

Systematic Approach for the Management of Urethrocutaneous Fistulae after Hypospadias Repair

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ABSTRACT

Urethrocutaneous fistula is one of the most frustrating complications seen after hypospadias repair. Fistula may result from, or be associated with, distal stricture or meatal stenosis. Other risk factors include failure to invert all epithelial edges at urethroplasty, devitalization of tissues, or failure to add appropriate second-layer urethroplasty coverage. The aim of our study is to describe a systematic approach for the management of primary or recurrent urethrocutaneous fistula using different vascularised flaps as a watertight second layer covering, 45 boys with urethrocutaneous fistula (UCF) were included in this study. We stratified fistulas according to the site, size and condition of local tissues as these factors influence the repair technique. According to the availability of local tissue, the decision for second layer covering was decided taking into consideration, the size of the fistula and its location. 38 patients had primary repair for distal hypospadias and 7 patients had proximal hypospadias. Four of our patients had multiple fistulas which were joined together forming only one defect. Distal stricture was present in 10 patients, 7 responded to frequent dilatation and 3 required meatotomy. Out of the 39 distal fistulas, 39 patients adequate local tissue and remnant of perpuceal mucosa were available for covering the first layer, 4 patients required tunica vaginalis and 2 patients we used dartos flap due to deficient local tissue and extensive scarring. The fistulas recurred in 3 patients of distal repairs and one patients in the proximal repairs with overall incidence of 8.9% In Conclusions, Although simple closure of fistula appears to be technically easy and not time consuming, it associated with considerable rate of recurrence. The multilayer covering with the use of watertight vascularized flap appears to an important influence factor for the success of fistula repair. However the decision for flap harvesting should be taken according to the site of the fistula and the condition of the near by local tissue.

INTRODUCTION

Many techniques for Hypospadias repair have been described according to the length of the defect. However none of them was free of complications. Urethrocutaneous fistula is one of the most frustrating complications seen after hypospadias repair. Many authors reported the incidence of this complication at different frequency according to the technique adopted [1].

The urethrocutaneous fistula encountered after hypospadias repair may be single and simple or it may be multiple and complicated. Common sites include the site of the original meatus, the corona and the glans penis. Fistulae at the corona and the glans are more difficult to treat and have a higher incidence of recurrence.

Multiple and complicated fistulae are less common; they may occur due to technical factors such as ischemia, infection and distal stenosis [2].

The occurrence of urethrocutaneous fistulae may be related to the technique of urethral tube fashioning, the number of suture line whether single as with the TIP and Duplay procedure or multiple as with the Onlay flaps, suture material and needle used, the present of overlapping suture line without interposing layer [3,4].

Fistula may result from, or be associated with, distal stricture or meatal stenosis. Other risk factors include failure to invert all epithelial edges at urethroplasty, devitalization of tissues, or failure to add appropriate second-layer urethroplasty coverage. The latter of these, second layer coverage of the neourethra, has been shown to significantly reduce the fistula rate as reported by several authors. Repair of urethrocutaneous fistula is optimized by the same principle [3,5].

Many modifications for fistula repair were introduced starting by improving surgical techniques in primary hypospadias repair; use of fine suture with proper needle design, optical magnification, fine tissue handling and the most important aspect is the use of interposing watertight tissue layer [4].

The use of well vascularised watertight interposing flaps appears to be the most important factor

preventing the recurrence of fistula. These flaps can be derived either from remnant of prepuce, Dartos based flap, tunica vaginalis flap. Many authors reported the results of using varying flaps with improving the fistula repair rate and decrease recurrences [6-9].

The choice of the proper flap varies according to the site, size and number of the fistulae, the presence of excessive local tissue scarring, duration from the primary procedure, previous fistula repair also the skills of surgeon is very crucial [10].

The aim of our study is to describe a systematic approach for the management of primary or recurrent urethrocuteaneous fistula using different vascularised flaps as a watertight second layer coveri.

PATIENTS AND METHODS

Between November 2006 and November 2008, 45 boys with urethrocuteaneous fistula (UCF) were admitted to Cairo University children's hospital, Pediatric Surgery Department and Pediatric Urology Department.

