Journal of Sports Medicine and Allied Health Sciences: Official Journal of the Ohio Athletic Trainers Association

Volume 6
Issue 2 *JSMAHS Fall Issue 2020*

Article 1

October 2020

Recurrent Patellar Fracture in a Healthy Collegiate Basketball Player: An Exploration Clinical Case Report

Mikaela Boham
Texas A&M University-Corpus Christi, mikaela.boham@tamucc.edu

Jerry Hilker
Texas A&M University-Corpus Christi, Jerry.hilker@tamucc.edu

Recommended Citation

Boham, Mikaela and Hilker, Jerry (2020) "Recurrent Patellar Fracture in a Healthy Collegiate Basketball Player: An Exploration Clinical Case Report," *Journal of Sports Medicine and Allied Health Sciences: Official Journal of the Ohio Athletic Trainers Association*: Vol. 6 : Iss. 2 , Article 1.
DOI: 10.25035/jsmahs.06.02.01
Available at: https://scholarworks.bgsu.edu/jsmahs/vol6/iss2/1

Recurrent Patellar Fracture in a Healthy Collegiate Basketball Player: A Case Report

Mikaela Boham EdD, ATC, LAT; Jerry Hilker MsEd, ATC, LAT
Texas A&M University-Corpus Christi

Purpose: Patellar fractures only account for approximately 1% of all skeletal injuries. Patellar fractures usually result from direct trauma (i.e. falling on the knee, dashboard injury, etc.), or, less frequently, occur as a combination of direct and indirect mechanism (i.e. receiving a direct blow while contracting the quadriceps). While indirect trauma is the least common mechanism, it usually occurs due to an extensor mechanism failure during eccentric loading such as landing. **Method:** Case report, Level 3: Exploration Clinical Contribution to the Available Sources of Evidence (CASE) Report. **Results:** A 21-year-old Division I collegiate basketball athlete sustained two separate transverse patellar fractures via non-contact mechanisms in the same knee over a 21-month period. The patient had no prior history of knee injury nor predisposing risk factors for fractures; delayed union or nonunion. **Conclusion:** The uniqueness of this case is twofold: 1) The rareness of this injury among a healthy athletic population; and 2) The unusual non-contact mechanism of the injury. Patellar injuries are extremely rare in athletics. In NCAA Division I men's basketball, patellar injury accounts for only 2.4% of all injuries during games and 3.7% during practice. **Recommendations:** Although rare, it is important for athletic trainers to recognize traumatic high-impact injuries can occur during non-contact activity in a healthy population. In addition, athletic trainers should be mindful to suspect fracture without associated defect when a patient sustains a subsequent injury with an analogous mechanism even following successful rehabilitation. ***Keywords:*** *Patellar Fracture, Knee Injuries, Knee Pain, Fracture, Patella*

INTRODUCTION

Fractures account for 2.9% of all injuries among National Collegiate Athletic Association (NCAA) male basketball participants;[1] patellar fracture represents approximately 1% of all fracture occurances.[2] A patellar fracture is a rare sports related injury.[3,4] Incidence of fracture is more commonly associated with injuries among older populations (average age 54 ± 21 years old)[5]; the majority of fractures occurred as a result of a vehicular accident (78.3%), followed by occupational- (13.7%) and domestic-related accidents (11.4%).[4,5] Although a previous report indicated men were twice as likely to sustain a fracture to the patella,[2] a recent 10-year longitudinal study[5] has suggested females have an incidence of patellar fractures (1.3 times higher).

