

Compound Ankle Fracture and Dislocation in a 20-Year-Old Female Gymnast: A Case Study

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Background

- Women's gymnastics highlights the human body's incredible ability to leap and twist through the air in an elegant fashion, which often involves high-impact landings.
- Early specialization coupled with the high-impact nature of the sport place collegiate female gymnasts at an increased risk for injury.
- Over 70% of injuries in the sport occur during competition, with floor exercises and vault accounting for the largest number.
- While uncommon, the high-impacts gymnasts endure can cause fracture and dislocation, and in even rarer instances, a combination of the two.
- Ankle position and force direction upon landing can cause traumatic injury to the ankle.

Case Presentation

- A 20-year-old female collegiate gymnast was performing a vault routine and landed on her right ankle pronated, resulting in a compound tibial dislocation.
- The fracture lacerated the skin exposing approximately an inch and a half of the distal tibia.
- Normal circulation, motor function, and sensation was present distal to the injury site. The patient was placed in a vacuum splint and transported via ambulance to a nearby hospital for surgery.
- The patient presented with an oblique distal fibula and medial malleolar fracture and dislocation of the tibiotalar and talofibular joints with a disruption of the tibiofibular syndesmosis.

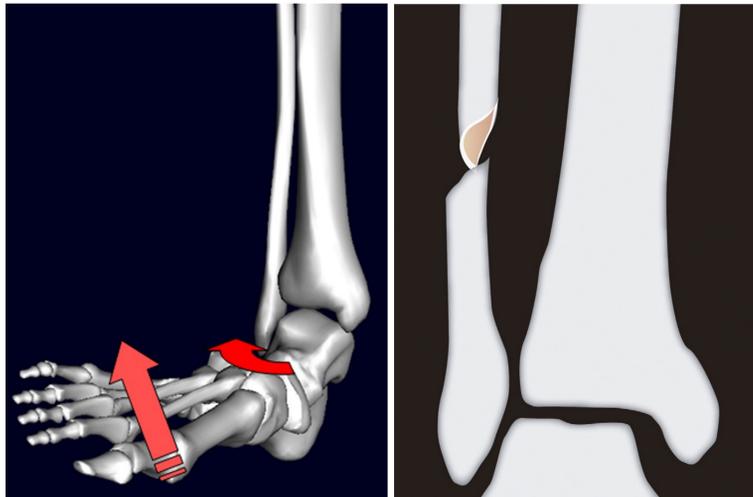


Figure 1A and 1B: diagram of the pronation and external rotation forces and the resulting Lauge-Hansen pronation-external rotation fracture.
Retrieved from: Haraguchi, N. & Armigr, R. S. (2009). A new interpretation of the mechanism of ankle fracture. *The Journal of Bone and Joint Surgery*, 91(82), 1-9.

References

- Deng, Y., Dong, C., Yang, X., Liu, R., Hou, F., Li, S., & Tang, K. (2018). High-Energy Transyndesmotom Ankle Fracture Dislocation: A Case Report and Systematic Literature Review. *Case Reports in Orthopedics*, 2018, 1-8.
- Haraguchi, N. & Armigr, R. S. (2009). A new interpretation of the mechanism of ankle fracture. *The Journal of Bone and Joint Surgery*, 91(82), 1-9.
- Jacob, N. Amin, A., Giotakis, N., Narayan, B., Nayagam, S., & Trompeter, A. J. (2015). Management of high-energy tibial pilon fractures. *Strategies in Trauma and Limb Reconstruction*, 10(3), 137-147.
- Kerr, Z. Y., Hayden, R., Barr, M., Klossner, D. A., & Dompier, T. P. (2015). Epidemiology of national collegiate athletics association women's gymnastics injuries, 2009-2010 through 2013-2014. *Journal of Athletic Training*, 50(8), 870-878.
- Marshall, S. W., Covassin, T., Dick, R., Nassar, L. G., & Agel, J. (2007). Descriptive epidemiology of women's gymnastics injuries: National collegiate athletics association injury surveillance system, 1988-1989 through 2003-2004. *Journal of Athletic Training*, 42(2), 324-240.
- Meinberg, E. G., Agel, J., Roberts, C. S., Kellam, J. F., & Karam, M. D. (2018). Fracture and dislocation classification compendium. *Journal of Orthopedic Trauma*, 32(1), 1-170.
- Priyanka, D. (2020). Radiology report findings (Report No. 999). Springfield, MA: Baystate Medical Center.
- Tartaglione, J. P., Rosenbaum, A. J., Abousayed, M., & DiPrea, J. A. (2015). Classifications in brief: Lauge-Hansen classification of ankle fractures. *Clinical Orthopedics and Related Research*, 473(10), 3323-3328.
- Wang, Z., Tang, X., Li, S., Wang, X., Gong, L., Zhong, T., & Wang, K. (2017). Treatment and outcome prognosis of patients with high-energy transyndesmotom ankle fracture dislocation—the "Logsplitter" injury. *Journal of Orthopedic Surgery and Research*, 12(3), 1-10.
- Zamboni, C., Campos, F. A. G., Foi, N. O., Souza, R. C., Christian, R. W., & Mercadante, M. T. (2016). Tibial shaft fracture and ankle injury: A case report. *Brazilian Society of Orthopedics and Traumatology*, 51(5), 597-600.

