Using the Pedicle Anterolateral Thigh Flap as an Optional Method in Fournier’s Gangrene Wound Reconstruction

Erh-kang Chou, *Yu-Tzu Tai, Meng-Shi Lin, Sophia Chia-Ning Chang, Chao-I Wu, Hsin-Han Chen

Division of Plastic Surgery, Department of Surgery, China Medical University Hospital
*Department of Dermatology, Chung-Shan Medical University Hospital

Fournier’s gangrene is the progressive necrotizing infection of the perineum and genital fascia with gangrene of the overlying skin. The effective treatment includes aggressive debridements, broad-spectrum antibiotics, and intensive supportive care. Radical debridements often result in spermatic cord and testis exposure and need secondary reconstruction after infection controlled. How to achieve a cosmetic and functional reconstruction is a challenge. We provide our experience in scrotum reconstruction using the pedicled anterolateral thigh flap. From October 2005 to August 2006, there were seven patients who received pedicled anterolateral thigh fasciocutaneous flaps transfer for the complex perineal defects at the China Medical University Hospital. There were six male patients and one female patient, aged from 45 to 70 years old. The seven patients received one to three times wound debridements and were finally resurfaced with a pedicle anterolateral thigh fasciocutaneous flap transfer, to cover the scrotum, perianal, or lower abdominal skin defect. No cutaneous flap suffered from partial necrosis after transfer. There are two patients who received the split skin graft simultaneously with flap transfer for bigger abdominal defect. The size of the flaps ranged from 50 to 180 centimeter square and was supplied by single perforator. Post-operation wound healing and outlook is very good. Pedicle anterolateral thigh fasciocutaneous flap is a good surgical option in Fournier’s gangrene reconstruction. The skin paddle can be adjusted geographically to match the critical defect and the pedicle length can be easily lengthened by “pedicle extension technique”. The outlooks of the results are natural and less post-op morbidity were noted in our series. (J Plast Surg Asso R.O.C. 2007;16:197–205)
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Key words: Fournier’s gangrene, anterolateral thigh flap, perineum reconstruction

Introduction

Fournier’s gangrene is the result of a highly lethal and rapidly progressive necrotizing infection of the perineum and genital fascia with gangrene of the overlying skin. The infection is generally polymicrobial and probably synergistic in nature. The disease can affect both sexes and any age group. Even though the most popular mechanism of the disease is from the infectious origins such as perianal abscess or fistula, however, undiagnosed neoplasm is also reported as related to the Fournier’s gangrene. The effective treatment includes aggressive debridements, broad-spectrum antibiotics, and intensive supportive care. The mortality rate is related to the general condition and the infection control. After radically wound debridements, the most common situation is scrotum necrosis and spermatic cord and testis exposure. The testis and spermatic cord is usually spared ischemic change because of its independent blood supply from aorta. But the “homeless” testis and cord definitely need secondary reconstruction after the wound debridement is finished. (Fig 1)

Fig. 1 45 y/o male diabetic patient suffered from bilateral lower portion scrotum necrosis and testis exposure

The good functional and cosmetic results in small size perineum defect can be achieved with primary closure of remaining scrotum or closure after staged expansion. The success will be mainly owing to the scrotal remnants size and their elasticity. This is usually possible with small defects. If the defect is too large to be closed primarily, advance inner thigh flap is another option. But permanent placement in the thigh pocket has such concerns over temperature regulation and reports of pain and adverse psychological effects generally support relocating the testicles anatomically at some point in the reconstruction. Functionally speaking, the placement of the testes in the thighs can cause discomfort while walking or stretching of the testis. Skin graft on the testis is reported as one good option in scrotum reconstruction. But the outlook is not really natural and the wall is too thin to protect the reproductive organ. Multiple methods for perineum reconstruction using flaps have also been described, including thigh fasciocutaneous flaps, gracilis fasciocutaneous and musculocutaneous flaps, groin flaps, or rectus abdominis muscle flaps. Muscle flaps, on the contrary, are too bulky to be a good option to cover the perianal area and testis. Thin and pliable anterolateral thigh flap (ALT), from the descending branch of lateral circumflex femoral vessel, has increased in popularity and has already become the workhorse flap for reconstruction of skin and soft-tissue defects in recent years. Beginning from the experience in buccal cancer reconstruction surgery, we are now familiar with ALT flap anatomic variation and have extended the practice. For example, we use it as a flow trough flap in vascular trauma combined with skin loss; with chimeric design
for 3 dimensional wound coverage, and in trunk and perineum reconstruction. This article demonstrates further versatility of this flap in the Fournier’s gangrene reconstruction with especial emphasis on the scrotum and perineum wound management. Technique about how to lengthen the pedicle is also mentioned in this article.