The majority of the fractures follow a transverse pattern although an occasional avulsion, stellate, vertical, or comminuted fracture can transpire.[6] Patellar fractures usually result from direct trauma (e.g., falling directly on the patella or a car dashboard being forcefully driven into the patella during an accident),[3,7] or, less frequently, occur as a combination of direct and indirect mechanisms (e.g., receiving a direct blow during quadriceps muscle contraction).[3,6,8] Indirect (non-contact) trauma is the least common mechanism, and usually happens as the result of an extensor mechanism failure during a forceful eccentric contraction of the quadriceps muscle group (e.g., landing from a jump).[3,6,8]

Stable closed fractures with minimal to no displacement (<2 mm articular step-off or <3 mm of fragment separation) can be managed conservatively. Many fracture cases however require operative intervention due to significant displacement of bone fragments or the discontinuity of the extensor mechanism.[3,9-11] Results of surgery are frequently unsatisfactory.[12-17] Patients undergoing osteosynthesis often reported lingering and/or long-term dysfunction.[12-17] The overall rate of complication with this surgery has been reported to be as high as 48.7%.[14] In a prospective review of 113 cases, despite confirmed clinical healing, only 27.7% of the patients reported being pain free, 21.7% reported no limitation in physical activities and 19.3% reported normal activities of daily living after a follow-up period of six years.[14] Symptomatic hardware is one of the most frequently documented complications and can ultimately require implant removal,[15] occurring between 17.6% to 60.2% of fracture cases.[12,13,14,18,19] Anterior knee pain (80.0%),[13] patella baja (56.7%),[13] range of motion (ROM) deficits in flexion (37.5%) and/or extension (15.0%),[12] and decreased extensor strength[12-14,16]

are also common concomitant conditions following surgery.[12-14,16] Despite aggressive physical therapy, the patients demonstrated strength deficits (41%), power deficits (47%), and endurance deficits (34%) in knee extension at 12 months of follow-up.[13] Combining these findings, unsurprisingly, these patients reported significantly lower health-related quality of life compared to the age-matched control population, even up to eight and a half years following surgery.[16] The purpose of this case study is to examine available evidence concerning the rare incidence of two transverse patellar fractures in the same knee of a collegiate male basketball athlete over a 21-month period.

CASE REPORT

Patient

The patient was a 21-year old NCAA Division I basketball athlete, prior to injury, the patient was healthy and well-nourished with normal mood and affect. The patient reported no previous usage of alcohol, caffeine, illicit drugs or tobacco. The patient was participating in an open gym basketball game when he loaded for a routine jump off his left foot. During the knee extension in the explosive portion of the loading, the athlete felt a "pop" in his knee and fell to the ground during the land. The athlete experienced immediate severe pain over the left patella and was unable to bear weight. He was transported via ambulance to the local Emergency Department. A radiograph revealed a closed transverse fracture of the left patella with proximal migration of the large fragment at the inferior pole (Figure 1). The patient was placed in a knee immobilizer brace, provided crutches and was sent home with medication to modulate pain.

Figure 1. Radiograph demonstrating initial patellar fracture

Intervention

The following day, there was notable swelling and a palpable defect at the inferior pole of the patella with moderate joint effusion. Selective tissue tests indicated potential medial and lateral retinaculum tears. The patient was unable to perform a straight leg raise or extend his knee from a flexed position. The patient had a consultation at the Orthopedic Surgical Center where treatment options were discussed between the orthopedic surgeon and the patient, who elected to proceed with open reduction internal fixation (ORIF) of the patella fracture. Surgery was performed five days post-injury to repair the fracture; both retinacular tears extended posterior to the midline and the lateral portion of the patellar tendon was shredded during injury. An ORIF procedure utilized one 5.5 Arthrex SwiveLock anchor for the fractured patella and repair of the retinacular injuries with FiberWire. A c-arm was used to visualize fracture reduction. Radiographs were taken several days following surgery to ensure retention of patellar alignment (Figure 2).

