Original article

Pediatric conjoint Hoffa's fracture: An uncommon injury and review of literature

Bushu Harna*, Anshul Goel, Pritish Singh, Dhananjaya Sabat

Lok Nayak Hospital, New Delhi, India

ARTICLE INFO

Article history:

Received 23 May 2016

Accepted 2 December 2016

Available online 20 January 2017

Keywords:

Distal femur fractures

Hoffa fracture

Swashbuckler approach

Headless compression screw

ABSTRACT

Coronal plane fracture of femoral condyles was first elaborated by Hoffa. These are difficult articular injuries, often described in adult skeleton and very rarely in pediatric age group. Conjoint variety with intact bone bridge between condyles in intercondylar notch area is rare. We report a conjoint variety of bicondylar Hoffa's fracture in a child which was surgically treated using headless compression screws along with a brief review of literature about fracture entity and complexities associated with it.

© 2016

1. Introduction

Hoffa fracture is an uncommon and difficult articular injury where coronal orientation of fracture line separates a large condylar articular portion of distal femur from distal femur. Such peculiar pattern of injury leaves fragments floating in joint and devoid of vital soft tissue attachments; thereby jeopardizing blood supply of fractured bones.¹ Pure bicondylar Hoffa fracture is a rare injury and the conjoint variety where an intact bone bridge in intercondylar notch area connects both condyles is further rare.² We hereby report a case of conjoint bicondylar Hoffa fracture in a seven year old child, which was successfully treated by open reduction and internal fixation. To best of author's knowledge, four cases of bicondylar Hoffa fractures have been reported in English literature of which only two were conjoint type. The case highlights treatment complexities associated with such intra-articular injury patterns.

2. Case report

A seven-year-old male child presented to orthopedic emergency after being hit by a speeding motor vehicle with a painful swollen right knee. Physical examination revealed a painful,

swollen knee with single superficial abrasion on the anteromedial side. Movements of knee were grossly restricted and painful. There was no distal neurovascular deficit. The child was stable with no other system or limb injury (Table 1).

Plain radiographs revealed displaced coronal plane fracture of both condyles with part of fracture line merging with distal femur epiphyseal line. Computed tomographic scan of the knee revealed conjoint bicondylar Hoffa fracture with posterior subluxation and angulation of condylar fragments. It was a Salter and Harris type IV epiphyseal injury with propagation of fracture line in both epiphysis and metaphysis.

The injured limb was initially splinted in an above knee posterior splint. Under general anesthesia and tourniquet control the knee was flexed over a radiolucent triangular support. Swashbuckler approach was used and some added knee flexion with patellar retraction gave adequate exposure of fracture anatomy. Under direct vision, fracture fragments were realigned anatomically and provisionally stabilized with smooth pins. Due care was taken to avoid any surgical trauma to cartilage. Passage of fracture line through femoral attachment to anterior cruciate ligament necessitated gentle handling and prevention of any residual laxity in ligament.

Fixation and inter-fragmentary compression was achieved using 2.9 mm Herbert screw buried under articular cartilage. Due care was taken to avoid any inadvertent penetration of epiphyseal plate by screw. Limb was splinted in long leg slab till suture removal. After suture removal, supervised flexion and extension exercised were started on a hinged knee brace.

* Corresponding author at: Room No. 77 PG Mens Hostel, MAMC Campus, New Delhi, India.

E-mail addresses: bushu.edu@gmail.com (B. Harna), Anshul.Goel@wwl.nhs.uk (A. Goel), dr.pritish.singh@gmail.com (P. Singh), drdsabat@gmail.com (D. Sabat).

Table 1

Pediatric bicondylar Hoffa's profile in literature.

Author	Year	No of pts	Age in years	Conjoint/non-conjoint	Surgical approach	Fixation	Outcome
Lal ²	2011	1	9/male	Conjoint	Arthroscopy assisted fixation	Cannulated cancellous screws	Good
Haq ¹	2013	1	17/male	Conjoint	Swashbuckler approach	5 cancellous screws	
Flanagan ¹⁰	2011	1	14/male	Non-conjoint	Lateral approach	CC screw	
Kondreddi ⁵	2014	1	17/male	Non-conjoint	Lateral parapatellar	4 cannulated cancellous screws	

Fracture healing as depicted by presence of bridging trabeculae between bony fragments was achieved by 10 weeks. Knee range of motion was improved with active assisted mobilization with CPM. Weight bearing was allowed after 3 months. At 6 months follow up, 0°–130° range of motion achieved which was painless. No extension leg and residual instability was noted in the knee. Patient returned to his preinjury activity level at the end of 6 months.

3. Discussion

The isolated tangential posterior articular fracture of the distal femur in coronal plane was first described by Hoffa in 1904.¹ This fracture variant is often unicondylar. Bicondylar variety is rare, more so in pediatric age group.^{1–5}

Hoffa fractures are supposed to happen by a shearing force on the posterior femoral condyle; both direct impact and vertical shear with twisting mechanisms have been proposed. Lewis et al.⁹ argued that axial load to the lateral femoral condyle with the knee in 90° or more of flexion produces these posterior tangential fracture patterns and rotational force may modify orientation of fracture line. Lateral condyle is most often affected due to presence of physiological genu valgum. Bicondylar injuries can be proposed to be an extension of the fracture pattern as the next level of severity of the traumatic insult.

