

ACL Degeneration as an Early Marker of Future Osteoarthritic Changes in the Knee

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Summary:

This study provides evidence in support of an association between degeneration of the posterolateral (PL) bundle of the ACL, as indicated increased MRI signal intensity and the development of symptomatic radiographic knee osteoarthritis within 4 years.

Abstract:

INTRODUCTION

Atraumatic degeneration of the ACL is prevalent in knees with osteoarthritis (OA).¹ The posterolateral (PL) bundle is degenerated more often and to a higher degree than the anteromedial (AM) bundle.² These degenerative changes can precede or initiate the development of OA.³ The primary aim of this study is to determine if degeneration of the AM and/or PL bundles predicts the future development of symptomatic, radiographic knee OA.

METHODS

This case-control study included subjects from the "incidence" cohort of the Osteoarthritis Initiative (OAI), which is a prospective longitudinal study of individuals at "elevated risk" of developing OA over 4 years. Knees were determined to have OA if both symptoms and radiographic findings were present. Ninety-eight subjects with (cases) and 98 controls without symptomatic, radiographic OA at the end of 4 years were selected and matched for sex, age and BMI. Subjects were excluded if they had a partial or complete ACL tear on baseline MRI. Baseline-levels of ACL degeneration were quantified using MRI signal intensity as a marker of degeneration. MRI signal intensities were standardized using the signal/noise quotient (SNQ): $SNQ = (\text{signal ACL} - \text{signal patellar tendon}) / \text{signal air}$. SNQs of the proximal, mid and distal portions of the AM and PL bundles were calculated. The mean SNQ for each bundle were also calculated by averaging all portions of each bundle. The measurements were made by 2 independent masked raters. Statistical analysis included paired t-tests to determine differences in the SNQs of the AM vs. PL bundles and differences in cases vs. controls. Intra-class correlation coefficients (ICCs) were calculated to determine reliability using 10% of subjects.

RESULTS

There were no differences in age (60.0 ± 8.5 vs. 59.9 ± 8.3) and BMI (29.4 ± 4.7 vs. 29.4 ± 5.4) for controls and cases. Seventy-four percent of subjects in each group were female. The PL bundle had higher mean SNQs than the AM bundle in cases (7.1 vs. 4.0, $p < .001$, controls (6.5 vs. 4.2, $p < .001$) and both groups combined (6.8 vs. 4.1, $p < .001$). There were no significant differences in AM bundle SNQs in cases vs. controls (mean SNQ: 4.0 vs. 4.2, $p = .478$). The SNQs of the proximal and distal portions of the PL bundles were significantly higher in cases vs. controls (proximal: 6.8 vs. 6.1, $p = .035$; distal: 7.7 vs. 6.8, $p = .024$). The mean-PL SNQ was higher in cases vs. controls, although not statistically significant (7.1 vs. 6.5, $p = .063$). The difference between mean SNQs of the PL and AM bundles was greater in cases vs. controls (3.1 vs. 2.3, $p = .015$). The ICC for reliability was 0.87.

CONCLUSION

This study provides evidence of an association between degeneration of the proximal and distal region of the PL

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bundle and the future development of OA. The finding that the PL bundle has significantly higher signal intensity than the AM bundle (difference between means of bundles) in cases compared to controls provides additional support of an association between the development of knee OA and preceding PL bundle degeneration.