Figure 2. Radiography taken following initial surgery

The patient progressed through a traditional rehabilitative and return-to-play (RTP) protocol designed by the orthopedic surgeon and athletic trainer (AT) at the university. The patient was compliant with the rehabilitation protocol and was dedicated to returning to play. The patient struggled with quadriceps activation and tone throughout the recovery. Passive ROM for knee flexion returned to normal at seven weeks post-surgery; however, at approximately 11 weeks, the patient continued to have an extensor lag (lacking 10°). The patient reported continued increase in strength 14 weeks following surgical intervention; however, he reported his knee was giving out

occasionally which suggested eccentric control of the quadriceps muscle was still an issue. Other than manual muscle testing, no other strength tests were performed at this point to evaluate strength gains. Despite this symptom, radiographs and a physical evaluation confirmed the clinical healing of the patella fracture and the retinacular injuries. The patient was instructed to increase activities under the direction of his AT.

At 36 weeks post-surgery, the patient reported his strength had increased; however, his overall RTP progression was slow. While the patient denied pain with running, tenderness remained over the superior third of the patella with palpable retropatellar crepitus throughout the knee ROM. Quadriceps tone continued to improve; however, visual atrophy was still present compared to the contralateral limb. To acquire a more detailed image of the patella, a left knee computed tomography (CT) scan was obtained which indicated: 1) Linear calcification and thickening of the patellar tendon; 2) mild to moderate prepatellar and superficial infrapatellar bursitis; and 3) delayed union over the anterior half of the fracture (posterior half of the fracture was healed at the level of the anchor; however, the anterior half of the fracture remained ununited). Overall, an estimated one third of the fracture was healed and therefore to facilitate bone healing the patient was prescribed a bone stimulator (Exogen 4000+™, Smith & Nephew GmbH, Schenefeld, Germany) and instructed to use the unit twice a day for 20 minutes. No activity restrictions were placed on the patient and he continued to progress through his rehabilitation protocol with the daily addition of the bone stimulator.

An additional CT scan was performed at 47 weeks post-surgery and the anterior half of the patella was still not unified. Diffuse osteopenia was noted, and the amount of joint fluid was at the upper limit of normal. The patient discontinued the use of the bone stimulator around 49 weeks post-surgery as the maximal amount of dosage was reached based on a pre-determined protocol. The patient continued a strength and condition program with the AT and could return to full athletic activity around 56 weeks post-surgery. Since this was at the conclusion of the academic year and the patient was returning home for a month; he was provided a home exercise program. Around 60 weeks post-surgery, the patient completed the annual team physical examination, was asymptomatic performing functional tasks and reported to be pain free. He was cleared with no limitations and started playing in open gym basketball practices.

Approximately 21 months following the original fracture, the patient was playing in an away basketball game (Figure 3). When the patient made a cut between two defenders while moving to the left, eccentrically loading the quadriceps muscles, he felt a “pop” and pain in the left knee. He was able to limp off the court without any assistance. The AT immediately assessed the patient; the evaluation revealed no obvious deformity, no crepitus, no ecchymosis and no edema over the left knee. The patient reported pain over the mid-portion of the patella around the original fracture site and was tender to palpation. Due to the patient’s relatively high functional status, the attending AT suspected a scar tissue disruption, although refracture of the patella was not ruled out of the differential diagnosis. The injury occurred prior to winter break and the team was “dismissed” from the away site. The patient was therefore instructed to go home as planned and see a physician if his pain continued. A subsequent radiograph was ordered and obtained by the patient’s personal physician, which confirmed the presence of a transverse patellar fracture over the same location (Figure 4). Upon his return to the university, the patient consulted with the original orthopedic surgeon concerning treatment options. Due to the timing of the injury within the season, the availability of the surgeon’s schedule, and the required post-surgical care required by the athlete, it took several weeks for his surgical consultation to occur and his surgery was scheduled for a future date. Approximately five weeks after the second fracture, the patient underwent a surgical procedure to address the recurrent patellar fracture. An ORIF utilizing two 4.0 partially threaded cannulated screws was performed. The medial screw was 42-mm-long, and the lateral screw was 44-mm-long (Figure 5A and Figure 5B). Cancellous crunch bone graft was also utilized during the procedure. The patient completed a successful rehabilitation protocol and returned to basketball to participate in his final season of eligibility without any further lower extremity injury or incident. During the basketball season, the patient continued to participate in a strength and endurance strengthen and maintenance program.

