

M inverted V glansplasty: an update on technique and outcomes 30 years later

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Distal hypospadias is a common congenital urology anomaly for which numerous corrective procedures have been described. Over the last 40 years, the gold-standard operative technique for distal hypospadias has switched from the meatal advancement and glanuloplasty (MAGPI) procedure to the tubularized incised plate (TIP) urethroplasty. A modification to the MAGPI procedure, first described 30 years ago, is the M inverted V (MIV)

glansplasty, which improved upon the MAGPI procedure to reduce instances of meatal retraction. The MIV glansplasty is unique compared to many commonly used procedures as it does not require a formal urethroplasty or incorporation of a dartos flap, and it does not always necessitate as extensive mobilization of the glans wings. We describe our updated technique and outcomes of the MIV glansplasty and delineate situations where the MIV is best employed.

Key Words: hypospadias, urethra, penis, surgery, complication

Introduction

One of the standard operative techniques for distal hypospadias from the 1980s to 1990s was Duckett's meatal advancement and glanuloplasty (MAGPI) procedure.^{1,2} The MAGPI's main advantage was the avoidance of a formal urethroplasty making the

procedure technically easier with good functional outcomes. The MAGPI, however, was known to have late occurrence of meatal retraction and was sometimes associated with an unsatisfactory glans configuration. Since the mid-1990s it and other procedures for distal hypospadias have been largely replaced by the tubularized incised plate (TIP) urethroplasty.³ The TIP procedure necessitates a formal urethroplasty and wide mobilization of glans wings. Nevertheless, the TIP urethroplasty achieves low complication rates and good cosmetic results. It has emerged as the most popular technique for distal hypospadias repair utilized today.⁴

Decter proposed the MIV glansplasty as a variation of Duckett's MAGPI operation in 1991. The foundation of the MIV glansplasty is the M-shaped glans incision reconfigures into an inverted V-shape during the operation facilitating secure glans approximation

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ventral to the neomeatus. This surgical technique was developed to address concerns of meatal retraction associated with the MAGPI procedure.⁵ In addition to correcting the problem of meatal retraction, the MIV glansplasty resulted in a more conical, normal-appearing glans, which improved upon the abnormal glans configuration often seen following the MAGPI procedure. Importantly, the MIV glansplasty incorporated Duckett's concept of avoiding a formal urethroplasty and retained the MAGPI procedure's simplicity.

Since Decter's original paper, no studies have addressed improvements, modifications, or longer-term outcomes for the MIV glansplasty technique. Following the publication of this initial series, the MIV glansplasty was incorporated into regular use at our institution for suitable children. This paper provides an updated description of the original MIV technique and our results, and describes phallic characteristics in which it is best utilized.

Operative technique

Since the technique was originally described, several minor changes to the procedure were made and will be highlighted. However, the core concept of the initial M-shaped incision that reconfigures to an inverted V-shape during the operation remains.

The patient most suitable for the MIV glansplasty has a glanular or coronal, and occasionally a subcoronal meatus with no to moderate congenital curvature. Patients suited to this technique should possess a moderate to deep ventral cleft. This technique is not employed in children with flat urethral grooves. The urethra, once the glans wings are fashioned, requires a degree of mobility that readily allows for meatal advancement and reconfiguration. If the urethra is not pliable, there is a risk of meatal retraction and/or fistula formation.

Initially, an M-shaped marking is inscribed on the ventral aspect of the penis with the distal peaks of the M positioned where the ventral aspect of the neomeatus will be placed and the valley of the M proximal to the existing meatus, Figure 1A. The distance between the meatal opening and the portion of the M incision subjacent to it is approximately 1 to 2 mm. This ensures adequate tissue in which to place the stay suture. The width of the peaks in the M are wide enough to provide de-epithelized portions of glans adequate to facilitate successful glans approximation. One must take care at the valley of the M to avoid entry into the urethra. The lateral descending arms of the M's are extended proximally to form the ventral midline aspects of

the mucosal collars. A distal circumcising incision is marked on the lateral and dorsal aspects of the penis.

The M shape is then incised with a microsurgical scalpel and the tissue within the confines of the M-shaped incision is de-epithelized using sharp dissection, Figure 1B. Once this portion of the procedure is completed the penile shaft skin is degloved. An artificial erection is performed. If present, congenital curvature is corrected utilizing non-absorbable plicating sutures.

If there is a blind-ending pit in the ventral glans cleft, the ventral wall of the pit is opened to connect it to the meatus. In the original description of the procedure, we described making a vertical incision in the tissue of the dorsal wall immediately distal to the native meatus. We generally no longer perform this if there is no distal pit present. Rarely, we incise the urethral plate at the original meatus to further open it or to divide a protuberant band of tissue in the urethral plate. This is usually performed before the M-shaped marking is incised.

