CASE REPORT

Paediatric Salter-Harris type IV injury of distal tibia with talus fracture

Swapnil Kothadia,¹ Umesh Birole,² Ashish Ranade²

¹Department of Arthroscopy & Sports Medicine, Kothadia Institute of Orthopaedics, Solapur, Maharashtra, India
²Department of Orthopaedics, Deenanath Mangeshkar Hospital and Research Centre, Pune, Maharashtra, India

Correspondence to
 Dr Ashish Ranade,
 ranadea2@gmail.com

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SUMMARY

Fracture of talus with Salter-Harris injury of the distal end of tibia is a rare injury in paediatric age group. The authors report a case of a 13-year-old male child who sustained type IV Salter-Harris injury to the medial malleolus with coronal spilt along with spilt and depressed fracture of the neck of talus and fracture of the lateral process of talus with stable compression fracture of spine sustained due to fall from 6 meters height. CT scan delineated the morphology of fracture pattern and helped in preoperative planning. Talar articular fracture was reduced and fixed arthroscopically while distal tibial fracture was fixed under image intensifier. We observed favourable outcome following arthroscopic reduction at 4-year follow-up.

BACKGROUND

Fracture of distal tibial physis accounts for 25%–38% of all physeal fractures.^{1 2} In addition, fracture of talus is very rare in childhood and adolescence.^{3 4} Predominant cause for talar fractures is fall from height. Foot is forcibly dorsiflexed and the neck of talus impinges against the anterior lip of distal tibia leading to vertical or oblique fracture at the body and neck junction. When dorsiflexion occurs more medially, the medial malleolus also gets fractured.^{4–6}

Talar fractures in children, if not diagnosed and treated early, can lead to a number of complications

such as avascular necrosis, delayed union, arthrosis and neuropraxia.⁷

We report a unique case of a 13-year-old male child who sustained a type IV Salter-Harris injury to the right medial malleolus with coronal spilt along with spilt and a rare depressed fracture of talus with fracture of the lateral process of talus. Also, it was associated with stable compression fracture of L1 vertebra sustained due to fall from 6 meter height.

We fixed these fractures in closed manner. Preoperative CT scan helped us in knowing the morphology of fracture pattern and helped in preoperative planning. Talus fracture was reduced arthroscopically and fixed under image intensifier while distal tibial fracture was fixed under image intensifier.

We observed favourable outcome following surgery and without any complications.

CASE PRESENTATION

A 13-year-old male child presented to emergency room with complains of pain and swelling in the right ankle, unable to bear weight over the right lower limb and swelling in the back following history of fall from 20 feet height while playing on the roof of a house.

The child was conscious, well oriented and responding to verbal commands. There was no history of head, thorax or abdominal injury. He had no medical and surgical history.

Local examination revealed swelling, tenderness and ecchymosis of right ankle. Swelling over the back was present. There were no external injuries and no neurodeficit. He was sent for ankle, foot and dorsolumbar spine radiographs to delineate the injury.

INVESTIGATIONS

Right ankle anteroposterior (AP), lateral and mortise views pointed towards type IV Salter-Harris injury of medial malleolus as fracture line passing through epiphysis, physis and metaphysis with displacement and fracture of talus (figure 1). Plain radiograph of lumbar spine in AP and lateral views showed compression fracture of L1 vertebra (figure 2).

CT scan of the right ankle and foot was performed to identify fracture geometry. The CT scan demonstrated depressed fracture of lateral dome of talus with sagittal split, fracture of the lateral process of talus and Salter-Harris type IV injury medial malleolus with coronal spilt (figure 3).

Figure 1 Anteroposterior and lateral views of right ankle showing Salter-Harris type IV injury, with fracture line passing through epiphysis, physis and metaphysis with displacement. Fracture is also involving medial malleolus and talar body.

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Figure 2 Lateral radiograph of dorsolumbar spine showing L1 vertebra fracture.

TREATMENT

We preferred non-operative treatment for L1 vertebra fracture in view of stable fracture pattern and gave lumbar support belt. Right below knee plaster slab was given with ice fomentation and limb elevation to alleviate pain and swelling. Once the fracture pattern was delineated by CT scan, we planned closed reduction and internal fixation of type IV Salter-Harris injury of distal tibia with 4 mm cannulated cancellous screw and arthroscopy-assisted

Figure 3 CT scan sagittal view, coronal and axial view of right ankle showing fractured neck of talus and Salter-Harris type IV injury of medial malleoli.

Figure 4 Arthroscope camera view of reduction of talus fracture using probe.

closed reduction and internal fixation of talus with 4 mm cannulated cancellous screw and Herbert screw.

Under spinal anaesthesia and tourniquet control, valgus traction was given to right ankle and foot. Once the reduction was confirmed on AP and lateral views on image intensifier, 2.5 mm K-wires were passed across the fracture site, one from metaphysis and two as transepiphyseal across the fracture site. None of them crossed the epiphyseal plate. Length of the wires was confirmed with depth gauge, and each wire was replaced with 4 mm cannulated cancellous screw.

