

Reconstruction of overlying the achilles tendon with island V-Y advancement flap

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Abstract

Introduction: Soft tissue defects with exposed Achilles tendon is common in trauma. Surgically covering these defects by fasciocutaneous flap can preserve normal function of the Achilles tendon. Various methods have been described and reported in the literatures: local advancement flap, region flap, or free flap. The purpose of this article is to report the results of 10 cases who were operated to cover the Achilles tendon by perforator V-Y advancement flap, discuss the indications and advantages of using this flap.

Patients and methods: A retrospective study describes 10 cases: 8 males and 2 females, aged from 4 to 71. The patients had soft tissue defect with expose Achilles tendon who were operated cover by V-Y advancement flap based on perforator of peroneal artery from 07/2018 to 05/2021. Follow-up time from 3 months to 3 years.

Results: The size of defect is from 3x2 cm to 8x6 cm. The size of flap is from 3,5x4cm to 16x6 cm. All 10/10 flaps were total survival and completely cover the defect. All patients preserved normal function of the Achilles tendon.

Conclusions: Using the V-Y advancement flap based on perforator of peroneal artery to cover the soft tissue defect with expose Achilles tendon had good results, restore normal function with good aesthetic.

Keywords: V-Y advancement flap, Island perforator flap, Achille tendon coverage, Exposed Achille tendon.

Introduction

Soft tissue defect of the Achilles tendon is a common injury due to many causes such as soft tissue disorder, complications after surgery repairing damaged or open tendon rupture, and scar removal. Plastic surgery is to cover these defects with soft, healthy skin flaps will ensure the normal function of the Achilles tendon.

Management of Achilles tendon injuries usually involves two aspects. The first is to repair or reconstruct a ruptured Achilles tendon. The second is to cover the skin over the repaired Achilles tendon, to ensure that the tendon is no longer exposed, the sutures are not stretched, and to avoid complications such as infection and necrosis of the skin flap [1]. Through the literature review, many techniques have been described and reported such as skin grafting, using local flaps, adjacent flaps, cross-leg flaps or microsurgical flaps [2,3]. The V-Y advancement flap with subcutaneous peduncle was first described by Barron and Emmett, this flap often has random feeding, so the flap's mobility is very limited. In 2020, Singh S.B. et al [4] used the V-Y advancement flap with the perforating pedicle to cover the soft part of the Achilles tendon for good results. In Vietnam, seeking through the literature we have not seen any reports of using this flap. In this article, we report the results of 10 cases of using the VY advancement flap with the perforating pedicle to cover the exposed Achilles tendon defect, discussing the indications and advantages of using this flap.

Patients and methods

A retrospective study describing 10 cases of soft tissue defect exposing the Achilles tendon surgically covered with a perforator V-Y advancement flap, from July 2018 to May 2021 at the Department of Maxillofacial Surgery - Plastic Surgery - Aesthesia America, VietDuc University Hospital. The patients were examined and evaluated for damage to determine the size, depth, and injury of the heel tendon. Software evaluation of the lower third of the

lower leg for selection and orientation of flap use. Take pictures before, during and after surgery.

Surgical procedure:

- Anesthesia and patient position: Patients are anesthetized with general anesthesia or spinal anesthesia. Lie on the opposite side or on prone position.

- Before surgery: draw a directional line connecting the midpoint of the hamstring crease with the midpoint of the lateral edge of the Achilles tendon and the apex of the lateral ankle. Use a handheld doppler ultrasound machine to find and locate the percutaneous vascular branches around this orientation in the lower third of the leg. Inverted V-shaped skin flap design with percutaneous vascular branch.

- Tendon injuries are treated with stitches, lengthening. Debridement and removal of necrotic tissue.

- Dissection of the flap: Incision of the skin according to the design line, dissection under the fascia to find the previously identified perforating branch with doppler, dissection of the flap stem to the peroneal artery depending on the flap's movement. In some cases, it may be necessary to cut the central tip of the peroneal artery using a retrograde pedicle to increase flap mobility downward. Lifting the flap completely from the position can preserve the nerve and saphenous vein in case the flap displacement is not much. Move the flap downward to completely cover the exposed skin defect of the Achilles tendon, sew and fix the flap to the receiving platform. V-Y direct donor suture or an autologous thin skin graft.

- After surgery, put a cast on the instep of the foot in the ankle stretch position for 4 weeks, remove the skin graft pillow after 5 days if there is a skin graft, remove the sutures or the skin pins after 2 weeks, and then instruct the ankle movement and pressure on the patient.

Evaluation of results: based on the following criteria: wound healing phase, flap vitality, ankle motor function:

Good: Wound healing on the first phase, no flap necrosis, the ankle function is normal;

Average: Wound healing on the second phase, partial necrosis of the flap, preserved ankle function;

Poor: Wound healing on the second phase, partial necrosis of the flap, poor ankle function.

Results

Ten cases of soft tissue defect with the exposed Achilles tendon were surgically treated using perforator based V-Y advancement flap from 07/2018 to 05/2021 which included 8 male patients, 2 female patients, ages 4 to 71 years.