At this point, the glans wings are fashioned using sharp dissection after injection with lidocaine and epinephrine. These wings are mobilized as necessary to provide an adequate tension-free glans approximation. Because no formal urethroplasty is performed, a dartos flap does not need to be harvested and accommodated under the glans closure. We have found that glans wings formation often requires less mobilization to achieve an adequate tension-free closure compared to a typical tubularized incised plate urethroplasty.³

To convert the M-shaped incision into an inverted V, a stay stitch of 7-0 Vicryl is placed in the skin of the meatal opening at the 6 o'clock position/valley of the M, Figures 1C and 1D. The "weaving suture" currently referred to as the "fixation suture" of 7-0 Vicryl is then positioned, Figure 1E. The initial stitch is placed from outside to inside 1 to 2 mm proximal to the apex of the short, inside arm of the M. The suture then goes down adjacent to the valley of the M from inside to outside on the ipsilateral side, then from outside to inside on the other side of the valley of the M, and finally goes from inside to outside at a position just below the peak on the inside arm of the M. Once the fixation suture has been placed loosely, the stay stitch is reflected distally, and the incision reconfigures into an inverted V. The fixation suture is secured with the knot on the outside of the urethral lumen, Figure 1F. A vertical mattress suture of 7-0 Vicryl is placed through the apices of the M just distal to the knot of the fixation suture to buttress the repair at the ventral aspect of the neomeatus, Figure 1G.

