

Is the double cross flap technique the panacea for avoiding fistula formation in hypospadias surgery?

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Objective The aim of this study was to analyze retrospectively the 9-year experience of a single institution in the use of the double cross flap technique to interpose a double dartos flap to protect the neourethra with the aim of preventing fistula formation.

Patients and methods Between October 2005 and September 2014 a total of 127 children with distal and mid-shaft primary hypospadias underwent tubularized incised plate urethroplasty by means of a double dartos flap obtained with a double cross flap to protect the neourethra. A Foley catheter was left *in situ* for 7 days. Success was defined as no incidence of complications requiring reintervention, along with good cosmetic result. A questionnaire was administered to estimate parental satisfaction. Parents were asked to evaluate the cosmetic appearance of the penis as good, acceptable, bad, or indifferent.

Results The patient age at the time of surgery ranged from 12 months to 10 years (median 39 months). Three patients exhibited fistula at follow-up (2.3%). In two patients a glandular dehiscence of the urethroplasty occurred (1.5%). Mild stenosis of the neomeatus occurred in three patients (2.3%). No penile iatrogenic rotation

occurred. A 'good' cosmetic result was reported by 68.5% of parents, acceptable by 22.8%, bad by 3.9% and indifferent by 4.7% of parents as per the parental questionnaire.

Conclusion The double cross flap technique is not the panacea to prevent fistula formation in hypospadias surgery. Nevertheless, it offers an unquestionable advantage in terms of avoidance of fistula formation. The experience and skills of the surgeon performing urethroplasty remain the mainstay for best results. *Ann Pediatr Surg* 12:150–154 © 2016 Annals of Pediatric Surgery.

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Introduction

Urethrocutaneous fistula represents one of the most frequent causes of morbidity in urethroplasty. Hypospadias can be repaired using different surgical techniques but, regardless of the technique, incidences of recurrent fistula have been reported with a rate of 10–15% associated with one-stage repairs [1].

The etiology of fistula and wound dehiscence has been a controversial issue in pediatric urology. Several factors such as suture material, infection, previous operations, catheterization and surgical skill may significantly affect the outcomes. Various procedures have been developed to avoid fistula formation and the frequency of fistula development has decreased over the last two decades. Nowadays, a 5% fistula rate is usually anticipated [2].

One of the most important factors for avoiding the development of a fistula is the application of a protective intermediate layer of tissue between the neourethra and the skin [3].

Using tubularized incised plate (TIP) urethroplasty [4] in conjunction with a protective layer of tissue to cover the suture line can help prevent fistula formation, either in first correction of hypospadias or in reoperative urethroplasty [3,5].

Here we report our 9-year experience in using the double cross flap technique (DCFT) [6] to interpose a double

dartos flap (DDF) to protect the neourethra with the aim of preventing fistula formation.

