

Immediate versus delayed skin grafting of free muscle flaps for limb salvage: does timing matter?

Karen R. Li, BBA^{1,2}; Christian X. Lava, MS^{1,2}; Nicole Episalla, MD²; Sabrina DeLeonibus, MS¹; Winnie Li, BS¹; Cameron M. Akbari, MD³; Richard C. Youn, MD²; Christopher E. Attinger, MD²; Karen K. Evans, MD²

1.

Georgetown University School of Medicine, Washington DC, USA
2.

Department of Plastic and Reconstructive Surgery, MedStar Georgetown University Hospital, Washington DC, USA
3.

Department of Vascular Surgery, MedStar Georgetown University Hospital, Washington DC, USA



Background

- The free muscle flap (FMF) is an invaluable option for treating chronic, atraumatic wounds of the lower extremity (LE) because FMFs can fill large soft tissue defects while introducing robust blood supply to poorly vascularized wounds.¹⁻³
- FMFs sometimes carry the disadvantage of requiring secondary procedure for for later skin grafting if not performed at the time of free tissue transfer (FTT).⁴
- Patients have demonstrated relatively high rates of graft failure over FMFs, despite skin grafts generally thriving on theoretically well-perfused wound beds provided by FMFs.⁵

Study Aim

Identify the risk factors for skin graft failure over FMFs in the diabetic and vasculopathic population and determine if timing of skin grafting influences graft survival.

Methods

- A retrospective review of patients that underwent LE FMF and FTT with split-thickness skin graft (STSG) from January 2017 through December 2022.
- Patients were compared between two cohorts: the “immediate” cohort that underwent SGST on the same day versus “delayed” cohort that underwent SGST at a later date. The primary outcome was rate of graft failure.
- Patient data was collected on demographics, comorbidities, FMF details, STSG details, and complications.

Results

Table 1. Patient Demographics				
Variable	Total	Immediate STSG	Delayed STSG	p-value
n (%)	91	65 (71.4)	26 (28.6)	
<i>Patient Demographics</i>				
Age, median (IQR)	57 (20)	56 (18)	59 (19)	0.103
Sex, Male	49 (53.9)	35 (53.9)	14 (53.9)	1.000
BMI (kg/m ²), mean ± SD	32.2 ± 12.9	31.4 ± 6.8	34.3 ± 6.6	0.074
Hospital LOS (days), median (IQR)	30 (16)	27 (15)	37.5 (15)	0.0001
<i>Comorbidities</i>				
Smoking				0.613
Never smoker	60 (65.9)	42 (64.6)	18 (69.2)	
Former	19 (20.9)	13 (20.0)	6 (23.1)	
Current	12 (13.2)	10 (15.4)	2 (7.7)	
CCI, mean ± SD	4.3 ± 2.5	3.7 ± 2.4	5.6 ± 2.2	0.0007
Diabetes Mellitus	65 (71.4)	40 (61.5)	25 (96.2)	0.001
PVD	35 (38.5)	18 (27.7)	17 (65.4)	0.001
ESRD	9 (9.9)	5 (7.7)	4 (15.4)	0.270
Chronic Kidney Disease	26 (29.2)	14 (21.5)	12 (46.2)	0.019
Hx Charcot Arthropathy	10 (11)	7 (10.8)	3 (11.5)	1.000
<i>Home Regimen at Time of Presentation</i>				
Home AC	5 (5.5)	3 (4.6)	2 (7.7)	0.621
Home AP	44 (48.4)	27 (41.5)	17 (65.4)	0.040

STSG: Split-Thickness Skin Graft; IQR: Interquartile Range; SD: Standard Deviation; BMI: Body Mass Index; Hx: History; LOS: length of stay; CCI: Charlson Comorbidity Index; ESRD: End-Stage Renal Disease; PVD: Peripheral Vascular Disease; VTE: Venous Thromboembolism; AC: anticoagulation; AP: antiplatelet

Table 2. Immediate and delayed STSG Characteristics

Variables	Total	Immediate STSG	Delayed STSG	p-value
n (%)	91	65 (71.4)	26 (28.6)	
<i>STSG Characteristics</i>				
Time to delayed STSG (days), median (IQR)	--	--	12 (9)	
Skin Graft size, cm ²	161 (138)	128 (120)	234 (149)	0.0003
Post-STSG NPWT	17 (18.9)	3 (4.7)	14 (53.9)	0.000
<i>SG: Skin Graft; NPWT: Negative-Pressure Wound Therapy</i>				
<i>Values in bold statistically significant p-values</i>				