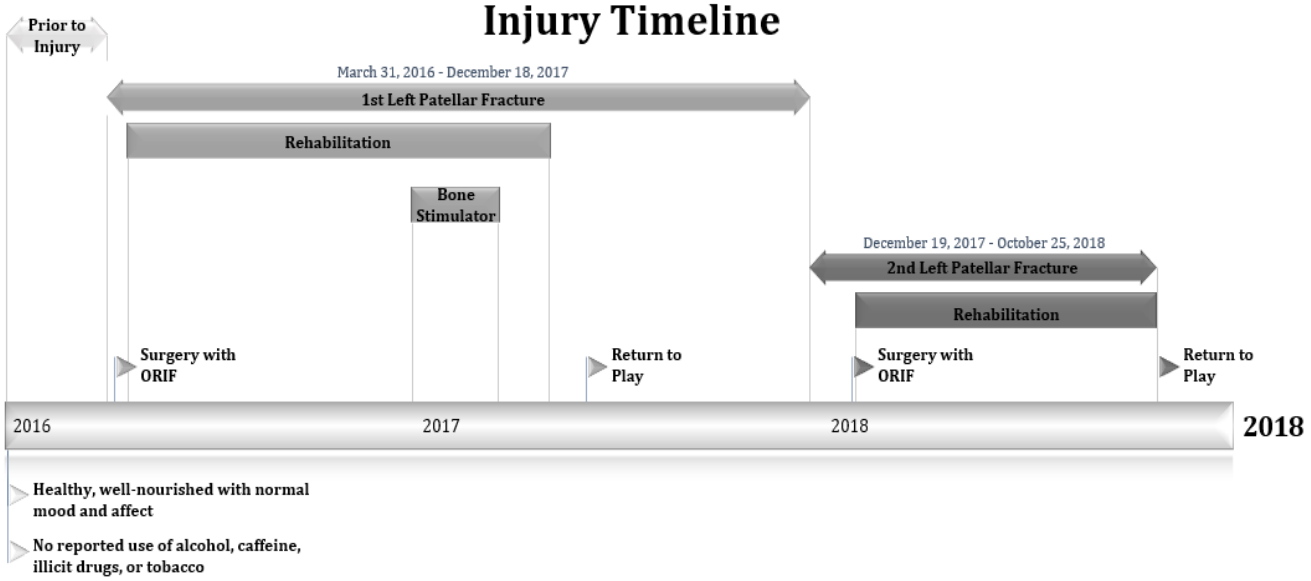

Figure 3. Timelines for the patellar fractures

Figure 4. Radiograph following second fracture

Figure 5A. Radiograph from second patellar fracture with cannulated screws

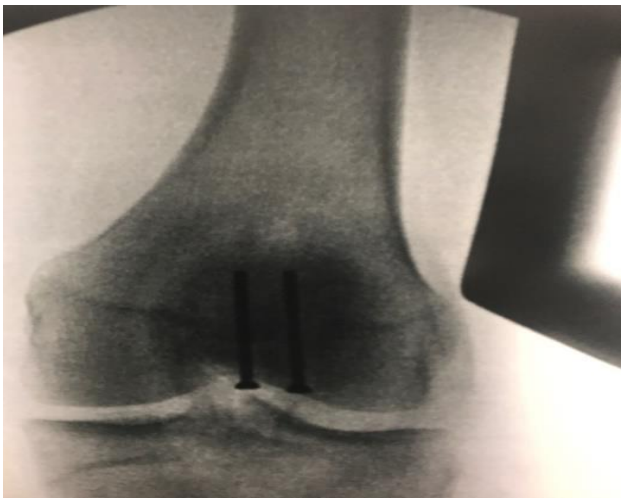

Figure 5B. Anterior-posterior radiograph following the second surgery

DISCUSSION

Complex fracture (> 3 pieces), fracture severity, extensive tension-band constructs and history of smoking have all been identified as major factors adversely affecting the overall severity of symptoms and functional recovery, and tend to result in increased health care costs associated with patellar fractures.[14] Nonunion or delayed union is rare (5.7%),[20] yet can impose a serious threat to a patients' athletic career. A meta-analysis concluded age, gender, open vs closed fracture, or operative technique does not increase the risk of nonunion healing.[21] A more recent analysis[17] reported similar findings; however,

they identified two additional specific comorbidities associated with higher rates of patellar fracture complications: 1) A history of cerebrovascular accident significantly increased the risk for nonunion (Odds Ratio [OR] = 14.9; 95% confidence interval [CI] = 1.2, 188.1; *P* = .037); and 2) a current diagnosis of diabetes was highly associated with a second operation (OR = 8.69; 95% CI = 1.8, 41.9; *P* = .007).[17] This study did not distinguish between a type 1 or type 2 diabetes diagnosis for the involved patients.[17] The patient presented in this case was completely absent from these risk factors and thus the reason(s) why he developed delayed union remains unknown.

This patient eventually experienced a refracture, which could be considered a poor outcome. The incidence of two patellar fractures in a single patient within the literature is extremely rare. Lazaro et al[13] only reported one in 30 patients (3.3%) suffered a refracture. No documented cases were reported by LeBrum et al (40 cases, 6.5-year follow-up),[12] Reul et al (113 cases, 6.0-year follow-up),[14] Vedel et al (49 cases, 8.5 year follow-up)[16] and Kadar et al (188 cases, 2.5-year follow-up)[17].