The size of the lesion was from 3 x 2 cm to 8 x 6 cm, 6/10 cases of injury were caused by an open wound in the heel tendon area, 4/6 cases were complications after treatment of closed heel tendon injuries. There were 6/10 cases of Achilles tendon injury.

The smallest flap size was 3.5 x 4 cm, the largest was 16 x 6 cm. There were 4/10 cases where the central tip of the peroneal artery must have been removed using the retrograde pedicle, 5/10 cases where the flap was closed directly without skin grafting.

Table...

No.	Age (ys) / Gender	Injury size	Flap size	Open wound	Complication after closed tendon injury	Tendon injury	Skin grafting	Vascular bundles removal	Result
1	4/Female	3x4	3,5x4	x	0	0	0	0	Good
2	8/Male	5x7	12x7	x	0	0	x	x	Good
3	9/Male	6x7	13x7	x	0	0	x	x	Good
4	18/Male	3x2	12x4	0	x	x	0	0	Good
5	27/Female	5x6	16x6	x	0	0	x	x	Good
6	34/Male	4x2	7x5	0	x	x	0	0	Average
7	40/Male	3x2	9x6	0	x	x	0	0	Good
8	46/Male	6x8	12x8	x	0	x	x	x	Good
9	68/Male	4x5	9x7	x	0	x	x	0	Good
10	71/Male	4x5	13x7	0	x	x	0	0	Good

Ten flaps were completely healthy, and covering entirely the soft part that exposes the Achilles tendon. All patients retained ankle function. 9/10 cases had good results, 1/10 cases with average result had wound healing on the second phase, which had to be processed many times to remove the tendon suture material.

Discussions

Soft tissue defect with exposed Achilles tendon is a very common injury in clinical practice, the most common cause was disorganized wound healing after trauma with or without accompanying Achilles tendon injury. Another common cause is

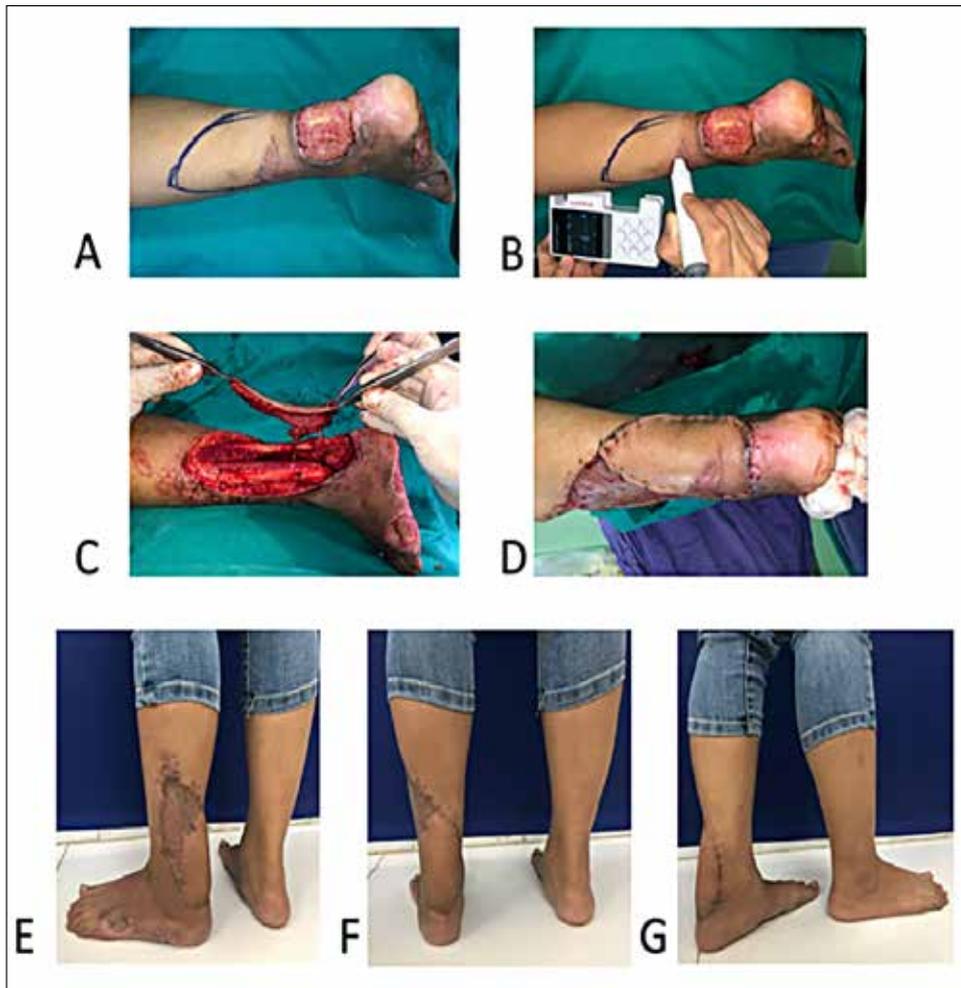
complication after the repair of closed heel tendons such as skin necrosis, infection. Especially when there has non-absorbable suture materials, there is an increased risk of infection and delayed wound healing. The patients in our study encountered both of these causes, in which 4/10 cases were complicated by soft tissue infection after repair of closed tendon rupture. In particular, there was a case after repair of a closed Achilles tendon rupture, we had to operate many times to remove all the non-absorbable sutures so that the wound would heal completely.

