



The multi-modality approach in a case of fracture of the humerus with an ipsilateral floating knee: A case report

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ABSTRACT

Ipsilateral fractures of humerus, femur and tibia is a rare entity. The number of fractures resulting due to road traffic accidents is on the rise. These Type of injuries usually occur due to high-velocity road traffic accidents. High-velocity road traffic accidents are associated with multiple bony injuries as well as injuries to various internal organs. These injuries are often difficult to manage due to their complex nature. Mostly multiple fractures are produced in ipsilateral limbs. This condition makes the management even more difficult. Hence a multi-modality approach is often required. A 55-year-old male sustained floating knee with ipsilateral shaft humerus fracture. After a three-staged surgical approach with three modalities for treating the compound injury, the patient had an excellent result with the full range of motion in the knee and complete coverage of wound. Compound floating injuries should be treated with simultaneous fixation of femur and tibia fractures to achieve early full range of knee motion with Vacuum-assisted closure followed by skin grafting for complete wound coverage.

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INTRODUCTION

Ipsilateral fractures of humerus, femur and tibia is a rare entity. The number of fractures resulting due to road traffic accidents is on the rise. These Type of injuries usually occur due to high-velocity road traffic accidents. High-velocity road traffic accidents are associated with multiple bony injuries as well

as injuries to various internal organs (Lundy and Johnson, 2001). These injuries are often difficult to manage due to their complex nature. Mostly multiple fractures are produced in ipsilateral limbs. This condition makes the management even more difficult. These injuries are usually associated with life-threatening injuries to the head, chest and abdomen. There is a high incidence of fat embolism noted (Kao et al., 2010). Due to considerable variability in the presentation, management of these injuries vary according to involved organs. Many of these fractures are open with associated vascular injuries. Surgical stabilisation of both fractures at the same time and early mobilisation of the patient and extremity produce the best clinical outcomes (Oh et al., 2005). All the relevant reports in the literature emphasise the importance of early mobilisation of these patients to facilitate their better care and quick respiratory recovery. This recovery can only be achieved by good stabilisation of the fractures of the leg, which also promotes a successful and able

functional result of the adjacent joints of the injured limb (Omer *et al.*, 1968). However, there is no generally accepted guideline in treating these fractures. The recommended methods of treatment vary very widely. In this case report, we have described how we have managed a patient with ipsilateral fractures of the humerus with an ipsilateral floating knee.

Case scenario

A 55 years old male presented to Casualty of Acharya Vinoba Bhave Rural Hospital Sawangi Meghe after a high-velocity road traffic accident with pain and swelling over right arm, thigh and wound over the right leg. After primary management in the casualty which included immobilisation of right upper limb with universal splintage, cleaning and dressing of the wound over the right leg, immobilisation of right lower limb with Thomas splint and fluid resuscitation patient was hemodynamically stabilised. The patient was examined to rule out internal injuries and then sent for X-Rays. X-rays showed that he had mid-shaft humerus fracture right side, supra-condylar femur fracture right side and compound grade IIIB fracture mid-shaft tibia and fibula right side. The patient was found to have Type I floating knee. The patient was taken into emergency OT, and thorough debridement of the wound over right leg with biplanar external fixator application for mid-shaft shaft tibia fibula fracture was done. Stay sutures were placed. Supra-condylar femur fracture was managed with open reduction internal fixation with plate osteosynthesis in the same sitting. Humerus was operated in subsequent sitting with open reduction internal fixation plate osteosynthesis within a week. Broad-spectrum antibiotic coverage was given to prevent infection. A tailored physiotherapy regimen was designed for the patient, which included knee range of motion exercises as tolerated, quadriceps and hamstring building exercises with TENS therapy to enhance muscle contraction, chest physiotherapy, early wheelchair mobilisation. Serial debridements and Vacuum-Assisted Closure (VAC) application were made to enhance the formation of the granulation tissue at the wound site. After the formation of healthy granulation tissue, split-thickness Thiersch skin grafting was done at the wound site. One month later definitive fixation for mid-shaft tibia fracture was done with Tibia interlock nail. Figure 1 shows pre and post-operative clinical pictures, and Figure 2 shows pre and post-operative X-rays.

