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Case report

Unusual combination of posterior cruciate ligament tibial avulsion fracture and Segond fracture: A case report

Krisna Yuarno Phatama *, Albert Lesmana, Felix Cendikiawan, Ananto Satya Pradana, Edi Mustamsir, Mohamad Hidayat

Orthopaedics and Traumatology Department, Faculty of Medicine, Universitas Brawijaya-RSUD Dr. Saiful Anwar, Malang, East Java, Indonesia

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ABSTRACT

Introduction and importance: Posterior cruciate ligament (PCL) avulsion fracture is an uncommon entity, but it poses significant morbidity to patient's knee and activities. A combination of PCL avulsion fracture with Segond fracture is rare and has not been described much before in known literature. In this case report, we present a rare case of a combination of these two injuries.

Case presentation: A 16-year-old cyclist who sustained left knee injury after a high-velocity fall while cycling. He fell with his anteromedial side of his left knee hitting the ground in flexion. After the fall, he felt excruciating pain and unable to bear weight. Examination revealed severe joint effusion, tenderness on posterior and lateral side of the left knee, no vascular injury and neurological deficit present. Radiographic examination revealed PCL avulsion fracture and Segond fracture. Five days after the injury, the avulsed PCL fragment and the lateral tibial plateau fragment were reduced and fixed with 3.5 mm cortical screw and washers. On the follow up, the patient stated that there is no pain on weightbearing position and after evaluated with Knee injury and Osteoarthritis Outcome Score (KOOS), the result is 90%.

Clinical discussion: Although the combination of PCL avulsion fracture and Segond fracture is rare, this pattern of injury could happen and could be considered when evaluating knee injuries.

Conclusion: Both fractures need to be addressed and managed adequately to restore knee stability and prevent early joint degeneration.

1. Introduction

Posterior cruciate ligament (PCL) tibia avulsion fractures are a rare variant of PCL injuries. The incidence of PCL tibia avulsion fractures is still unknown due to its rarity [1–3]. This injury has devastating impact to patient's knee. Instability and early degenerative changes might develop if not treated properly [1]. In the other hand, Segond fracture is a small avulsion fracture at the lateral aspect of the proximal tibia plateau that cause by pull of anterolateral ligament (ALL) due to internal rotation of tibia and varus stress with knee in flexion. This fracture known as a pathognomonic sign of Anterior cruciate ligament (ACL) injury and also associated with ALL injury and lateral meniscus tear, causing knee instability [4–6]. Based on recent study, the incidence of Segond fractures in patients with ACL injury was only 7.4% [7]. Furthermore, PCL tibial avulsion concomitant with Segond fracture is a very unusual pathology. In this article we report this unusual combination of PCL tibia avulsion fracture and Segond fracture, which has not been described before. This article has followed SCARE checklist and guidelines [8]. Consent was given by our patient and his parents regarding the data obtained in this case would be submitted for publication.

2. Case report

A 16-year-old male cyclist sustains an injury to his left knee after fell down from bike. Upon cycling a road bike, patient loss his balance after hit a boulder in high speed and thrown off the bike with his antero-medial side of the left knee hit the ground in flexion. After patient experienced excruciating pain, swelling and abrasion of the knee, and unable to bear weight on the left leg. The patient then transferred to our emergency department for treatment.

Upon clinical examination, we found abrasion wound on the

* Corresponding author at: Orthopaedics and Traumatology Department, Faculty of Medicine, Universitas Brawijaya-RSUD Dr. Saiful Anwar, Jl. Jaksa Agung Suprapto No.2, Klojen, Malang 65111, East Java, Indonesia.
E-mail address: krisnayuarno@ub.ac.id (K.Y. Phatama).

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proximal-medial side of the left tibia and severe effusion on the left knee. There was tenderness on the lateral side and posterior side of the knee, and no neurovascular deficit was found. The patient complained pain and unable to move his knee. At this time others knee examination was not done due to severity of pain and swelling. Plain X-ray was taken and revealed avulsion fracture of the posterior intercondylar fossa of the tibia, suggestive PCL tibia insertion site and Segond fracture on the lateral side (Fig. 1). Three-dimension computed tomography (3D-CT) was taken and sized, displacement and configuration of the fracture was evaluated. Patient then placed in long leg posterior splint with knee in 30 degrees flexion (Fig. 2). The initial KOSS score for this patient is 30%. One step surgery was planned for fractures fixation.

