

Woman, 57, With Painful, Swollen Ankle

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A 57-year-old horticulturist is working on a ladder leaned up against a tree trunk when the ladder slips, causing her to fall six feet onto concrete. Her right foot and ankle sustain the force of the fall; she is in excruciating pain and unable to bear weight on the foot. She is immediately transported to a local emergency department for evaluation.

Physical exam reveals a tearful middle-aged female in moderate distress and acute pain. There is moderate swelling of the right medial and lateral malleolus, as well as the midfoot, with blue and purple discoloration on the medial and lateral malleolus. Radiographs of the right ankle identify non-displaced fractures of the distal fibula and tibia. Foot x-rays are unremarkable. A splint is ordered. The patient is given crutches (non-weight-bearing status), pain medication, and a referral to orthopedics.

On day 3, the patient presents to orthopedics, where the splint is removed. An irregular, 4 × 3-in (at largest diameter), serohemorrhagic blister is discovered on the medial aspect of the lower leg, above the right malleolus (see Figure 1). Multiple 1- to 3-mm vesicles surround much of the anterior border. Moderate edema is noted from the top of the lesion to the midfoot, concentrated around the lateral and medial malleolus. Extensive blue, purple, and black discoloration is seen below the malleolus. The patient is diagnosed with a fracture blister.

DISCUSSION

Fracture blisters are taut, bullous, subepidermal vesicles that can accompany fractures or severe twisting injuries. They overlie markedly edematous soft tissue and histologically resemble a second-degree burn.^{1,2}

Physiologically, blisters are caused by increased interstitial pressure due to swelling,

with subsequent increased filtration pressure and colloid osmotic pressure in the epidermal gap.³ This causes a disruption that allows fluid to move into the weakened area.³ Areas most at risk for fracture blister formation are those with tight, closely adhered skin without muscle or enveloping fascia, where there is less soft tissue between the skin and bone prominences (eg, ankle, elbow, foot, distal tibia).²⁻⁴

Approximately 3% of all patients with acute fractures requiring hospitalization

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FIGURE 1



On day 3 postinjury, the patient was found to have an irregular, 4 × 3-in, serohemorrhagic blister on the medial aspect of the lower leg.

FIGURE 2



The case patient's fracture blister was electively unroofed on day 3 postinjury.

develop a fracture blister.⁴ Any condition that predisposes a patient to poor wound healing (eg, peripheral vascular disease, diabetes, hypertension) increases risk for a fracture blister.² Recognizing which patients are at greatest risk is vital, as implementing prevention strategies and intervening when fracture blisters do form can help decrease complications—including infection and delayed surgery—and improve fracture resolution. In this patient's case, the extent of the injury and force of the fall caused the fracture blister to form.

Diagnosis

Diagnosis of a fracture blister is based on clinical presentation. There are two types: hemorrhagic blisters and clear fluid-filled blisters. Hemorrhagic blisters indicate more severe injury and longer healing time (approximately 16 d), while clear fluid-filled blisters demonstrate minimal injury and therefore are quicker to heal.^{2,4}

The differential diagnosis for fracture blisters includes friction blisters and disorders such as epidermolysis bullosa and bullous pemphigoid. *Friction blisters* form when the epidermis is subjected to repeated friction or shear forces (eg, from a cast or splint).^{5,6} These forces mechanically separate epidermal cells at the stratum spinosum layer.⁷ The pressure that moves across the skin forces fluid into the deeper open spaces, filling them but leaving the surface layer intact.¹

Epidermolysis bullosa (EB) is a group of rare inherited cutaneous and mucous membrane disorders. EB involves fragility and detachment of subepithelial tissues, which results in blistering and erosions.^{8,9} The blisters tend to develop in areas subject to minor trauma, such as the extensor aspects of the elbows and the dorsal aspects of the hands and feet.⁹ They can also be triggered by exposure to heat, friction, scratching, and adhesive tape.¹⁰

Bullous pemphigoid, a chronic autoimmune skin disorder, is characterized by pruritic, bullous lesions. When IgG autoantibodies bind to certain hemidesmosomal antigens, complement activation causes a subepidermal blister.¹¹ While bullous pemphigoid most commonly affects those older than 60, it can also occur in children. Diagnosis is confirmed by skin biopsy and immunofluorescence testing.¹¹

Treatment and management

Although several recommendations have been published, there is no gold standard and treatment of fracture blisters remains controversial. Early surgical intervention for fractures could decrease the incidence of fracture blisters.^{1,3}

The goal of treatment is to achieve reepithelialization of the dermis.^{3,12,13} Once a blister forms, management techniques vary. Some recommend keeping closed blisters covered with a dry dressing to protect them from damage.³ Strauss et al recommend unroofing to avoid traumatic rupture; however, this does increase risk for infection.¹² Recommendations differ depending on provider preference and each patient's individual situation.

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FIGURE 3



Complete resolution of the fracture blister occurred 21 days after initial discovery, and the patient sustained no cutaneous complications.

Elective unroofing of a blister is typically followed with one of several treatment options. These include covering the open blister with a topical antibiotic cream (eg, silver sulfadiazine 2%); applying a nonadherent, occlusive bismuth-tribromophenate-petroleum gauze dressing; or elevating and immobilizing the affected extremity.^{12,13}

Treatment of spontaneously ruptured fracture blisters entails

- Unroofing the blister completely and applying a topical antimicrobial (eg, silver sulfadiazine, polymyxin B, neomycin, bacitracin).
- Applying a hydrocolloid dressing to keep the environment moist.
- Using a first-aid gel containing melaleuca (tea tree) oil.
- Initiating prophylactic oral antibiotics.
- Using whirlpool treatments.
- Elevating and immobilizing the affected extremity.^{3,12,14}

OUTCOME FOR THE CASE PATIENT

The fracture blister was electively unroofed (see Figure 2, page 30) based on provider preference. The patient was instructed to clean the wound daily and apply topical cream (silver sulfadiazine 2% bid) to the wound and cover it with gauze. The patient was made non-weight-bearing to the right lower extremity. Continuous elevation was highly encouraged except for bathing and restroom use, and an NSAID was recom-

mended as needed for pain. She was reassessed the following day and, due to partial refilling, the blister required additional unroofing. The patient was instructed to resume previous wound care orders.