DISCUSSION

Though Ipsilateral fractures of humerus, femur and tibia is a rare entity, the number of fractures result-

ing due to road traffic accidents is on the rise. These Type of injuries usually occur due to high-velocity road traffic accidents. High-velocity road traffic accidents are associated with multiple bony injuries as well as injuries to various internal organs. These injuries are often difficult to manage due to their complex nature. Mostly multiple fractures are produced in ipsilateral limbs. This kind of fracture makes management even more difficult. Poly-trauma with floating knee injuries is complex injuries with various co-morbid conditions. Given the challenges associated with managing both the floating knee injury and compound wound with ipsilateral shaft humerus fracture, such patients are likely best served in a centralised location such as a tertiary referral centre. Posttraumatic wound infection and osteomyelitis portend substantial morbidity (Theodoratos *et al.*, 2001). Decreased function due to knee stiffness and likely need for multiple debridement procedures, extensive physiotherapy, pain, and overall quality of life all are negatively affected by floating knee injury associated with the compound wound. Besides, an ipsilateral humerus fracture will hinder the ability to achieve an early weight-bearing mobilisation, decreasing the likelihood of a stable, well-functioning and pain-free knee postoperatively without ensuing knee stiffness. Historically, the prognosis for recovery is considered to be low, but there have been relatively few studies with consistent data regarding the appropriate management of such injuries, likely due to the rarity of the injury.

Treatment of compound injuries is challenging. Primary stable fixation is not indicated in compound injuries because of extensive contamination of wound leading to local site infection and osteomyelitis as its sequelae (Adamson *et al.*, 1992). There may be a role for Vacuum assisted closure in these cases at the time of the first surgery (Liu *et al.*, 2018). Patients who do not develop local site infection and have a bed of healthy granulation tissue following primary stabilisation can be considered for split-thickness skin grafting or skin flap to achieve wound closure. Recent studies have supported the use of Vacuum-assisted closure to gain faster healing of compound injuries with decreased risk of infection and improved outcomes (Costa *et al.*, 2018).

The result of the present case was excellent; the patient had excellent ROM, the knee was stable, and the wound had good coverage. Three factors potentially explain these results: the early first surgery, simultaneous fixation of tibia and femur fracture and the use of a multi-modality surgical approach (Schiedts *et al.*, 1996). The primary stabilisation was performed on the day of injury, dur-



Figure 1: I - wound over right leg at the time of injury, II - after debridement, III- VAC application, IV- healthy granulation tissue after VAC application, V- Skin grafting is done, VI- At two and half months post-injury, VII- full knee range of motion at two and half months post-injury.

