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Heterotopic Ossification after Open Anchor Fixation of the Posterior Cruciate Ligament Avulsion in a Multiligament Injury of the Knee: A Case Report

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Learning Point of the Article:

A combination of major trauma, open reduction along with massage potentially increase the chance of heterotrophic ossification.

Abstract

Introduction: Heterotopic ossifications (HO) are a well-recognized but infrequently encountered condition. In the lower limb, the literature commonly reports the formation of HO around the hip after surgeries. However, HO is uncommon around the knee and a rare complication after open fixation of posterior cruciate ligament (PCL) avulsion fracture.

Case Report: Here, we describe a case of HO in a 42-year-old patient with multiligament injury, including PCL and arcuate ligament avulsion, partial ACL tear, and medial meniscus root tear with suspected vascular compromise. He underwent open reduction and internal fixation of PCL avulsion fracture and medial meniscus root repair after the injury. At a 6-week follow-up, a plain radiograph revealed posterior capsule HO which kept increasing over successive follow-ups compromising his knee function. The patient was not willing for any mode of intervention for the same at any given time.

Conclusion: HO after open PCL avulsion fixation is an uncommon entity. This article sheds light on how open fixation of PCL bony avulsion in a multiligament injured knee could result in a HO.

Keywords: Posterior cruciate ligament avulsion, multiligament injury, open fixation, suture anchor, heterotopic ossification, posterior capsule.

Introduction

Heterotopic ossifications (HO) are defined as the formation of mature lamellar bone in soft tissues such as muscles, fascia, tendon, ligament, subcutaneous tissue, and vessel wall, which possibly occur due to untimely differentiation of pluripotent mesenchymal cells into precursors of osteoblasts [1]. HO is of two types, the most common non-genetic type and rare genetic type (fibrodysplasia ossificans progressiva and progressive osseous heteroplasia) [1, 2]. The typical non-genetic type is usually a result of local trauma or surgery in up to 75% of cases [2]. It is commonly reported in patients after hip arthroplasty [3], fractures or dislocation, high energy extremity trauma, traumatic brain or spinal cord injury, and severe burns. It is common around the elbow, hip, thigh, and shoulder [4]. Local factors such as edema, hematoma, prolonged immobilization, massage, and forcible manipulations to achieve movements are cited as predisposing factors [5]. Although there is a report of HO after PCL reconstruction [6, 7], there is no report of HO in English literature after open PCL avulsion fixation.

Case Report

A 42-year-old diabetic man presented to our emergency room after a road traffic accident with an injury to his left knee and inability to weight bear. Examination of the left knee revealed

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Author's Photo Gallery


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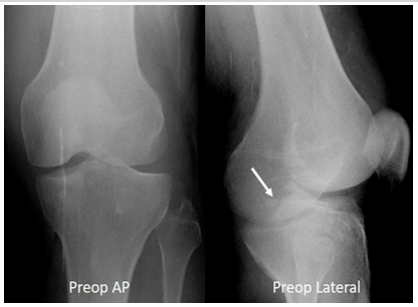

Figure 1: Plain radiograph of the knee: Anteroposterior and lateral view (white arrow shows posterior cruciate ligament avulsion).

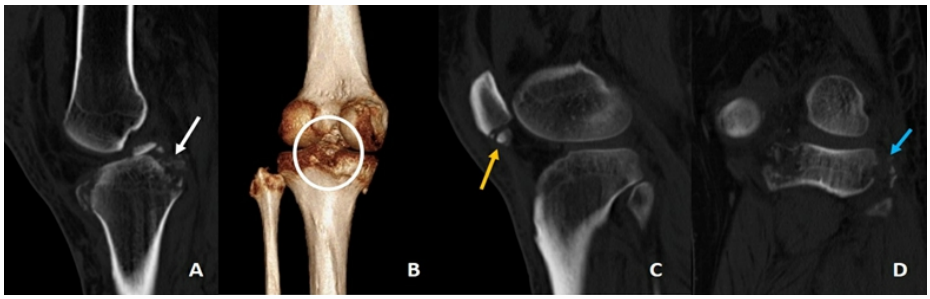

Figure 2: (a, b, c, d) CT scan of the knee shows comminuted posterior cruciate ligament avulsion (a, b); (c) shows inferior pole of patella fracture, and (d) shows lateral tibial plateau chip avulsion.