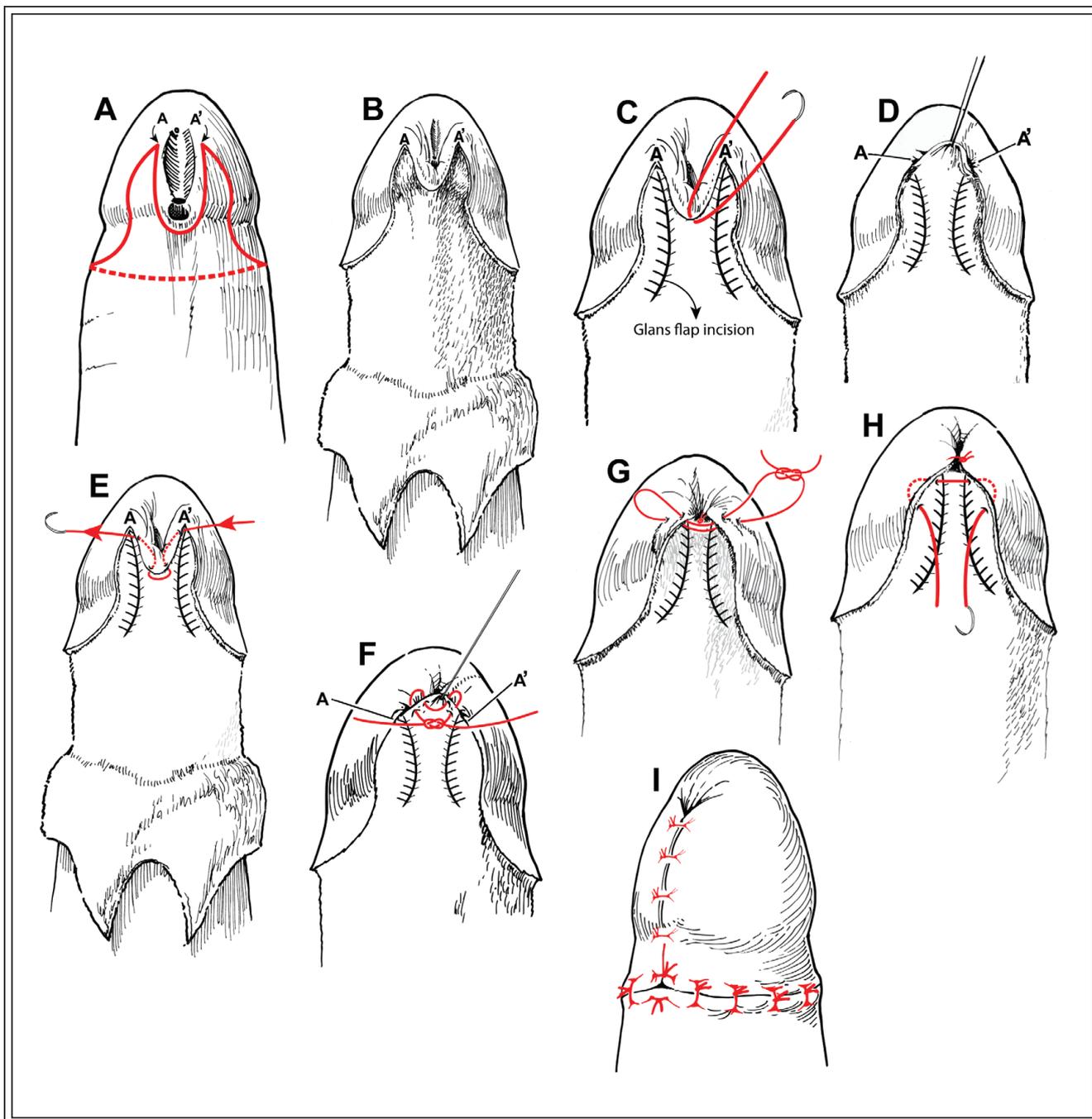


Figure 1. (A) Red lines indicate M shape of ventral portion of initial markings. A and A' indicate ventral position of subsequent neomeatus. (B) Skin within confines of M deepithelialized and shaft skin dropped down. (C) Glans flap incisions indicated by dark lines and "stay stitch" positioned in depth of the M shape. (D) Tension on "stay stitch" converts M to inverted V. (E) Placement of "fixation suture" starting and finishing slightly below the peak of the M (note "stay stitch" not shown for clarity). (F) With tension on "stay stitch" the "fixation suture" is tied to form ventral aspect of neomeatus. (G) Horizontal mattress suture of 7x0 Vicryl in skin at ventral neomeatus to further secure it. Note previously tied fixation suture at ventral aspect of meatus. (H) Positioning of 6x0 Vicryl in glans substance slightly below skin level to achieve deep glans closure (I) Completed closure. Adapted with permission from Wolters Kluwer Health, Inc.: Decter RM. M inverted V glansplasty: a procedure for distal hypospadias. *J Urol* 1991 Aug;146(2 [pt 2]):641-643. www.auajournals.org

The glans wings are then approximated in the ventral midline with horizontal buried stitches of 6-0 Vicryl into the glans substance. Positioning these sutures at a short distance below the skin into the glans substance allows for closure without excessive tension on the underlying urethra, Figure 1H. We use several of these sutures and they each encompass smaller portions of the glans than the original diagrams depicted. These sutures are critical to prevent glans separation and meatal retraction. The number of buried horizontal stitches varies from 3 to 6 depending upon the glans size and configuration. We often continue these sutures to include the tissue proximal to the glans subjacent to the mucosal collars.

Superficially, closure of the glans skin and the mucosal collars are accomplished by employing interrupted vertical mattress sutures of 7-0 Vicryl to mature the skin edges. Suture tracts, even in the mucosal collars, are rarely seen. Resurfacing of the penile shaft can often be performed by simply pulling the sleeve of the penile shaft skin distally and transecting it at an appropriate position to allow for the circumcising incision, Figure 1I.

After the surgery, a 7 French round silicon drain is placed and secured using the holding stitch placed at the initiation of the case. The penis is dressed with a bio-occlusive dressing. The catheter is secured to the abdomen with tape and draped over the inner of the double diaper system. Both the dressing and catheter are typically removed on postoperative day five.

It is important to emphasize the optimal phallic and tissue characteristics that are required for the success of the repair. In the ideal situation with good tissue compliance, the M will truly configure into an inverted V with cinching of the fixation suture. However, at times, the inverted V configuration is not quite achieved with this maneuver. This is typically due to poor mobility of the ventral meatal tissue resulting in too much tension on the fixation suture. In the original description of the technique, if the tissues were not adequately compliant then two stitches were utilized to bring the urethral edges together. Part of the appeal of the MAGPI procedure was the ability to do a distal repair without doing a formal urethroplasty. We subsequently decided that tissue reconfiguration into an inverted V shape was required to adequately perform this procedure. If this important tissue characteristic and reconfiguration is not present, we abandon the MIV glansplasty and convert it to a Thiersch-Duplay (TD) or TIP procedure. This transition to another technique is seamless and requires no additional maneuvers in preparation for the urethroplasty other than possibly needing to

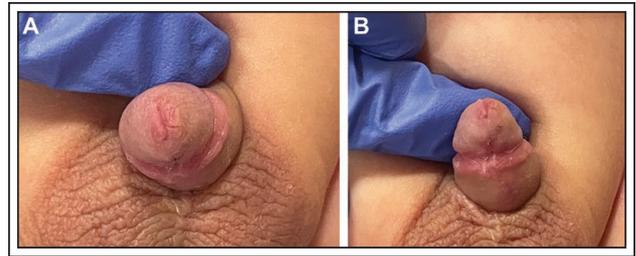


Figure 2. Patient 13 days postoperative after MIV repair showing slit-like meatus (A) and excellent glans approximation ventral to the meatus (B).

further mobilize the glans wings and incise the urethral plate. We estimate that an attempted MIV glansplasty is abandoned approximately 25% of the time for glanular and coronal meatuses and more often for subcoronal meatuses in favor of TD or TIP procedure.