Preoperative assessment included: Site, size and number of fistulae, condition of local tissue (Table 1). The presence of distal stenosis or obstruction was excluded by routine calibration of the urethra distal to the fistula site. The Type of hypospadias repair and number of previous fistula repair were also recorded (Table 2).

We stratified fistulas according to the site, size and condition of local tissues as these factors influence the repair technique.

In all patients the attempts of repair was delayed for at least 6 months after the last procedure to allow for maximum tissue recovery and scar maturation.

Table (1): Pre-operative characteristics of fistula.

Site of fistula (number of patients)	Distal (36) Midpenile (3) Proximal penile (4) Penoscrotal (2)
Number of fistula (number of patients)	Single (41) Multiple (4)
Condition of the local skin	Good 39 Bad 6
Size of fistula (number of patients)	<5mm (36) >5mm (9)

Table (2): Type of hypospadias and primary repair.

Type of Hypospadias (%)	Type of repair (Number of patients)
Distal 38 patients (84.4%)	TIP (30) Mathieu (3) Onlay (2) Dupley (3)
Proximal 7 patients (15.6%)	TIP (3) Duckett (2) Dupley (1) Buccal mucosa (1)

After the administration of general anesthesia and caudal block, patients were painted and draped, suspension suture 5/0 vicryl applied at the glans. The site and number of fistula were identified by injecting iodine solution with a syringe through the meatus after applying manual pressure proximally at the penoscrotal region to close the urethra. It helped to identify the site of the fistula and to exclude any further fistulas.

The site of fistulas was then marked with a skin marker. Adrenaline at concentration of 1: 200000 was injected around the fistula. After calibration of the distal urethra an 8 French Neleton catheter is inserted.

Before attempting any repair of a fistula, it was important to recognize the presence of a distal urethral stricture, because any such structure leads to recurrence of the fistula.

The distal urethra was examined for evidence of obstruction. Any obstruction found was corrected simultaneously with the fistulas repair.

Surgical technique:

The edge of the fistula is excised following the marks down to the healthy urethra, in fistulae less than 5mms, The edges were trimmed, de-epithelialised and inverted under optical magnification (2.5X surgical loupe) using 6/0 vicryl continuous suture water tight as the first layer of closure and interrupted suture as a second layer. In fistulae larger than 5mm, skin flaps with wider base were developed to allow closer of the fistula without tension. In cases with multiple fistulas they are joined together into single defect and managed as large fistula.

According to the availability of local tissue, the decision for second layer covering was decided taking into consideration the size of the fistula and its location as presented at Fig. (1).

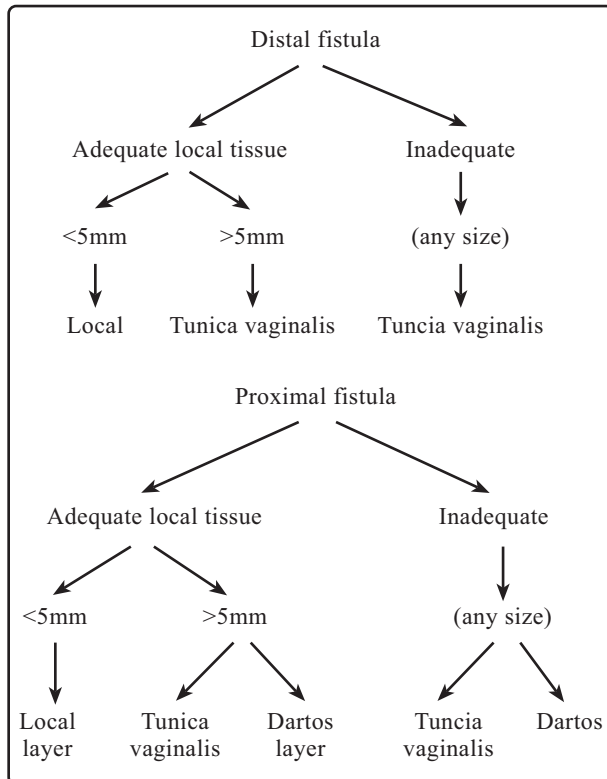


Fig. (1): Algorithm for acquiring the second layer covering according to the site, size of the fistula and the condition of local tissue.