diffuse swelling, tenderness over the popliteal fossa, and a painfully restricted range of movement. Further careful examination revealed a stable knee in the varus and valgus plane. The Lachman test revealed a hard anterior endpoint, but the posterior stop was soft. There was no neurological deficit, but the pulsation of dorsalis pedis and posterior tibial arteries was feeble. The plain radiograph of the knee revealed posterior cruciate ligament (PCL) bony avulsion (Fig. 1). CT scan of the knee revealed comminuted displaced avulsion fracture of the PCL from the tibial side, undisplaced fracture of the lower pole of the patella, and chip fracture of lateral tibial plateau with tibiofibular subluxation and the tip of fibula avulsion (arcuate avulsion) (Fig. 2). MRI of the knee revealed extensive edema around the joint along with posterior capsule injury, PCL bony avulsion, partial ACL tear, medial meniscus posterior root avulsion, and partial avulsion of the arcuate ligament from fibular head (Fig. 3). Since peripheral pulses were feeble, a CT angiogram was ordered, which revealed poor contrast opacification of peripheral vessels in the arterial phase and normal contrast opacification in the delayed phase. Given multiple ligament injuries, capsular tear, several minimally displaced fractures, and a borderline vascular compromise almost akin to a near dislocation (three major ligament injuries; PCL, ACL, and arcuate), the knee was immobilized for 10 days to let capsule and other soft-tissues heal. After 11 days of injury, the patient underwent arthroscopy of the knee which confirmed partial ACL tear from the femoral end (<30–40% fibers torn), medial meniscus posterior root avulsion and PCL bony avulsion. However, arthroscopic fixation of the PCL avulsion was unsuccessful due to gross comminution and wide displacement of the fragments. Hence, the surgical team decided to fix the PCL avulsion fracture by the open method. Nevertheless, gross swelling around the knee following the arthroscopy prevented the open fixation at the same setting. Five days later, he underwent open reduction and internal fixation of the PCL avulsion fracture and medial meniscus root repair by Burks-Schaffer approach with suture anchors in a prone position. PCL avulsion was fixed with the suture bridge technique [8]. The medial meniscus root was also fixed with anchor. Capsule was sutured. Following PCL avulsion and root fixation, the knee appeared stable in the varus plane in both 0° and 30°, and hence the arcuate ligament fixation was not performed. The wound was closed in layers over a drain. Postoperatively, the knee was immobilized in a PCL brace for a total of 3 weeks to let the inferior pole of patella, arcuate complex, and capsule heal. Straight leg raising and static quadriceps strengthening exercises were started and the patient was allowed non-weight bearing ambulation using bilateral axillary crutches. At 3 weeks post-operative, the patient was asked for admission and mobilization of the knee as he belonged to a rural area with no rehabilitation facility. However, he refused the same and decided to continue rehabilitation at home. Early HO was noted in the knee X-ray at 3 weeks (Fig. 4), and he was started on indomethacin 75 mg once a day for 6 weeks. He admitted that he did a light massage for a brief duration on the advice of a local quack at the end of 2 weeks. At a

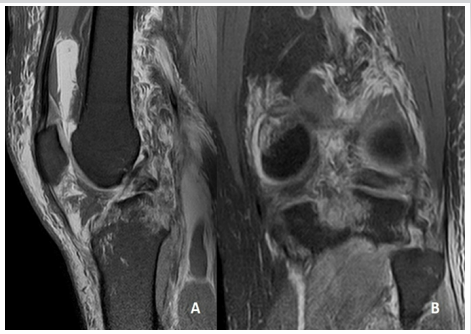

Figure 3: (a, b) MRI of the knee shows posterior cruciate ligament bony avulsion, partial ACL tear, arcuate ligament injury, and extensive capsular injury resulting in periarticular edema.

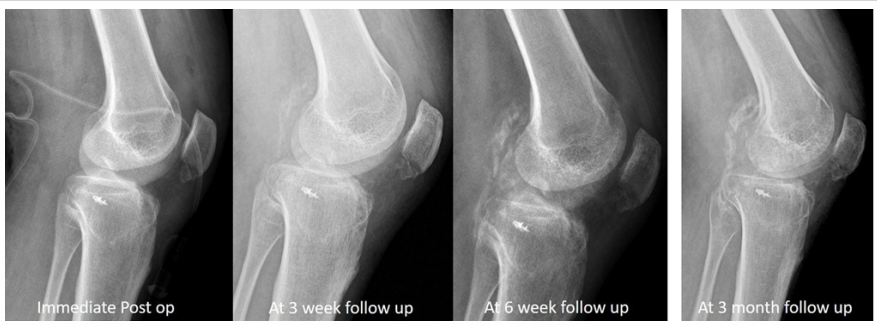

Figure 4: Plain lateral radiograph of the knee shows immediate post-operative reduction of posterior cruciate ligament avulsion with anchor in situ. Three-week follow-up X-ray shows early posterior ossification followed by further increasing ossification at 6 week and 3-month follow-up.