Table 3. Postoperative Outcomes

Variables	Total	Immediate STSG	Delayed STSG	p-value
n (%)	91	65 (71.4)	26 (28.6)	
<i>Skin Graft Outcomes</i>				
Graft Failure*	28 (31.5)	17 (27.0)	11 (42.3)	0.157
Time to graft fail (days), median (IQR)	35 (54)	34 (25)	36 (83)	0.778
<i>Postoperative Flap Outcomes</i>				
Flap Success (POD 0-7)	85 (93.4)	60 (92.3)	25 (96.2)	0.504
<i>Long-Term Outcomes</i>				
Postoperative Ipsilateral Amputation	14 (15.4)	12 (18.5)	2 (7.7)	0.670
Mortality	12 (19.2)	8 (12.3)	4 (15.4)	0.737
Follow-up duration (months), median (IQR)	17 (27.7)	20.6 (31)	10.5 (18.7)	0.073
<i>POD: Post-Operative Day</i>				
<i>*Data for outcomes of graft failure only available for 89/91 patients</i>				

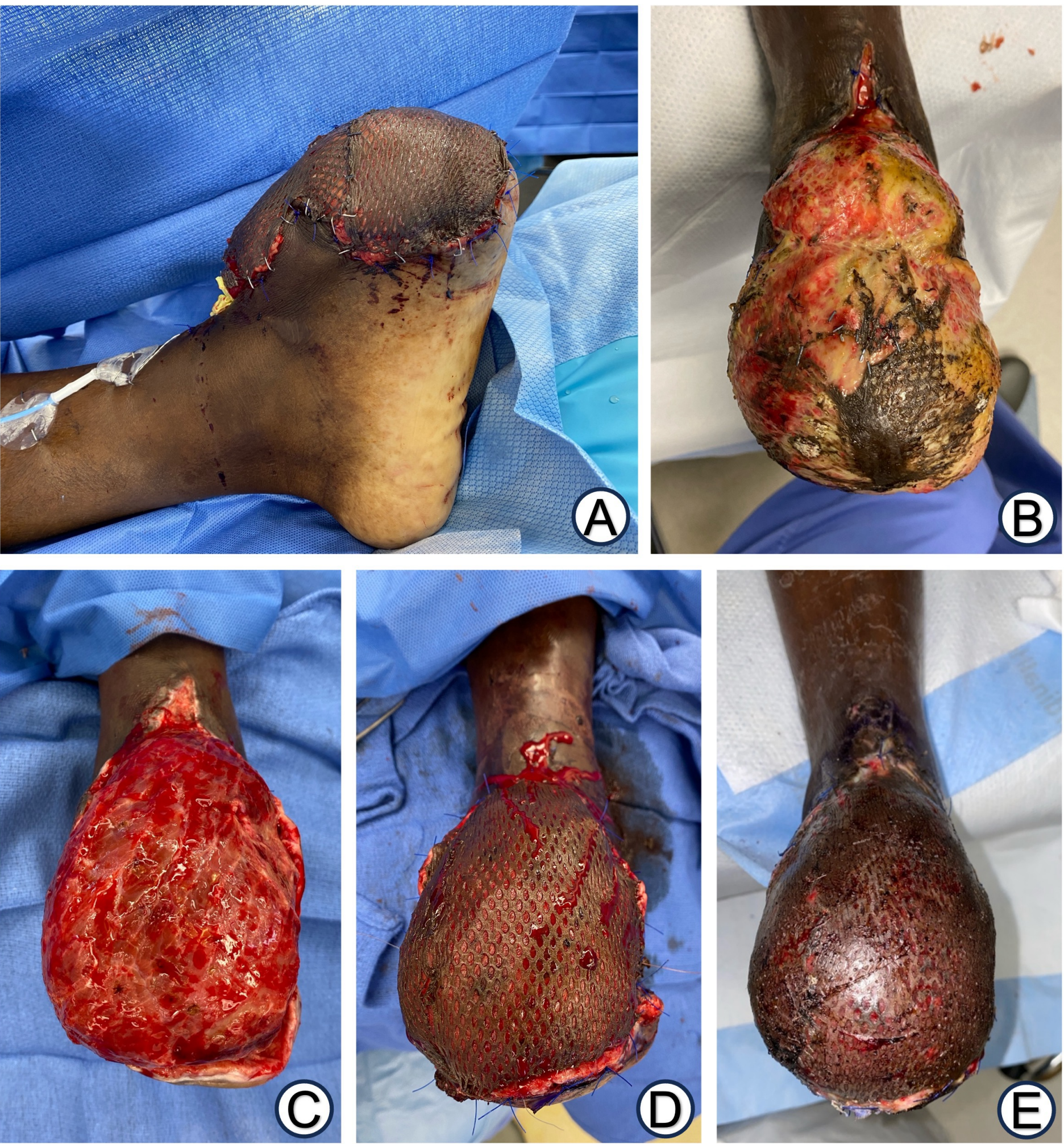


Figure 1. Immediate STSG on muscle free flap. A 50 year old male with a history of ESRD, DM, and HTN who received a vastus lateralis (VL) free muscle flap post-trans metatarsal amputation. (A) Intraoperative photograph of immediate split-thickness skin graft (STSG) coverage over VL free muscle flap. (B) Follow-up in clinic on postoperative day 20 with partial skin graft take, graft breakdown, and areas with necrotic tissue. (C) Intraoperative photograph on postoperative day 24 where muscle flap was extensively debrided to healthy, bleeding tissue in preparation for a second STSG. (D) Intraoperative photograph of secondary application of a meshed STSG over muscle free flap (E) Follow up in clinic 6.3 months from secondary STSG showing successful STSG take.



Figure 2. Delayed STSG on muscle free flap. 68 year old male with a lateral ankle defect requiring a free VL flap. (A) Photograph of lateral ankle defect (B) Photograph of PriMatrix (Integra LifeSciences Corp, Princeton, NJ) used at the time for free muscle flap coverage. Patient received a delayed STSG 10 days later. (C) Follow-up in clinic 5 months post free muscle flap with full skin graft take and complete healing.

Discussion

- In our study, we found an overall 31.5% graft failure rate with no differences between groups (immediate 27% vs. delayed 42.3%, p= 0.157)