The priority was given for local tissue either remnant of prepuce or bucks fascia to cover the repaired fistula. Flaps from neighboring tissue were elevated and approximated with interrupted 6/0 vicryl over the second layer (Fig. 2-a,b,c). In case of Local tissues that were found deficient in fistula repaired more than one time, the choice for another alternative was considered.

Tunica vaginalis flap in the more distal fistulae is acquired through 1 cm incision at the penoscrotal junction where the tunica is delivered taking care to avoid the cremasteric muscle fibers. The length of the flap is made 2-3 mm longer then the distance from the penoscrotal junction and the distal part of the fistula. Careful dissection elevates the tunica vaginalis from the spermatic cord. This dissection is carried out parallel to the spermatic cord toward the superficial inguinal ring as far as vision and retraction allow, taking care to leave all of the surrounding tissue and cremaster fibers with the pedicle to ensure its rich blood supply (Fig. 2-d).

The tunica vaginalis flap is then tunneled under the shaft skin and brought out through the most distal part of UCF tract and then fixed over the first layer in four corner fashion using 5/0 vicryl. The skin overlying the fistula is then closed.

Dartos flap were used for proximal fistulae where a skin incision extending from the proximal end of the fistula extending into the scrotum for 2-3cm is made. The incision was just skin-deep until the subcutaneous Dartos muscle was visualized. The scrotal skin was then undermined on both sides of the incision for about 1-1.5cm on either side and a tongue-shaped flap was marked on the Dartos (Fig. 2-e). The length of the flap is being 2-3mm more than the length from the distal end of the fistula to the penoscrotal junction so as to overlap the fistula and its width also 2-3mm more than the maximum width of the UCF. The flap is then fixed over the repaired fistula in four corner fashion using 5/0 vicryl. The skin overlying the fistula is then closed.

Urethral stent was then kept in place 7-10 days. Afterward patients were followed-up weekly in the first month then every month for 6 months.

RESULTS

The mean age was 4.7 years ranging from 2-9 years.

38 patients had primary repair for distal hypospadias and 7 patients had proximal hypospadias. TIP was the most procedure done for both distal and proximal hypospadias, also other procedures were used Table (2).

The majority of fistulas were distal extending from the sub coronal to midpenile area, where 6 patients had proximal fistula two of them were at the penoscrotal junction. We further stratified the fistulas according to the size as in fistulas larger then 5mm in transverse diameter were dissected widely to provide longer skin flaps to avoid closure under tension. 6 patients had previous attempt of closure.

Four of our patients had multiple fistulas which were joined together forming only one defect.

Distal stricture was present in 10 patients, 7 responded to frequent dilatation and 3 required meatotomy.

According to the availability of local tissue, the decision for second layer covering was decided. The type of second layer was dependent on several factors: The site of the fistula, availability

of local tissue according to the primary repair. Out of the 39 distal fistulas, 36 patients adequate local tissue and remnant of perpuceal mucosa were available for covering the first layer as circumcision was done as a step in the primary hypospadias repair, 3 patients required tunica vaginalis due to deficient local tissue and extensive scarring and those four fistulas were Anterior penile in position. The remaining 6 fistulas were located from proximal to the mid-penile region to the penoscrotal junction with only two fistulas at the penoscrotal junction. In 3 patients the fistula were covered by local tissue which was found enough for covering, two fistulas required scrotal based Dartos layer and in one fistula tunica vag-

inalis was used for covering (Table 3). The watertight flap was anchored in place by four corner 5/0 vicryl stitches avoiding the base of the flap. Then skin is closed. Dressing using Vaseline gauze with minimal compression.