Under regional anaesthesia during surgery, the left knee was re-examined for stability. Posterior tibial sag was apparent, and the posterior drawer test revealed a grade-III instability with a soft endpoint. The varus stress test was positive grade II with knee in 30° flexion. However, the result of the Lachman test, pivot shift test and anterior drawer test was negative. As the surgical technique, Burks-Schaffer approach and direct small anterolateral approach were used for PCL tibial avulsion and the segond fracture, respectively. Definitive fixation for those two fractures was achieved using 3.5-mm one-third threaded cannulated cortical screw and augmented with washer (Fig. 3). After the fractures had been fixated, we found all of the stability tests were negative. Hinged knee brace was applied post-operatively. On the follow up, the patient stated that there is no pain on weightbearing position and after evaluated with Knee injury and Osteoarthritis Outcome Score (KOOS), the result is 90%.

3. Discussion

This case report describes a very unusual case of PCL tibia avulsion fracture, concomitant with Segond fracture. To the best of our finding, not much of this identical case has been described or reported previously, even though some cases of PCL avulsion have similar mechanism of injury. Meanwhile reversed segond is an avulsion fracture of the tibial attachment on the anteromedial of the knee, segond fracture is an avulsion fracture of the knee that involves the lateral aspect of the tibial plateau. Usually, segond fracture is associated with ACL avulsion however on our cases we report the segond fracture with PCL avulsion. In this case the possibility that cause concomitant Segond fracture was the direct force from the anterior medial side of the knee to posterior and possibly varus force and twisting mechanism caused stretching of the anterolateral ligament that made Segond fracture possible, beside avulsion of the PCL tibia attachment. Considering patient's age, in pediatric population or adolescent, the ligaments appear to be much stronger than the growth plate, predisposing to osteochondral avulsion fractures rather than ligamentous tears [1,9].

The PCL arises from the lateral surface of the medial femoral condyle, terminates 3 mm proximal to the articular cartilage margin and extends in a posterolateral direction to the posterior tibia 1 cm from the joint line. PCL is the primary restrain of posterior tibial translation with knee in 90° flexion and the strongest ligament of the knee; 2 times stronger than the ACL. Make injuries of the PCL uncommon compare to ACL. PCL avulsion fracture is rare compare to intrasubstance PCL tear. From radiographic findings, we can classify PCL avulsion injuries into 3 types. Type I fractures are non-displaced fracture, type II fractures are "hinged" with superior displacement of only the posterior aspect of the avulsed fragment and type III fractures are completely displaced [1,2,10]. In this case, from 3D-CT scan reconstruction, we can classify it as type III fracture.

Previous study by Hall and Hochman [11], assumed that reverse Segond fracture is associated with PCL rupture and medial meniscal tear. However recent publications showed reverse Segond fracture not always present with PCL rupture and medial meniscal tear. Some reported incidence of reverse Segond fracture without PCL injury, instead ACL and MCL tear. These findings indicate that reverse Segond fracture is not solely associated with PCL injury but also ACL and MCL injuries [4,12,13].

Even though Segond fracture is highly associated with ACL injury, but it only occurs in approximately 7% of all ACL tears [7]. Tibia internal rotation and varus stress of the knee in flexion thought to be mechanism of injury that may produce Segond fracture. This mechanism of injury also may produce ACL injury and meniscal tear [7]. Recently, study form Flores et al. [4], based on MRI evaluation of 146 patients

Fig. 1. AP and lateral left knee X-ray, showing PCL avulsion fracture and Segond fracture.