Once distal tibia fracture fixation was achieved and stability confirmed on image intensifier, ankle arthroscopy was performed for talar fracture. Anteromedial portal was made medial to tibialis anterior tendon and anterolateral portal was made lateral to peroneus tertius tendon. Curved probe was inserted through anterolateral portal and 4 mm arthroscope from anteromedial portal. Curved end of probe was used to reduce the talar fracture fragment ([figure 4](#)) and 2.5 mm K-wires were used as joystick under image intensifier to hold the reduced fragments. The lateral process of talus was fixed with one K-wire. Reduction was confirmed under image intensifier. One K-wire was replaced with 4 mm cannulated cancellous screw and other one was replaced with Herbert screw. Mini incision used for portals was closed using Ethilon 3–0 suture ([figure 5](#)).

Postoperatively, the patient was given below knee plaster slab with limb elevation and advised complete bed rest for the spine fracture. On the 10th postoperative day stitches were removed and non-weight-bearing below knee was cast given for 6 weeks. Knee and toe range of movements were allowed within cast.

Figure 5 Images showing anteromedial and anterolateral portals for inserting arthroscope and mini incision which were closed using Ethilon 3–0 suture.

Figure 6 Anteroposterior and lateral radiographs of the right ankle at 6 weeks postoperatively, showing good positioning of screws and fracture alignment.

OUTCOME AND FOLLOW-UP

Initial radiograph at 6 weeks showed good alignment of fracture (figure 6). Spine radiograph showed consolidation at fracture site.

We advised non-weight-bearing ambulation with walker. Full range of movements at ankle was encouraged. Follow-up was done every 6 weeks for a period of 6 months. At the end of 6 months, ankle dorsiflexion was 20° and plantar flexion was full. At 12-month follow-up, implants were removed (figure 7).

Four years following index surgery, right ankle dorsiflexion was restricted to 20° (figure 8) compared with 40° of left ankle, and both ankle plantar flexion were 45°. The patient had pain-free range of movement, and he could resume all his activities of daily living, including walking, running and playing cricket.

DISCUSSION

Talus fractures are rare, comprising just over 5% of all foot injuries.⁸ In skeletally immature patients, talar neck fracture usually follows high-energy trauma. Incidence of talar neck fracture in paediatric age group is still less, comprising just 0.008% of all childhood fractures.⁹ Byrne and Stephens have reported the rare talar neck fracture in skeletally immature patients in their study but advocated the use of CT scan in early diagnosis of avascular necrosis (osteonecrosis).⁹

Boack and Manegold have also emphasised CT scan as the imaging modality of choice and its role in decision-making.¹⁰

Figure 7 Anteroposterior and lateral radiographs of right ankle at 4 years from index surgery.

Figure 8 Ankle range of movements with dorsiflexion at 20° compared with 40° in left ankle, and both ankle plantar flexion of 45° at 4-year follow-up.

We did CT scan to study the fracture geometry of talus fracture which helped us in planning the approach and fixation technique.

Panagopoulos and Van Niekerk and Lectum and Ireland have used arthroscopy in the management of juvenile tillaux fractures. While Panagopoulos has used arthroscopy-assisted reduction of epiphyseal fragment and excision of chondral fragment, Lectum used mini arthrotomy to reduce epiphyseal fragment.^{11 12} In our patient, there were no chondral fragments. We did arthroscopy-assisted reduction of talar neck and lateral process and fixed it with percutaneous K-wires which were eventually replaced by cancellous screw and Herbert screw, respectively. Mini arthrotomy was avoided.

Arthroscopy-assisted reduction technique is minimally invasive, has a small incision, and allows direct visualisation of fracture and chondral fragments.¹¹

However, there are certain limitations of using arthroscopy in ankle fractures as reported by Lectum and Ireland who did mini arthrotomy for epiphyseal fragment reduction and Miller who extended the anterolateral portal for accessing the fracture fragment.^{12 13}

Also, if we miss the lateral process fractures, it may lead to loose bodies obstructing joint movement and need removal at later stage. Our patient had an unusual injury which needed evaluation and combination of screw treatment. Arthroscopic reduction helped in direct visualisation of injury and early mobilisation following surgery.

Learning points

- Paediatric ankle injuries require high index of suspicion for fracture identification.
- CT scan plays an important role in fracture pattern delineation and planning management.
- Combination of percutaneous and arthroscopic fixation offers favourable results in terms of small incision, minimal tissue damage, less pain and good range of movements.

Contributors SK is the operating surgeon for this case. He is instrumental in planning and conduct of surgery, investigation and use of arthroscopy as novel approach for management. He is keeping the follow-up of this patient since the surgery. He has provided critical data for concept and design of this case report, revising the manuscript and approval of final manuscript. UB was instrumental in collection of data, writing the manuscript, references and literature search. He has analysed the data, formulated the concept, designed and drafted the manuscript, checked for any error and kept tab on patient follow-up. He has also searched for recent advances about the topics concerned to this case report. He has done proof reading of final manuscript. AR has provided critical orthopaedic inputs, drafting of manuscript, literature search, analysis of patient's preoperative and intraoperative imaging. He has provided scientific articles concerning the case report. He has done proof reading of final manuscript and approved the same.

Competing interests None declared.

Patient consent Obtained.

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