Materials and Methods

Between October, 2005 to August of 2006 at the China Medical University Hospital, pedicle anterolateral thigh fasciocutaneous flaps were used in seven patients with complex perineal defects. The causes, predisposing factors, treatment modalities, ages, length of hospital stay, and outcome were reviewed. There were six male patients and one female patient, with a mean age of 60 years (range, 45 to 70 years) (Table I). Four of the seven patients were transferred from the colorectal surgery department, two from internal medicine and one from urology department. Broad-spectrum antibiotics such as penicillin G, thridgeneration cephalosporin, and amino-glycoside and metronidazole combinations were administered intravenously. All the seven patients received one to three times wound debridements and were referred to plastic surgery department for the wound management. The scrotum, abdominal wall and perineum skin defects were closed with pedicle ALT fasciocutaneous flap. For the extensibility of the pedicle length, we select the main perforators far away from the main trunk for the purpose of extending the pedicle length. We describe this design as “pedicle extension method” in the following paragraph.

Table 1 Patient Summary

<table>
<thead>
<tr>
<th>Case No.</th>
<th>Gender/age</th>
<th>Etiology</th>
<th>underline condition</th>
<th>Defect location</th>
<th>Flap size (cm)</th>
<th>Pedicle length (cm)</th>
<th>Combined procedure</th>
<th>Complication</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>M/56</td>
<td>Perianal abscess</td>
<td></td>
<td>Scrotum+ Abd wall</td>
<td>7*18</td>
<td>10</td>
<td>STSG</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>M/68</td>
<td>Rectal cancer</td>
<td></td>
<td>Scrotum+ Perianal</td>
<td>9*11</td>
<td>16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>M/45</td>
<td>Perianal abscess</td>
<td>DM</td>
<td>Scrotum</td>
<td>5*10</td>
<td>13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>F/58</td>
<td>Anal fistula</td>
<td></td>
<td>Scrotum+ Perianal</td>
<td>6*15</td>
<td>13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>M/70</td>
<td>Pressure sore DM, parkinsonism</td>
<td></td>
<td>Scrotum+ Sacrum</td>
<td>7*16</td>
<td>11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>M/58</td>
<td>Scrotum carbuncle</td>
<td></td>
<td>Scrotum+ Perianal</td>
<td>8*18</td>
<td>11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>M/67</td>
<td>Pressure sore stroke</td>
<td></td>
<td>Scrotum+ Sacrum+</td>
<td>8*20</td>
<td>10</td>
<td>STSG</td>
<td>Partial skin graft loss</td>
</tr>
</tbody>
</table>

DM= diabetic mellitus
STSG= split thickness skin graft
abd= abdominal
Operative Technique

The flexibility of using the lateral circumflex femoral artery descending branch is already documented in literature. For the longest pedicle length, we suggested to select the most distal located strong perforator be our nutrition vessels. A hand-held doppler probe helps preoperative identification of the perforators but may not completely correlate with true anatomical locations. The ultimate design of the flap only make when sizable perforators are to be decided intraoperatively. First, a medial skin incision was made through the deep fascia. The stronger cutaneous perforators were usually located on the line from anterior superior iliac spine to lateral patella within 3 centimeter diameter from the midway of this line. All sizable perforators were traced in a retrograde fashion to the descending branch of the lateral femoral circumflex vessel. The distal end of the descending branch can be ligated earlier for better flap mobilization. To gain the maximal pedicle length, it’s wise to choose as distal-sited perforators as possible. After marking the main perforators, the lateral incision can be done subcutaneously. Thinning procedures can be finished during this time. A nontraumatic vascular clamp helps us in choosing one reliable perforator that can supply a whole skin paddle. Complete the skin paddle mobilization and dissect the lateral circumflex femoral vessel to its junction with other major main trunk. The skin portion was later transferred to the defect under the subcutaneous tunnel and the pedicle can be placed below or above the rectus femoris muscle depending on the tension. Pedicle kinking or compression should be avoided for the success of surgery. By using the pedicle extension method, the rotation arc, that skin could cover, is almost equal to the sum of the length of lateral circumflex femoral artery and the distance from proximal flap margin to the main perforator.

