Anatomic Structures at Risk When Utilizing an Intramedullary Nail for Distal Fibular Fractures: A Cadaveric Study.
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Introduction/Purpose: Distal fibula fractures are most commonly fixated with plate and screw constructs. Conversely, modern generation fibular intramedullary nails are load-sharing devices that offer rigid internal fixation via percutaneous technique with only transaxial screws residing subcuticularly. The relative risk of damage to nearby structures is well characterized for plate and screws constructs; however, no such data is available for fibular nails. As a result, the purpose of this anatomic study was to assess the relative risk to nearby anatomic structures when implanting a current generation retrograde locked intramedullary fibular nail.

Methods: This was an IRB-exempt study. Ten human cadaveric lower extremities were instrumented with a contemporary retrograde locked intramedullary fibular nail with three distal locking and two syndesmotic fixation options. The cadavers were then dissected by a single experienced orthopedic foot and ankle surgeon in a standardized fashion. The shortest distance, in millimeters (mm), between the site of procedural steps and nearby named structures of interest (i.e. sural nerve, superficial peroneal nerve and the peroneal tendons) was measured and recorded. Levels of risk were then assigned based on observed distances as high (0 to 5 mm), moderate (5.1 to 10 mm) and low (greater than 10 mm).

Results: The peroneus brevis tendon was at high risk when making the distal skin incision in all specimens (Table). When reaming and inserting the nail through the distal fibula aperture, the peroneus brevis was at high risk in 7 specimens. The peroneus longus tendon was at moderate to high risk when inserting both the proximal and distal syndesmotic screws in 9 specimens. The superficial peroneal nerve was at high risk when inserting an anterior to posterior distal locking screw in 7 specimens. The sural nerve was at low risk for all procedural steps. Of note, no structures were observed to have been directly damaged.

Conclusion: The current findings indicate that strict adherence to sound percutaneous technique is needed in order to minimize iatrogenic damage to neighboring structures when performing retrograde locked intramedullary fibular nail insertion. This includes making skin-only incisions, thorough blunt spreading down to bone, and maintaining close approximation between tissue protection sleeves and bone at all times. The current findings indicate that the peroneal tendons and superficial peroneal nerve are at the highest risk, and should be considered when performing relevant clinical outcomes studies.
Distances Between Structures at Risk and Intramedullary Fibula Fixation Instrumentation

- Distal syndesmotic screw to SN
- Proximal syndesmotic screw to SN
- Distal syndesmotic screw to PT
- Proximal syndesmotic screw to PT
- AP screw incision to SPN
- Proximal locking incision to PT
- Distal locking incision to PT
- Fibula aperture to SPN
- Fibula aperture to PB
- Distal skin incision to SN
- Distal skin incision to SPN
- Distal skin incision to PB

- Low Risk = >10mm
- Moderate Risk = 5.1 - 10mm
- High Risk = <5mm

PB = Peroneal Brevis
PT = Peroneal Tendon
SPN = Superficial Peroneal Nerve
SN = Sural Nerve