

Step-By-Step

Mucosal-sparing augmented non-transected anastomotic (MsANTA) urethroplasty: a step forward in ANTA urethroplasty

Pankaj Joshi¹ , Marco Bandini²  and Sanjay B. Kulkarni¹

¹Kulkarni Reconstructive Urology Center, Pune, India and ²Unit of Urology, Urological Research Institute (URI), IRCCS Ospedale San Raffaele, Milan, Italy

P. J. and M. B. contributed equally to this work.

The surgical advancement of urethral reconstruction is a rapidly moving field. In the last decade, the technique for bulbar urethroplasty has evolved towards less invasive approaches with minimal transection and more tissue sparing in order to increase the patency rate. In this study, we provide a step forward in the augmented non-transected anastomotic (ANTA) urethroplasty proposed in 2012, with a true mucosa-sparing modification of the technique. In detail, the bulbar urethral lumen is approached with either a ventral or dorsal urethrotomy. Differently from previous techniques, the native urethral mucosa is neither transected nor resected but is reconstructed with a direct mucosa-to-mucosa anastomosis. This allows a complete sparing of communicant vessels that come from the corpus spongiosum to the urethral mucosa. The technique aims to preserve the native vascularity of the urethral mucosa by enlarging the native urethral plate with a direct anastomosis at the level of the stricture, and without the need for resection. In our hands the technique was easy and reproducible, and it carried promising results in the preliminary cohort where it was applied.

Keywords

urethroplasty, urethra, stricture, graft, buccal mucosa

Urethroplasty is a rapidly evolving art that never stops to improve and reinvent itself. After a century of silence were the anastomotic repair was the only solution for approaching the strictured urethra, the 1990s can be considered as the Renaissance period for reconstructive urology. Pioneers of this new era were Barbagli et al. [1] who developed the dorsal onlay urethroplasty in 1996 and Morey and McAninch [2] who first published the technique for ventral onlay again in 1996. In 2007, another breakthrough was introduced by Palminteri et al. [3] with the double-face urethroplasty for nearly or completely obliterated stricture. In 2009, our group presented the one-sided dissection for dorsal onlay [4] and thereafter in the same year the penile invagination technique for pan-urethral stricture [5]. In 2012, Andrich and Mundy [6] demonstrated the non-transecting approach for short bulbo-membranous stricture where the lumen is augmented with the principle of Heineke–Mikulicz strictureplasty, without graft or flap. Last in chronological order came the technique of Welk and Kodama [7], who published the augmented non-transected anastomotic urethroplasty.

According to this technique, the two walls of urethra are augmented in two different ways: on the dorsal aspect a buccal mucosa graft (BMG) is placed over the corpora as dorsal onlay; on the ventral side instead, the fibrotic portion of mucosa is resected keeping the underlying corpus spongiosum intact, and the two edges of healthy mucosa are joined together. All these approaches revealed a tendency of preserving as much as possible of the native urethra trying to avoid any damage of the corpus spongiosum, which represents a vital support for the graft and the urethral mucosa itself. Indeed, by decreasing the dissection of native tissue, the fibrotic process is reduced, and the patency rates improve. With this in mind, we developed new way of thinking about the augmented urethroplasty, especially in patients with very narrow strictures where single augmentation was not sufficient. Herein, we are proposing a new technique that advances the approach of Welk and Kodama [7]. Specifically, our modification aims to completely avoid any resection on the residual native urethral plate. Instead, our approach aims to spare completely the native

mucosa whilst the lumen is augmented. Patients were defined as eligible for the technique if they had a non-traumatic bulbar stricture. Additionally, the narrowest portion of the stricture (where the calibre was <7 F [1.5 cm]) should have not exceeded 1.5 cm in length [8]. The study was approved by the Institutional Ethics Committee (KESI/22006). The technique starts with a perineal dissection of the urethra, which can be carried on one-side or circumferentially, according to the preference of the surgeon and the characteristics of the stricture. Then, the urethra is opened dorsally at the level of the stricture. The ventral wall is examined, and the narrowest portion is demarked. Here, the edges of the mucosa are re-approximated with interrupted suturing in a true non-resecting approach (Fig. 1 and Fig. 2). The ventral wall is augmented transposing the distal and proximal healthy mucosa edges together without any resection of the midline portion. We usually rely on 5/0 polydioxanone suture to re-approximate the urethral mucosa. The sutures should pass through the mucosa and the sponge on one edge and then come through the sponge and the mucosa on the opposite side. Re-approximating the mucosa is possible if the gap is ~1 cm (maximum 1.5 cm). For longer gaps the anastomosis can be under tension and creates a bulging of the corpus spongiosum (in case of dorsal approach). In these cases, mucosa excision and double-face augmentation, as described by Gelman and Siegel [9] for the dorsal approach and Palminteri *et al.* [3] for the ventral approach, is advised. To complete the procedure, the dorsal wall is augmented with an onlay graft as described by Barbagli *et al.* [1]. The reconstruction of the ventral wall enlarges the strictured portion recreating a new urethral plate of ~1.5 cm wide. This approach is also possible with the ventral onlay, where the dorsal wall is enlarged with the non-

