

STATEMENT OF PURPOSE

- Intraoperative C-arm is a useful tool for assessment of articular reduction but it is not as sensitive as traditional radiographs or CT.
- The purpose of this case study was to describe a technique where the addition of intraoperative CT was used to critically evaluate the reduction before and after fixation of a juvenile Tillaux fracture.

BACKGROUND

The Tillaux fracture is a unique transitional fracture of the anterior-lateral distal tibial epiphysis that is often a result of an external rotation injury. Currently, ORIF is recommended for fractures with > 2mm of displacement. Precise, anatomic reduction of the articular surface is required to reduce the likelihood of post-traumatic arthritis. While direct visualization of the anterior aspect of the fracture is readily available, it is often difficult to assess articular reduction in the central aspect of the tibia.

Chowdhary et al. evaluated the use of intraoperative 3 dimensional CT in foot and ankle surgery. The authors concluded that the use of intraoperative CT allowed for accurate visualization of the position of bones and thus such imaging helped reduce intraoperative complications and may lead to better outcomes. [1]

Furthermore, Garner et al. compared the use of intraoperative fluoroscopy of post operative CT concluding that the use of CT allowed for better evaluation of anatomical reduction. [2]

In addition, Franke et al. showed that the use of intraoperative CT imaging improved the outcomes of up to 32.7% of cases with syndesmotic injuries. [3]

To our knowledge there has been little literature describing the use of CT imaging intraoperatively for pediatric ankle fractures. Our study sought to describe a case where the addition of intraoperative CT would influence anatomic reduction in a displaced pediatric ankle fracture.

METHODS

A 14 year old male was seen in clinic 3 days after sustaining an external rotation injury to his right ankle while playing hockey. Standard radiograph revealed a traditional juvenile Tillaux fracture of the anterior-lateral distal tibial physis with 4.5 mm of fracture displacement. ORIF was recommended to reduce the articular surface. Surgery was scheduled five days post injury.

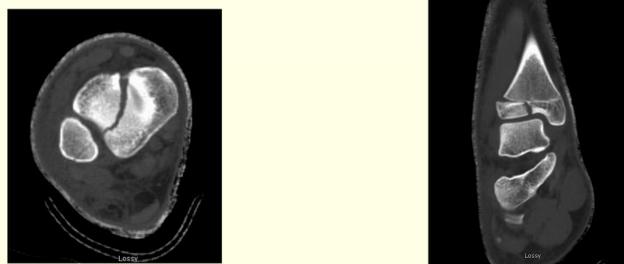


Figure 1AB Pre Op CT Scan demonstrating Tillaux fracture.

Surgical Technique

Intraoperatively, an ankle arthroscopy was performed to evaluate the joint for intra-articular debris and to evacuate any hemarthrosis. Arthroscopic evaluation showed significant articular displacement of the distal tibia. Closed manipulation of the fracture was attempted under arthroscopic visualization but could not be achieved. Traditional ORIF was performed with an anterior-lateral incision. Pointed periarticular reduction clamps were applied to reduce the fracture, which was then stabilized with several k-wires for temporary fixation. Intraoperative CT was used to critically assess fracture reduction and restoration of the articular surface. The CT images revealed some persistent subtle displacement of the articular surface and a repeat reduction was performed. A 4.0mm cannulated screw was placed from a lateral to medial direction, just distal to the open tibial physis and parallel to the ankle joint surface utilizing standard lag technique. Final intraoperative CT scan was then used to confirm anatomic reduction of the fracture and articular surface. The patient was then kept non-weightbearing until radiographic healing at 8 weeks.



Figure 2ABC. Pre Op Xrays AP, Ankle Mortis, Lateral views



Figure 3ABC. Post Op Xrays AP, Ankle Mortis, Lateral views

RESULTS

The use of intra-operative CT was helpful in assessing and confirming anatomic reduction of the fracture and alignment of the articular surface prior to fixation and prior to leaving the operating room.

We believe that the use of intra-operative CT improved the accuracy of our reduction.



Figure 4ABC. Intraoperative CT Scans

ANALYSIS & DISCUSSION

The use of intraoperative CT has been a debated topic based on the concerns of radiation exposure and cost.

Hsu et al. found that a single intraoperative CT scan emitted radiation equivalent to 5.6 standard radiographs. [4] Although this may appear as a significant amount of radiation exposure, more precise anatomic reduction can be achieved with use of CT as compared to intraoperative fluoroscopy. In addition, Eckardt and Lind showed that intraoperative radiation exposure with the CT was less than conventional CT postoperatively. [5]

Regarding the cost of intraoperative CT, many institutions may already have intraoperative CT equipment for other services, and it could be shared for use in foot and ankle surgery. The cost would then be reduced to the sterile draping material and the technician required to operate the equipment. Additionally, intraoperative CT minimizes the need for postoperative CT if needed, thus reducing some costs.

The real benefit of intraoperative imaging and navigation is to decrease intraoperative complications and improve surgical outcomes, minimizing the need for secondary procedures.

Given the potential long-term morbidity associated with malreduction and/or malalignment, surgeons should consider the use of intra-operative CT to help with intra-articular fracture reduction for juvenile Tillaux fractures of the distal tibia.

REFERENCES

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