Journal of Scientific Research & Reports
3(22): 2916-2922, 2014; Article no. JSRR.2014.22.008
ISSN: 2320–0227

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An Unusual Source of Knee Pain in a Competitive Breaststroke Swimmer

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Author's contribution

Author DWK evaluated the patient and participated in the treatment and follow-up. Author DWK managed the literature search, wrote and approved the final manuscript.

Article Information

DOI: 10.9734/JSRR/2014/12195
Editor(s):
(1) Vito Di Maio, nstitute of Cybernetics "E. Caianiello" CNR, C / O Complex Olivetti, Via Campi Flegrei, 34, Italy.
Reviewers:
(1) Ayhan Goktepe, Department of Geodesy and Photogrammetry, College of Technical Science, Selcuk University, Konya, Turkey.
(2) Anonymous, University of São Paulo, Brazil.
Peer review History: http://www.sciencedomain.org/review-history.php?iid=637&id=22&aid=6130

Case Study

Received 22nd June 2014
Accepted 22nd July 2014
Published 16th September 2014

ABSTRACT

Aims: The purpose of this case report is to present an unusual source of knee pain in a competitive breaststroke swimmer and review the clinical, etiologic, and radiographic features of the disease process.
Presentation of Case: A 20-year-old collegiate swimmer presented with complaints of left knee pain and weakness. Physical findings of tenderness in a lateral condylar location, measurable thigh atrophy, and pain on a resisted knee extension test were present. Plain radiographs demonstrated osteochondritis dissecans of the lateral femoral trochlear groove and evidence of moderate trochlear dysplasia. Surgical findings confirmed a 3 cm by 1 cm loose osteochondritis dissecans fragment.
Discussion: The knee is forcefully extended against the resistance of the water during the propulsive phase of the whip kick used by breaststroke swimmers. This movement results in high lateral patellofemoral contact loads and increased lateral patellar

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displacement forces. In a knee with trochlear dysplasia there are additional increases in patellar displacement and contact pressures. Osteochondritis dissecans involving the lateral trochlear groove has been associated with repetitive tangential type shear stresses.

Conclusion: The findings in the present case report would suggest a very unique situation in which high lateral trochlear shear stresses were created by the repetitive whip kick activity in the knee of a breaststroker swimmer and that these unusual stresses were further magnified by underlying trochlear dysplasia. With continued intense training efforts, the shear stresses eventually exceeded a critical threshold of the subchondral bone of this region and failure occurred, resulting in osteochondritis dissecans of the lateral trochlea.

Keywords: Breaststroker's knee; trochlear dysplasia; osteochondritis dissecans; whip kick.

1. INTRODUCTION

Competitive swimming demands long hours of intense training efforts to generate greater and greater propulsive forces. This training involves repetitive movements that can exceed tolerance levels in various joints and at times injury results. The knees of breaststroke swimmers are particularly vulnerable. Investigators have shown high stresses in medial knee structures associated with the whip kick leading to overuse knee injuries and have suggested the term "breaststroker's knee" [1-5].

We report a case of a competitive breaststroke swimmer with unique findings and an unusual source of knee pain not previously reported.

2. CASE REPORT

A 20-year-old collegiate swimmer presented with complaints of left thigh weakness for 18 months and of left lateral knee pain occurring after workouts for 3 months. The patient had been actively competing in swimming for over 12 years. He participated in freestyle, butterfly, and backstroke, but his main event was the breaststroke. Over 75% of his workouts involved the breaststroke and the use of the whip kick.

Physical examination found a healthy appearing male whose height was 72 inches and whose weight was 185 lbs. He had a calculated BMI (body mass index) of 25. Slight tenderness was noted over the anterior aspect of the lateral femoral condyle of the left knee. Pain was produced by resisted left knee extension at 45º of knee flexion with the tibia held in external rotation. The left thigh circumference was found to be 2 cm less than the right when measured 10 cm above the patella. Wilson's test [6] with internal rotation produced no pain. The left knee range of motion, as measured by goniometer, was from 0º to 135º. Q-angle measurement was normal at 12º [7].