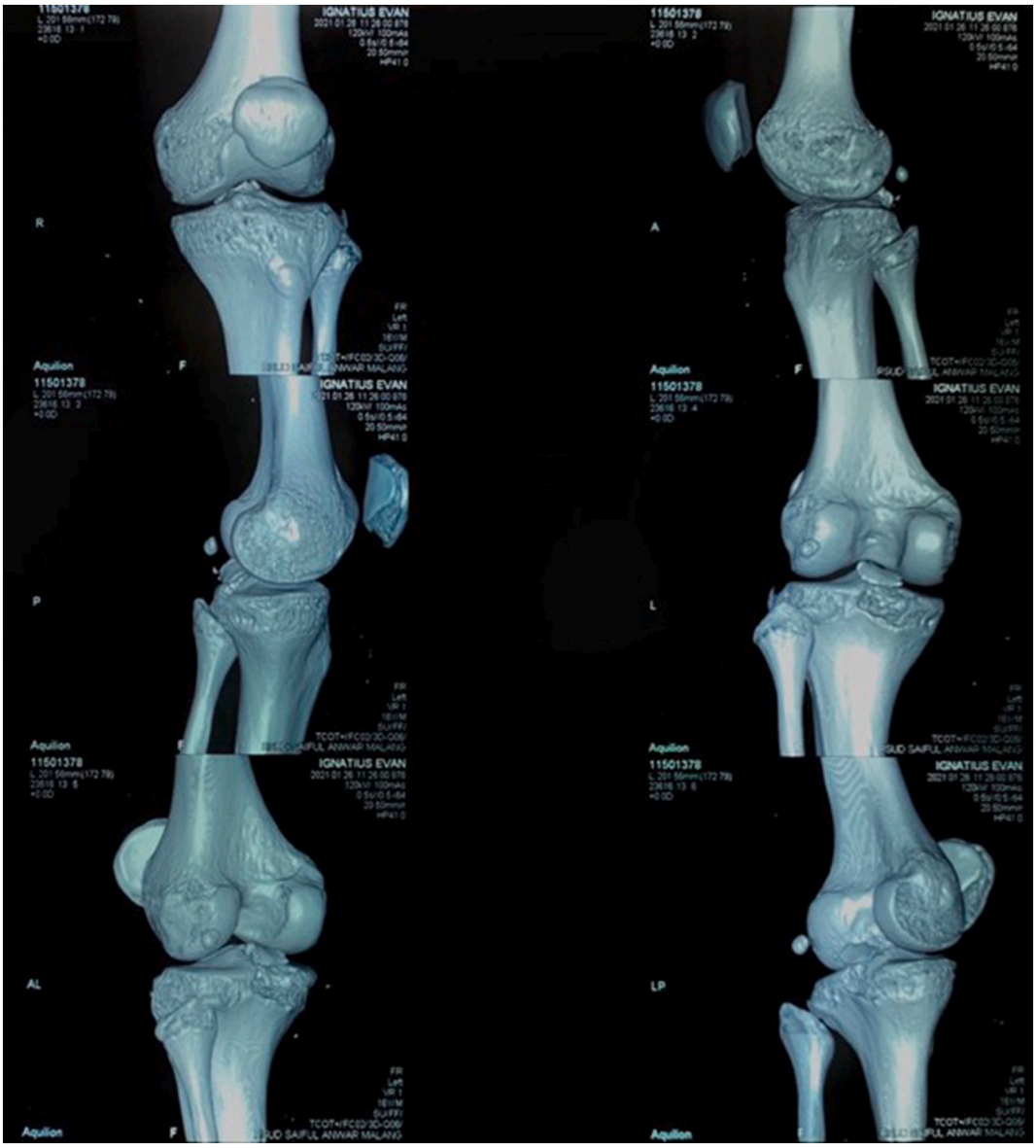

Fig. 2. Three-dimension computed tomography (3D-CT) scan of the Left Knee, showing fracture configuration of the avulsed PCL fragment and Segond fracture.

with acute/subacute ACL tear, Segond fracture only present in 1.25% of the cases. Based on all of this findings, Segond fracture might not be considered as pathognomonic for ACL injury but may give a clue for significant soft tissue damage around and inside knee joint if present [14,15]. These findings correlated with our case which is the present of Segond fracture concomitant with PCL avulsion fracture, not ACL injury based on physical examination and radiologic findings. However, another soft tissue structures of the knee joint need to be evaluated further with other diagnostic modalities like MRI, ultrasound or arthroscopic in near future.

Regarding displaced PCL avulsion fracture, surgical treatment is mandatory to regain PCL function as a primary stabilizer for posterior tibia translation. Two main approaches to fix this fracture are open and arthroscopic approach. We decided to performed open reduction and internal fixation instead of arthroscopic approach in the acute setting, considering the shorter duration of surgery and tourniquet time. Arthroscopic may benefit for diagnostic purposes to evaluate other structures and possibility to repair it at the same time. On the other side, open technique allowed to perform reduction and internal fixation directly and accurate in shorter duration for both fractures. As some recently published studies mentioned, both open and arthroscopic methods for the treatment of PCL tibial-side avulsion fracture, yield a comparable good clinical and radiological outcome, fracture healing. However, open surgery has shorter duration of surgery and lower cost compared to arthroscopic [16,17].

