LABRAL SECTION DOES NOT CAUSE RAPID DEGENERATION IN A SHEEP HIP MODEL

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Relevance to Musculoskeletal Conditions:

Hip arthroscopy has shown a relationship between injuries to the acetabular labrum and arthritis of the hip\(^2\), but it is not known whether labral disfunction itself will lead to arthrosis in a joint that is not dysplastic. Thus, ideal treatment of a labral tear — resection, repair or observation -- is not defined.

Introduction:

In humans and experimental models, meniscectomy leads to degenerative changes in the knee joint\(^1,4\). The consequences of resection of the labrum, itself a robust intra-articular fibrocartilaginous structure, have not been delineated. In this study, the hypothesis that removal of the labrum will lead to hip degeneration and altered mechanics is studied in an animal model.

Materials and Methods:

Following institutional animal care guidelines, a 15mm segment of acetabular labrum was removed from one, randomly selected hip joint of 20 adult white alpine sheep using a trochanteric osteotomy. A sham procedure including capsulotomy was performed on the opposite hip. With rigid trochanteric fixation, the sheep could walk immediately and were allowed to do so up to the time of sacrifice at 6 weeks (6 sheep), 12 weeks (8 sheep) and 6 months (6 sheep). Immediately following sacrifice, the entire hip joint was removed, loaded at one body weight for thirty minutes within 8 hours and plunge-frozen in pre-cooled isopentane slush at – 160° C. Fixation was by freeze-substitution with aldehydes in methanol-acetone solutions and was followed by embedding in methylmethacrylate. Sections were cut through the center of the acetabular dome in an orientation that included the area of labral resection. The specimens were then stained by toluidine blue for study by light microscopy (LM). The hip joints were evaluated by three independent observers using LM at 4 to 100X magnification for evidence of: labral healing, joint subluxation, bone remodeling and degenerative changes in articular cartilage surfaces.

Results:

On all but four hips, a dense scar (Fig. 1) had formed where the labrum had been removed. Replacement by scar was evident in all hips in the 6 month group. This tissue was distinguished from intact labrum by the absence of characteristic circumferential bands. In all cases, the capsule had healed and, except in the four cases where no distinct scar formed, the lateral femoral head was contained by scar or labrum. All joints remained located. The observers identified signs of joint remodeling or arthrosis in over half of the animals, but these changes were mild and usually symmetrical. The most common sign of remodeling was in the subchondral bone on the medial aspect of the acetabulum, and just lateral to the fossa (Fig. 1). Degenerative arthritis was visible as superficial fibrillation of the articular cartilage on the lateral, uncovered portion of the femoral head, or, more rarely, on the superior acetabular surface adjacent to the fossa. The presence of hypertrophic chondrocyte clusters was evident only in five hips, mostly on the lateral, cartilage-covered portion of the femoral head and/or in the medial cartilage wall of the acetabulum. These changes were neither more common nor more severe on the side of labral resection.

Discussion:

This is the first animal study of acetabular labral injury. While small and of limited duration, several observations are important. First, the labrum, unlike the meniscus, evinced rapid repair and filled the void created by surgery. The joints did not sublux, and joint surface destruction was not observed in weight-bearing areas. Especially when compared to effects of rabbit meniscectomy and canine ACL section in a similar time period, resection of the acetabular labrum does not rapidly lead to arthrosis. Fixation of whole joints under load made it possible to evaluate joint congruity, and to correlate regions of arthrosis with joint anatomy.

These sheep were not subjected to heavy exercise, but they all returned to normal activity and gait with remarkable speed. Thus disuse is not a likely factor in joint recovery.

The negative findings do not contradict clinical experience. Although labral abnormalities are associated with hip arthrosis, the abnormalities may be secondary. A tendency to subluxate, as in acetabular dysplasia, may render a hip more sensitive to labral disruption. Dysplasia could be introduced into a model.

Spontaneous degenerative changes in the alpine sheep hip are too prevalent for the species to serve as an ideal model, but it may be difficult to find a large animal with no such tendency.

References:


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**Figure 1 (LM): close frontal view of a left sheep hip joint showing the main loading area and a scar (arrow) replacing resected labrum. Load was applied from above (white arrow). Typical subchondral remodeling lateral to the fossa is seen to the left of the white arrow. 10X magnification.**