The fistulas recurred in 3 patients of distal repairs and patients in the proximal repairs with overall incidence of 8.9%. The cause of recurrence was wound infection in 2 cases and persisting meatal narrowing in the remaining two. All patients were advised to do meatal calibration three times daily for ten days. Three fistulae healed spontaneously and the remaining were given a date for repair after six months.



Fig. (2-A): Anterior penile fistula.

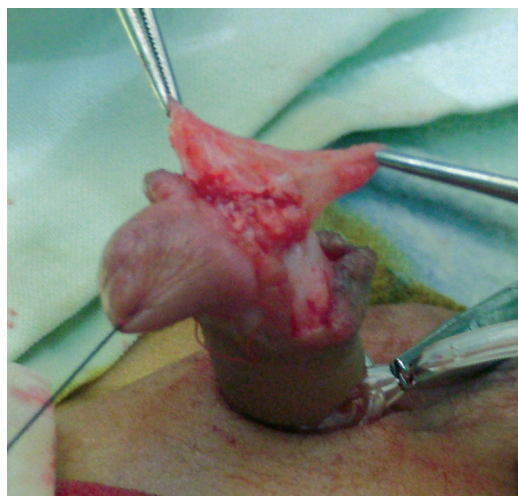


Fig. (2-B): Local tissue flap elevated to cover the repaired fistula



Fig. (2-C): One month postoperative.

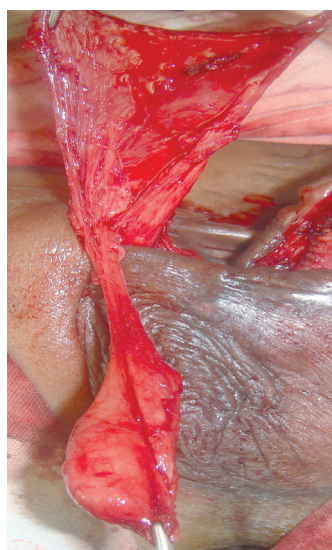


Fig. (2-D): Tunica vaginalis flap.

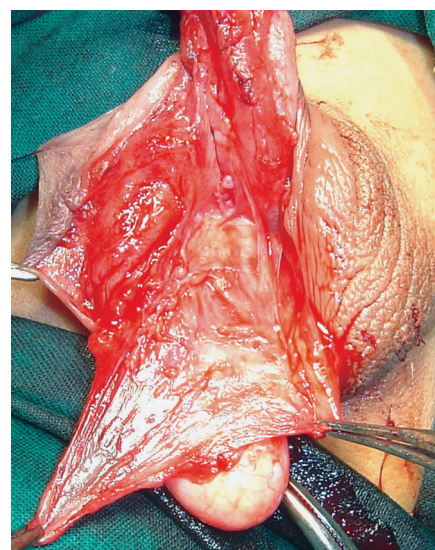


Fig. (2-E): Dartos muscle flap.

Table (3): Type of fistula covering.

Distal fistulas	Local tissue (36 patients)
	Tunica Vaginalis (3 patients)
Proximal fistulas	Local tissue (3 patients)
	Tunica Vaginalis (1 patients)
	Dartos fascia (2 patients)

DISCUSSION

Repair of hypospadias is not free of complications; urethrocutaneous fistula remained the major and most frustrating complication [3]. Their incidence has been used to evaluate the effectiveness of the surgical procedure [11]. In 1973, Horton and Devine estimated the incidence of fistula following hypospadias surgery to range between 15% and 45%. In 1996, Duckett and Baskin estimated the incidence to be between 10% and 15%. Some procedures are more prone to fistula formation than others [11].

Often, distal obstruction is related to persistent fistulas. Once a fistula has matured, closure procedures may be ineffective because of a discouraging rate of fistula recurrence. Therefore, some have suggested repairing urethrocutaneous fistulas using the principles of wide mobilization, adjacent skin flaps, multilayered closures and use of urinary diversion [5].

Many principles have been proposed to decrease fistula development. Delicate tissue handling, maintaining adequate vascularity to the edges, use of eye cautery, perfectly inverting of the edges with fine absorbable sutures, optical magnification and avoiding overlapped suture lines [12]. Despite strict adoption of proper technique urethrocutaneous fistula still occurs and unfortunately recurs [13].

