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"Simple Anatomical Closure-SAC" for distal hypospadias repair without glans wings dissection: Technical description and preliminary results

Ali Ekber Hakalmaz, Ali Sezer, Ayşe Karagöz Hakalmaz, Haluk Emir *

Division of Pediatric Urology, Department of Pediatric Surgery, Cerrahpaşa Faculty of Medicine, İstanbul University-Cerrahpaşa, İstanbul, Türkiye

* Correspondence to: Haluk Emir, Cerrahpaşa Tıp Fakültesi, Prof.Dr.Murat Dilmener Hastanesi, H-4 Blok, Çocuk Cerrahisi Anabilim Dalı, Yeşilköy Mah, Yeşilköy Cad, 34153, Bakırköy, İstanbul, Türkiye
hemir@iuc.edu.tr (H. Emir)

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Summary

Introduction
Glans wings dissection is an important part of hypospadias repair to ensure safe coverage of the neourethra. We here describe our technique entitled "Simple Anatomical Closure (SAC)" procedure, without extensive glans wings dissection, to preserve the distal continuity of spongious tissues and their glanular attachments.

Objective
Our aim is to evaluate the clinical results of the SAC procedure, while questioning the absolute necessity of glans wings dissection.

Patients and method
Cases that underwent SAC procedure between 2018 and 2023 were retrospectively analyzed for demographic data, perioperative findings, and clinical outcomes. Anatomical inclusion criteria for performing SAC procedure were: primary distal hypospadias cases with a wide glans penis, wide ventral periurethral triangles and well-developed distal periurethral spongious tissues. Cases with more than 30 degrees of ventral curvature and/or dysplastic urethral plate were excluded.

For the SAC technique: following total penile degloving and exposure of distal penile structures, the urethral plate mucosa is separated from glanular mucosa while ventral glanular periurethral triangles are deepithelialized. Urethral plate incision with or without inlay grafting is applied if indicated. A limited distal urethral spongious tissue dissection is performed towards the glans penis while preserving spongious continuity and glanular attachments. Dorsal midline plication and/or complete urethral dissection with ventral corporotomies are applied if necessary for correction of ventral curvature. Penile structures are then closed according to their anatomical order.

Results
SAC procedure was applied in 43 (2 glanular, 18 coronal, 23 subcoronal) primary distal hypospadias cases between 2018 and 2023. The median operation age was 25 months. Urethral plate incision was done in 39 cases and preputial inlay grafting added in 18. Ventral curvature was present in 34 cases (15—30°), which was corrected with penile degloving, dorsal midline plication, urethral dissection/separation and superficial ventral corporotomies, when necessary. Mean follow-up period was 32.5 months. Late term results revealed 1 fistula, 1 glanular tilt, and 2 mild distal glans dehiscences with no ventral curvature recurrence, penile rotation, diverticula, or stenosis.

Discussion
Glans wings dissection is a commonly used technique during hypospadias repair that possibly increases success rates. However, in selected cases, reconstruction of penile structures without extensive glans wings dissection is possible. Recently described surgical modifications also have similar principles and recommend glanuloplasty without extensive glans wings dissection.

Conclusion
"Simple Anatomical Closure" procedure without glans wings dissection is a safe method for primary distal hypospadias repair, with satisfactory outcomes and a low complication rate.

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Introduction

There are hundreds of surgical techniques described for hypospadias repair. In distal hypospadias cases, neourethra is usually formed using native urethral plate, with or without additional maneuvers such as a midline incision, inlay grafting or meatal based flaps. Presence of a healthy urethral plate with well-developed spongious tissues and a sufficiently sized glans penis are important anatomical factors that have an impact on surgical outcome. In addition, applied techniques and maneuvers are crucial for successful surgery. Dissection of glanular wings to cover the neourethra is almost a routine part of hypospadias surgery. Creating a supportive layer over the neourethra with subcutaneous tissue such as a dartos patch, is the other common maneuver used to increase success rate [1—3].

Although the development of ventral penile tissues is affected in the embryologic pathogenesis of hypospadias, a healthy urethral plate with well-developed spongious tissues are found to be present in most of the distal cases, which are used to reconstruct the neourethra and perform spongioplasty as a second layer [3]. In most of the surgical techniques, separation of the urethral plate from glans penis with a peri-urethral "U" shaped incision and preparation of the glans wings laterally, are recommended as routine maneuvers. While doing so, the existing spongious tissues are either cut or their continuity to the glans penis is impaired. In our clinical experience, we observed that in a significant amount of distal hypospadias cases; the urethral mucosa, spongious tissue and glans penis could be reapproximated according to their anatomical order, with neither a deep "U" shaped peri-urethral incision nor glans wings dissection applied. The aim of this study is to describe the Simple Anatomical Closure (SAC) technique for primary distal hypospadias cases and present its' clinical results. Our second objective is to question the absolute necessity of glans wings dissection and subcutaneous tissue coverage of the neourethra, to achieve surgical success in distal hypospadias cases.