Results

There were totally seven pedicle fasciocutaneous ALT flaps in our series for the scrotum and perianal wound coverage. None of our patients underwent orchidectomy because testicular involvement was absent in all patients. A diverting colostomy was performed in five patients, except case 1 and 6, and were closed within 5 months after wound healed. Five flaps were harvested from left and two from right side. Our priority is using non-dominant thigh. The skin sizes ranged from 5 to 9cm in width and 10 to 20 cm in length. The mean skin paddle size is 110 centimeter square. Case 2 is a case of rectal cancer, and was diagnosed after occurrence of Fournier's gangrene. For the improving of life quality and to prepare for radiotherapy, he accepted flap transfer to cover the testis exposure. Post operation course is smooth and he completed the treatment of radiotherapy. Case 3 used the right pedicle ALT fasciocutaneous flap to cover the right scrotum defect and case 7 used the right ALT flap owing to an old scar for left femoral bone fracture fixation. Two patients received the meshed split thickness skin graft over abdomen wall with the wound closure surgery. Case 7 resulted in wound infection and partial graft necrosis and the residual wound was healed with secondary intention. No other complication happened to these patients. In the following times, no patients complained about testicular pain or discomfort.
Fig. 2a flap design to match to the scrotum defect on left anterolateral thigh

Fig. 2b. Select single perforator to supply the whole flap, design it over the distal thigh can easily extend the rotation arc and catch the defect with its proximal pole.

Fig. 2c. Pedicle can be placed under the subcutaneous tunnel or under the rectus femoris muscle.

Fig. 2d. Three months after flap transfer, the shape is natural and pocket is soft and elastic.

Fig. 3. 56 y/o male patient received pedicle ALT flap and STSG to cover the left hemiscrotum and lower abdomen defect.

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Discussion

From the literature review, analysis of the predisposing and accompanying conditions suggests that most cases suffered from Fournier’s gangrene as a result of one of three mechanisms: (1) trauma to the area, included examination or procedures, providing access of organisms to the subcutaneous tissues; (2) extension from urinary tract infection, probably most commonly from a glandular infection, with dissection along the fascial planes involving the penis and scrotum; and (3) extension of an infection from the perianal area, uncontrolled fistula, abscess or un-diagnosed cancer necrosis along fascial planes to the penis and scrotum. Various cancers have been found to be associated with the Fournier’s gangrene or perianal abscess as its first presentation, such as colorectal cancer, lymphoma, multiple myeloma.

Once the disease happens, repeat aggressive radical debridement, strong antibiotics and multiple systems supportive care is most critical to the survival of Fournier’s gangrene victims. Debridement includes the wide incision and drainage of all involved areas, and excision of all necrotic and devitalized skin and subcutaneous tissue. Involvement of the deep fascial layers and muscle seldom occurs with this syndrome, it is not necessary to continue debridement into normal-appearing tissue.

Scrotal skin has a great capacity in regeneration and wound contraction, small defects can wait for secondary intention healing and a new envelope can form from the remaining scrotal skin. However, split-thickness skin grafts can expedite the healing process and shorten the hospital course. If loss of substantial scrotal skin has occurred, the exposed testes can be placed in the subcutaneous pocket using the medial thigh redundant skin. In the current series, surgical management included excision of all devitalized skin and subcutaneous tissue. Additional tissue transfer is recommended if the local condition reconstruction ladder is appropriated. Fournier’s gangrene involves the upper thigh to varying degrees. The surviving tissue is edematous and friable, and sufficient time must be allowed for the tissue to recover before flaps from this area can be safely transferred. But muscle flap was no more recommended because of its bulkiness, eventually fibrotic change, and constant need for skin graft resurfacing. The donor site morbidity is also the negative reason to use it in the perineum reconstruction.