Figure 5: Successive X-rays at 18-, 30-, and 53-month follow-up show increasing dense heterotrophic ossificans. AP radiograph also shows osteoarthritis of the knee.

Figure 6: Lateral view of the knee reveals limited knee flexion at final follow-up.

6-week follow-up, the patient achieved flexion range of motion (ROM) of 5°–60°, and plain X-ray noted uniting fracture along with increasing HO around the PCL in midline (Fig. 4). At 3-month follow-up, the patient had a flexion ROM of 10°–70° and the radiograph revealed intense HO at the back of the knee (Fig. 4). We advised him that he may require an intervention to excise HO. However, he decided to continue physiotherapy and refused any intervention. Eight-month follow-up revealed further reduced ROM to 10°–60°, and at a 10-month follow-up, the patient had a ROM of 15°–45°. Radiographs of the knee at 18-, 30-, and 53-months post-operative continued to show maturing HO (Fig. 5). There is no change in ROM, at last, follow- up at 4 years and has remained as 15°–45° (Fig. 6). His present Tegner-Lysholm score at 4 years follow-up is 42. The patient refused any intervention of HO excision at 18 months and afterward, too.

Discussion

Heterotrophic ossification is a benign, meta-plasmatic, mostly self-limiting process in which mature lamellar bone formation occurs at any extraosseous site.

Although uncommon, HO is a rare complication of high-velocity injury to the knee, especially in knee dislocation [9]. In a multiligament injured knee or knee dislocation, PCL reconstruction is an independent factor in the development of HO [9, 10]. Patton et al. believed that the reaming for the graft tunnels contributes to the development of HO [11]. Almost all cases in the literature have described HO after PCL reconstruction; ours is likely the first case of HO after PCL avulsion fixation in a multiligament injured knee. In our said case, multiple injured ligaments, fractures, and capsular tear, twice surgical procedures along with PCL fixation became the risk factor for HO.

Any progressive loss in the joint movement range after gaining the initial movement must raise the suspicion of HO, which should be promptly investigated and treated appropriately. In the early phase, HO presents as localized pain, tenderness, swelling, and decreased ROM. Early HO could be challenging to distinguish from soft-tissue sarcoma, cellulitis, osteomyelitis, or thrombophlebitis. Later stages of HO present with localized firm swelling and grossly decreased ROM.

The plain radiograph of the early phase of HO may be normal or may show irregular flocculent calcification, while the later stage may show a classic "egg-shell calcification." CT is the second modality preferred which generally depicts the zonal maturation of the lesion. Alternative modalities such as MRI and PET-CT scans may also be of benefit in diagnosing HO. For prevention of HO, either a non-steroidal anti-inflammatory drug such as indomethacin (25 mg thrice a day for 6 weeks) [12], a diphosphonate such as ethane-1-hydroxy-1, 1-diphosphate [13], or local low-dose radiation therapy (especially in hip arthroplasty) is recommended [14]. Surgical resection of HO is recommended in patients who have failed to respond to conservative treatment, typically after 6 months of initiation of HO to preserve joint mobility. Resection of HO earlier than 6 months risks the chance of recurrence [15]. Our patient was not willing for surgical intervention.

Conclusion

Any surgery of the PCL, repair or avulsion fixation or reconstruction, is an independent risk factor for HO in a multiligament injured knee. In a high-risk case, prevention with the help of indomethacin is warranted. Timely diagnosis and treatment should be the goal. Once HO is established, the prognosis is guarded even if it excised as recurrence is not uncommon.

Clinical Message

The HO is always a risk factor in a multiligament injured knee, especially if surgery around PCL is warranted. Hence, one must be careful in such cases and counsel the patient regarding the possibility of the same if the surgery of PCL has to be undertaken.

Declaration of patient consent : The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient's parents have given their consent for patient images and other clinical information to be reported in the journal. The patient's parents understand that his names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Conflict of interest: Nil **Source of support:** None

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