The diagnosis requires high index of clinical suspicion and good radiographs; even a CT scan or MRI especially in pediatric age group. Bicondylar variant may also be missed on plain radiographs due to overlapping of condylar shadows.⁹

Open reduction is preferred treatment for Hoffa fractures.^{9,10} In bicondylar fractures, standard anterior midline incision with medial parapatellar release and lateral dislocation of the patella, allows direct access to the articular aspect of the fracture, and can be safely used.⁹ An individualized screw only construct is often practiced. Violation of growth plate by screws may hamper residual growth of limb and need protection from screws. The application of two anteroposterior cancellous screws from the anterior intact cortex to both Hoffa fragments, to provide rotational stability, is usually recommended.^{1,2,4–10}

Depending on the extension of the fracture line, detachment of the insertions of the popliteus tendon, lateral head of the gastrocnemius muscle, anterior cruciate ligament, and lateral ligaments are common and may lead to knee instability or disruption of blood supply to the fragments.⁶ The popliteal vein and artery with their branches (superior lateral and medial genicular arteries) are situated directly between the medial and lateral condyles. Bicondylar Hoffa's fracture predisposes trauma to these arteries. Interruption of ingressing genicular branches to condyles may cause subchondral necrosis.⁷

Of the two cases of conjoint bicondylar Hoffa fractures reported in patients with open physes, only one was a child of 9 years and the other was adolescent of 17 year age. Even in adults, only six such cases have been described.

Arthroscopy-guided fixation of these fractures has also been advocated; the advantages include avoidance of soft tissue

dissection without arthrotomy, decrease blood loss, intra articular visualization, fast recovery and mobilization. Arthroscopy before internal fixation gives additional information regarding the morphology of the fracture and forming the surgical protocol. Managing fractures of the posterior femoral condyle with arthroscopic reduction and fixation with cannulated screws is simple and effective and could be reproducible with good results and a good prognosis. Arthroscopic fixation is beneficial for acute Hoffa's fracture with large fragments with minimal comminution.

Discrete fracture anatomy, difficult diagnosis, difficult surgical exposure, infeasibility of conventional implants for distal femur fractures and variable fixation construct with poor strength, high amount of shear forces across fracture line and high propensity of avascular necrosis and arthrosis add to complexities and prognosis associated with Hoffa fracture.^{2–5}

4. Conclusion

Bicondylar Hoffa's fracture in pediatric age group is uncommon fracture. Such rare injury should be treated by early open reduction and internal fixation to avert problems like avascular necrosis, joint instability and growth disturbance while simultaneously taking cautions to avoid surgical trauma to vascularity of fragments and growth plate.

Conflicts of interest

The authors have none to declare.

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at [doi:10.1016/j.jcot.2016.12.001](https://doi.org/10.1016/j.jcot.2016.12.001).

References

1. Ul Haq R, Modi P, Dhammi IK, Jain AK, Mishra P. Conjoint bicondylar Hoffa fracture in an adult. *Indian J Orthop*. 2013;47:302–306.
2. Lal H, Bansal P, Khare R, Mittal D. Conjoint bicondylar Hoffa fracture in a child: a rare variant treated by minimally invasive approach. *J Orthop Traumatol*. 2011;12:1114.
3. Hoffa A. *Lehrbuch der Frakturen und Luxationen*. Stuttgart: Verlag von Ferdinand Enke; 1904:451.
4. Gavaskar AS, Tummala NC, Krishnamurthy M. Operative management of Hoffa fractures—a prospective review of 18 patients. *Injury*. 2011;42:1495–1498.
5. Kondreddi V, Yalamanchili RK, Kiran KR. Bicondylar Hoffa's fracture with patellar dislocation – a rare case. *J Clin Orthop Trauma*. 2014;5:38–41.
6. Letenneur J, Labour PE, Rogez JM, Lignon J, Bainvel JV. Fractures de Hoffa: a propos de 20 observations. *Ann Chir (Paris)*. 1978;32:213–219.
7. Lewis SL, Pozo JL, Muirhead-Allwood WF. Coronal fractures of the lateral femoral condyle. *J Bone Jt Surg Br*. 1989;71:118–120.
8. Holmes SM, Bombardier D, Baumgaertner MR. Coronal fractures of the femoral condyle: a brief report of five cases. *J Orthop Trauma*. 2004;18:316–319.
9. Dua A, Shamsheery PK. Bicondylar Hoffa fracture: open reduction internal fixation using the swashbuckler approach. *J Knee Surg*. 2010;23:21–23.
10. Flanagan BA, Cruz AI, Medvecky MJ. Hoffa fracture in a 14-year-old. *Orthopedics*. 2011;34:138–140.