From our experience, we preferred pedicle ALT fasciocutaneous flap as a good option in Fournier’s gangrene reconstruction. From the buccal cancer reconstruction experience, we are familiar with harvesting of free ALT perforator flap and intramuscular dissection techniques. The flap has sufficient advantages in reliable skin circulation, sizable in diameter, has good length in pedicle, and can be debulked intraoperatively. We are able to design a geographical match skin paddle according to the scrotum shape and size then harvest the pedicle flap with only single perforator connection. The flap can be thinned to fit the thickness of scrotum skin. The rotation arc can easily include all the scrotum, perianal portion, and lower abdomen without tension on the pedicle. The skin portion can be applied loosely to cover the exposed testis, and to the fragile anal mucosa tissue to secure the better wound healing. Some color mismatch and slightly different hair density between the flap and native skin. Vascular variation and technique demand.

The best indications we concluded were...
especially in (1) total scrotum reconstruction (2) substantial scrotum loss combined with perianal tissue loss or (3) abdominal wall defect combined with hemiscrotum loss. Even hemiscrotum defect can be closed with scrotum and medial thigh skin advancement, but in our observation post-operative experience is not so ideal. Inadequate pocket size, too much traction of the perineum tissue or external compression to the testis will induce visceral pain of the testis and limit early ambulation and will prolong the hospital stay. The skin graft can resurface the wound quickly but is difficult to fit perfectly.

In our six male patients, there was no complaint about testis pain or lower abdominal pain after the flap transfer. The ambulation usually can be started 10 days after removal of the stitches.

No visceral pain or tightness feeling happened in the normal ambulation posture. The cosmesis and function of the reconstructed neoscrotum are all good.

**Conclusion**

Pedicle ALT fascio-cutaneous flap is a good surgical option in Fournier’s gangrene reconstruction. The skin paddle size and thickness can be designed to match the defect and the pedicle is easily mobilized at flap inset. The outlook of the reconstructed scrotum is natural and full of elasticity. For so many advantages, we recommend using the pedicle ALT flap in scrotum and perineum reconstruction after Fournier’s gangrene radical treatment.

**Reference**


Reprints request from: Wu, Chao-I M.D.
Division of Plastic Surgery, Department of Surgery, China Medical University Hospital
Department of Dermatology, Chung-Shan Medical University Hospital
Address: No.2, Yude Rd., North District, Taichung City 404, Taiwan
Email: ciwu@ms29.hinet.net
Tel: 886-4-22030777
Fax: 886-4-22030777
以根蒂式股前外側皮瓣作為佛耳尼埃式
壞疽清瘡術後傷口覆蓋的良好選擇

周爾康 戴育慈 林孟義 張家寧 吳肇毅 陳信翰

佛耳尼埃式壞疽是發生於生殖器、會陰部、肛門周圍的壞死性筋膜炎。治療成功的關鍵在於早期診斷、即時清殼，配合輸液及抗生素使用。在積極清殼手術、病情穩定之後，男性病人往往會有睾丸暴露、及肛門周圍組織脆弱易碎的問題。為了兼顧重建之後的外觀及睾丸的保護，重建以皮瓣移植為一較恰當的方式。基於我們對於大腿血管解剖學上的熟悉，根蒂式股前外側皮瓣是我們的優先選擇。由 2005 至 2006 年中，一共有 7 位病人接受根蒂式股前外側皮瓣移植手術重建會陰部。手術方式及病患治療經過在文中有詳盡的說明。

結論：根蒂式股前外側皮瓣的血液循環穩定，血管莖粗且長，很適合會陰部下腹部及肛門周圍缺損的覆蓋。術後病人的外觀自然，步態正常，局部不舒適的情況發生率低，對佛耳尼埃式壞疽清殼術後的重建是一個很好的選擇。