transected mucosa-to-mucosa anastomosis and the ventral wall is augmented with the graft. Here, a tension-free anastomosis is more difficult to achieve giving the reduced mobilisation of the dorsal urethral wall, as per ventral onlay approach, and due to the lesser thickness of the sponge dorsally. For ventral onlay, we avoided the non-transected mucosa-to-mucosa anastomosis when the narrow portion was >1 cm. Our technique is extremely simple but efficacious because it avoids any resection and leaves the corpus spongiosum and the vascular supply to the native urethra completely intact.

The blood supply of the urethral mucosa comes from the corpus spongiosum, which receives anterograde and retrograde supply from the bulbar arteries and the dorsal penile arteries, respectively. From an anatomical point of view, the resection of the sponge interrupts the continuity of the arterial flow, and for this reason, it is contraindicated in patients with no sponge obliteration (i.e., patient with no traumatic aetiology). The technique of Welk and Kodama [7] relies on this concept; indeed, the sponge is preserved, and it is not transected. Nevertheless, the urethral mucosa at the level of the stricture is resected and re-anastomosed. Thus, even if the arterioles that cross the sponge are left untouched, the communicant branches between the corpus spongiosum and the urethral mucosa are interrupted. Our technique avoids this microvascular injury leaving intact the submucosa and the native mucosa so that no insult is carried on the communicant branches. The result is a complete preservation of the blood supply to the native urethra, with the exception of a part of the perforators that must be sacrificed for the one-sided mobilisation. This vascular preservation may facilitate the healing process by improving the oxygenation

Fig. 1 Urethra is mobilised on one-side and opened dorsally. The native urethral plate is reconstructed in a true mucosal-sparing non-transected approach. The two healthy edges of the mucosa are joined together to widen the new ventral urethral plate. To approximate the two ends, 5/0 polydioxanone suture is passed through the mucosa and the sponge on one edge and then comes through the sponge and the mucosa on the opposite side. The narrow urethral plate at the level of the stricture is thus converted to a wide urethral plate. If the urethra presents multiple narrowing, the non-transected mucosa-to-mucosa anastomosis can be made at each level giving that each narrow part does not exceed 1 cm (maximum 1.5 cm) in length. On the dorsal aspect, a BMG is allocated as dorsal onlay.

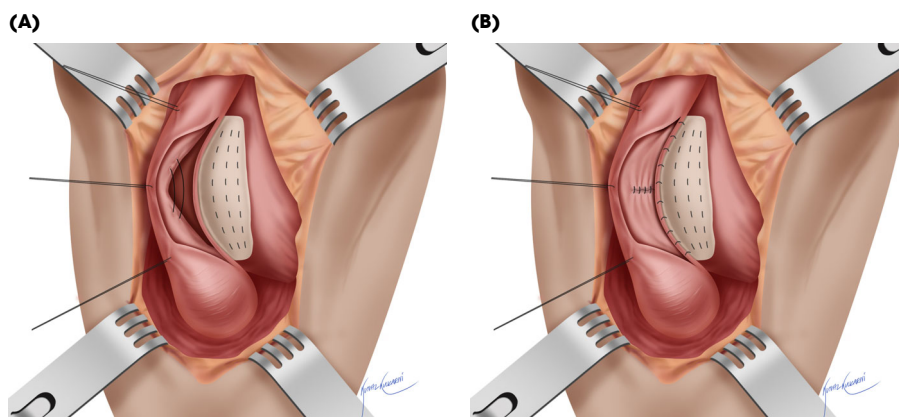
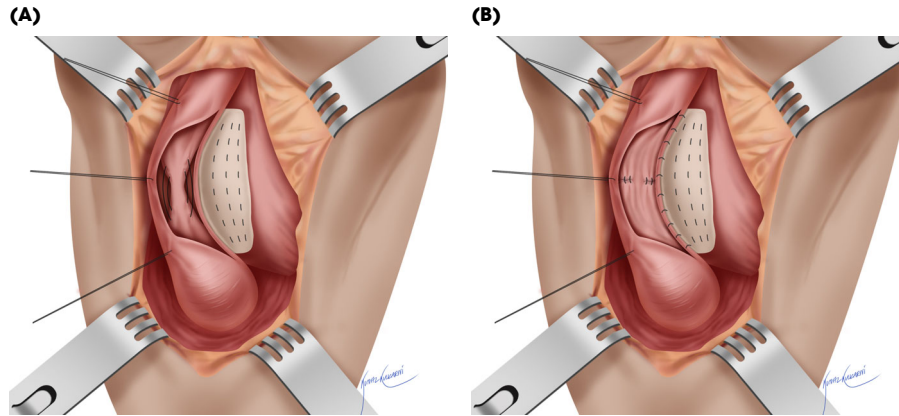