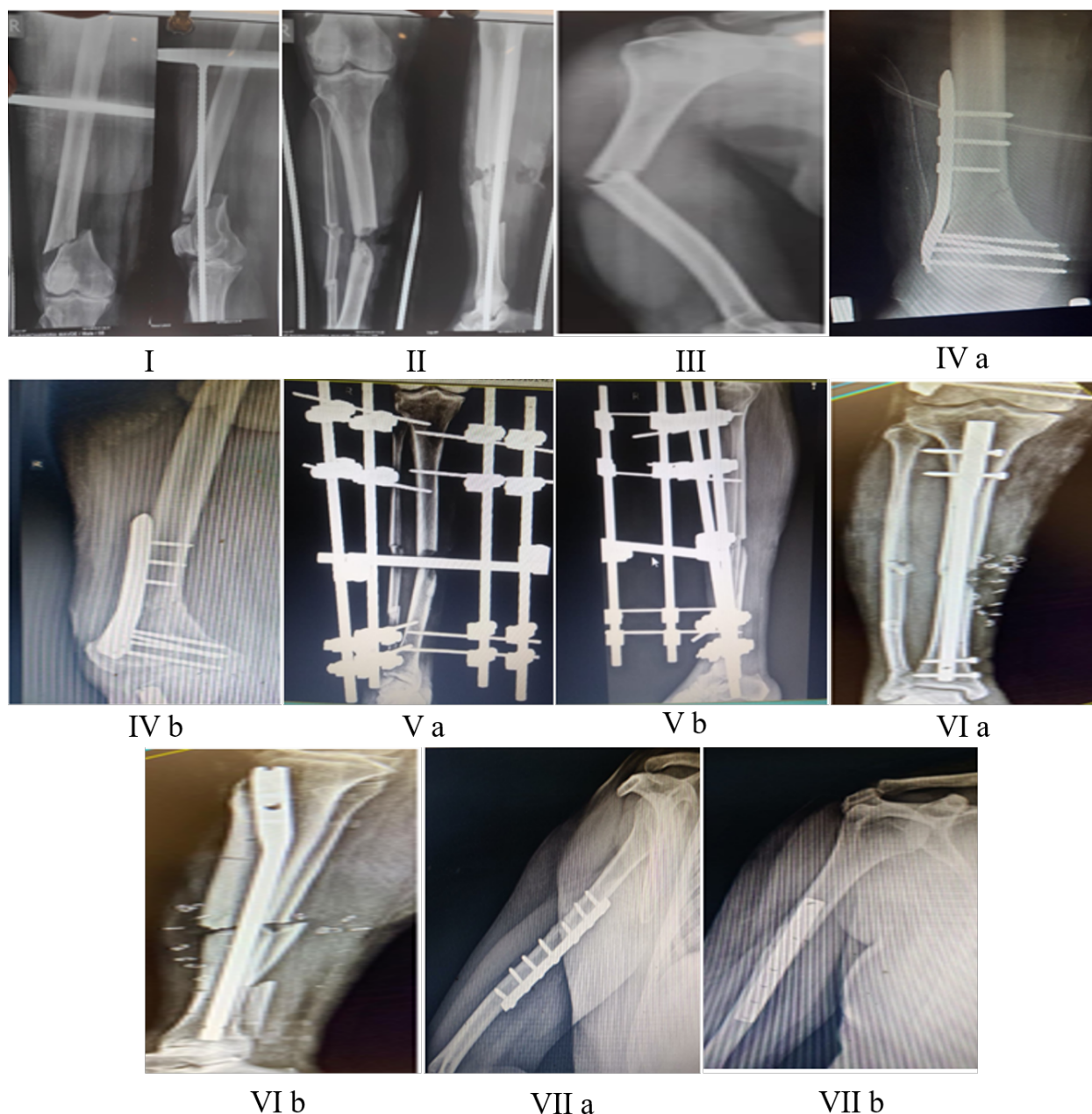


Figure 2: I-III = pre-operative x rays for fracture femur, tibia and humerus. IV-VII = post-operative x rays for with plate osteosynthesis for fracture femur and humerus and external fixator and tibia interlocking nail for fractured tibia

ing which stable definitive fixation of distal femur fracture was done with stay sutures given for wound over the leg to prevent the skin edges from retracting during subsequent days till vacuum-assisted closure was performed. After a week, vacuum-assisted closure was done. After 20 days of primary stabilisation and formation of healthy granulation tissue at the wound site, skin grafting with a definitive fixation for fracture shaft tibia was done. During this time the shaft humerus fracture fixed with plate osteosynthesis started showing sign of union (Modabber and Jupiter, 1998). At three months, the post-

operative period patient had full knee, shoulder and elbow range of motion with full weight bearing on the affected side and returned to activities of daily living and work without assistance.

CONCLUSION

Polytrauma as a result of high-velocity Road traffic accidents is a devastating injury with poor outcomes and pulmonary embolism, joint stiffness, wound infections, and osteomyelitis is frequent associations. Management of these problems is varied and

depends on many factors (the type of injury, the timing of intervention, bone loss, associated neurovascular injuries and injuries to vital organs). Controversy exists concerning the best surgical treatment. The results of the present case were excellent; the patient had excellent knee, shoulder and elbow ROM, the wound completely healed without any sequelae, and he was able to return to work within three months. Three factors potentially explain these results: the early first surgery with simultaneous fixation of tibia and femur fracture, use of the multi-modality approach for treating compound tibia fracture and a tailored physiotherapy regimen.

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Conflict of Interest

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