The management of fistula differs from the concept of the primary hypospadias repair as we are dealing with scarred tissue [14]. Many factors influence the approach for fistula repair including the site of the fistula (distal versus proximal), size, number, presence of distal obstruction, condition of local tissues, primary technique of hypospadias repair, time of occurrence and interval between surgery and time of fistula repair [5].

The basic principle for fistula repair based on proper identification of the site, size and number of fistula, excising and de-epithelialization of fistulous tract, removing all scar tissue, inverting the edges, providing second layer covering from local

tissue and avoiding crossing suture lines [15]. Despite all precautions still fistulas occurs. Snodgrass reported an incidence of 2.4%, however other series reported higher incidence, including Chatterjee et al., 15%, Amukele et al., 17% and Guralinck et al., 16% [11,5,17,18].

For a purpose to increase blood supply and provide watertight covering the concept of multi-layer closure has replaced the simple closure approach which has a high failure rate [5,10].

Since then many authors emphasized the importance of providing well vascularised watertight secondary covering after fistula closure [6-9].

Second layer coverage of the neourethra with the use of various vascularized flaps has significantly decreased urethrocutaneous fistula as a complication of hypospadias repair [5,19].

In this series we tried to design an algorithm for management of different type of fistula. Fig. (1) stressing on avoiding the factors that leads to its recurrence mentioned before.

The site, number of the fistula and the type of primary hypospadias repair dictate flap most appropriate for each fistula. As for primary distal hypospadias, distal fistula can be covered with peripucial flap. The majority of distal fistulae in our series were covered with local tissue derived from remnant of prepuce. For failed and recurrent fistula local tissue is usually deficient and scarred especially at the coronal and sub coronal fistula where vascularized local tissues are not available. For that distant vascularized flap is better to be harvested. Tunica vaginalis appeared to be the most appropriate as long flap can be developed reaching up to the glans penis without exerting tension or leading to ventral curvature or rotation. This coincides with Kirkali et al., 1990, Snow et al., 1995 and the more recent results of Landau et al., 2003, who mentioned that Tunica vaginalis flap was found to be an excellent vascularized flap with favorable results regardless the site of fistula [9,15,16].

Some series tested the effectively to use a scrotal Dartos flap for distal fistula with favorable outcome [7,18,19,20]. However it seems to us that having long flap to cover coronal fistula without having some tension is challenging so we keep it for proximal fistulas. The dual blood supply, mobility, simplicity and availability of Dartos flap makes it useful for the urethral coverage. The Dartos flap is mobile since its base at the penoscrotal junction. Limitation of the Dartos flap includes the need for

a penoscrotal incision and so it is not suitable for distal urethroplasty [18,19].

For Proximal fistula some flexibility are available for choosing the proper flap. Dartos and tunica vaginalis flaps are easy to develop regardless of the primary hypospadias repair technique and should be considered in recurrent and large fistula as they are always generous donor site [19,20].

Conclusion:

Although simple closure of fistula appears to be technically easy and not time consuming, it associated with considerable rate of recurrence. From the results of our series and others it is extremely important to recognize a concomitant urethral stricture at the time of fistula closure. These should be repaired to ensure the success of the fistula closure. Occasionally, a meatoplasty may be necessary at the time of fistula repair. Excision of the fistulous tract down to healthy thin urethral tissue is important without the fear of making a small fistula larger. Healthy tissue should be incorporated in the repair at all times.

For a small fistula, simple transverse approximation of healthy urethral tissue is often possible. A running subcuticular inverting suture of 6-0 vicryl is used to close the urethral edges. In the case of large fistula, a meatal-based flap usually gives good results by preventing tension on the suture line and narrowing of the urethral lumen.

The multilayer covering with the use of watertight vascularized flap appears to an important influence factor for the success of fistula repair. However the decision for flap harvesting should be taken according to the site of the fistula and the condition of the near by local tissue.

