ACS Case Reviews in Surgery
Vol. 5, No. 1

A Novel Technique: In Situ Autologous Skin Graft to Manage Traumatic Extremity Hematomas in the Older Adult

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Background	Older adults are at increased risk of severe injury from seemingly minor trauma, such as ground-level falls, due to age-related frailty. Comorbidities frequently necessitate anticoagulation in this population, which can present unique challenges in wound management.
Summary	An older adult patient presented to the emergency department after sustaining a large, skin-dissecting hematoma following a fall. Contributing factors likely included her age and ongoing anticoagulation therapy. We implemented a novel approach for treating extensive hematoma: following evacuation, the patient's avulsed skin was meshed and used as a biological dressing, augmented with negative pressure wound therapy (NPWT).
Conclusion	This case describes a novel approach to managing large, skin-dissecting extremity hematomas in a unique patient population. This technique, utilizing meshed avulsed skin as a biological dressing, offers the potential for adequate wound coverage, reduced healing time, and avoidance of donor site morbidity associated with traditional skin grafting.
Key Words	trauma; anticoagulation; avulsed skin graft; negative pressure wound therapy; older adult

DISCLOSURE STATEMENT:
The authors have no conflicts of interest to disclose.

FUNDING/SUPPORT:
The authors have no relevant financial relationships or in-kind support to disclose.

RECEIVED: April 27, 2022
REVISION RECEIVED: September 7, 2022
ACCEPTED FOR PUBLICATION: November 2, 2022

To Cite: Kryskow MA, Velasquez AR, Kartiko K. A Novel Technique: In Situ Autologous Skin Graft to Manage Traumatic Extremity Hematomas in the Older Adult. *ACS Case Reviews in Surgery*. 2025;5(1):40-43.

Introduction

Older adults are particularly susceptible to severe injuries, even from seemingly minor falls, with over 30% experiencing falls annually.[1] The concurrent use of anticoagulation therapy in a substantial proportion of this population further increases the risk of post-traumatic bleeding. Consequently, emergency departments frequently encounter older adults presenting with large lower extremity hematomas resulting solely from falls.

If left untreated, these hematomas can expand significantly, causing skin dissection from underlying tissues due to the substantial pressure gradient between the hematoma and the delicate dermal and subdermal capillaries.[2] The resulting tissue necrosis and loss of skin coverage present a significant management challenge, particularly in cases with extensive wounds and substantial tissue loss.[2]

Standard management typically involves incision and drainage followed by debridement. When broader coverage is required, split-thickness skin grafts are frequently used.[3] Recent studies investigating the use of autologous skin grafts in traumatic wounds[4–8] suggest promising applications. These studies demonstrate the potential of utilizing the patient's skin as a grafting substrate, potentially achieving adequate wound coverage, reducing healing time, and eliminating the need for a separate donor site.

Case Description

An 83-year-old female with a complex medical history including diabetes, hypertension, hyperlipidemia, congestive heart failure with reduced ejection fraction, obesity, obstructive sleep apnea, bilateral breast cancer, and vulvar squamous cell carcinoma (status post right groin dissection with subsequent lymphedema of the right lower extremity [RLE]) presented to the ED after sustaining a traumatic RLE injury while using her wheelchair. She was anticoagulated with rivaroxaban for atrial fibrillation. The injury resulted in significant skin avulsion and a large hematoma (20 × 15 cm) distal to the knee (Figure 1A). Due to persistent hypotension and reported substantial blood loss, she received two units of packed red blood cells (pRBCs) in the emergency department.

Figure 1. Presentation and Techniques of In Situ Autologous Skin Graft. Published with Permission

(A) *The presentation of the wound with the skin changes and significant clot burden under the skin flap.* **(B)** *The skin flap after the clot underneath has been debrided.* **(C)** *The skin flap was left with a skin bridge and meshed using a scalpel.* **(D)** *The meshed skin flap was refitted and stapled peripherally around the wound edge.* **(E)** *Adaptec placed over the wound for eventual covering with* **(F)** *wound vac at 125 mm Hg.*

Within 24 hours, the patient underwent surgery for wound debridement and washout of subdermal adipose tissue and hematoma. Subcutaneous tissue and the hematoma were debrided, with no gross contamination observed. Notably, antibiotics were not administered during the procedure or hospitalization. A remaining skin bridge was preserved to potentially aid skin flap perfusion. The avulsed skin flap was meshed with a scalpel to promote drainage and then secured to the wound edges using staples (Figures 1B-1F). A single layer of gauze was applied, followed by negative pressure wound therapy (NPWT) with a VAC device (VAC; KCI, San Antonio, TX, USA). No signs of infection were identified during follow-up.

The patient received one additional unit of packed red blood cells (pRBC) postoperatively despite no active bleeding. This hemoglobin drop was attributed to potential blood volume equilibration. Anticoagulation therapy resumed on postoperative day 2 after hemoglobin stabilization. Throughout hospitalization, she received pain management and physical therapy and was eventually transferred to an acute rehabilitation facility. Leg elevation was maintained except during physical therapy sessions.

On postoperative day 5, the patient returned for NPWT removal (Figure 2A). The surgical team observed approximately 60% graft uptake and transitioned to a dry dressing regimen using Xeroform gauze for outpatient wound care. A follow-up visit two weeks later revealed persistent central necrosis but ongoing healing in other areas (Figure 2B). Continued dry wound care with Xeroform gauze was recommended until complete healing.

Discussion

Despite their frequent occurrence in trauma surgery, traumatic lower extremity hematomas lack a standardized treatment algorithm, encompassing initial management, timing of surgical debridement (when indicated), reconstructive techniques, and subsequent wound care. This lack of consensus is compounded by the involvement of various surgical specialties (e.g., wound care, general surgery, plastic surgery), often leading to diverse and sometimes conflicting approaches with limited supporting evidence.

Figure 2. Postoperative Appearance of In Situ Autologous Skin Graft. Published with Permission

Figure 2a.

Figure 2b.

(A) *The wound appearance five days after in situ autologous skin graft.* **(B)** *The wound appearance 14 days after in situ autologous skin graft.*

This case report presents a novel surgical technique utilizing the patient's avulsed skin as an in situ graft. Traditionally, such wounds undergo nonoperative management, allowing hematoma resorption, followed by elective debridement and potential autologous skin grafting if spontaneous wound closure is inadequate. In contrast, our approach involved immediate debridement and in situ skin grafting, offering potential advantages:

- **Reduced hospital stay:** This technique facilitates shorter hospitalizations compared to traditional management.
- **Minimized pain and scarring**: Using the patient's avulsed skin eliminates the need for a separate donor site, reducing associated pain and scarring.
- **Earlier anticoagulation resumption:** In this case, early intervention facilitated a more rapid resumption of anticoagulation, which was clinically advantageous.

Crucially, the success of in situ skin grafting hinges on early intervention, occurring before complete skin flap necrosis takes hold.

Conclusion

We explored a novel technique utilizing the patient's avulsed skin as a meshed biological dressing for managing traumatic lower extremity hematomas in older adults. This approach presents a potential alternative to traditional skin grafting, potentially reducing healing time and eliminating the morbidity associated with donor site creation. However, further investigation through controlled trials is necessary to validate the efficacy and generalizability of this method.

Lessons Learned

Although the patient had no prior diagnosis of venous stasis, our patient exhibited clinical signs suggestive of the condition. Adjunctive measures, such as compression stockings combined with leg elevation during non-ambulatory periods, could potentially improve graft take. Furthermore, debridement of any compromised areas within the avulsed skin flap may also enhance graft success.

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