CASE REPORTS

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Case report

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BILATERAL SIMULTANEOUS ANTERIOR CRUCIATE LIGAMENT RUPTURE:
A CASE REPORT AND LITERATURE REVIEW

ISTOVREMENO OBOSTRANO KIDANJE PREDNJEG UKRŠTENOG LIGAMENTA:
PRIKAZ SLUČAJA I PREGLED LITERATURE

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Introduction

Anterior cruciate ligament (ACL) injuries are rather common in adolescents and young adults. They are mostly associated with recreational, competitive and professional sports activities. The incidence of ACL injuries in general population ranges from 0.01 – 0.08% inhabitants/year, but it is much higher in athletes playing multidirectional sports [1]. The overall incidence of bilateral ACL ruptures at two separate times is 2.4 – 6% [2–4]. Simultaneous bilateral ACL ruptures are rare, and only a few cases have been previously reported in the orthopedic literature (Table 1) [5–10].

Looking into these case reports, many questions have arisen about the mechanism of injury and the optimal treatment. The aim of this study is to present a case of simultaneous bilateral ACL tears in an actor who was injured during a theatre performance after landing from a guitar jump. He was treated surgically with staged bilateral ACL reconstruction using bone-patellar-tendon-bone (BTB) autograft.

Case Report

A 30-year-old male professional actor, 174 cm tall and weighing 74 kg, body mass index (BMI) 24.4, with no significant past medical or family history of collagen disorders, was injured during a theatre performance on a punk-rock concert while playing the bass guitar. Prior to the injury, he had a very exhausting period with very little sleep (3 – 5 hours per night). During the performance, he was wearing a very heavy costume, and ill-fitting, untied shoes. The floor was wet and made of rubber, with many cables lying around. After he jumped high in the air, with his left leg extended to the front and his right leg fully bended behind, he hit his right buttock (Figure 1), landed back on the floor, and heard a ‘pop’ sound in both knees. He felt severe pain in both knees, and could not get up. Ultimately, he felt like his legs were not his own, and when he attempted to walk, his every step was very unstable – his legs felt like rubber. At that point he decided to go to the hospital where he underwent a two-stage bilateral ACL reconstruction using bone-patellar-tendon-bone autograft.

Summary

Bilateral simultaneous anterior cruciate ligament ruptures are very rare and only a few cases have been previously reported in the orthopedic literature. We present a case of simultaneous bilateral ACL tears in an actor who sustained injuries after landing from a guitar jump during a theatre performance. The patient underwent a two-stage bilateral ACL reconstruction using bone-patellar-tendon-bone autograft.

Key words: Anterior Cruciate Ligament; Anterior Cruciate Ligament Reconstruction; Rupture; Rupture, Spontaneous; Knee Injuries; Bone-Patellar Tendon-Bone Grafts

Sažetak

Istovremeno obostrano kidanje prednjeg ukrštenog ligamenta kolena je retko i samo nekoliko slučajeva ove povrede je do sada prikazano u ortopedskoj literaturi. Prikazujemo slučaj istovremene, obostrane povrede prednjeg ukrštenog ligamenta kolena koji je nastao pri doskoku za vreme „gitarskog skoka” tokom pozorišne predstave, koji je lečen rekonstrukcijom predneg ukrštenog ligamenta kost−ligament čašice−kost kalemom u dva vremena.

Ključne reči: prednji ukršteni ligament; rekonstrukcija prednjeg ukrštenog ligamenta; ruptura; spontana ruptura; povreda kolena; kost-ligament čašice-kost kalem

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Emergency Center (EC). In the EC, he had mild bilateral knee effusions, but there was no collateral instability, neither in full extension nor at 30° flexion, but the medial collateral ligament (MCL) femoral attachment was tender to palpation. Positive Lachman test with soft endpoint was present in both knees. The posterior drawer test was negative. His neurovascular status was intact. Bilateral knee X-rays (anteroposterior and lateral) were normal. Magnetic resonance imaging of both knees revealed the following: left knee - complete ACL tear, partial tear of medial collateral complex (MCL and medial part of the retinaculum at the femoral attachment grade I - II), discrete lesion of the medial meniscus, without a real meniscal tear and discrete impaction lesion of the posterior, lateral tibial plateau (Figures 2a, b and c); right knee - partial tear of ACL located in the proximal third, partial tear of MCL grade I - II, complex tear of the posterior horn of the medial meniscus, partial lesion of the posterolateral corner and ‘kissing’ impaction lesions of the lateral femoral condyle and posterior medial tibial plateau (Figures 3a, b and c). The posterior tibial slope in both knees was 8 degrees, the notch width index (NWI) in both knees was 0.22 (NWI is defined as the ratio of the width of the intercondylar notch (18 mm) to the width of the distal femur at the popliteal groove (79 mm)).