REFERENCES

- 1- Cimador M., Castagnetti M. and De Grazia E.: Urethrocutaneous fistula repair after hypospadias surgery. *BJU Int.*, 92: 621-3, 2003.
- 2- Hadidi A.T. and Azmy A.A.F.: Fistula repair; Hypospadias Surgery, 28: 2-277: 281, 2004.
- 3- Elbakry A.: Management of urethrocutaneous fistulae after hypospadias repair: 10 years' experience. *BJU Int.*, 88: 590-5, 2001.
- 4- Eardley I. and Whitaker R.H.: Surgery for hypospadias fistula. *Br. J. Urol.*, 69: 306-10, 1992.
- 5- Richter F., Pinto P.A., Stock J.A. and Hanna M.K.: Management of recurrent fistulas after hypospadias repair. *J. Urol.*, 170 (1): 327-8, 2003.
- 6- Oswald J., Korner I. and Riccabona M.: Comparison of perimeatal-based flap (Mathieu) and the tabularized incised-plate urethroplasty (Snodgrass) in primary distal hypospadias. *Br. J. Urol. Int.*, 85: 725-7, 2000.
- 7- Joseph V.T.: Concepts in the surgical technique of one-stage Hypospadias correction. *Br. J. Urol.*, 76: 504-9, 1995.
- 8- Blandy J.P., Singh M. and Tresidder G.C.: Urethroplasty by scrotal flap for long urethral strictures. *Br. J. Urol.*, 40: 261-7, 1968.
- 9- Kirkali Z.: Tunica vaginalis: An aid in Hypospadias surgery. *Br. J. Urol.*, 65: 530-2, 1990.
- 10- Retik A.B., Mandell J., Bauer S.B., et al.: Meatal based hypospadias repair with the use of a dorsal subcutaneous flap to prevent urethrocutaneous fistula. *J. Urol.*, 152: 1229-31, 1994.
- 11- Duckett J.K. and Baskin L.S.: Hypospadias. In: Gillenwater J.Y., Grayhack J.T., Howards S.S., Duckett J.W. (eds): *Adult and pediatric urology*, 3rd edn. Mosby-year Book, St Louis. Pp 2549-2589, 1996.
- 12- Latifoglu O., Yavuzer R., Unal S., Cavusoglu T. and Atabay K.: Surgical treatment of urethral fistulas following hypospadias repair. *Ann. Plast. Surg.*, 44: 381-6, 2000.
- 13- Zagula E.M. and Braren V.: Management of urethrocutaneous fistulas following hypospadias repair. *J. Urol.*, 130: 743-5, 1983.
- 14- Moscona A.R., Govrin-Yehudain J. and Hirshowitz B.: Closure of urethral fistulae by transverse Y-V advancement flap. *Br. J. Urol.*, 56: 313-5, 1984.
- 15- Snow B.W., Cartwright P.C. and Unger K.: Tunica vaginalis blanket wrap to prevent urethrocutaneous fistula: An 8-years experience. *J. Urol.*, 153: 472-3, 1995.
- 16- Outcome analysis of tunica vaginalis flap J. Urol. for the correction of recurrent urethrocutaneous fistula in children. *J Urol.*, 170 (4 pt 2): 1596-9.
- 17- Ehle J.J., Cooper C.S., Peche W.J. and Hawtrey C.E.: Application of the Cecil-Culp procedure repair for treatment of urethrocutaneous fistulas after hypospadias surgery. *Urology*, 57: 347-9, 2001.
- 18- Galtzeiler J. and Belman B.: Results of closure of urethrocutaneous fistulas in children. *J. Urol.*, 132: 734-6, 1984.
- 19- Churchill B.M., van Savage J.G., Khoury A.E. and McLorie G.A.: The dartos flap as an adjunct in preventing urethrocutaneous fistulas in repeat hypospadias surgery. *J. Urol.*, 156: 2047-9, 1996.
- 20- Djordjevic M.L., Perovic S.V. and Vukadinovic V.M.: Dorsal dartos flap for preventing fistula in the nodgrass hypospadias repair. *BJU Int.*, 95: 1303-9, 2005.