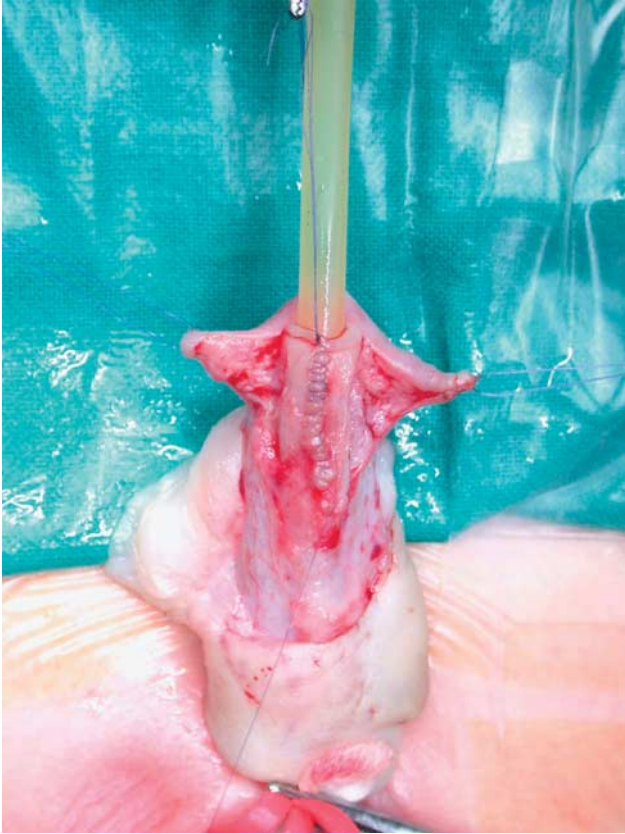
Patients and methods

A total of 127 children aged 12 months to 10 years (mean 39 months) underwent TIP urethroplasty with DCFT between October 2005 and September 2014. All patients were submitted to the intervention for distal and mid-shaft hypospadias. No patient had undergone urethroplasty previously.

After creating the neourethra through TIP urethroplasty (Fig. 1), the de-epithelialized preputial flap is prepared as a transverse island flap. To preserve the course of vascular supply transillumination is used, and then a longitudinal incision is made along the vascularized flap to create two halves (Fig. 2).

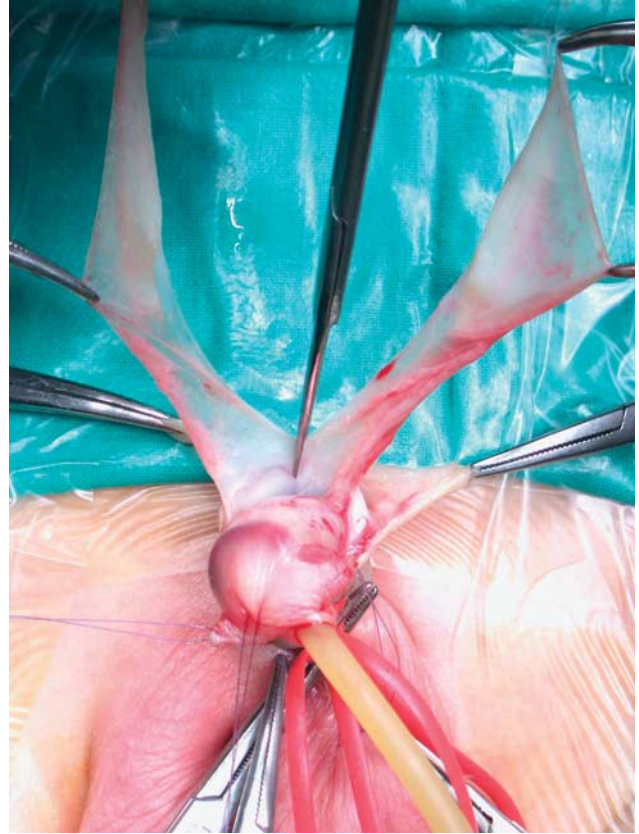
The two halves are de-epithelialized, and ventrally rotated over the neourethra, one to the right and one to the left. Continuous or interrupted sutures can then be used to fix the flaps over the neourethra. The first flap is positioned over the neourethra and sutured along both sides of the neourethra with two continuous polyglactin 7-0 sutures (Fig. 3). The second flap is then transposed exactly over the first flap, covering it entirely (Fig. 4). Interrupted sutures of the same material are used. This approach creates a double cross flap on the neourethra

Fig. 1



A tubularized incised plate urethroplasty is created.

Fig. 2



A longitudinal incision is made along the vascularized flap to create two halves.

but the sutures of the two flaps do not overlap each other (Fig. 5).