Examination of plain radiographs of the left knee revealed a boney lesion in the anterior trochlear region best identified on an axial patellar view (Fig. 1). A diagnosis of osteochondritis dissecans of the lateral femoral trochlear groove was made. A small trochlear prominence and a crossing sign, pathognomonic for trochlear dysplasia, were identified on the lateral radiograph. These findings and a femoral sulcus angle measuring 155º indicated the presence of moderate trochlear dysplasia [8,9].

A pre-operative Cybex isokinetic evaluation comparing right and left quadriceps strength at 4 different speeds revealed that the left quadriceps averaged 30% of the overall strength of the right quadriceps.

Surgery was proposed with a pre-operative diagnosis of osteochondritis dissecans of the lateral femoral trochlear groove. The patient underwent arthroscopy followed by an arthrotomy that included a lateral retinacular release of his left knee. A 3 cm by 1 cm lesion of the lateral trochlear groove was found loose and depressed by 2 mm (Fig. 2). The subchondral defect was bone grafted and the fragment was internally fixed with multiple pins.

Fig. 1. Axial patellar radiograph demonstrating lateral femoral trochlear groove osteochondritis dissecans lesion (arrow). The femoral sulcus angle measures 155º and the trochlea appears dysplastic

The patient went on to successful radiographic healing and resolution of symptoms. He received formal physical therapy from 3 to 6 weeks postoperatively. Three months following surgery he resumed swimming workouts and progressed to competitive breaststroke swimming.

3. DISCUSSION

Osteochondritis dissecans (OCD) of the knee is a relatively uncommon but important pathologic condition. It has been extensively studied, but its true etiology is unknown and remains a source of debate. The most widely accepted theories indicate repetitive microtrauma in the etiology of both adult and juvenile forms of OCD. Both forms are being seen with increasing frequency in pediatric and young adult athletes. This may be in part due to growing competitive sports participation and intensive training demands placed on children at younger ages [10,11].

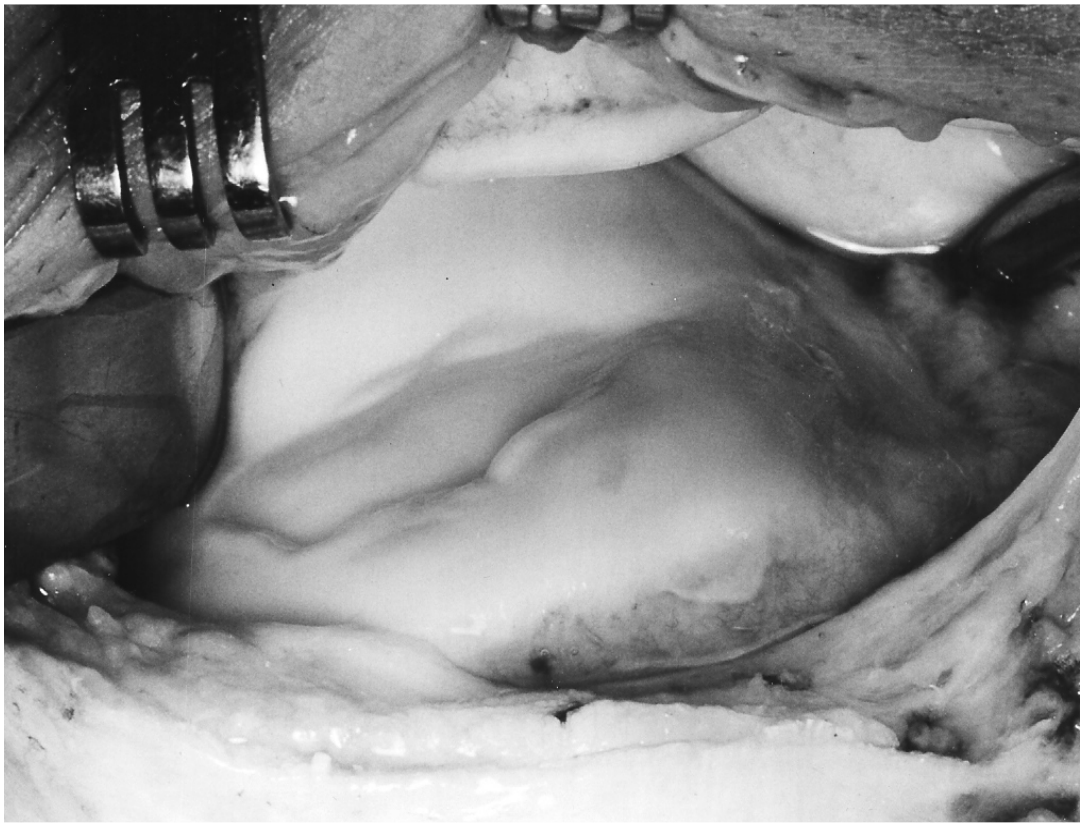

Fig. 2. Intraoperative photograph showing osteochondritis dissecans lesion measuring 3 cm by 1 cm and slightly depressed

