

Reverse Segond Fracture without Posterior Cruciate Ligament Injury – A report of Two Cases and Review of the Literature

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Learning Point of the Article:

Based on this study and previous rare reports, reverse Segond fracture may not be accompanied by PCL injuries in all cases.

Abstract

Introduction: Reverse Segond fracture is a cortical avulsion fracture off the medial tibial plateau of the knee, associated with tears of the posterior cruciate ligament (PCL), medial collateral ligament (MCL), medial meniscus, and probably the anterior cruciate ligament (ACL). Unlike Segond fracture, it is a very rare injury of the knee.

Case Report: Case one is a 24-year-old male with left tibial plateau and reverse Segond fracture with an magnetic resonance imaging (MRI) showing MCL avulsion, medial meniscus entrapped in fracture site and ACL tear but intact PCL. The second case is a 56-year-old female showing reverse Segond and lateral tibial plateau fracture confirmed by X-ray and computed tomography scan. MRI revealed intact PCL, detached medial meniscus from peripheral capsule and ACL injury.

Conclusion: Based on this study and previous rare reports, reverse Segond fracture may not be accompanied by PCL injuries in all cases.

Keywords: Reverse Segond fracture, posterior cruciate ligament injury, cortical avulsion fracture, medial tibial plateau.

Introduction

Hall and Hochman were first who described a reverse Segond type fracture as a small cortical avulsion fracture from the medial aspect of the proximal tibia just below the level of the tibial plateau [1], best demonstrated on anteroposterior view of the knee [2]. He described it as posterior cruciate ligament (PCL), medial collateral ligament (MCL), and medial meniscus tear. That may also be associated with anterior cruciate ligament (ACL) injury [1]. Segond fracture is more common than reverse Segond fracture [3, 4] and includes a triad of avulsion fracture of the lateral tibial plateau with ACL tear and lateral meniscus tear [5]. The mechanism of reverse Segond fracture is valgus and external rotation forces to the knee in flexion position that is completely different to Segond fracture [2]. In this study, we described two tibia plateau fractures with reverse Segond fracture with no PCL injuries

which is only reported twice in separate studies in current English literature. We also reviewed all previously published cases of reverse Segond fracture and discussed its demographic and clinical characteristics, imaging findings, and treatment options.

Case Report

Case 1

A 24-year-old male was brought to the emergency room after suffering a motorcycle versus car accident. On the initial examination and radiographic evaluation, he had left tibial plateau and reverse Segond fracture (Fig. 1). He had normal vascular and neurologic examination at initial and following evaluations. Computed tomography (CT) scan showed a large fragment avulsed from peripheral rim of medial tibial plateau in

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Figure 1: Left knee anteroposterior and lateral X-ray on admission show lateral tibial plateau and reverse Segond fracture.

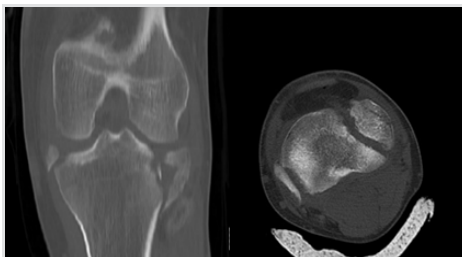


Figure 2: Left knee computed tomography scans (coronal and axial views) show tibial plateau fracture and reverse Segond fracture.

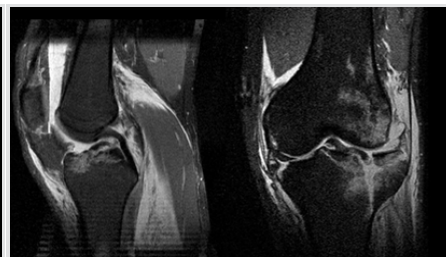


Figure 3: Magnetic resonance imaging shows avulsion of medial collateral ligament but intact posterior cruciate ligament.

addition to lateral tibial plateau fractures (Fig. 2). Magnetic resonance imaging (MRI) showed MCL avulsion, medial meniscus entrapment and ACL tear but intact PCL (Fig. 3). The patient was approached with two separate incisions, and both fractures were fixed (Fig. 4). The medial meniscus was pulled out from fracture site and repaired. No treatment was done for ACL in acute phase. He had full knee range of motion and complete union of fractures after 12 weeks.