No surgical intervention was required. CT of the right foot and ankle without contrast (performed on day 4 postinjury) confirmed a nondisplaced transverse fracture of the medial malleolus and a sagittal avulsion fracture of the anterior-inferior lateral malleolus. Multiple smaller fracture fragments were noted posterior and medial to the medial malleolus as well as inferiorly along the course of the deltoid ligament. There was a small, nondisplaced avulsion fracture of the medial malleolus at the anterolateral and posterolateral tibial plafond.

Due to the extent of the swelling, multiple fractures, and blister formation, the patient was essentially bed bound for the first three weeks; complete resolution of the fracture blister occurred 21 days after initial discovery (see Figure 3). The patient did not experience cutaneous complications. Her lower extremity was then casted in a short-leg removable cast for 10 weeks. She underwent physical therapy, and after 12 weeks, the patient was weight-bearing and was discharged from orthopedics. The patient reported refractory pain and swelling for an additional eight weeks following injury, warranting daily ibuprofen.

CONCLUSION

Fracture blisters are rare, and experience and knowledge about them in primary care is lacking. But clinicians need to be able to identify, diagnose, and refer at-risk patients to orthopedics in a timely manner.

Current management and treatment recommendations are inconsistent. Treatment varies depending on the site, severity, type, and status of the blister and the overall health of the patient. Fracture blisters may be left intact, electively unroofed, or treated after spontaneous rupture. More research is needed to clarify management recommendations, specifically regarding the decision to unroof a blister or leave it intact. Early surgical intervention may prevent the development of a fracture blister. **CR**

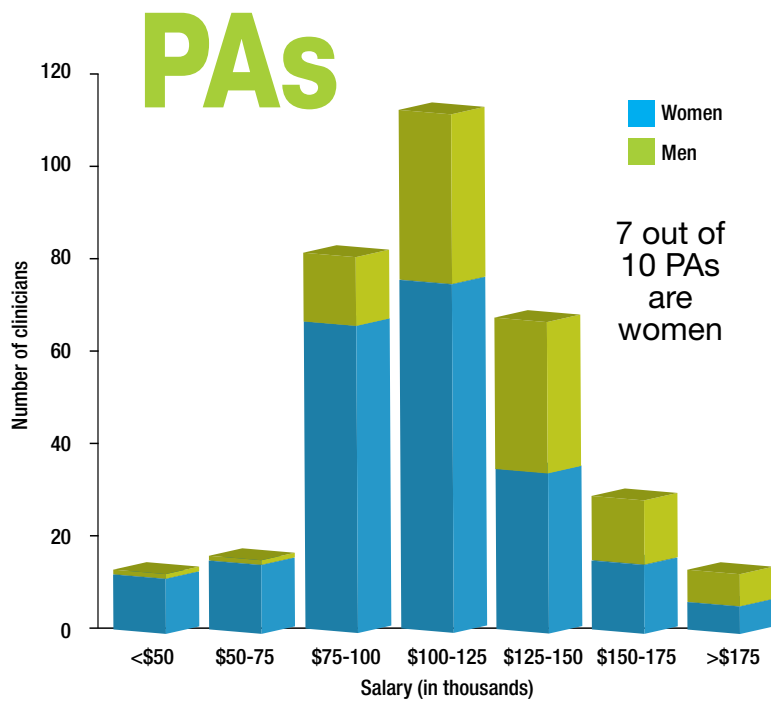
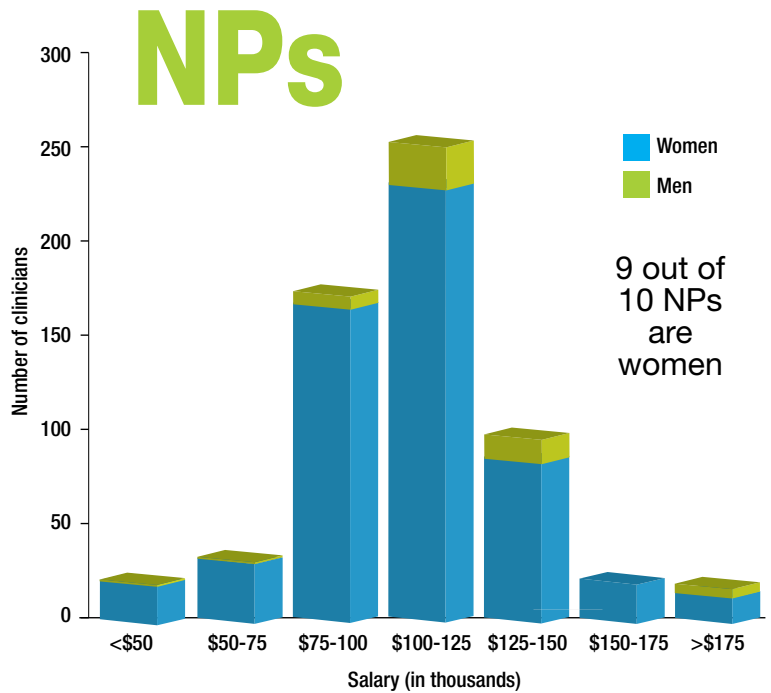
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