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Wrapping rectus abdominis flap for complete vascular protection in the groin region

Kasık bölgesinde tam damar korumasında sarmal rektus abdominis flebi

Eyüphan Gencel,[1] Cengiz Eser,[1] Erol Kesiktaş,[1] Uğur Göçen,[2] Atakan Atalay[2]

Departments of [1]Plastic, Reconstructive and Aesthetic Surgery, [2]Cardiovascular Surgery, Medical Faculty of Çukurova University, Adana, Turkey

ABSTRACT

In this article, we present a novel method utilizing a wrap-around muscle flap for the treatment of groin wounds with infected vascular grafts or femoral vessels. Five patients underwent operations involving the wrap-around vertical rectus abdominis muscle flap due to peripheral arterial disease (n=3) or high-energy gunshot trauma (n=2). Hemorrhagic complications were not encountered in patients with gunshot wounds. No portion of the vascular system became exposed during the two year follow-up period. Among those with peripheral vascular disease, one patient died and one patient underwent a late amputation. We suggest that the wrapping technique can decrease the early postoperative complications in patients with high-energy gunshot wounds.

Keywords: Groin; peripheral arterial disease; postoperative complication; rectus abdominis; soft tissue infection.

ÖZ

Bu yazıda enfekte vasküler greft veya femoral damarları ile kasık yaralarının tedavisinde sarmal kas flebinin uygulandığı yeni bir yöntem sunuldu. Beş hastaya periferik arter hastalığı (n=3) veya yüksek enerjili ateşli silah yaralanması (n=2) nedeniyle sarmal vertikal rektus abdominis kas flebi içeren ameliyatlar yapıldı. Ateşli silah yaralanması olan hastalarda kanama komplikasyonu ile karşılaşılmadı. İki yıllık takip sürecinde, vasküler sistemin hiçbir bölümü açığa çıkmadı. Periferik damar hastalığı olanlarda bir hasta kaybedildi ve bir hastaya geç amputasyon yapıldı. Sarmal tekniğin yüksek enerjili ateşli silah yaralanmalı hastalarda ameliyat sonrası erken dönem komplikasyonları azaltabileceği kanısındayız.

Anahtar sözcükler: Kasık; periferik arter hastalığı; ameliyat sonrası komplikasyon; rektus abdominis; yumuşak doku enfeksiyonu.

The management of complex groin wounds, which also involves the vascular system, is of utmost importance for limb salvage. The use of muscle flaps is well known in such cases. However, the complete wrapping of the muscle around the vascular system (wrap-around technique) has not been documented in the groin region. Herein, we present the results of wrapping the femoral artery with the vertical rectus abdominis muscle (VRAM) to manage five complex groin defects.

CASE REPORT

In this retrospective case series, the records of five patients who underwent a wrap-around VRAM flap operation between January 2012 and May 2014 were analyzed. An informed consent was obtained from each patient. All patients had large groin defects with exposed vascular systems. The patient characteristics are shown in Table 1. Hemorrhage, infection, flap loss and amputation were considered to be possible complications. Magnetic resonance imaging (MRI) was used to evaluate the muscle viability during the third month.

Surgical technique

Under general anesthesia, the cardiovascular team performed vascular interventions with debridement around the femoral vessels. Vascular graft infections were confirmed based on excised alloplast cultures

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Correspondence: Eyüphan Gencel, M.D. Çukurova Üniversitesi Tıp Fakültesi, Plastik Rekonstrüktif ve Estetik Cerrahi Anabilim Dalı, 01330 Balcalı, Adana, Turkey.
Tel: +90 322 - 338 60 60 e-mail: eygencel@yahoo.com

from specimens obtained during the operations. An "ipsilateral" (cases 2, 3, and 5) or "contralateral" (cases 1 and 4) VRAM flap was performed depending on the choice of a suitable flap pedicle. The flap was created through a longitudinal, mid-abdominal incision, preserving the umbilicus. The fascia closure (without mesh) was performed with a 2-4 cm opening which allowed the muscle cuff to pass through. Care was taken to protect the small muscle cuff at the pubic bone to prevent the pedicle from stretching. The VRAM flap was wrapped and sutured circularly only around the superficial femoral artery or vascular graft (Figure 1a, b). All anastomosis sites were completely covered by muscle. A split thickness skin graft was applied to the muscle surface (Case 1: Figure 1d, e; Case 2: Figure 1f, g; Case 3: Figure 1h, ı; Case 5: Figure 1j, k).

