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ARTICLE

Beyond the anterolateral thigh: the descending branch intermuscular septal (DBIS) flap

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ABSTRACT

The anterolateral thigh flap (ALT) is widely utilized for coverage of a variety of defects across the body, though use of this flap is limited due to the its size and bulky nature. We describe a flap from the descending branch of the lateral circumflex system including the intermuscular septum (DBIS) without use of the perforator for use of an ultra-thin flap for defect closure. A retrospective review of all patients who underwent wound closure with use of the DBIS flap from March 2016 to August 2018 was performed. Data on patient demographics and date on operative time, defect type, defect size, flap size, vessel size, complications and need for revisions were collected. Seven patients were identified who underwent reconstruction with DBIS flap, six patients for ankle defects and one for a scalp defect. Average age of patients was 66 years and average BMI was 28.9. The most common indication for flap coverage was tendon or joint exposure following total ankle arthroplasty. Average flap area was 36cm^2, average operative time with a single team of surgeons was 258 min, and average length of hospital stay was 3.7 days. The DBIS flap is an excellent option for reliable coverage of defects requiring thin, pliable tissue. Advantages of this flap include ease of dissection, relatively short operative time, primary closure of donor site and minimal contour deformity. Disadvantages include need for a skin graft for flap coverage and limited pedicle length. In the reported series, no complications were reported.

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Introduction

The anterolateral thigh (ALT) flap is a widely utilized flap, able to provide coverage for numerous types of defects across the body. The flap initially was described by Song et al. [1] as a septocutaneous flap. However, despite its versatility, the flap can be large and bulky, especially in obese patients. Numerous variations have been described to alleviate this problem to allow for coverage of smaller defects or across joint lines. Primary thinning, delayed thinning, liposuction, suprafascial, and adipofascial modifications of the ALT have all been deployed in attempt to solve this challenge.

The adipofascial ALT (aALT) as described by Hseih initially involves thinning of the skin and subcutaneous tissue [2]. However prior descriptions of the flap involve identification and ligation of the perforator at the level of the fat [3,4]. Here we describe a flap from the descending branch of the lateral circumflex system including the intermuscular septum (DBIS) without use of the perforator, which allows for simplified flap dissection with an ultra-thin flap.

Methods

Patients

A retrospective review was performed of all patients who underwent reconstruction with DBIS flaps from March 2016 to August 2018 by a single surgeon at a single institution. Patients were analyzed based on operative time, body mass index (BMI), defect type, defect size, flap size, vessel size, complications, and need for revisions.

Operative technique

Similar to the ALT flap, a line is marked from the anterior superior iliac spine (ASIS) to the lateral border of the patella. A 12–18cm incision is made at the point centered just proximal to the midline and the dissection is carried down to the intermuscular septum between the vastus lateralis and the rectus femoris. Care is taken to maintain as much of the intermuscular septum intact and attached to the descending branch of the lateral circumflex as able. Perforating branches to the vastus or skin typically included in an ALT, are clipped as they terminate within the septum, avoiding perforator dissection. Dissection of the pedicle is then carried more proximally until sufficient length is achieved. The pedicle can be dissected out to as long as 8 cm, however the soft tissue of the flap running alongside the pedicle can limit this length. A skin graft can be taken and the donor site closed primarily adjacent to or overlying the incision. Inset of the flap must be performed with care as the pedicle runs along the thin septum. Therefore, the skin graft must be carefully sutured to the surrounding skin, and the flap must be free from pressure postoperatively.

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Table 1. Summary of cases treated with the DBIS flap, including patient characteristics, cause of defect and flap attributes.