Corner[22] described the occurrence of patella refracture in the year 1900 as "not infrequent" and identified that 30 out of 254 patellar fracture cases resulted in refracture by retrospectively reviewing hospital records. This data must be interpreted carefully as this article is over 120 years old. In 1952, Rowe[23] reported a case of a 71-year-old patient who refractured her patella approximately 40 days following partial patellectomy surgery as the result of a falling incident. Rees and Thompson[24] noted three nonoperatively-managed patellar refracture cases in 1985 attributed to osteoporosis developed after periods of immobilization. No other current reports were found in the literature, and thus this is the first documented case of a patellar refracture in a young, healthy collegiate male basketball player who underwent ORIF.

CLINCAL BOTTOM LINE

According to the literature, the likelihood of sustaining a non-contact patellar fracture in a healthy athletic patient is extremely low. Sustaining two fractures from the same mechanism in less than two years is even more uncommon. It is important for an AT to understand and recognize that high-impact injuries such as fracture can occur during non-contact activity in a healthy population. The surgical choice, rehabilitation process and RTP decisions were all made utilizing clinician expertise and patient values. The rarity of this injury is exhibited by the lack of cases reported in the literature.

As best practices and future advice, ATs are encouraged to consider ruling out a refracture when a patient sustains an injury with a similar mechanism or presentation, even if some hallmark signs, such as a physical deformity, are missing. Regardless of successful rehabilitation, it is advisable to refer the patient for further evaluation/testing when in doubt to rule out injury or re-injury.

