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## Statement of Purpose

The lateral extensile approach has been utilized for access to calcaneal fractures as it offers generous exposure while making use of the unique vascular supply at the lateral calcaneus. While various medial hindfoot incisions have been described, an extended incision has not been elucidated in the literature. The objective of this investigation was to evaluate the safety and utility of a medial extensile approach in an adolescent with calcaneal aneurysmal bone cyst.

## Literature Review

Various medial hindfoot incisions have been described in the literature, yet none offering wide access to the medial aspect of the calcaneal body. A medial extensile approach akin to the lateral extensile has not been discussed in the literature. Proximity to the neurovascular bundle in the flexor retinaculum presents a challenging dissection interval fraught with potential complications. Based on the angiosome work done by Attinger et al, we know the medial calcaneal artery branches off the posterior tibial artery inferiorly and branches into multiple tributaries that travel in a coronal direction to supply the heel. The medial calcaneal artery's angiosome boundary includes the medial and plantar heel, with its most distal boundary being the glabrous junction of the lateral posterior and plantar heel. Elevating a thick soft tissue flap at the medial heel exposes the medial and inferomedial aspects of the calcaneus yet risks the medial calcaneal nerve and medial calcaneal artery angiosome.

## Case Study

**HPI and PMH:** A 15-year-old otherwise healthy male presented with pain in his right heel when running. No pain was present with normal ambulation. Radiographs revealed small cyst in the calcaneus. He was given a heel cup and MRI was ordered, but not obtained. His pain subsequently improved.

Two years later, patient presents for evaluation after sustaining injury while playing basketball. Reports he landed on foot heard crack/pop. He had no pain at this time.

**Workup:** Radiographs revealed a medially oriented expansile lesion in the calcaneus with some cortical breakthrough. The lateral aspect of the calcaneus appeared to be thick with good bone stock. Magnetic resonance imaging revealed cystic lesion with fluid levels and enhancing septations. This likely represented an aneurysmal bone cyst, however did appear more aggressive than typically seen with cortical erosion, probably breakthrough, and enhancing surrounding edema. Differential diagnosis included giant cell tumor and telangiectasia osteosarcoma. He was made non-weightbearing in a CAM boot and crutches and referred to an orthopedic oncologist who recommended biopsy with interventional radiology. Blood work was obtained and a chest x-ray to rule out lung metastases. Bone biopsy was negative for malignancy.

## Case Study

**Day 0:** Given the location, a medial approach was preferred. The incision consisted of a vertical arm, posterior to the neurovascular bundle and medial to the Achilles tendon, and a plantar arm along the glabrous junction, superior to the abductor hallucis.

**Day 7:** Patient developed small amount of eschar along the plantar arm of the incision. There was also mild edema about the incision. There was a 2 cm area of reduced sensation just inferior to the incision. Otherwise, sensory and motor function was intact. He was allowed to partially bear weight as tolerated in the boot.