	Age	Sex	Defect	Exposed Structures	Cause	Size	Flap Size	Flap Area (cm^2)	Complication	Follow up (months)	BMI (kg/m^2)	Time (min)	Vein Diameter (mm)	LOS (days)
	71	F	L Ankle Wound	Tendon	TAA	2 × 2cm	5 × 3cm	15	None	2	19.7	317	2	2
	59	F	R Ankle	Tendon	TAA	5 × 5cm	7 × 7cm	49	None	4	28.9	244	2	3
	63	F	R Ankle	Tendon, Joint	TAA	7 × 5cm	8 × 6cm	48	None	2	23.3	282	2	4
	51	M	R Ankle	Tendon, Joint	Hematoma after fusion	5 × 3cm	5 × 3cm	15	None	3	30.5	227	2.5	3
	68	F	L Ankle	Tendon	TAA	2 × 2cm	8 × 2cm	16	None	10	33.6	250	2	4
	76	F	Scalp	Bone	Radiated SCC	3 × 3cm	8 × 8cm	64	None	28	30.4	244	2	5
	74	F	L Ankle	Hardware	Failed Ankle Arthrodesis	9 × 5cm	9 × 5cm	45	None	2	35.6	242	2	5
Average	66.0							36.0		10.1	28.9	258.0	2.1	3.7

TAA: Total ankle arthroplasty; SCC: Squamous Cell Carcinoma.

Results

Seven patients were identified who underwent reconstruction with the DBIS flap, six women and one male. The characteristics of all seven patients are found in Table 1. Six patients had ankle wound defects, while one had a scalp defect. The most common indication for flap coverage was exposed tendon following total ankle arthroplasty. Average age was 66.0 years, average BMI was 28.9, average flap size was 36.0cm^2 and average operative time was 258 min.

Post-operatively patients remained in the hospital for an average of 3.7 days (range 2–5). Flaps were monitored through the skin graft using a pencil doppler. For patients with ankle wounds, the operated lower extremity was maintained in an elevated position with limited dangling permitted for transfers for the first two weeks post-operatively. Patients were then allowed to dangle with incremental increases during the following two weeks.

Case example

Approximately three weeks following a right revision total ankle arthroplasty, Achilles tendon lengthening, superficial deltoid ligament reconstruction and lateral ligament reconstruction, a 63-year-old female developed some eschar/demarcation at the distal end of the anterior incision and in the medial skin bridge. She had been discharged to a skilled nursing facility on clindamycin and treated with hyperbaric oxygen therapy until presenting to the plastic surgeon for a consult on wound management. There was concern for exposed tendon and hardware and the patient was taken for debridement. The patient underwent debridement of the right foot and ankle wound, ultimately resulting in exposed joint and tendon (Figure 1). The structures were ultimate covered with a DBIS flap with split-thickness skin graft (Figure 2). Cultures taken at the time of surgery returned negative for any organism growth. She recovered uneventfully and was discharged from the hospital on postoperative day 4. Local wound care was performed at home and physical therapy initiated with regular visits to the plastic surgeon and had resumed all weight bearing activity by two months post-operatively from flap closure (Figure 3).

Discussion

The descending branch of the lateral circumflex system has been used for reliable coverage of defects for decades. The most common flap described is the ALT. The ALT flap has had numerous variations reported, largely to combat the thickness of the flap. Here, we report on a series of patients in which DBIS flap provided reliable vascularized coverage in areas where a thin flap was needed. The most common area of need in this series was in lower extremity wounds with exposed tendon or hardware.

The DBIS flap has numerous advantages for wound coverage beyond its thin profile. First and most importantly is the ease of flap dissection. By eliminating need for perforator dissection when compared to the ALT, the entire procedure described may be completed in just over 4 h using a single team approach. This could be significantly reduced using a second team for flap harvest. Second, the flap size can vary, allowing coverage of small to relatively large defects. While the majority of these cases were smaller flaps performed in the lower extremity, a larger flap was used in the scalp with good results (Figure 4).