Additionally, in hindsight, vitamin D and calcium levels could have been assessed during the healing process from either the first or the second fracture. However, due to the age of the athlete and his overall physical health and condition, the medical team did not elect to evaluate bone mineralization numbers. Additionally, CT scans could provide confirmation of healing during the return to play protocol. The athlete was cleared from the first fracture based on the patient being asymptomatic and completing of functional movement tests; however, further confirmation of healing might have assisted the medical team's decision making. Clinicians should also examine other testing procedures which may be useful in determining objective return to play criteria for the athlete. A DexaScan® may provide a diagnostic evaluation to assess healthy verses (osteopenia or osteoporosis) unhealthy bone density levels by using t-scores comparative to normative values and could measure tissue healing. Isokinetic testing assessing quadriceps: hamstring ratios, hip internal and external rotation, and hip abduction strength as a functional return to play protocol. Additionally, objective measures for strength should have been assessed within the return to play protocol and as a part of team physicals. Often strength is assessed in a subjective manner; however, isokinetic evaluations or other objective measurements may be a better pre-participation measure to identify weaknesses and areas of concern. Clinicians should evaluate foot mechanics during the biomechanical gate and for anatomical deviations (quadriceps angle, pronation/supination, etc.) which may impact the kinetic chain potentially contributing to additional future lower extremity injuries (patella

dislocation, knee and ankle ligament ruptures, etc.). Strength imbalances have been implicated in many different lower extremity injuries including anterior cruciate ligament ruptures, patellofemoral pain syndrome and patellar tracking.[25] Multi-angle biomechanical analysis such as Vicon® motion capture, could be utilized to evaluate quality of movement during the return to play protocol. This filming can be slowed down to ¼ or ½ speed to assess joint angles and to look for potential weaknesses in the lower extremity kinetic chain.

A non-contact patellae injury is rare in an athlete. Whether a lack of bone healing may have contributed to the subsequent second patellar fracture it is difficult to ascertain. It is not uncommon for young, healthy athletes to sustain bone injuries and to return to activity while bone remodeling is still occurring. Additionally Unfortunately, DexaScans® , isokinetic testing, and biomechanical analysis may not be readily available in all clinical settings and often have a significant associated cost. This was a complicated case, and clinicians are encouraged to practice evidence-based medicine when treating all injuries.