Case 2

A 56-year-old female was brought to the emergency room after suffering a motorcycle versus pedestrian accident. She had severe left knee pain and swelling. Vascular and neurologic examination was normal at initial and following evaluations. In that case, X-ray and CT scan showed reverse Segond fracture with lateral tibial plateau fracture (Fig. 5). MRI revealed MCL and ACL injuries but intact PCL (Fig. 6). The lateral plateau fracture was fixed, but reverse Segond fracture was kept intact because of small fragment. The MCL and ACL injuries were treated conservatively. The results were excellent after 12 weeks.

Discussion

Reverse Segond fracture is a cortical avulsion fracture off the medial tibial plateau of the knee, and it is associated with complex injuries of the knee including the (1) tears of the PCL, (2) MCL, (3) the medial meniscus, and occasionally also (4) ACL. The reverse Segond fracture has been shown to have an association with specific injury complex of the knee joint, just like the Segond fracture [1]. Reverse Segond fracture almost always results from high-energy trauma to the knee and usually affects young adults [6]. The mechanism of the

previously reported cases has been postulated to be an injury causing valgus stress with the knee in flexion and external rotation [4]. Hall and Hochman considered the reverse Segond fracture as a radiographic clue for a significant internal derangement of the knee, and they showed that reverse Segond fracture is associated with PCL rupture and medial meniscal tear [1]. However, a wide variety of associated injuries has been reported so far [1, 7, 8, 9, 10, 11, 12, 13, 14, 2]. Unlike its original description, PCL rupture is not always an essential component of this injury complex. Varney [11] and Kwon et al. [14] showed intact PCL in their cases based on MRI findings which confirmed at surgery. Our study also showed the same results. One possible reason in our cases may be lateral tibial plateau fracture that compensates the force and preserves the PCL, but it needs to be evaluated more. Based on literature, medial meniscal tear is not an essential component of this complex [6, 9, 10, 11, 13, 2]. Many studies also showed intact ACL in cases with reverse Segond injuries [1, 7, 8, 9, 10, 11, 12, 13, 14, 2]. A general principle in treating reverse Segond fracture is the possibility of knee dislocation [6]. The surgeon should be aware of this possibility to prevent related complications. In previous studies, the appropriate treatment for reverse Segond fragment was to ignore small fragments on medial side [6]. However, if the fragment is large and compromising anteromedial knee stability and meniscal function, fixation of the fragment is advocated [6]. We fixed the large bony fragment in one case and ignore small one in another patient. High-grade injury of the MCL and the complete separation of the medial meniscus from the capsule represented by the reverse Segond fracture suggest that surgical intervention would be necessary to restore the anatomy of these medial structures [8]. In both of our cases, the detached medial meniscus was repaired. Although limited reports on the treatment of combined PCL and MCL injuries

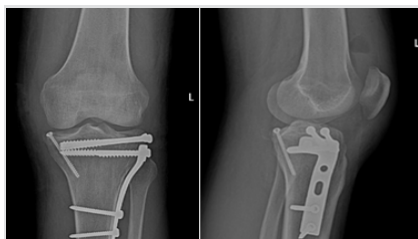


Figure 4: Open reduction and internal fixation of both fractures.



Figure 5: Knee X-ray and computed tomography scan show lateral tibial plateau fracture with reverse Segond fracture.

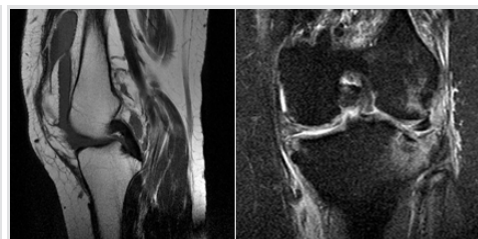


Figure 6: Magnetic resonance imaging shows intact posterior cruciate ligament.

are in the literature, many clinicians would like not to manage them by operative procedures. The high-grade damage of the MCL and medial meniscus and combined PCL injury accompanied in reverse Segond fracture suggest surgical intervention to restore the anatomy of these structures [8]. In our patients, the PCL was intact, so there was no need special treatment.

Conclusion

Based on this study and previous rare reports, reverse Segond

fracture may not be accompanied by PCL injuries in all cases.

Clinical Message

It could be mentioned that general principle in treating reverse Segond fracture is the possibility of knee dislocation. The surgeon should be aware of this possibility to prevent related complications.

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