The septum itself may also be taken as an additional component to a traditional ALT or vastus lateralis flap in order to fill defects, which furthers its versatility. Additionally, the donor site is closed primarily after skin graft harvest. This leaves minimal

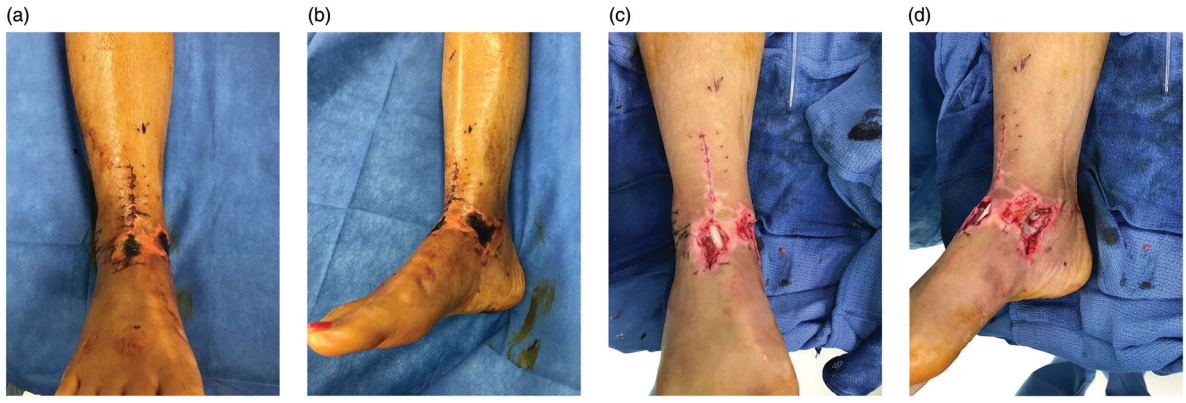

Figure 1. Preoperative photographs demonstrating the defect over the dorsal foot in the case example (a,b). Post debridement photo demonstrating the exposed midfoot joint and tendon (c,d).

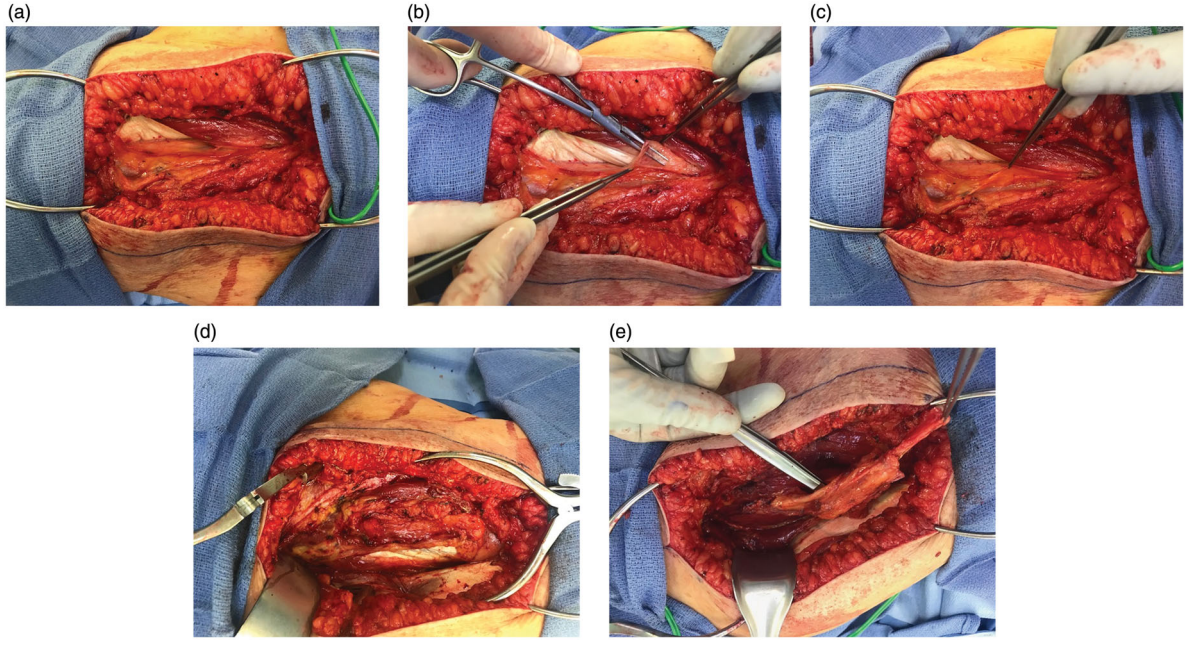

Figure 2. Intraoperative photographs demonstrating the operative approach (a), the loose areolar tissue dissection (b,c) and the thin DBIS flap insitu prior to division (d,e).