Patients and method

In our clinic, SAC procedure was first used in 2011 and was standardized in 2018. For this study, data have been collected regarding primary distal hypospadias cases operated with SAC procedure between September 2018—November 2023. All the operations were done or actively supervised by the same senior consultant surgeon (HE). Demographic data, peri-operative findings, early and late term clinical outcomes were retrospectively evaluated.

Patient selection

At peri-operative physical examination, primary distal hypospadias cases were evaluated to be suitable for SAC procedure if the following anatomical criteria was met: presence of a wide glans penis, wide ventral periurethral triangles (that could effortlessly be wrapped around an 8/10 French urethral catheter, according to the patients' age) and well-developed distal periurethral spongious tissues (Fig. 1 A, B, C).

Surgical technique

Following penile degloving, the urethral plate, periurethral spongious tissues and ventral glanular spongious tissues are exposed (Fig. 1 D). The width of the glanular wings is re-evaluated to effortlessly wrap around a proper sized catheter at coronal level, and if so, the decision to perform SAC is made. Afterwards, the borders of the urethral plate mucosa and glanular mucosa are identified and incised, then ventral glanular periurethral triangles are deepithelialized by sharp excision on both sides (Fig. 1 E, F). If indicated, a urethral plate incision with or without inlay grafting to augment the urethral plate, dorsal midline plication and/or a complete urethral dissection with multiple ventral corporotomies to correct the ventral curvature can be applied at this stage. Penile structures are then closed according to their normal anatomical order. The urethral mucosa is closed (using separate 7/0 polyglycolic acid or polydioxanone sutures) as the first layer (Fig. 2 A). The spongious tissues are closed from proximal to distal using 6/0 sutures as the second layer (Fig. 2 B), followed by glans penis closure where the deepithelialized surfaces of glans penis are closed on the midline (Fig. 2 C, D). The operation is then completed with skin closure (Fig. 2 E,F), and the urethral catheter is replaced with a same size silicon catheter (Zaontz urethral stent, Cook Medical, Bloomington, USA) with the tip of the catheter being

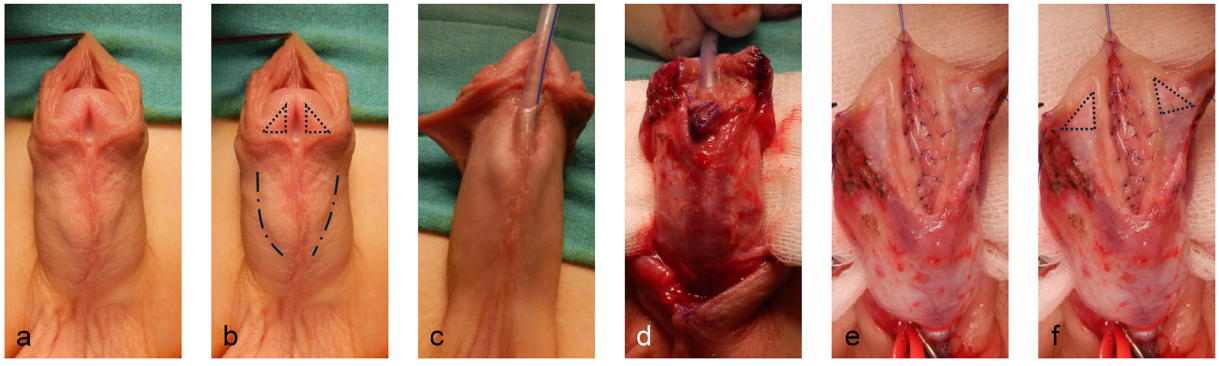


Fig. 1 A distal hypospadias case, with a wide glans penis that could be wrapped around a 10 fr catheter (A, B, C). Penile degloving and exposure of ventral tissues (D). Ventral glanular triangles (dotted area on F) are deepithelialized on both sides (E, F).