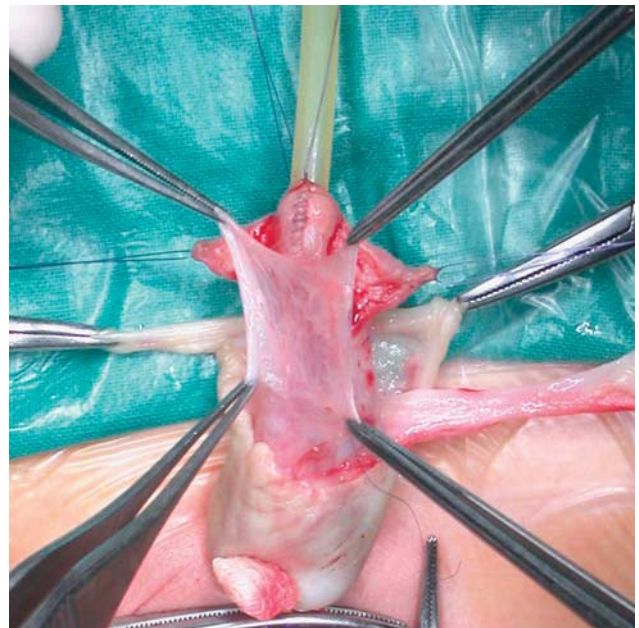
The glans and skin are closed conventionally (Fig. 6). In all cases we used 6-0 and 7-0 polyglactin sutures. Patients were discharged home the following day. For all patients, the postoperative course was standardized as follows. A Foley catheter (6Ch or 8Ch for younger patients, and 10Ch for older patients) was left *in situ* for 7 days. Compressive penile dressing was removed on the fourth day postoperatively and a noncompressive dressing was applied. Antibiotic therapy with amoxicillin + clavulanic acid was given to all patients until the Foley catheter was removed. Success was defined as no incidence of complications requiring reintervention, along with good cosmetic result. Cosmetic parameters evaluated were as follows: normal appearance of the meatus (size, position and orientation), and parental satisfaction. To estimate parental satisfaction a questionnaire was administered. Parents were asked to evaluate the cosmetic appearance of the penis as good, acceptable, bad, or indifferent.

This study was approved by the ethics committee of S. Maria della Misericordia Hospital of Perugia, Italy.

Results

The median follow-up time was 4 years and 8 months (range, 1 year–9 years); age at the time of surgery ranged from 12 months to 10 years (median 39 months); 19 children presented with ventral curvature, which resolved

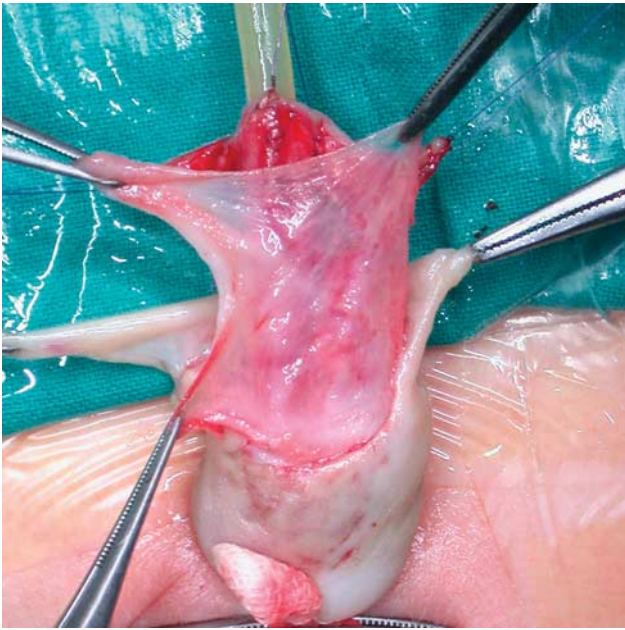
Fig. 3



The first flap is positioned over the neourethra.