Figure 3. Postoperative photographs at one month (a,b) and three months from surgery (c,d) demonstrating the final contour.

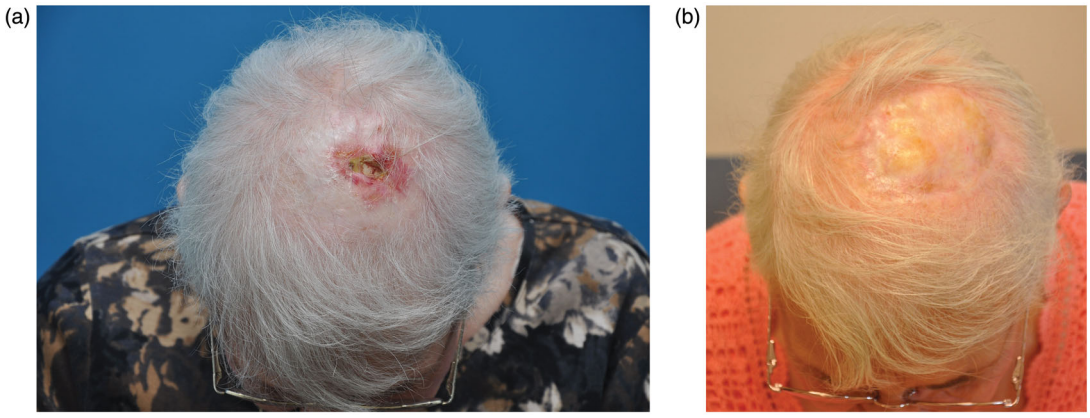

Figure 4. Case example demonstrating coverage following excision of scalp squamous cell carcinoma (a) and postoperative results at 18 months (b).