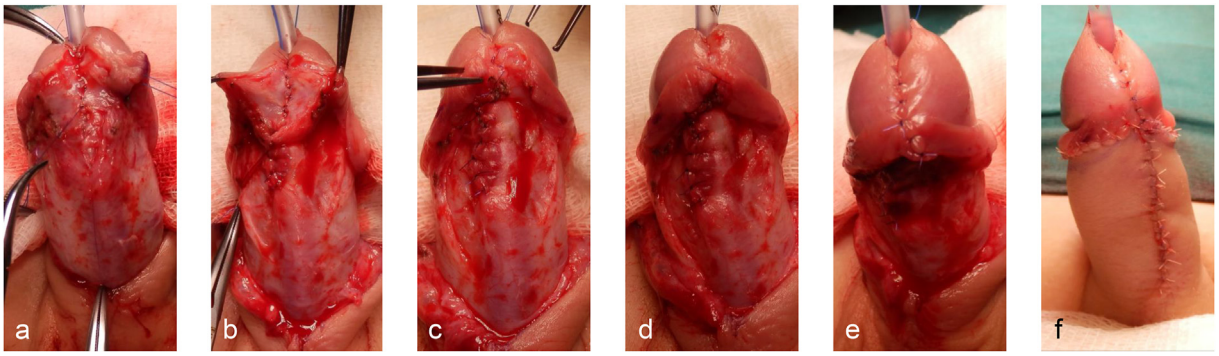


Fig. 2 The urethral mucosa is closed (with separate 7/0 polyglycolic acid or polydioxanone sutures) as the first layer (A). The second layer, spongious tissue is closed from proximal to distal (B). Glans wings, and deepithelialized surfaces of glans penis are closed on midline (C, D) and the skin closure is done (E, F) (at the end of operation, urethral tube is replaced with a same size silicone catheter).

at the bulbar urethra. Bladder drainage is maintained for one week by placing a 4 Fr or 5 Fr stent through Zaontz catheter.

Results

In the years between 2018 and 2023, the SAC procedure was used in 43 primary distal hypospadias cases. The median age of the patients was 25 months (range: 8 mo-10 yr). The location of the urethral meatus was glanular in 2, coronal in 18 and subcoronal in 23 cases. A urethral plate incision was applied in 39 cases and inlay preputial grafting was applied in 18 of these cases.

Ventral curvature was present in 34 cases, with an average of 21.7° (range: 15—30°). After dissection of the spongious tissue, 20 cases had residual curvature and underwent dorsal midline plication. Curvature persisted in 9 of these cases, in which the urethra was mobilized by dissecting it off the corpus cavernosum. Finally, in 7 of these cases, superficial ventral corporotomies were added to correct the remaining curvature.

Penile tourniquet was applied in all cases, with an average of 19.3 min (range: 2—30 min).

The mean time for urethral stent removal was 12 days (range:7—20 days) postoperatively. After stent removal, the topical application of betamethasone containing lotion to the urethral meatus, twice a day for four weeks, was routinely prescribed in all cases.

Mean postoperative follow up was 32,5 months (range:18—76 mo). No curvature recurrence, urethral stenosis, diverticula, or penile rotation was encountered. Late term complications were seen in 4 cases. One case with a dorsal plication developed a mild ventral glanular tilt, and one case developed a thin subcoronal fistula, both of whom were not grafted. Two cases with graft repair developed distal glans dehiscence, while their external meatus stayed at the glanular level. One of these cases had had a prior localized infection, which was the only early postoperative complication in our series.

Discussion

In this study we described the "Simple Anatomical Closure" procedure without routine glans wings dissection and a supportive layer of dartos patch, for the repair of primary distal hypospadias. Our clinical results demonstrated that it is a safe and effective method, with a low complication rate.

Although there are numerous surgical techniques described in the literature, there is no standard method which can be applied for all hypospadias cases. The specific anatomical qualities of each case possibly determine the preferred surgical technique. If the native urethral plate is available and healthy, it is generally used to create the neourethra. The urethral plate can be tubularized without an additional maneuver when it is wide enough (Tierch-Duplay technique), otherwise the urethral plate may be augmented by midline incision (TIPU) with/without inlay graft, or by meatus-based flaps (Mathieu & Barcat techniques). Adding a supportive layer coverage over the neourethra, using dartos or similar tissues, is a widely accepted maneuver that has been shown to reduce complication rates. Another surgical detail that possibly increases success rate is glans wings dissection. During glanuloplasty, careful dissection and separation of the ventral glans wings from the cavernous bodies up to the lateral border on both sides, makes an easier and tension free glans closure over the neourethra, and reduces the risk of possible postoperative glans dehiscence. The glans wings dissection provides space for the supportive patch as well.