According to the reconstructive ladder, a variety of covering methods can be applied to soft

tissue lesions located on the Achilles tendon. Skin grafting is indicated in only a few cases due to the appropriate characteristics of the skin and soft tissue in that region, which is highly elastic and mobile [5,6]. The perforator-based flap is an optimal choice for this lesion. The perforator based flap is not only responsible for protecting the heel tendon but must be mobile, not too thick or too big to affect the patient's future use of footwear [1,7]. In situ flaps are usually only applied to small defects, the surrounding soft tissue organization is still good, but the mobilization of surrounding organizations in this area is very little due to respecting the ratio of random-pattern skin flaps [8], [9]. The retrograde flap is used by many surgeons,

but it has two disadvantages: one is that the pedicle is often protruding and sometimes need to be repaired on second phase, the second disadvantage is in the case of retrograde or twisted pedicle, the phenomenon can easily occur like anemia or venous stasis. Propeller flaps using a perforation circuit sometimes also encountered twisted pedicle as abovementioned [10]. Microsurgical free flap is usually indicated for cases with large defects or inability to choose other methods, however, the patient has to undergo a long and complicated surgery [1,11,12].

The V-Y advancement flap as described by Barron and Emmett uses a subcutaneous pedicle with random feed, during surgery the subcutaneous



Referencing picture: 27-year-old female patient, soft tissue defect with exposed left heel tendon (Figure A, B: Preoperative injury; Figure C, D: Intraoperative; Figure E, F, G: 6 months after surgery)

part is not dissected much, so the flap movement is very limited. In 2020, Singh S.B. et al [4] used the V-Y advancement flap with the pedicle to cover the soft part of the heel tendon, size 3x7 cm, with good results. In Vietnam up to now, there have been no reports of using this type of flap. The results of 10 cases in the study showed many advantages: The lesions were treated in one surgery, the skin flap had a constant pedicle that was the percutaneous vessels of the peroneal artery in the lower third of the lower leg. has good vitality and reliability, the flap movement is sliding so there is no twisting of the petiole. Skin organization and soft tissue are mobilized from adjacent skin, so they are very appropriate in thickness, elasticity and color. Overall results 10/10 cases all achieved good results in ankle function and very convenient in walking and using shoes during activities.

The presence of multiple percutaneous feeder vessels in the lower third of the leg arising from the posterior tibial and peroneal arteries is an additional advantage to the selection of V-Y advancement flaps, which may easily determine before or during surgery by hand-held doppler [1,13,14,15]. During surgery with microsurgery technique, the most suitable perforation branch in terms of size and length to slide the flap down to cover the entire heel tendon without straining the flap stem and suture joints was chosen. In all 10 out of 10 cases in our series, the percutaneous pedicle was derived from the peroneal artery.

In the case of defects with short length, the flap lift surgery and perforating pedicle are enough to move the flap to completely cover the defect. However, in cases where the defect has a large length, it is not enough to cover it and when the suture is closed, it will be very tight both on the vascular peduncle and the skin suture. In our study, there were 4/10 cases of defect length from 5 to 6 cm, we used a new technique that was to conduct pedicle dissection through to the peroneal bundle and cut the central tip, using upstream feed to increase the length of the pedicle to help the flap advance further. According

to the literature study, we found that no author has used this technique. Larger studies are needed to clearly determine in which cases this technique should be indicated.

According to some authors, to ensure that the Achilles tendon and the skin sutures are not stretched, to facilitate the healing process, after surgery all cases are fixed with a cast iron splint in the right position. ankle extension for 4 weeks. In case there is an accompanying Achilles tendon injury, the cast will be transferred to the open window for 4 to 6 weeks in a perpendicular ankle position. After healing, the patients were instructed to exercise and rest their feet. The long-term follow-up with physiotherapy functions of flexion, compression and walking of the ankle helps to improve the treatment effect [1,16]. In all the cases in the study, the skin flap was completely covered, soft, and aesthetic results were achieved, the tendon function was guaranteed and the patients were satisfied with the overall results.

Conclusions

Soft tissue defect with exposed Achilles tendon should be covered with soft and healthy skin flaps. Using the V-Y advancement flap has many outstanding advantages for this type of injury: phase one is not too complicated, the skin flap is stable and convenient for the operation of the ankle region. For large defects, it is possible to apply the central debridement of the main artery, using the retrograde pedicle. General results 09/10 cases of using V-Y advancement flap with vascular pedicle to cover the soft part of exposed Achilles tendon gave good functional and aesthetic results.

Conflict of interest: The authors declare that they have no conflict of interest.

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