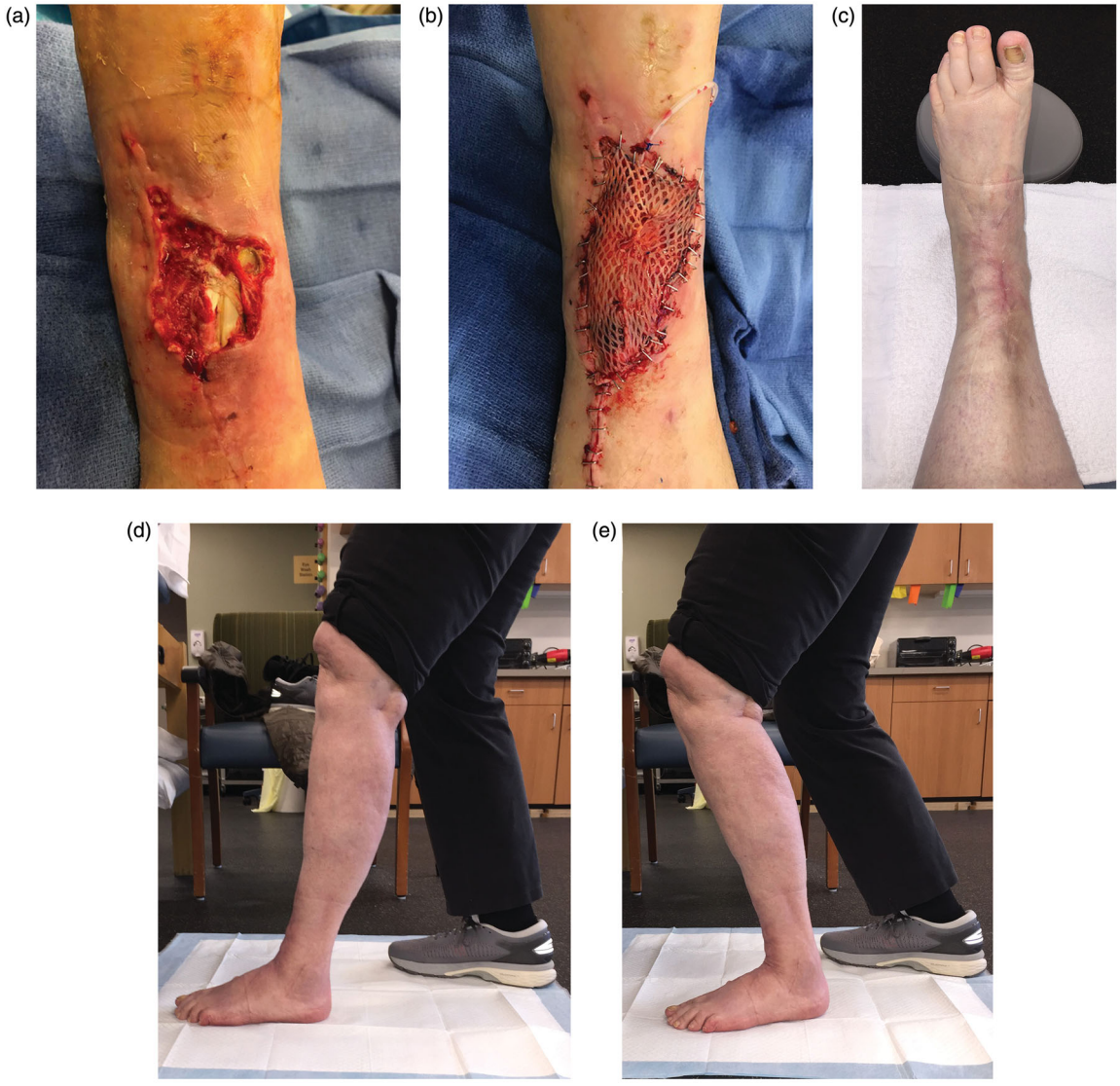

Figure 5. A case example demonstrating preoperative exposed tendons (a), immediate postop appearance with skin graft (b), final contour at one year (c) and maintained pliability with flexion/extension (d,e) indicating adequate tendon gliding.

contour deformity and limited potential space for seroma formation. When compared to a traditional vastus lateralis flap, the morbidity of sacrificing a muscle is also avoided. Lastly, given that septum provides a smooth, fascia-like tissue, the flap allows a smooth surface for tendons to glide underneath. While the need for skin graft over the flap raises the potential of scarring or decreased durability across tendons or joints when compared to a fasciocutaneous flap, that has not been our experience. We have

noted that with proper skin grafting technique, adequate recipient site preparation and flap inset this is not an issue as the septum provides a rather durable bed for skin grafting in addition to its gliding properties. This is demonstrated in Figure 5 with the patients ability to flex and extend at the ankle.

The main disadvantage to this technique is the need for skin graft harvest. However, if taken adjacent to the incision, the donor site can be excised and closed primarily, which minimizes the donor site morbidity. Additionally, the skin graft may provide slightly less durable soft tissue in the event of future operations in the region when compared to fasciocutaneous or septocutaneous flaps. Second the intermuscular septum used to cover the defects runs along the pedicle, thus if there is a large soft tissue requirement, pedicle length may be limited.

Conclusion

The DBIS flap is an excellent choice for reliable, thin flap with potential to cover both small and large surface defects with thin pliable coverage. It also has minimal donor site morbidity and has been reported to have low complication and revision rates. Given the ease of dissection and reliability of this flap, it should be considered for extremity defects and when a thin flap is desired, even in the obese patient.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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