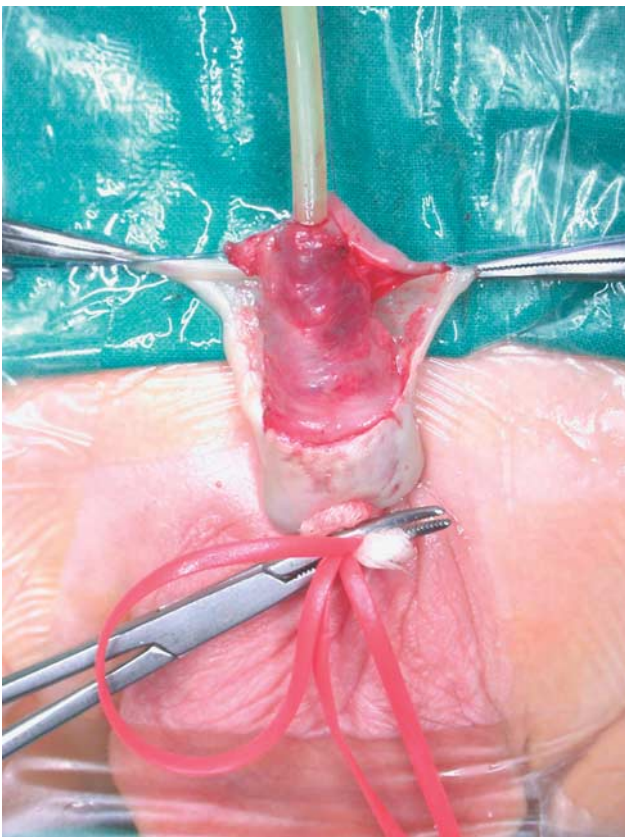
in four following the Nesbit procedure and in 15 following excision of the ventral chordee. Surgical time ranged from 90 to 120 min.

Fig. 4



The second flap is then transposed exactly over the first flap, covering it entirely.

Fig. 5



A double cross flap over the neourethra is created.

Overall, the surgery was successful in 119 patients (94.7%). Three patients were seen to have developed fistulae at follow-up (2.3%). Of these fistulae,

Fig. 6



The penis at the end of the intervention.

one resolved spontaneously, another one was repaired by application of cyanoacrilate [7], and the last needed a new intervention [8]. In two patients a glandular dehiscence of the urethroplasty occurred (1.5%).

Mild stenosis of the neomeatus occurred in three patients (2.3%), which was treated and resolved with dilations at home for 15 to 20 days using a self-lubricating catheter of the same caliber as the urinary catheter used for urethroplasty.

The catheter was inserted just above the native hypospadiac meatus for 15 min twice daily. All dilations were performed by parents of the patients, who had received training. Follow-up was 20–34 months and no recurrence was observed.

No penile iatrogenic rotation occurred. A slit-like neomeatus on the tip of the glans was obtained in most of the cases.

From the parental questionnaire we obtained the following results: 'good' cosmetic result was reported in 87 cases (68.5%), acceptable in 29 (22.8%), bad in five (3.9%), and indifferent in six cases (4.7%).

Discussion

One of the most important ways for avoiding the occurrence of a fistula is the application of a protective intermediate layer of tissue between the neourethra and the skin [3]. In fact, flapless urethroplasties have a higher risk for fistula development [9].

It is not clear how a urethrocutaneous fistula develops in the presence of an interposed flap. Moreover, when a single dartos flap is used, a fistula track can develop through the suture line next to the flap edge. The fistula can develop through a small perforation of flap due to injury during dissection, focal ischemic injury, or infection.

The technique of applying an intermediate flap of dartos was introduced by Belman [10], who demonstrated that the layer between the neourethra and the skin can contribute remarkably to hypospadias repair.

The use of other protective intermediate layers has been described as alternatives to the dorsal ones especially in circumcised boys or those undergoing reoperation [3,11–13].

Finally the use of adjacent spongiosum tissue to protect the neourethra as second-layer coverage [14] has been reported but it is limited especially in mid-shaft and proximal hypospadias.

Some authors have reported no incidence of fistula after hypospadias repair with a single overlay [5,15]. Others using only a single flap for urethral coverage have reported an incidence of fistula ranging from 4.8 to 14% [16,17].

