Leg Hammock for Closed Reduction of Tibial Shaft Fractures

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Abstract: Tibial shaft fractures are common injuries in emergency departments (EDs). Although many of these fractures require surgery, nearly all are stabilized in the ED with a long leg splint or bivalved cast. Long leg splinting is often challenging for a single health care provider. Further, even with assistance or previously described techniques for fracture reduction and stabilization, fracture angulation may occur, potentially leading to pain for the patient, fracture displacement, or further soft tissue injury. The authors propose a method for splinting tibial fractures that avoids fracture angulation, is cost-effective and quick, and can be easily performed by a single healthcare provider. [Orthopedics. 2015; 38(2):113-116.]

Diaphyseal tibial fractures are among the most common injuries consulting orthopedic surgeons evaluate in emergency departments (EDs). The majority of these fractures are treated with surgical intervention. However, closed reduction and splinting is indicated for nearly all of these injuries for temporary stabilization. The most common splint applied to diaphyseal tibial fractures is a plaster “U slab” extending to the proximal thigh for coronal plane stability and a posterior slab for sagittal plane stability. Unfortunately, application of this splint often requires at least 1 assistant and becomes challenging in intubated or very obese patients. In the setting of restricted work hours, orthopedic colleagues may be absent and the consulting orthopedic resident may need to rely on less experienced hospital staff for assistance with the procedure.

Konda et al. described a novel technique for closed reduction of tibial shaft fractures: 3 pieces of stockinette are secured transversely below the injured leg to railings of a hospital bed. This creates a hammock to support the injured leg while a single orthopedic surgeon applies a long leg splint. One of the authors’ critiques of their own method is that during elevation of the injured leg, extension forces are placed at the fracture site. Although they described no excessive post-splinting fracture angulation, the motion they described at the fracture site is extremely painful to the patient and may potentially soft tissue injury around the site.

The modified leg hammock described here relies on principles similar to those described by Konda et al. However, the current authors use a single piece of woven gauze to elevate the injured leg as a unit. The authors believe that their modified technique improves upon the earlier technique of Konda et al. First, by elevating the upper leg and the lower leg as a single unit, patient pain is minimized and fracture angulation is nearly absent. Second, the construct is set up more quickly using a single piece of gauze that relies on only 2 knots instead of 6 to secure the hammock. Finally, prewashed woven gauze is more easily obtained than stockinette in many resource-poor EDs or in those located in rural areas.

Technique

The patient is placed supine on an ED stretcher. The
The railings of the stretcher are raised. One end of the woven gauze is then tied to the ipsilateral rail, roughly at the level of the distal third of the femur of the injured leg. The authors prefer a large Kerlix gauze (Covidien, Mansfield, Massachusetts). This gauze is then carefully passed beneath the injured leg, around the contralateral rail, back beneath the injured leg proximal to the fracture site, around the ipsilateral rail once again, and finally distal to the fracture site and around the contralateral rail (Figure 1). This configuration allows for support at 3 sites: the distal thigh, proximal to the fracture site, and distal to the fracture site. The health care provider then carefully pulls the gauze tight (Figure 2). This elevates the injured extremity’s thigh and lower leg as a single unit.

The gauze is then tied to the ipsilateral rail, allowing for complete elevation of the injured limb above the stretcher. At this point, open injuries may be easily irrigated, as bins can be comfortably placed beneath them (Figure 3). Cast padding is wrapped over the injured extremity and the woven gauze (Figure 4).
around the injured extremity, padding all bony prominences. The cast padding can be rolled on top of the gauze (Figure 4). The U and posterior slabs can then be applied, again over the gauze (Figure 5). An elastic bandage can be applied (Figure 6).

Finally, the gauze is carefully cut and the patient’s leg is placed on the hospital stretcher (Figure 7). The position of the leg at the time of splinting during this technique affords slight flexion of the splint at the knee to improve patient comfort. The gauze is then easily pulled from the splint as the leg is carefully allowed to rest on the hospital stretcher (Figures 8-9). Figure 10 illustrates the technique.

**DISCUSSION**

This splinting technique has been universally effective in the ED and trauma bay of the authors’ level I trauma center. The authors have employed it for both open and closed fractures of the tibia with excellent results. They have also used this technique to splint injuries of the hindfoot such as calcaneus and talus fractures. Stable ankle fractures have also been successfully splinted with this technique. The authors typically do not use it for unstable ankle dislocations, as the gauze does not provide adequate stabilization of the joint during the splinting process. They have also found that the leg hammock allows a single individual to easily irrigate open injuries to the leg in the ED setting. Furthermore, the fracture site is stabilized throughout the procedure, and a single practitioner can easily apply the splint. Finally, patient participation is not required, and all materials needed for the procedure are readily available.

The authors believe that the proposed method is an improvement on the tibial suspension technique previ-
ously described by Konda et al.\textsuperscript{1} The current technique involves minimal angulation at the fracture site, as the leg is elevated as a unit. This is critical because strict parameters exist for both coronal and sagittal plane angulation for successful closed treatment of tibial shaft fractures.\textsuperscript{2,3} Figure 11 and Figure 12 show coronal and sagittal alignment before and after application of the leg hammock. Additionally, with a stabilized fracture site, patient discomfort is minimized and further soft tissue disruption at the fracture site is mitigated.

Importantly, there is no need for an assistant to stabilize the fracture site during elevation. Additionally, the modified leg hammock is easily and quickly applied with only 2 knots. Finally, the authors’ ED, like many resource-poor EDs, does not have a readily available cast cart or stockinette. The authors establish that woven gauze is an excellent material for this procedure, as it has adequate strength and is of appropriate length to easily traverse the injured extremity 3 times.

**CONCLUSION**

Tibial fractures are common injuries with which most orthopedic consultants are familiar. The authors propose this modest technique for tibial splint application as a useful tool in the arsenal of the busy orthopedic resident working alone in the trauma bay in the middle of the night.

**REFERENCES**