- We found that patients who underwent delayed STSG had similar outcomes to those who underwent immediate STSG despite having a significantly higher number of comorbidities.
- Delaying skin grafting allows patients to overcome obstacles to wound healing, which explains the similarity in outcomes between delayed versus immediate STSG groups.

Conclusion

Little evidence exists to help guide the decision to perform immediate versus delayed skin grafting of FMFs in highly comorbid patients undergoing limb salvage. It is important to consider comorbidities, nutritional status, and intraoperative factors when determining skin graft timing. Delaying skin grafts in patients with significant comorbidities may improve graft take.

References

1.

Klebuc M, Menn Z. Muscle flaps and their role in limb salvage. Methodist Debakey Cardiovasc J. 2013 Apr;9(2):95-9. doi: 10.14797/mdcj-9-2-95. PMID: 23805342; PMCID: PMC3693523.

2.

Varghese BK, Babu P, Roy T. Microsurgical free muscle flaps for reconstruction of post-traumatic complex tissue defects of foot. Med J Armed Forces India. 2016 Apr;72(2):131-9. doi: 10.1016/j.mjafi.2016.02.004. Epub 2016 Apr 16. PMID: 27257323; PMCID: PMC4878945.

3.

Ducic I, Attinger C.E. Foot and ankle reconstruction: pedicled muscle flaps versus free flaps and the role of diabetes. Plast Reconstr Surg. 2011;128(1):173–180.

4.

Gayle L.B., Lineawear W.C., Oliva A. Treatment of chronic osteomyelitis of the lower extremities with debridement and microvascular muscle transfer. Clin Plast Surg. 1992;19:895–903.

5.

Cho, Eugenia H. B.S.; Shammass, Ronnie L. B.S.; Carney, Martin J. B.S.; Weissler, Jason M. M.D.; Bauder, Andrew R. M.D.; Glener, Adam D. B.S.; Kovach, Stephen J. M.D.; Hollenbeck, Scott T. M.D.; Levin, L. Scott M.D.. Muscle versus Fasciocutaneous Free Flaps in Lower Extremity Traumatic Reconstruction: A Multicenter Outcomes Analysis. Plastic and Reconstructive Surgery 141(1):p 191-199, January 2018. | DOI: 10.1097/PRS.0000000000003927