However, urethrocutaneous fistulae represent the most frequent complication for hypospadias repair [18,19] and the reported incidence ranges from 2 to 16% [20,21].

The first author to publish a DDF to protect the neourethra was Kamal [22], affirming that DDF provides more protection against fistula development than a single flap. When a DDF is fashioned, a possible damage to the first flap, which may cause fistulae, would be protected by the second one.

Since this date, other authors have reported their experience in covering the neourethra with a double layer of dartos tissue in TIP urethroplasty, adopting similar techniques and with excellent results [6,23–26]. In 2011 a multicentric study on this method was published that included 394 patients, with a fistula rate of 1% [27].

It is well known that fistulae appear in areas of least resistance of the reconstructed urethra because of an inadequate cicatrization process and/or due to infective processes that are often related to poor blood supply. In the case of DCFT, in order to enable adequate blood supply to the flap, dissection transillumination is used to preserve the course of the vascular supply and to make a longitudinal incision along the vascularized flap.

We think that the double well-vascularized flap interposed between the neourethra and the skin might have a very good blood supply for the neourethra.

In our previous manuscript [6] we reported an incidence of fistula of 0%, as well as the results of other authors who used a DDF [24,25]. In this more extensive series, three patients exhibited fistulae at follow-up (2.3%). Nevertheless, considering that in one patient the fistula recovered spontaneously the incidence of fistula decreased to 1.5%.

Meatal stenosis is another complication that may be observed after the TIP procedure. The literature indicates the occurrence of meatal stenosis to be between 0.7 and 17% after TIP repair [28,29]. In the study by Lorenzo and Snodgrass [28], the dorsal midline incision wound healed without cicatricial evidence and did not cause meatal and urethral stenosis. However, tight closing of the distal neourethra could cause a narrow meatus [29].

In our experience we had only three cases of mild stenosis (2.3%). In all cases stenoses were limited to the meatus and they were managed by simple meatal dilation. None of these cases required meatotomy.

Dehiscence in the presence of the dartos flap is a rare complication, but Elbakry [9] claimed that the dartos flap should not be used because it hinders tension-free closure of the glans flaps and increases the risk for glanular dehiscence. We believe that the drawback of the DCFT might be the considerable thickness of tissue that may make approximation and closure of the glanular wings difficult. Therefore, the presence of a double cross flap to protect the neourethra could pose a greater risk for glanular dehiscence.

In the present case series glanular dehiscence was seen only in two cases (1.5%), which was probably due to the limited experience of some surgeons in this technique. To avoid this complication we suggest that the glans wings be widely separated and generously deepened to obtain good mobility for later closure. Nevertheless, dehiscence limited to the glans occurred in two cases of repaired mid-shaft hypospadias, which needed reoperation.

Penile rotation may be another possible complication after TIP urethroplasty carried out using a single flap with a transverse island of dorsal subcutaneous tissue to protect the neourethra as described by Retik and colleagues. Limiting factors such as poorly developed ventral skin, insufficient flap length, and asymmetric flap were reported to be the cause of penile rotation.

Snodgrass [4] originally described the technique as involving protection by a transverse island of dorsal subcutaneous tissue used as a flap. Later on, probably for the possibility of penile rotation, Snodgrass [30] transposed the flap ventrally in a buttonhole fashion to cover the neourethra.

In a well-fashioned TIP urethroplasty protected by a double cross flap, both flaps are ventrally rotated and

transposed over the neourethra, with symmetric rotation and equal tension trying to avoid penile rotation. In this case penile rotation did not occur.

The DCFT is simple to perform, and the flaps used to protect the urethroplasty are easy to obtain. Although the DCFT is not the panacea to prevent fistula formation in hypospadias surgery, it offers an unquestionable advantage in terms of avoidance of fistula formation. Nevertheless, the experience and skills of the surgeon performing urethroplasty remain the mainstay for best results.

Acknowledgements

Conflicts of interest

There are no conflicts of interest.

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