduces trauma and the local inflammatory process and therefore facilitates rapid recovery (Figure 5).

We opted to use buccal mucosa to carry out this technique.

Currently, buccal mucosa is the replacement tissue of choice for anterior urethral reconstruction for various reasons: buccal mucosa is available in all patients, obtaining the graft is rapid and simple, the site where it is taken is not visible and so cosmetic results are excellent, 6 the graft is free from hair, its epithelium is rich in elastin, making it easy to manage, and it also has a thin and well-vascularized lamina propria that facilitates inosculation, imbibition, and finally rapid graft integration. 6

Complications associated with graft obtention in our series were minimal (local pain for more than 3 weeks in two patients that was completely resolved (100%), mild dysesthesia in one patient that was resolved in 3 months, and difficulty in opening the mouth in one patient). None of the patients presented with infection or more serious complications and so we consider this procedure to be safe and reproducible.

There are multiple incisions for approaching the anterior urethra and they should be selected based on the procedure to be performed and on the stricture site so that there is adequate exposure and the possibility to use the skin or surrounding tissue in order to have a more adequate reconstructive procedure. In the technique we used, we made a mid-perineal incision of a maximum 4 cm in length. This enabled us to expose the entire urethra, from the bulbar urethra to the navicular fossa with minimum dissection and excellent cosmetic results as described and illustrated above (Figure 11). This approach has a low complication rate, little postoperative pain, and provides a rapid recovery. In our series there were local complications in three patients; perineal and scrotal dysesthesia in two patients that disappeared 3 months after surgery, and one patient that presented with hematoma attributed to bleeding of one

Figure 9. Step 9. Dorsolateral placement of the buccal mucosa graft.

Figure 10. Step 10. 14 F Foley catheter is placed. Then the lateral portion of the urethra is closed with 5-0 vicryl running suture over the previously placed graft.

Figure 11. Step 11. Final appearance of the perineal wound.

Figure 12. Postoperative outcomes. Initial retrograde urethrography before surgery A. Control cystourethrography after surgery B.)
of the lateral edges of the corpus spongiosum that was resolved through general measures. There was only one case of local infection and it was resolved when the urethral catheter was removed and parenteral antibiotics were administered.

There were no complications associated with the lithotomy position (neurapraxia, thrombosis, etc.). Surgery duration varied from 90 to 270 minutes with a mean of 180 minutes. Duration time was reduced as the learning curve and technique standardization were covered. When two surgical teams worked simultaneously, one assigned to graft obtention and the other performing the dissection and urethral preparation, surgery duration was importantly reduced. The last five procedures carried out in this fashion were the shortest.

We believe this approach is safe and reproducible and it also provides satisfactory exposure. However, it is necessary to mention that we consider this technique to be adequate in patients presenting with long strictures involving the penile and bulbar urethra that have not undergone previous urethroplasties, in patients with strictures that are not associated with trauma, and in patients that have mild to moderate spongiofibrosis. We observed that patients that had had multiple procedures (urethrotomies or dilations) prior to surgery or previous urethroplasty, and patients that had important spongiofibrosis or inadequate local conditions, were the patients that had failed procedures.

Local urethral tissue conditions are essential for the success of this technique.

Today there are descriptions of multiple urethroplasty techniques that the urologist should be familiar with.
in order to be able to resolve any situation that might occur during surgery.\textsuperscript{7} In 1996 Morey and McAninch described the ventral onlay buccal mucosa free graft technique for 2 to 5 cm bulbar strictures. Barbagli et al. described the dorsal onlay technique that is useful in long complex bulbar strictures that are not associated with trauma.\textsuperscript{8,9} Over time, these two procedures have become the techniques preferred by many surgeons for bulbar urethral stenosis management, providing satisfactory short, mid, and long-term results with success rates of 83 to 91\% for ventral onlay and 79\% for dorsal onlay.\textsuperscript{10}

We used a modification of the dorsal onlay technique with similar results (76\%).

At present there are no national statistics on the epidemiology and current management of urethral stricture in our medical environment, but we believe that if a patient is treated adequately at the initial stage of the disease, there will be satisfactory long-term results. Therefore we also feel that the urologist in training should be familiar with the most frequent reconstruction techniques and offer the most adequate management to patients presenting with this pathology. The creation of reference centers for the management of these cases should be a priority.

The superiority of one technique over another has not been clearly defined. However, adequate preoperative evaluation is essential for deciding on the most suitable type of approach for each case. The technique that the surgeon is most experienced with and has had the best results with is considered the best. Nevertheless, we emphasize the importance of having a working knowledge of the recent available techniques for resolving any surgical eventuality.

\section*{Conclusions}

We consider this technique to be a good option for the one-stage management of complex anterior urethral strictures in patients presenting with mild to moderate spongiosis that offers very satisfactory functional and cosmetic results, along with a low complication rate.
REFERENCES