Conclusion

- Trans-syndesmotom ankle fracture-dislocations are usually the result of high-energy trauma.
- The Lauge-Hansen classification system is used to classify ankle fracture patterns by analyzing whether the foot was pronated or supinated during the application of abduction, adduction, or external rotation forces.
- A mechanism of ankle pronation with applied external rotation forces upon landing primarily caused the oblique fibular, medial malleolus fracture, and the associated dislocation.
- Under the Orthopedic Trauma Association (OTA) Fracture and Dislocation Classification Compendium the fracture is designated a 44C1.2u fracture.
- The designation describes a supra-syndesmotom simple diaphyseal fibular fracture at the malleolar segment with a medial malleolar fracture and an unstable syndesmosis.
- While Lauge-Hansen classifications are widely used and accepted to classify ankle fractures, OTA classifications are more comprehensive and based off long bone fracture patterns.
- Disruption of the distal tibiofibular syndesmosis is commonly associated with ankle fracture-dislocations.
- In women's gymnastics, the vault is the cause of over 25% of injuries in the sport, with the highest instance of injury occurring on the dismount and landing.
- Similar mechanisms of high energy injuries can result in other types of ankle fractures.
- High-energy axial or rotational forces transmitted to the ankle complex could result in a "log-splitter" injury, where the talus wedges between the tibia and fibula or distal tibiofibular joint with possible tibial and fibular fractures.
- Tibial pilon fractures occur when the talus is driven into the distal tibia, exploding the articular surface of the distal tibia caused by high-energy trauma from falls from a height or motor-vehicle-related accidents.

Diagnostic Imaging

- The patient received X-rays before and after surgery on the day of the injury.



Figure 3A and 3B: radiographs of the fracture-dislocation site before and after being reset.
Retrieved from: Priyanka, D. (2020). Radiology report findings (Report No. 999). Springfield, MA: Baystate Medical Center.

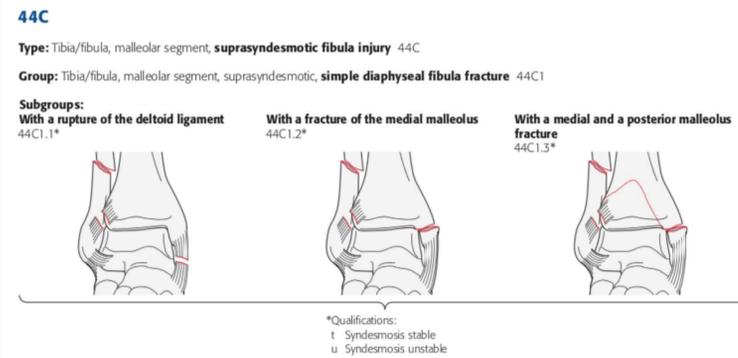


Figure 2: diagram of an OTA 44C1.2u fracture classification.
Retrieved from: Meinberg, E. G., Agel, J., Roberts, C. S., Kellam, J. F., & Karam, M. D. (2018). Fracture and dislocation classification compendium. *Journal of Orthopedic Trauma*, 32(1), 1-170.



Clinical Bottom Line

- Trans-syndesmotom ankle fracture-dislocations are extremely rare and require high-energy trauma to occur.
- When torque occurs in the lower limb, the ankle becomes susceptible to simultaneous injuries.
- A high-energy external rotation force on a pronated ankle in a gymnastics vault landing can produce enough energy to result in ankle fracture-dislocation.
- Better understanding of the mechanism of ankle fracture-dislocations can increase understanding of such injuries.

Figure 4: post-operative radiograph of the fracture-dislocation site.
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