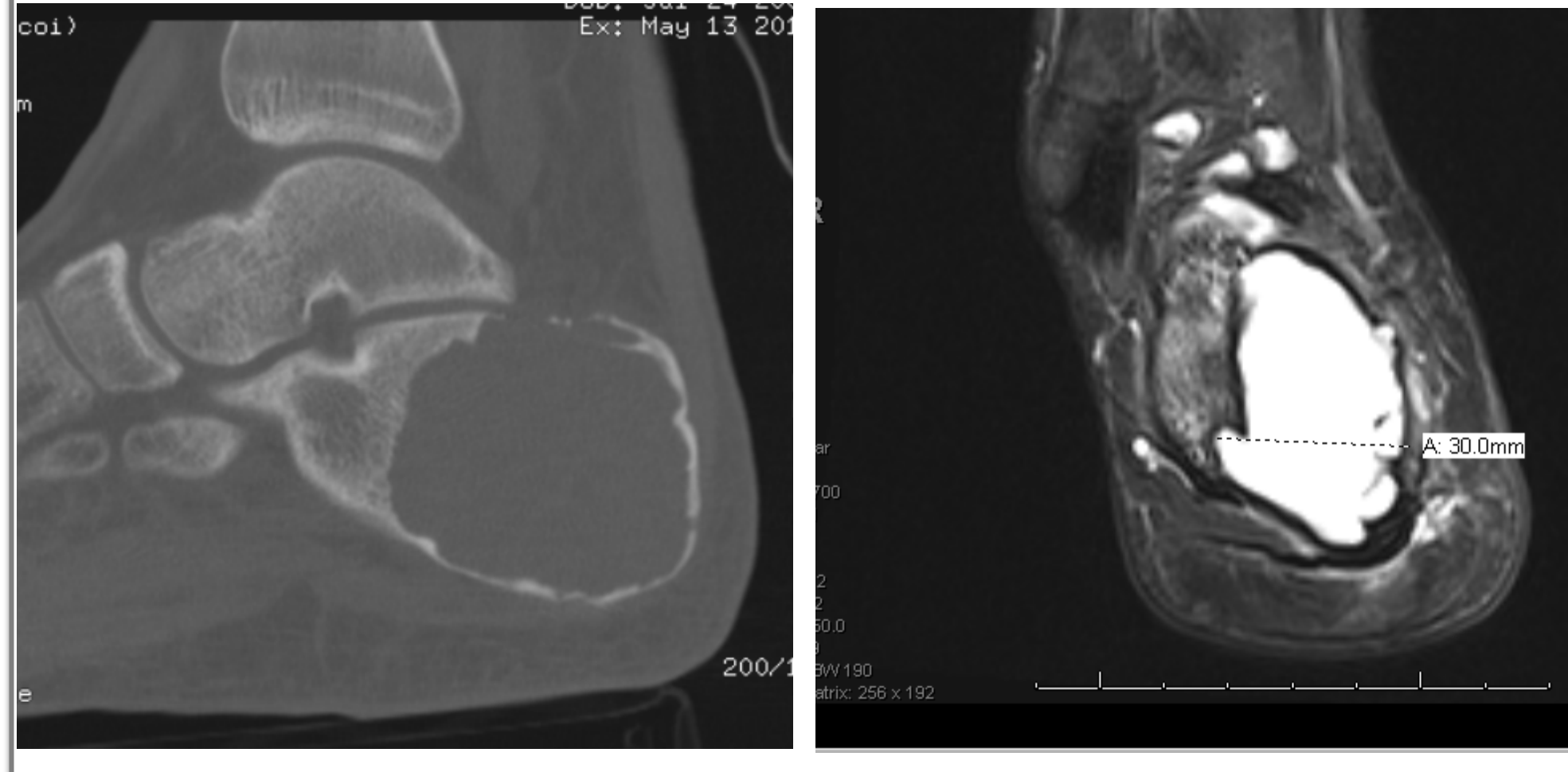
**Day 21:** Continued mild numbness in the plantar heel. Otherwise, no reported pain and minimal swelling. Other sensory and motor function remained intact and he had full ankle range of motion.

