Intercondylar Notch Stenosis in Degenerative Arthritis of the Knee

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Purpose: To present a classification of intercondylar notch stenosis (IS) adjacent to the anterior cruciate ligament (ACL) in degenerative knee arthritis, to raise awareness of this disorder, to describe the arthroscopic findings, and to promote an organized approach to its treatment with favorable results. **Type of Study:** Case series. **Methods:** Of 362 arthroscopies in patients with gonarthrosis, we identified 122 knees in 96 patients (34%) with central knee pain and subjective instability without ACL laxity to determine the notch changes adjacent to the ACL. We followed a cohort of 69 knees in 64 patients, 47 female (73%) and 17 male (27%), excluding 53 knees in 32 patients for other symptomatic lesions, noncompliance with protocol, or loss to follow-up. The average patient age was 66 years (range, 53 to 78 years). Stenosis was classified as: type I, anterior; type II, lateral; type III, mixed; and type IV, massive. Diagnosis was determined by manipulation during arthroscopy to visualize impingement and was followed by notchplasty. Average follow-up was 26 months (range, 12 to 36 months). **Results:** Type III was most common, appearing in 48% of knees. Type I was found in 29%, type II in 20%, and type IV in 3% of knees. Preoperatively, central pain occurred in all patients, being moderate in 40 knees (58%) and severe in 26 knees (38%), with diminished strength and subjective instability in all cases; only 42 (61%) had knee extension loss. Flexion contracture resolved in 81% of cases; 90% had good to excellent pain relief and 74% excellent relief of subjective instability, without significant complications. **Conclusions:** Intercondylar notch stenosis in the arthritic knee may be a cause of ACL damage, symptomatic instability, and loss of extension. A structured approach to diagnosis and treatment was beneficial in restoring more normal function for our patients and may prevent disease progression. **Level of Evidence:** Level IV. **Key Words:** Knee—Degenerative intercondylar stenosis—ACL damage—Arthroscopic classification—Decompression.

With routine knee arthroscopy, one can appreciate the normal congruency between the intercondylar notch and the anterior cruciate ligament (ACL), especially with knee extension. The implication of this relationship is that the notch must maintain its normal anatomy and dimensions in relation to the ACL for normal function, where full extension exerts biomechanical pressure and tension on the ACL,[1] causing stimulation of the higher concentration of mechanoreceptors found in the distal third of the ligament.[2] Unfortunately, the loss of this congruent relationship appears when osteophytes in the notch produce an intercondylar notch stenosis (IS) with reduction of the capacity of the notch to accommodate the ACL. In addition to earlier stimulation of the mechanoreceptors, osteophytes can cause a progressive impingement or erosion of the ACL during knee motion. Disruption of the ACL's structural integrity disrupts proprioceptive feedback[3] and causes quadriceps inhibition[4] and altered kinematics, leading to further progression of degenerative changes.[5] The sensory function of the ACL is essential for functional stability of the knee[6] and receptor afferents in the ACL

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contribute to muscle stiffness about the knee.[7,8] The ACL acts as the primary stabilizer of anterior tibial translation, and its role in afferent proprioceptive functional and pain feedback through its neural elements is well established.[9,10]

It is understandable that when the ligament is subjected to abrasion, impingement, compression, and progressive shear stress, its function can be altered, producing pathologic symptoms. Based on known ACL functions, observations of notch impingement, and suspicion that decompression of the notch might intervene in the pathologic degenerative process, we developed a classification of IS based on arthroscopically observed areas of ACL impingement and observed the response to arthroscopic decompression in a cohort of patients with these findings.

METHODS

Between December 1997 and January 2000, 362 outpatient arthroscopic procedures were performed at our institution in patients with symptoms and radiologic signs of primary gonarthrosis. During this time, we identified 122 knees (34%) in 96 patients with symptoms of central knee pain as well as subjective instability (referred to as knee failure, giving way, or knee insecurity while going down stairs, running, walking, and sitting) without patellofemoral disorder or actual ACL laxity or clinical findings sufficient to explain the instability symptoms. In these cases, we evaluated the degenerative notch changes and their relation to the ACL. Fifty-three knees (66%) in 32 patients were excluded for other causes of pain and instability such as meniscal tears and large osteochondral defects or actual knee laxity, noncompliance with protocol, or loss to follow-up. We included 69 knees in 64 patients; 37 (58%) were right knees, 22 (34%) were left knees, and 5 (8%) were bilateral knees (with surgery at different times). Forty-seven (73%) patients were female and 17 (27%) were male. The average age was 66 years, with a range of 53 to 78 years. The average follow-up was 26 months with a range of 12 to 36 months. Arthroscopic evaluation and treatment of IS was carried out with postoperative evaluation.

Preoperative Clinical Evaluation

The patients were evaluated and examined by 1 of the 2 first authors or both, and rated as follows: (1) *Intensity of pain* (visual analog scale of 0-10: mild 1-3, moderate 4-7, severe 8-10). (2) *Grade of anterior instability feeling* (0-10 scale, none = 0, mild 1-2, moderate 3-6, severe 7-10: symptoms with running, 1 point; stairs, 2 points; walking, 3 points; sitting, 4 points). (3) *Muscle strength* (scale of Lovett 5-0: normal muscle strength against resistance, 5; partial muscle strength against resistance, 4; muscle strength against gravity, 3; muscle strength without gravity, 2; muscle fibrillation, 1; no muscle strength, 0). (4) *Goniometry* (full extension = 0°).

Radiographic evaluation included 1 tunnel view and 1 Rosenburg posteroanterior weight-bearing view in 45° of flexion[11-13] noting any osteophytes within the tunnel. IS was classified by the location and combination of femoral intercondylar tunnel osteophytes (roof or condylar). Tibial hypertrophic spines were considered as indirectly suggestive of degenerative changes reaching the tunnel but were not used for classification of IS.

Technique of Diagnostic Arthroscopy

Arthroscopy was performed by the 2 first authors. The patient is placed supine on the operating table with the knee in a thigh holder at 30° of flexion. Intra-articular anesthesia with bupivacaine is used. A thigh tourniquet is placed and insufflated as needed. The knee is distended with normal saline solution and standard arthroscopy of the knee is carried out with the inferior lateral portal for placement of the 30° lens and the inferior medial portal for placement of instrumentation. Causes of instability such as meniscal tears and large osteochondral defects with loose bodies are treated (these cases were excluded from the study cohort). The presence of osteophytes narrowing the notch and their impact on the ACL is tested with a probe. Diagnosis is confirmed by flexion-extension maneuvers during arthroscopy to reproduce the impingement under direct vision and impingement is classified as follows.

Arthroscopic Classification Method

The distribution of lesions of the ACL are anatomically described within the distal, middle, or proximal portion and in its anterior, posterior, or lateral aspects. We take the combination of 1 portion and 1 side to describe a lesion area. The classification describes the areas in which the ACL is often damaged by tunnel osteophytes but excludes the posterior and proximal portions, which never showed damage.

Fraying, erosion, or impingement of the ACL by a tunnel osteophyte is considered a mismatch between the notch and the ACL, which is classified by type independent of the severity of ACL damage. An ar-