All vascular grafts were replaced during surgery. Tissue and excised graft cultures indicated the presence of *Acinetobacter baumannii* and *Pseudomonas* and the patients were treated accordingly. No hemorrhage was noted at the surgical wrapped site. All muscle flaps survived completely. No vessels or prosthetic grafts were exposed as documented with MRI imaging (Figure 1c). The postoperative graft (3/5 cases) patency was 66.6% by MRI (Case 5 - died). The follow-up period ranged from 1 to 36 months (mean: 14.4 months). The patients with peripheral artery disease (PAD) suffered from two major complications. One patient (Case 5) died (postoperative day 30) from diabetic complications-related sepsis. The other patient (Case 4) experienced hip disarticulation after four months of follow-up.

DISCUSSION

To date, a muscle wrapping technique for vascular system protection in the groin has not been reported. Surgeons routinely wrap a portion of a muscle over the exposed graft; however, they do not completely wrap the graft. The first case report involving the salvage of an infected axillofemoral prosthetic vascular graft was performed via a superiorly based rectus abdominis wrap-around muscle flap.[1] The salvage of infected grafts by wrapping a saphenous patch was reported by De Santis.[2] In our patients, we wrapped the VRAM to isolate the vascular system. On the other hand, the VRAM technique has several disadvantages including donor area scars, infection spreading to the abdomen or other late morbidities, such as incisional hernias.[3] Anterolateral thigh flap (ALT) was compared to VRAM for groin reconstruction.[3]

Table 1. Demographic and clinical variables

Case	Age/Gender	Etiology-medical history	Soft tissue defect (cm)	Previous operations	Flap size (cm^2)/ pedicle site	Exposed graft-vessel size (cm)	Prosthetic vascular graft	Complications-amputation level	Follow-up (months)
1	8/F	High-energy gunshot	15x15	None	80-contralateral	10	None	None	5 months
2	34/M	High-energy gunshot	25x15	Saphenous vein interposition	180 ipsilateral-	13	Completely replaced (PTFE graft)	None	30 months
3	59/M	Iliopopliteal bypass-single lower limb	6x6	Contralateral amputation and ipsilateral vascular graft+	210 ipsilateral-	8	+ Partially replaced (PTFE graft)	None	24 months
4	64/M	Thrombosis of femoral vessels after angiography, polio patient	8x8	Embolectomy and vascular stent application	138 contralateral	8	None	Late hip disarticulation (after 4 months)	12 months
5	70/M	Bilateral iliopopliteal bypass, diabetes mellitus, end-stage renal disease on hemodialysis	10x10	Bilateral vascular graft, embolectomy, profunda femoris artery anastomosis to graft	210 ipsilateral-	12	Completely replaced (PTFE graft)	Infection	1 month-Died during hospitalization

PTFE: Polytetrafluoroethylene.