**Day 42:** Transitioned out of the boot with progressive weightbearing. Island of reduced sensation resolved.

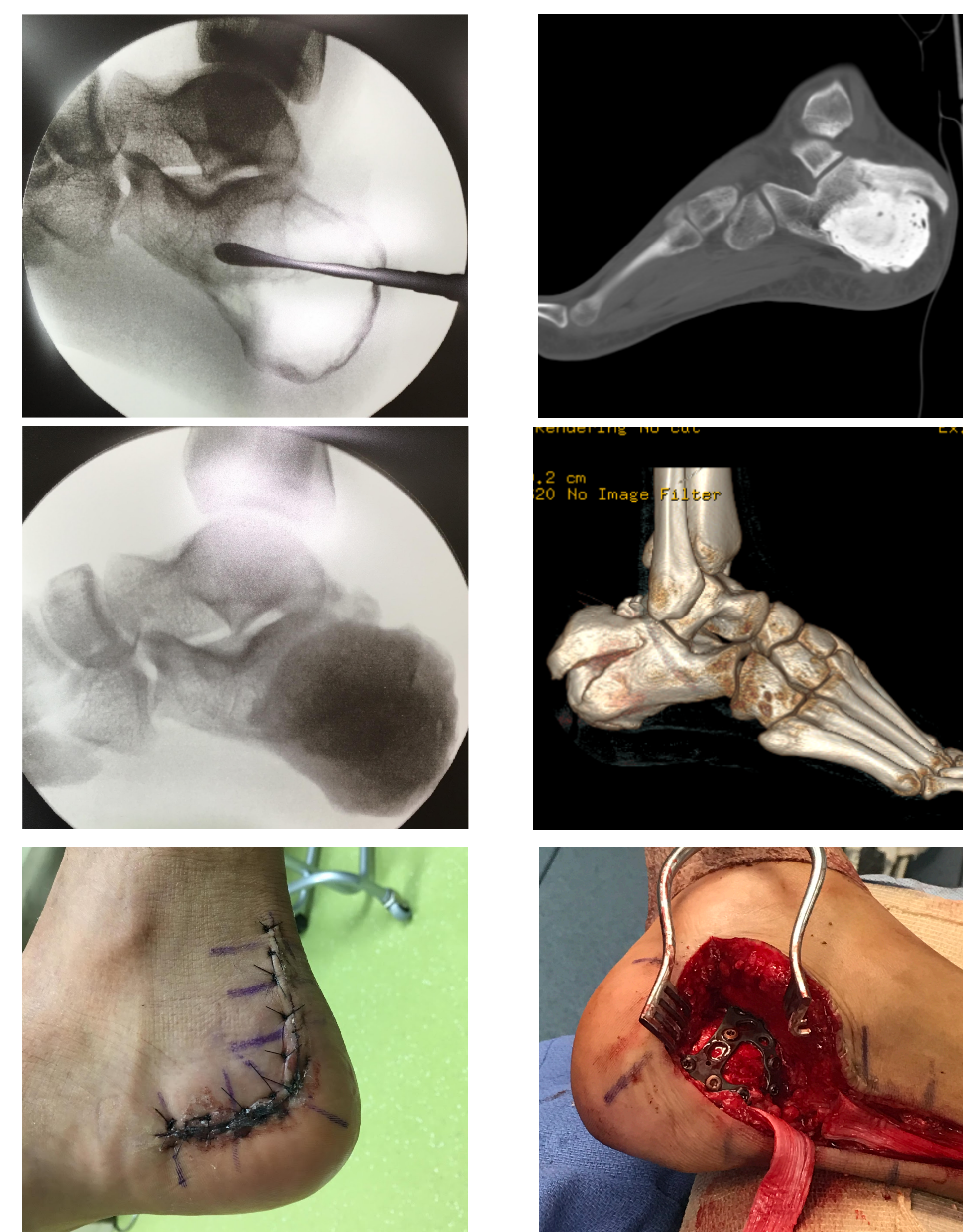
**Day 70:** Ambulating normally in regular shoe gear without pain.

**Day 300:** Sustained superior displaced calcaneal fracture with lucency transversely oriented along superior third of calcaneus overlying the cement

- Day 0**
  - Medial approach
  - Curettage and argon beaming
  - Cementation
- Day 7**
  - First post-op
  - Mild eschar and edema
  - Numbness to plantar heel
- Day 21**
  - Second post-op
  - Sutures removed
  - Partial weight-bearing as tolerated
- Day 42**
  - Third post-op
  - Numbness resolved
  - Transitioned out of boot
- Day 70**
  - Regular shoe gear
  - Normal ambulation
- Day 300**
  - Subacute calcaneal fracture
  - ORIF



## Images



## Analysis and Discussion

Anatomy of bone lesions as in this case of an aneurysmal bone cyst that is so medially oriented, created a situation where a lateral approach would not offer the right exposure and would sacrifice healthy bone. Utilizing Attinger's principles of angiosome determination, one can create a safe map for incision planning, especially with a young, healthy patient as in this study. The incision had few post-operative sequelae (numbness and eschar) that quickly resolved and the skin went on to heal uneventfully. The flap was healthy enough to use a second time when planning to repair the subsequent calcaneal fracture approximately one year later. The incision again healed without wound healing complication.

While a medial extensile incision risks critical neurovascular structures and can be technically challenging to perform, it may be a viable option for procedures necessitating wide access to the medial calcaneus when used judiciously. With individual variances in anatomic location of the medial calcaneal branch, the role of doppler sonography cannot be understated.

## REFERENCES

1. Taylor GI, Palmer JH. The vascular territories (angiosomes) of the body: experimental study and clinical applications. *Br J Plast Surg* 1987;40:113-41.
2. Taylor GI, Pan WR. Angiosomes of the leg: anatomic study and clinical implications. *Plast Reconstr Surg* 1998;102:599-616.
3. Attinger C, Cooper P, Blume P, Bulan E. The safest surgical incisions and amputations apply the angiosome principles and using doppler to assess arterial-arterial connections of the foot and ankle. *Foot Ankle Clin N Am* 2001;6:745-99.
4. Agnew SP, Dumanian GA. Angiosomes of the calf, ankle, and foot: anatomy, physiology, and implications. *Sarrafian's Anatomy of the Foot and Ankle*. 3rd Ed. Philadelphia, JB Lippincott; 2011.