Methods

Hypospadias repairs performed by a single surgeon between February 2000 and February 2020 at a tertiary care academic medical center were retrospectively reviewed following IRB approval. Study data were collected and reviewed for all hypospadias patients to identify cases that include the implementation of

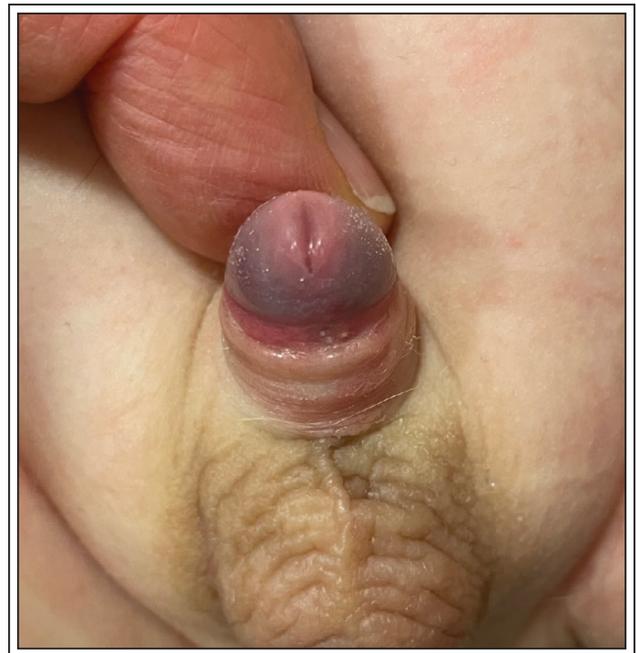


Figure 3. Another patient 2 months postoperative after MIV repair showing an excellent cosmetic outcome.

the MIV glansplasty. The data were managed using REDCap electronic data capture tools hosted at Penn State Health Milton S. Hershey Medical Center and Penn State College of Medicine. REDCap is a secure, web-based application designed to support data capture for research studies.⁶ Excluded from our study were procedures that did not utilize the MIV technique, procedures performed before February 2000, and repairs that were not performed by the senior surgeon.

For all eligible patients' operative variables included meatal position, glans size, glans groove, type of hypospadias repair technique, presence of congenital curvature, and curvature repair technique. Postoperative parameters analyzed included: length of patient follow up, the occurrence of a complication, type of complication, time to the complication, and the type of complication repair.

Results

Between 2000 and 2020, a single surgeon performed MIV repairs in 96 boys. Patient age at the time of procedure was between 4.1 months and 9.6 years with a mean age at surgery of 11.1 months and a median age of surgery of 7.6 months. The initial meatal location was glanular in 47, coronal in 38, and subcoronal in 11. Fifty-one of the 96 patients had concomitant congenital curvature; all of which were corrected utilizing permanent plication sutures. These boys were followed from catheter removal to 13.8 years with an average follow up of 6.9 months and a median follow up of 2.8 months. Four patients were lost to follow up immediately after catheter removal. There were a further 23 patients who were lost to extended follow up.

At the most recent postoperative visit, 90 (93.8%) of the 96 boys had excellent cosmetic outcomes with a slit-like meatus nicely positioned in the glans, Figure 2A and Figure 3, and definite ventral glans approximation, Figure 2B and Figure 3. Two boys had minor cosmetic issues not requiring an intervention.

Four boys developed complications necessitating surgical intervention following the MIV repair for a complication rate of 4.2%. Of the four complications, three were fistulas (3.1%) and the other complication was an inclusion cyst (1.1%). The fistulas developed 1.0, 4.1, and 17.7 months after surgery. The initial meatal location for the boys who developed a fistula was coronal in two and subcoronal in one. None of the 47 boys with a glanular meatus developed a fistula. The rate of fistula formation in boys with a coronal meatus was 5.3% (2 of 38). While only 11 boys had a subcoronal hypospadias the fistula rate in this population was higher at 9.1% (1/11).

All three fistulas were treated surgically. Two fistulas were repaired via a primary closure with each having an excellent appearance and no further complications. The third fistula was treated by dividing the tissue between the meatus and the fistula, leaving the patient with a subcoronal meatus. This re-operation was done based on parental preference.

There was no occurrence of complete glans dehiscence and there was no development of meatal stenosis. The inclusion cyst was excised with a good cosmetic outcome.

Conclusions

The MIV glansplasty consistently achieves excellent functional and cosmetic outcomes, especially in patients with glandular hypospadias. The procedure's success relies on tissue reconfiguration with a simple fixation suture and secure approximation of the glans wings. The procedure results in a cosmetic outcome of a normal or very near normal-appearing phallus and meatus, which has produced high parental satisfaction. Our data support that the MIV glansplasty is a reasonable choice for distal hypospadias in patients with appropriate glans characteristics. □

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