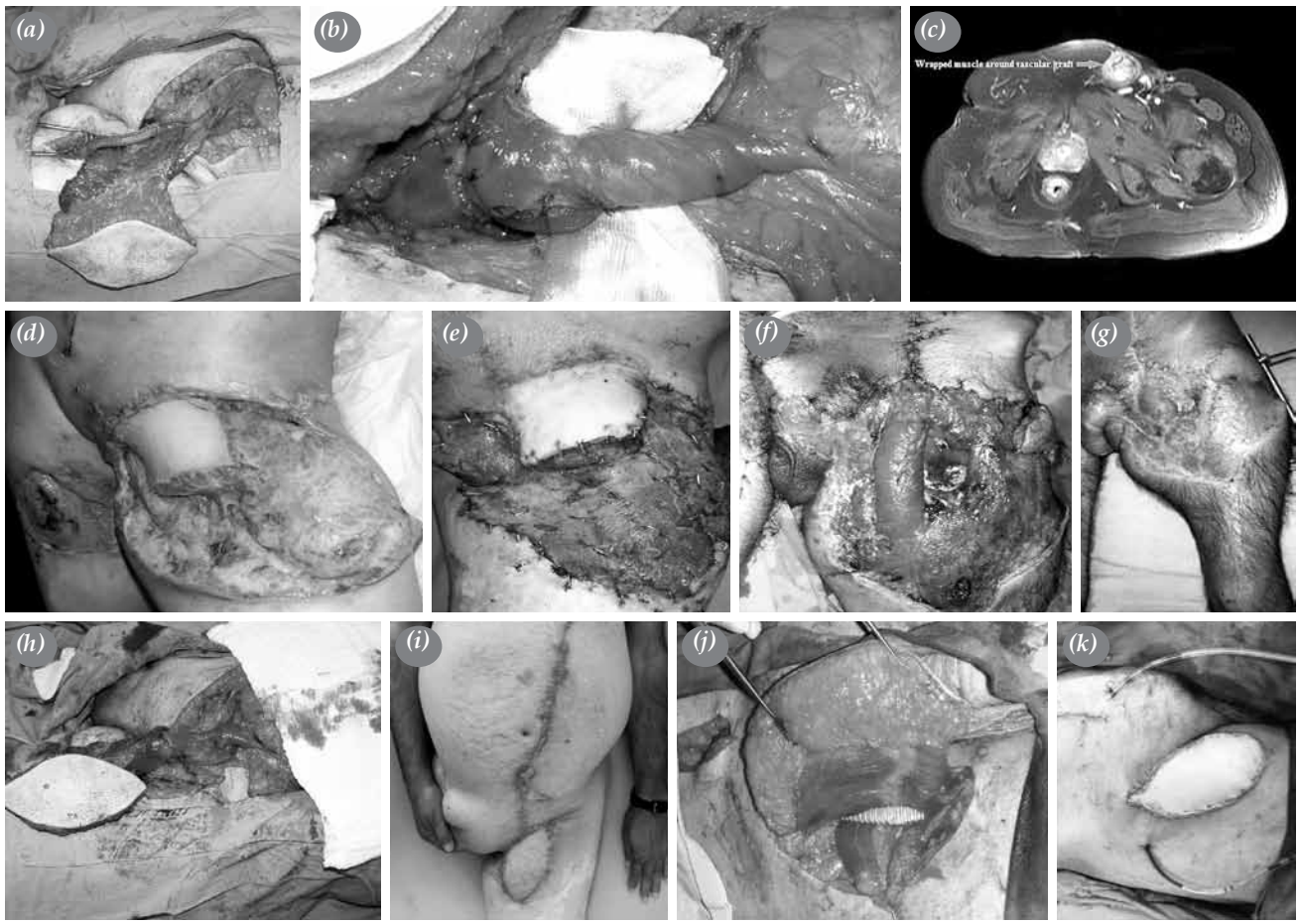

Figure 1. (a, b) Preoperative view of the VRAM-wrapped isolated femoral artery. **(c)** Magnetic resonance imaging of the completely wrapped superficial femoral artery with VRAM (Arrow). High-energy gunshot wound cases: **(d)** Case 1: Postoperative week two. **(e)** Postoperative week four. **(f)** Case 2: VRAM-wrapped superficial femoral artery. **(g)** Postoperative month six. Peripheral vascular disease cases: **(h)** Case 3: After VRAM was harvested. **(i)** Postoperative month 24. **(j)** Case 5: Wrapped vascular graft, **(k)** Postoperative view. VRAM: Vertical rectus abdominis muscle.

The primary disadvantages of the ALT flap in our cases were as follows: large skin defects on the thigh region, and obliterated or disrupted continuity of the profunda femoris artery (PFA).

Furthermore, the mortality rates are high in patients with prosthetic graft infections in the groin region which are related to PAD.[4] In PAD group, one patient died due to sepsis. Profunda femoris artery revascularization is a critical aspect of controlling thigh infections to prevent hip disarticulation, as described by Poi.[5] The long-term limb amputation and mortality rates in patients with PAD are still high (40%) and these rates are closely related to comorbidities. In our study, we observed no graft complications with normal PFAs in the patients with gunshot wounds.

However, this study has some limitations. Firstly, the sample size was small. Secondly, the follow-up period was less than five years. Further large-scale studies with long-term follow-up are required to confirm these results.

In conclusion, our study results suggest that the wrap-around technique can decrease the risk of complications during the reconstruction of complex groin defects in patients with high-energy gunshot wounds. For patients with PAD, this technique should be applied more cautiously.

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