Abbreviations
ACL – anterior cruciate ligament
BMI – body mass index
MCL – medial collateral ligament
EC – emergency center
NWI – notch width index
PTS – posterior tibial slope

Figure 1. Bilateral ACL injury occurred during a theatre performance, after landing from a ‘guitar jump’; the left knee is extended, the left hip is flexed, and both right hip and knee are flexed

Sljepaca 1. Istovremeno obostrano kidanje prednjeg ukrštenog ligamenta je nastalo za vreme predstave u pozorištu prilikom doskoka „gitarskog skoka“, pri čemu je levo koleno bilo ispruženo, lev kuk savijen, dok su desno koleno i kuk bili savijeni

Figure 2. Magnetic resonance images of the left knee

Sljepaca 2. Magnetno-rezonantni prikaz levog zgloba kolena
a) Sagittal T2w fat-saturated image of the left knee demonstrates a complete ACL tear (arrow)
b) Coronal T2w fat-saturated image of the left knee demonstrates a partial thickness MCL tear at the level of the femoral attachment (arrow)
c) Sagittal T2w fat-saturated image of the left knee showing a minor bone impaction at the posterior lip of the lateral tibial plateau (arrow)

Figure 3. Magnetic resonance images of the right knee

Sljepaca 3. Magnetno-rezonantni prikaz desnog zgloba kolena
a) Sagittal T2w fat-saturated image of the right knee showing a complete ACL tear (arrow)
b) Coronal PDw tomogram of the right knee showing partial medial collateral complex lesion (arrow)
c) Sagittal T2w fat-saturated image of the right knee showing recent “kissing” bone impactions at the anterior weight-bearing portion of the lateral femoral condyle, and at the posterior lip of the tibial plateau (arrows)

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<td>Both knees ACL rupture and lesion medial meniscus.</td>
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<td>A guitar jump. After he had jumped high in the air, with his left leg extended to the front and his right leg fully bended behind, he hit his right buttock, landed back on the floor.</td>
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INW – Intercondylar notch width/sirina interkonddilarnog useka batne kosti, DFV – Distal femoral width/sirina donjeg okrajka batne kosti, NWI – notch width index/odnos između sirine interkonddilarnog useka i sirine donjeg okrajka batne kosti.
The surgery was delayed for 6 weeks during which the patient had physical therapy. The first surgery involved right ACL reconstruction with bone-patellar tendon-bone BTB autograft fixed using titanium interference screws, and medial meniscectomy of the right knee. Four months later, ACL reconstruction of the left knee was done. One year after the second surgery, the patient started playing recreational soccer again. Five years later, the patient has stable knees with full range of motion, good quadriceps femoris muscle strength, bilaterally, and negative Lachman and pivot shift tests. The patient is still an actor and plays recreational soccer without any limitations.

Discussion

In the period from January 2003 to December 2014, 3,400 ACL reconstruction surgeries were performed at the Department of Orthopaedic Surgery and Traumatology, Clinical Center Vojvodina. Among these 3,400 patients, 73 patients (2.14%) had bilateral knee surgery. Only one patient (0.029%) had bilateral ACL injury requiring ACL reconstruction surgery, which is in concordance with the existing literature data describing this type of injury only in 7 cases [5–10]. Saadat et al. [10] reported that the majority of experienced sports medicine specialists have never seen a patient with bilateral simultaneous ACL ruptures, and of those most have only seen a single case.