4. Conclusion

Posterior cruciate ligament (PCL) avulsion fracture with concomitant Segond fracture is very unusual and never been reported before. Both fractures need to be addressed adequately to restore knee stability and prevent future damage to knee joint.

Source of funding

None.

Ethical approval

This study has been reviewed and approved by the authors'

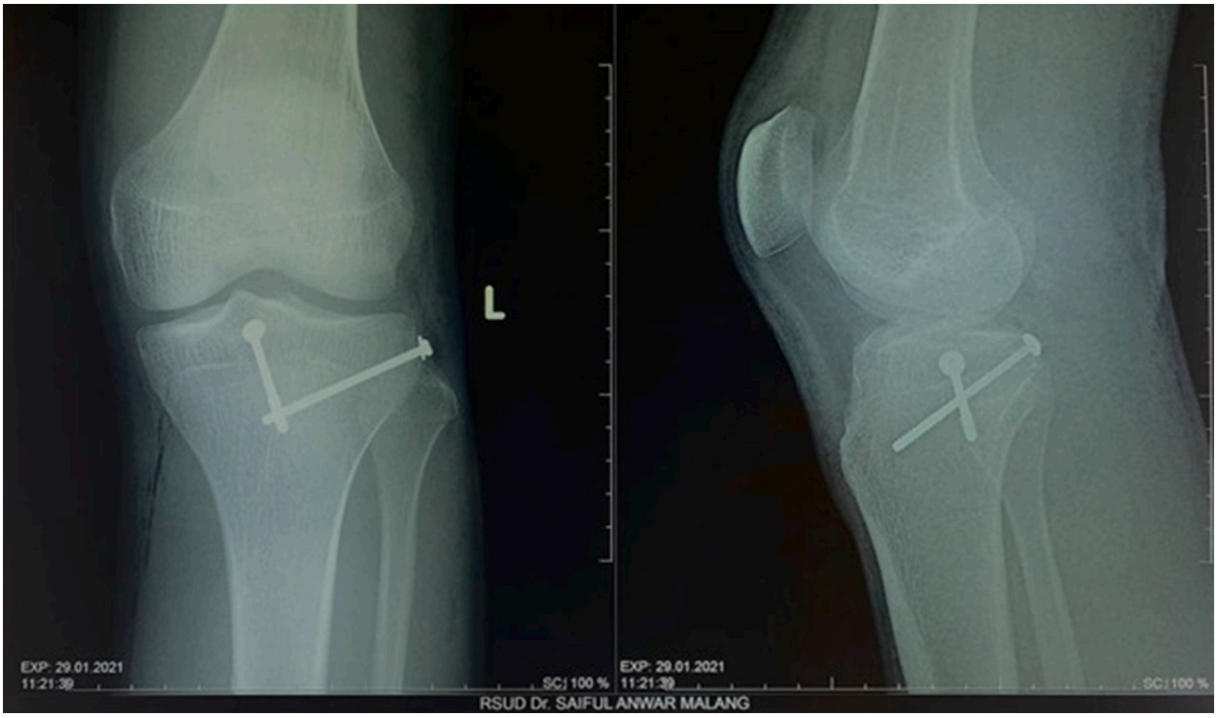

Fig. 3. Post-operative X-ray of the left knee, showing reduction of the avulsed PCL fragment and lateral tibia plateau fragment, fixed with 3.5 mm cortical screws and washers.

Institutional Review Board.

Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Author contribution

Krisna Yuarno Phatama: conceptualization, writing original draft preparation, supervision.

Albert Lesmana: data collecting, data interpretation, writing the paper and editing.

Felix Cendikiawan: data collecting, data interpretation, writing the paper and editing.

Ananto Satya Pradana: conceptualization.

Edi Mustamsir: conceptualization, writing original draft preparation, supervision.

Mohamad Hidayat: conceptualization, supervision.

Registration of research studies

This case report is not “First in Man” study.

Guarantor

Krisna Yuarno Phatama.

Orthopaedics and Traumatology Department, Faculty of Medicine, Universitas Brawijaya-RSUD Dr. Saiful Anwar.

Jl. Jaksa Agung Suprapto No.2, Klojen, Malang 65111, East Java, Indonesia.

E-mail address: krisnayuarno@ub.ac.id.

Declaration of competing interest

None.

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