Fig. 2 Urethra is mobilised on one-side and opened dorsally. The native urethral plate is reconstructed in a true mucosal-sparing non-transected approach. The two healthy edges of the mucosa are joined together to widen the new ventral urethral plate. To approximate the two ends, 5/0 polydioxanone suture is passed through the mucosa and the sponge on one edge and then comes through the sponge and the mucosa on the opposite side. The narrow urethral plate at the level of the stricture is thus converted to a wide urethral plate. If the urethra presents multiple narrowing, the non-transected mucosa-to-mucosa anastomosis can be made at each level giving that each narrow part does not exceed 1 cm (maximum 1.5 cm) in length. On the dorsal aspect, a BMG is allocated as dorsal onlay.



and thus reducing the fibrosis. This is particularly important in patients with microvascular deficiency such as patients with diabetes, lichen sclerosus, and previous failed surgery.

Of course, traumatic strictures represent a contraindication to this technique because the sponge and the submucosa are obliterated by severe fibrosis, and they cannot provide any vascular support to the anastomosis and to the graft placed on the opposite face.

To date, we have tested this technique in different scenarios, such as simple bulbar strictures or complex cases (e.g., failed urethroplasty, pan-urethroplasty, lichen sclerosus-induced strictures). In our hands, the technique could be easily applied in all selected cases. Even in panurethral stricture, mucosal-sparing augmented non-transected anastomotic (MsANTA) urethroplasty could be performed in multiple parts of the urethra without causing significant crumpling or chordee. This technique is also possible when performing a ventral onlay to augment the dorsal wall of the urethra. Here, given the lower elasticity of the dorsal wall, due to the lesser thickness of the sponge, a great approximation is not possible; thus, the technique should be applied only for a gap that does not exceed 1 cm.

Our results are still preliminary and limited to a small cohort of 24 patients. The median (interquartile range [IQR]) age at surgery was 38.5 (31–56.5) years. Aetiologies of the strictures were catheter induced in five (20.8%), post-infection in five (20.8%), idiopathic in four (16.7%), instrumentation in four (16.7%), lichen sclerosus in four (16.7%), and post-TURP in two (8.3%) patients, respectively. The median (IQR) stricture length and length of the most significant narrowest portion of the stricture were 4 (3.5–6.5) cm and 1 (0.8–1.1) cm,

respectively. The most significant narrowest portion was reconstructed with mucosal-sparing anastomosis as described above. The median (IQR) operative time was 75.5 (66.5–96.5) min. The median (IQR) follow-up was 11.5 (3.8–19.2) months. Failure was defined as the onset of obstructive symptoms or a maximum urinary flow rate of <10 mL/s, with or without need for instrumentation (dilatation or direct visual internal urethrotomy or intervention). A dorsal approach with dorsal onlay augmentation was the preferred approach (21 patients), while ventral onlay was adopted in only three patients. Six patients presented a stricture extending to the penile urethra and were approached with penile invagination, one-sided dissection and dorsal onlay with either two BMG (four patients) or preputial skin graft (two). Success was achieved in 87.5% of patients. After surgery, no perioperative complication of Clavien–Dindo Grade \geq III was recorded in the subsequent 30 postoperative days. Five patients had urinary infections requiring shifting to a different antibiotic treatment (Clavien–Dindo Grade II). Six patients presented with penile haematoma that was treated conservatively (Clavien–Dindo Grade I–II), one patient accidentally removed the catheter before the scheduled time, and it was replaced with no further complication (Clavien–Dindo Grade I). We acknowledge that a larger sample size, longer follow-up, and an appropriate methodology of complication reporting [10] are required to support our view and to gain confidence with this new technique that, we believe, will be an important gamechanger in the future of urethral reconstruction.

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Conflict of interest

None.

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None.

Informed consent

All patients signed an informed consent.

Research involving Human Participants and/or Animals

None to declare.

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Correspondence: Marco Bandini, MD, Unit of Urology, Urological Research Institute (URI), IRCCS Ospedale San Raffaele, Via Olgettina 60, Milan 20132, Italy.

e-mail: bandini.marco@hsr.it

Abbreviations: (Ms)ANTA, (mucosal-sparing) augmented non-transected anastomotic (urethroplasty); BMG, buccal mucosa graft; IQR, interquartile range.

Supporting Information

Additional Supporting Information may be found in the online version of this article:

Video S1: Mucosal-sparing non-transecting bulbar urethroplasty: adding a new step to NTBU.