The risk factors associated with ACL injuries are multiple and can be divided into intrinsic and extrinsic, or those that can or cannot be altered. The extrinsic risk factors, which can be altered, include environmental conditions such as the playing surface, footwear, weather conditions and type of sport [11]. Our patient’s injury occurred after landing a jump onto a wet surface while wearing untied shoes. The intrinsic risk factors can be divided into anatomic, hormonal, neuromuscular and familial [12]. Numerous anatomic variables include intercondylar notch width, posterior tibial slope, increased BMI, landing kinematics, female sex, and anatomic alignment [11]. Anatomic differences between males and females include Q-angles, pelvis slope, increased BMI, landing kinematics, female sex, and anatomic alignment [11]. Differences in PTS cannot comment on the mechanism of the injury. Shelbourne et al. [18] examined the relationship between intercondylar notch stenosis and noncontact ACL injuries and concluded that the notch of 15 mm width or less, puts a person at higher risk for contralateral ACL tearing than the notch of 16 mm width or wider. Souryal and Freeman [19] reported that an NWI of less than 0.18 in women is significant for intercondylar notch stenosis, and that athletes with a stenotic intercondylar notch are 26 times more likely to sustain a noncontact ACL tear than those with a normal sized notch. On the other hand, Teitz et al. [20] suggested that the NWI alone is not critical in patients with an unilateral ACL tear. Intercondylar notch width less than 16 mm was reported in three females with simultaneous bilateral ACL ruptures [5, 8, 9]. Our patient did not have a stenotic intercondylar notch.

The ACL injury mechanisms have been investigated through a variety of research models, including retrospective interviews, medical report reviews, and video studies. However, due to multiple study limitations, it is not possible to directly determine the mechanism of ACL injury [21]. Most reported injury mechanisms involve noncontact mechanisms during weight-bearing conditions, such as landing from a jump, sudden deceleration while running, with or without a change in direction and the knee movements in multiple planes [22]. In many cases patients reported that the injury happened when the injured foot was in contact with the ground, the knee went into valgus with either internal or external rotation, while the knee was in hyperextension or shallow flexion [23]. In three patients with simultaneous injury of bilateral ACL, the injury mechanism involved landing with both knees extended. Two girls were cheerleaders [5, 9], and one man was a plumber who fell into a channel [6]. Stilger [7] reported a female gymnast who fell and landed bilaterally on flexed knees. Also, two females and one male sustained a simultaneous bilateral ACL injury while downhill skiing, while both hips and knees were maximally flexed [6, 8, 10]. Bilateral ACL injury in our case occurred during a theatre-performance, while landing from a jump with the left knee being extended and left hip being flexed and both right hip and knee being flexed (‘guitar jump’). Based on the tenderness along the femoral insertion of MCL and magnetic resonance image (MRI) findings which showed partial MCL tear, it can be assumed that the knee went into valgus during landing with rotation. Just looking into the location of the bone bruise, one cannot comment on the mechanism of the injury.

The final challenge associated with simultaneous bilateral ACL rupture is the treatment approach. Tifford
and Jackson [9] and Stilger et al. [7] showed that simultaneous bilateral ACL reconstructions are more time- and cost-effective compared to staged bilateral ACL reconstructions. In our opinion, simultaneous ACL reconstruction of both knees is overly aggressive; standing on both feet post-operatively is difficult and mobility is reduced with a great risk for arthrofibrosis and troboembolia, so we opted for 2-stage bilateral ACL reconstruction [5, 6, 8, 10]. The optimal timing for reconstructive ACL surgery varies among authors. Tifford and Jackson [9] performed simultaneous bilateral ACL reconstruction 7 weeks after the initial injury, while Stilger et al. [7] did it after 9 weeks, when the swelling subsided and the range of motion and muscle strength were almost back to normal. In our case, the first ACL reconstruction was done 6 weeks after the injury, which is longer compared to other authors who performed staged reconstruction within the first two weeks from the injury [5, 6, 8, 10]. The second ACL reconstruction was done 4 months after the injury, which is similar to other reported time frames (from 2 to 5 months) [5, 6, 10].

In addition to the timing and surgery planning, there is a wide choice of grafts used for ACL reconstruction. Of those who preferred performing a simultaneous reconstruction, Tifford and Jackson [8] used a hamstring autograft and Stilger et al. [7] used a bone-patellar tendon–bone autograft. Of those who opted for a staged reconstruction, Maywood and Hechtman [5], and Lukas and Bauer [6], used bone-patellar tendon–bone autograft, Sanchis-Alfonso and Tintó-Pedrerola [8] used hamstring autograft, and Saadat et al. [10] used an allograft.

Conclusion

Simultaneous bilateral anterior cruciate ligament rupture is a very rare injury, which occurs through noncontact mechanisms, such as landing from a jump while the knees are hyperextended or hyperflexed and in valgus position at the same time. Although simultaneous bilateral anterior cruciate ligament reconstruction has its advantages, being time- and cost-effective, in our opinion staged anterior cruciate ligament reconstruction is less aggressive and better tolerated by the patients.

References