OCD involving the lateral femoral trochlear groove is extremely rare accounting for only 2% of OCD of the knee [12,13]. This lateral trochlear location appears to be a distinct clinical form of OCD. Recent investigators have described characteristic clinical features of this unusual form [13-15]. Typically young, active and athletic males present with a gradual onset of symptoms without an acute event. The symptoms usually are of long duration prior to diagnosis. Nearly all patients describe anterolateral knee pain and are found with lateral trochlear tenderness.

Repetitive microtrauma appears to be the most likely cause of OCD involving the lateral trochlea [10,13]. Investigators have noted the findings of lateral patellar tightness and/or functional malalignment. Both findings appear to be key factors in producing unusual shear-like stresses on the convex surfaces of immature cartilage of the trochlear groove [13,15].

There is evidence of stress accumulation in adolescent knees from the repetitive and high volume training required in competitive swimming. Significantly more MRI abnormalities have been noted in asymptomatic adolescent elite swimmers' knees than in aged-matched controls of non swimmers. The most common abnormalities noted were infrapatellar fat pad edema and bone marrow edema in the elite swimmers. These positive imaging findings

appear to represent preclinical lesions that eventually may become symptomatic or represent benign changes that may never exceed injury threshold [16].

The breaststroke kick or whip kick used by breaststroke swimmers is regarded as a highly abnormal movement that can induce pain in essentially normal knees [5]. It is a complex knee extension activity designed for propulsion. In the propulsive phase, with the tibia in a position of external rotation and valgus (at which time the Q-angle is effectively increased), the knee is forcefully extended against the resistance of the water. This movement results in high lateral patellofemoral contact loads and increased lateral patellar displacement forces, all of which result in the production of unusual patellar and trochlear shear stresses [17,18].

In a normal knee, the boney shape of the trochlea is of critical importance in providing patellar stability. It acts as a buttress limiting lateral patellar displacement. Knees with trochlear dysplasia fail to constrain the patella and have been shown to allow more than 1 cm of increased lateral patellar translation, a finding that likely contributes to increased shear stresses [19].

There has been no documentation of any association of trochlear dysplasia and of lateral trochlear OCD. Specific MRI review studies of OCD involving the lateral femoral sulcus report no underlying trochlear abnormalities [20]. Ali et al. [21] have noted a high incidence of severe patellofemoral cartilage defects in cases of abnormal trochlear morphology in their MRI review, but report no cases of OCD. However, a hypoplastic trochlear sulcus, as defined by MRI measurement of trochlear depth, appears to be a major contributing factor in the development of OCD of the patella [22].

4. CONCLUSION

The findings in the present case report would suggest a very unique situation in which a combination of factors acting simultaneously contributed to stress accumulation resulting in injury. We propose that high lateral trochlear shear stresses were created by the repetitive whip kick activity in the knee of a breaststroker swimmer and that these unusual stresses were further magnified by underlying trochlear dysplasia. With continued intense training efforts, the shear stresses eventually exceeded a critical threshold of the subchondral bone of this region and failure occurred. This resulted in OCD of the lateral trochlea, an unusual source of knee pain.

The current case report contains a description of a new diagnostic test of resisted knee extension with the tibia held in external rotation used in the evaluation of knee pain. This test appears to be sensitive for detecting lesions on either patellar or trochlear surfaces such as OCD in a lateral trochlear location.

To our knowledge, this is the first case report in the literature of OCD of the lateral femoral trochlear groove found in association with trochlear dysplasia. It is also the first report of this lesion in a breaststroke swimmer's knee. This case supports the role of repetitive microtrauma and documents the important contribution of altered patellofemoral mechanics in the development of lateral trochlear OCD.

COMPETING INTERESTS

Author has declared that no competing interests exist.