All the technical details mentioned above, with many others, have contributed to surgical success rates over the years. In our clinic, we have also successfully used glans wings dissection and second layer coverage over the neourethra for many years. However, during our daily practice, in some primary distal hypospadias cases, we discovered that a simple anatomical closure of distal penile structures is possible, without glans wings dissection and separation of glans wings from the urethral plate. Other points of importance were the distal spongious tissues that were usually ignored during glans preparation and dissection. Hence, we started using simple anatomical closure in selected cases 14 years ago. Initially, our selection criteria were the presence of a wide glans penis, a deep urethral plate and healthy distal periurethral spongious tissues on both sides, without accompanying severe ventral curvature. When we evaluated our clinical results with SAC procedure, we came across a low complication rate,

thereby it became a standard procedure in our clinical practice for suitable distal hypospadias cases. As we gathered experience, the technique was modified, and the selection criteria was extended. Consequently, cases with mild ventral curvature and/or a shallow urethral plate were also selected for the SAC technique.

In glans approximation procedure (GAP) which was described in 1989, deepithelialized ventral glans surfaces are brought together at midline over the neourethra [4]. This technique is selectively used in "glanular and coronal hypospadias with a wide, deep glanular groove and non-compliant urethral meatus". Similar to GAP, deepithelialized glans reconfiguration (DeGRe) procedure was described in 2021, in which the authors do not tubularize the urethra, relaying on its' secondary healing beneath the reapproximated deepithelialized glans tissue [5]. This technique is also recommended for coronal hypospadias cases with a wide, deep glanular groove. In our technique, we do deepithelialize ventral glanular surface in a triangular shape and reapproximate it on the midline. We also do not separate glanular tissue from the urethral plate or cavernous bodies. However, distinctly from GAP and DeGre procedures, we do successfully perform SAC procedure in cases that need urethral plate incision or augmentation, as in cases that need curvature correction.

An additional difference of our technique is that we perform routine penile degloving and spongioplasty. An important point of spongious dissection is to progress up until the glanular level while preserving its' distal continuity with glans penis and urethral plate. This dissection and preparation allow for an anatomical reconstruction of the penile structures, while the spongioplasty at the coronal level especially aids in bringing the glans wings together at the midline. We believe that this maneuver decreases glans dehiscence risk, as previously shown in clinical studies [1—3].

Ventral curvature correction is an important step of hypospadias surgery. Distal hypospadias cases do not usually present with curvature or have less than 30 degrees of ventral curvature, which can be fixed via dorsal or combined approaches. SAC procedure is also applicable for cases with mild ventral curvature. In our series, there were 34 cases with curvature that were successfully corrected under SAC procedure, mainly with dorsal midline plication and ventral corporotomies, when neeeded.

SAC procedure provides both spongious and glanular tissue support over the neourethra. Through minimal dissection on the surgical field, the healing process is thought to be improved in relation to extensive glans wings dissection. We do not use additional neourethral coverage with dartos or similar connective tissues. In this regard, we consider the subcoronal fistula that developed in one of our cases during follow-up as an acceptable complication, similar to those reported in the literature [6,7].

In 2021, Seleim reported "topography guided reassembly" technique for distal hypospadias [8]. This technique was used in 49 patients and was reported to have a very low complication rate with one ventral skin dehiscence and two urethrocutaneos fistulas that healed after urethral calibration. In the same year "Buck's fascia repair with wingless glanuloplasty" technique was described with similar principles which was used in both distal and midpenile hypospadias cases [9]. The authors reported a low complication rate of 2 % cutaneous fistula and no glans dehiscence.

Recently Gupta et al. described a detailed glans wings preparation technique that preserves the glanular vascular arcade [10]. Although the philosophy of the technique is similar with ours, they use a more extensive dissection under the glanular wings, preserving vascular arcade. They have encountered some minor perioperative complications but more importantly, reported almost zero postoperative complications.

All the above-mentioned recently described surgical techniques have a common principle with our technique, as they recommend glanuloplasty without extensive glans wings dissection. They have also reported similar clinical results as ours, supporting that the anatomical closure of glanular structures without extensive glans wings dissection and second layer coverage with dartos or other subcutaneous tissues, is a safe method for distal hypospadias cases, with a very low complication rate.

Limitations of our study include low case number and lack of long term, especially post-pubertal results.

In conclusion, "Simple Anatomical Closure" allows reconstructing glanular tissues in accordance with their anatomical order, without extensive dissection and extra tissue transposition, which possibly improves tissue healing and in turn positively effects short- and long-term clinical results. Therefore, SAC procedure can be considered a safe method for primary distal hypospadias repair without glans wings dissection.

Ethical statement

This study was approved by the Local Ethical Committee (date:18.02.2022 number: 316526).

Declaration of Generative AI and AI-assisted technologies in the writing process

Generative AI and AI-assisted technologies were NOT used in the preparation of this work.

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Declarations of interest

None.

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