Correlation between trochlear dysplasia and anterior cruciate ligament injury

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ABSTRACT

Purpose. To evaluate the correlation between trochlear dysplasia and anterior cruciate ligament (ACL) injury

Methods. Magnetic resonance images (MRIs) of 95 knees in 54 males and 36 females aged 4 to 74 (mean, 28) years who had anterior knee pain and suspected ligamentous injury were reviewed. The MRIs were independently reviewed by 2 musculoskeletal radiologists on 2 occasions. According to the Dejour classification, trochlear dysplasia was classified into types A, B, C, and D. Intra-articular injuries/disorders of the patients included patellofemoral osteoarthritis, chondromalacia patella, meniscal tears, and ligamentous injuries. Intra- and inter-observer variability was calculated.

Results. 58 of the knees had trochlear dysplasia, 38 of which were Dejour type A. The intra- and inter-observer variability was good to excellent (Kappa=0.76–1). ACL tear was the most common injury (n=13). No ACL injury occurred in patients without trochlear dysplasia. The odds of having sustained an ACL injury were 8.8 fold greater in Dejour type-A knees than in non-type-A knees (p=0.023).

Conclusion. Dejour type-A trochlear dysplasia was associated with ACL injuries.

Key words: anterior cruciate ligament; knee injuries

INTRODUCTION

The trochlear groove is the anterior continuation of the intercondylar notch that forms the femoral articular surface of the patellofemoral joint (PFJ). Its depth and morphology affect patellar stability during flexion and extension of the knee. Trochlear dysplasia is an abnormal morphology characterised by a shallow trochlear angle and depth. This can be assessed by measuring the sulcus angle on skyline-view radiographs, axial-view computed tomography, or magnetic resonance imaging. The sulcus angle has been used to evaluate patellofemoral instability. Females with a narrow intercondylar notch are more...
likely to have anterior cruciate ligament (ACL) tears. The incidence of patellar dislocation and PFJ dysplasia in females is also higher. This study investigated the association of trochlear dysplasia with ACL tears.

MATERIALS AND METHODS

Magnetic resonance images (MRIs) of 95 knees in 54 men and 36 women aged 4 to 74 (mean, 28) years who had anterior knee pain and suspected ligamentous injury were reviewed. Standard MRI sequences were used. These included coronal high-resolution, intermediate-weighted (2000/36, 3 mm, 512x70, FOV-10), T2-weighted, fat-suppressed (3660/90, 3 mm, 512x50, FOV-12), axial STIR (5500/60, 5 mm, 512x45, FOV-15), sagittal proton-density (2000/14, 3 mm, 512x50, FOV-18), and gradient echo sequences (700/10, 3 mm, 512x50, FOV-16).

The MRIs were independently reviewed by 2 musculoskeletal radiologists on 2 occasions separated by an interval of 8 months. In cases of disagreement, a consensus was reached. According to the Dejour classification, trochlear dysplasia was classified into types A (shallow trochlear sulcus), B (flat or convex trochlea), C (hypoplastic medial facet), D (cliff-shaped trochlea) [Fig.]. Intra-articular injuries/disorders of the patients that were assessed included patellofemoral osteoarthritis, chondromalacia patella, meniscal tears, and ligamentous injuries. Results were analysed using Fisher’s exact test and odds ratios. Cohen’s Kappa was calculated to study the intra- and inter-observer variability.

RESULTS

58 of the knees had trochlear dysplasia, 38 of which were Dejour type A (Table). In one knee, classification was not feasible owing to movement artefact. The intra- and inter-observer variability was good to excellent (Kappa=0.76–1). ACL tear was the most common injury (n=13). No ACL injury occurred in patients without trochlear dysplasia. The odds of having sustained an ACL injury were 8.8 fold (95% confidence interval, 1.13–83.6) greater in Dejour type-A knees than in non-type-A knees (p=0.023), but the difference was not significant in terms of medial meniscal tear, PCL tear, chondromalacia, and patellofemoral osteoarthritis.

DISCUSSION

A normal trochlear sulcus is essential for the normal biomechanics of the extensor mechanism. The diagnosis of the trochlea dysplasia can be made using radiography and magnetic resonance imaging, which is increasingly used.

In our series, the rate of trochlear dysplasia was higher than that in others, probably owing to a selection bias, as all patients were referred from a specialist knee clinic. Nonetheless, the proportions of Dejour types were comparable to those in other

The male predilection of ACL tears could be attributed to the higher number of male patients in our series and their ages.

The intercondylar notch is narrower and shorter in women than men.11 The rate of ACL injuries is higher in people, especially women, with narrower intercondylar notch.4 In patients with a small intercondylar notch, ACL tear is attributed to impingement of the ACL by the notch.12 As the trochlear notch is an extension of the intercondylar notch, any dysplasia of the trochlear groove is likely to be associated with a dysplastic intercondylar notch. The incidence of ACL injuries is higher in knees with a narrow notch. Biomechanically, in those with trochlear dysplasia, the increased stress on the anteromedial band of the ACL in the last few degrees of extension further increases in a partially flexed knee. Therefore, increased ACL loading can occur secondary to a malfunctioning extensor mechanism.13,14 In addition, patellofemoral maltracking with subluxation of the patella can also occur. Stresses increase disproportionately and involve mainly the lateral facet of the patella causing degeneration of the patellar cartilage.15 In patients with ligamentous injuries and meniscal tears, degeneration of the knee predominantly involves the tibiofemoral joint rather than the PFJ. The incidence of patellofemoral osteoarthritis with patellofemoral maltracking also increases.15 In our series, the rate of patellofemoral arthropathy was much less than that reported by others (10% vs. 65%).15 This could be due to the presence of very early degenerative change and lack of cartilage-specific MRI sequences of the PFJ. Chondromalacia patella is not associated with trochlear morphology.16,17 We suggest screening young athletes for trochlear dysplasia to increase their awareness of ACL injuries.

**DISCLOSURE**

No conflicts of interest were declared by the authors.

**REFERENCES**