REFERENCES

1. Kennedy JC, Hawkins RJ. Breaststroker's knee. Phys Sportsmed. 1974;2:33–35.
2. Stulberg SD, Shulman K, Stuart S, Culp P. Breaststroker's knee: Pathology, etiology, and treatment. Am J Sports Med. 1980;8(3):164–171.
3. Keskinen K, Eriksson E, Komi P. Breaststroke swimmer's knee: A biomechanical and arthroscopic study. Am J Sports Med. 1980;8(4):228-231.
4. Rovere GD, Nichols AW. Frequency, associated factors, and treatment of breaststroker's knee in competitive swimmers. Am J Sports Med. 1985;13(2):99-104.
5. Vizsolyi P, Taunton J, Robertson G, Filsinger L, Shannon HS, Whittingham D, et al. Breaststroker's knee: An analysis of epidemiological and biomechanical factors. Am J Sports Med. 1987;15(1):63-71.
6. Wilson JN. A diagnostic sign in osteochondritis dissecans of the knee. J Bone Joint Surg Am. 1967;49(3):477-480.
7. Insall J, Falvo KA, Wise DW. Chondromalacia patellae. A prospective study. J Bone Joint Surg Am. 1976;58(1):1-8.
8. Dejour H, Walch G, Nove-Josserand L, Guier C. Factors of patellar instability: An anatomic radiographic study. Knee Surg Sports Traumatol Arthrosc. 1994;2:19-26.
9. Davies AP, Costa ML, Shepstone L, Glasgow MM, Donell S. The sulcus angle and malalignment of the extensor mechanism of the knee. J Bone Joint Surg Br. 2000;82(8):1162-1166.
10. Cahill B. Osteochondritis dissecans of the knee: Treatment of juvenile and adult forms. J Am Acad Orthop Surg. 1995;3(4):237-247.
11. Kocher MS, Tucker R, Ganley TJ, Flynn JM. Management of Osteochondritis dissecans of the knee: Current concepts review. Am J Sports Med. 2006;34:1181-1191.
12. Aichroth P. Osteochondritis dissecans of the knee. A clinical survey. J Bone Joint Surg Br. 1971;53B:440–447.
13. Peters TA, McLean ID. Osteochondritis dissecans of the patellofemoral joint. Am J Sports Med. 2000;28(1):63-67.
14. Smith JB. Osteochondritis dissecans of the trochlea of the femur. Arthroscopy. 1990;6:11-17.
15. Mori Y, Kubo M, Shimokoube J, Kuroki Y. Osteochondritis dissecans of the patellofemoral groove in athletes: Unusual cases of patellofemoral pain. Knee Surg Sports Traumatol Arthrosc. 1994;2:242-244.
16. Soder RB, Mizerkowski MD, Petkowicz R, Baldisserotto M. MRI of the knee in asymptomatic adolescent swimmers: A controlled study. Br J Sports Med. 2012;46(4):268-272.
17. Huberti HH, Hayes WC. Patellofemoral contact pressures. The influence of q-angle and tendofemoral contact. J Bone Joint Surg Am. 1984;66(5):715-724.
18. Mizuno Y, Kumagai M, Mattessich SM, Elias JJ, Ramrattan N. Q-angle influences tibiofemoral and patellofemoral kinematics. J Orthop Res. 2001;19:834-840.
19. Amis AA, Firer P, Mountney J, Senavongse W, Thomas NP. Anatomy and biomechanics of the medial patellofemoral ligament. Knee. 2003;10:215–220.

20. Boutin RD, Januario JA, Newberg AH, Gundry CR, Newman JS. MR imaging features of osteochondritis dissecans of the femoral sulcus. AJR Am J Roentgenol. 2003;180(3):641-645.
21. Ali SA, Helmer R, Terk MR. Analysis of the patellofemoral region on MRI: Association of abnormal trochlear morphology with severe cartilage defects. AJR Am J Roentgenol. 2010;194(3):721-727.
22. Choi YS, Cohen NA, Potter HG, Mintz DN. Magnetic resonance imaging of osteochondritis dissecans of the patella. Skeletal Radiol. 2007;36(10):929-935.

Peer-review history:
The peer review history for this paper can be accessed here:
http://www.sciencedomain.org/review-history.php?iid=637&id=22&aid=6130