REFERENCES

1. Zuckerman SL, Wegner AM, Roos KG, Djoko A, Dompier TP, Kerr ZY. Injuries sustained in national collegiate athletic association men's and women's basketball, 2009/2010-2014/2015. *Br J Sports Med*. 2016;0:1-8. doi: 10.1136/bjsports-2016-096005.
2. Boström A. Fracture of the patella. A study of 422 patellar fractures. *Acta Orthop Scand*. 1972;143(suppl):1-80.
3. Wild M, Windolf J, Flohe S. Fractures of the patella. *Unfallchirurg.* 2010;113(5):401-411. doi: 10.1007/s00113-010-1768-x.
4. Gwinner C, Märdian S, Schwabe P, Schaser KD, Krapohl BD, Jung TM. Current concepts review: Fractures of the patella. *GMS Interdiscip Plast Reconstr Surg DGPW*. 2016;5:Doc01. doi: 10.3205/iprs000080.
5. Larsen P, Court-Brown CM, Vedel JO, Vistrup S, Elsoe R. Incidence and epidemiology of patellar fractures. *Orthopedics*. 2016;39(6):e1154-e1158. doi: 10.3928/01477447-20160811-01.
6. Melvin JS, Karunakar MA. Patella fractures and extensor mechanism injuries. In: Court-Brown CM, Heckman JD, McQueen MM, Ricci WM, Tornetta P, eds. *Rockwood and Green's Fractures in Adults.* 8th ed. Philadelphia, PA: Wolters Kluwer; 2015.
7. Nummi J. Fracture of the patella. A clinical study of 707 patellar fractures. *Ann Chir Gynaecol Fenn Suppl.* 1971;179:1-85.
8. Jarraya M, Diaz LE, Arndt WF, Roemer FW, Guermazi A. Imaging of patellar fractures. *Insights Imaging*. 2017;8(1):49-57. doi: 10.1007/s13244-016-0535-0.
9. Schuett DJ, Hake ME, Mauffrey C, Hammerberg EM, Stahel PF, Hak DJ. Current treatment strategies for patella fractures. *Orthopedics.* 2015;38(6):377-384. doi: 10.3928/01477447-20150603-05.
10. Sayum Filho J, Lenza M, Teixeira de Carvalho R, Pires OG, Cohen M, Belloti JC. Interventions for treating fractures of the patella in adults. *Cochrane Database Syst Rev.* 2015;(2):CD009651. doi: 10.1002/14651858.CD009651.pub2.
11. Kakazu R, Archdeacon MT. Surgical management of patellar fractures. *Orthop Clin North Am*. 2016;47(1):77-83. doi: 10.1016/j.ocl.2015.08.010.
12. LeBrun CT, Langford JR, Sagi HC. Functional outcomes after operatively treated patella fractures. *J Orthop Trauma.* 2012;26(7):422-426. doi: 10.1097/BOT.0b013e318228c1a1.
13. Lazaro LE, Wellman DS, Sauro G, et al. Outcomes after operative fixation of complete articular patellar fractures: assessment of functional impairment. *J Bone Joint Surg Am*. 2013;95(14):e96 1-e968. doi: 10.2106/JBJS.L.00012.
14. Reul M, Verschaeve M, Mennes T, Nijs S, Hoekstra H. Functional outcome and economic burden of operative management of patellar fractures: the pivotal role of onerous implants [published online September 30 2017]. *Eur J Trauma Emerg Surg*. 2017. doi: 10.1007/s00068-017-0850-2.
15. Petrie J, Sassoon A, Langford J. Complications of patellar fracture repair: treatment and results. *J Knee Surg.* 2013;26(5):309-312. doi: 10.1055/s-0033-1353990.
16. Vedel JO, Vistrup S, Larsen P, Elsoe R. Altered long-term health-related quality of life in patients following patella fractures: a long-term follow-up study of 49 patients [published online October 9 2017]. *Eur J Trauma Emerg Surg*. 2017. doi: 10.1007/s00068-017-0857-8.
17. Kadar A, Sherman H, Glazer Y, Katz E, Steinberg EL. Predictors for nonunion, reoperation and infection after surgical fixation of patellar fracture. *J Orthop Sci*. 2015;20(1):168-173. doi: 10.1007/s00776-014-0658-4.
18. Smith ST, Cramer KE, Karges DE, Watson JT, Moed BR. Early complications in the operative treatment of patella fractures. *J Orthop Trauma*. 1997;11(3):183-187.
19. Hoshino CM, Tran W, Tiberi JV, et al. Complications following tension-band fixation of patellar fractures with cannulated screws compared with Kirschner wires. *J Bone Joint Surg Am*. 2013;95(7):653-659. doi: 10.2106/JBJS.K.01549.
20. Nathan ST, Fisher BE, Roberts CS, Giannoudis PV. The management of nonunion and delayed union of patella fractures: a systematic review of the literature. *Int Orthop*. 2011;35(6):791-795. doi: 10.1007/s00264-010-1105-6.
21. Dy CJ, Little MT, Berkes MB, et al. Meta-analysis of re-operation, nonunion, and infection after open reduction and internal fixation of patella fractures. *J Trauma Acute Care Surg.* 2012;73(4):928-932. doi: 10.1097/TA.0b013e31825168b6.
22. Corner EM. Structure, fracture, and refracture of the patella. *Ann Surg*. 1900;32(6):749-768.
23. Rowe CA. Refracture of the patella following partial patellectomy. *West J Surg Obstet Gynecol*. 1952;60(8):404-405.
24. Rees D, Thompson SK. Refracture of the patella. *Injury*. 1985;16(8):559-563.
25. Boham MD, DeBeliso M, Harris C, Pfeiffer RP. Quadricpes-to-hamstrings imbalances in female collegiate soccer athletes: implication for injury. *J Athl Enhancement.* 2014;3(5):1-5. doi: 10.4172/2324-9080.1000169.