

CURRENT CONCEPT REVIEW**Evidence-Based ACL Reconstruction**

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*Research performed at La Paz University Hospital, Madrid, Spain**Received: 6 November 2014**Accepted: 15 December 2014***Abstract**

There is controversy in the literature regarding a number of topics related to anterior cruciate ligament (ACL) reconstruction. The purpose of this article is to answer the following questions: 1) Bone-patellar tendon-bone reconstruction (BPTB-R) or hamstring reconstruction (H-R); 2) Double bundle or single bundle; 3) Allograft or autograft; 4) Early or late reconstruction; 5) Rate of return to sports after ACL reconstruction; 6) Rate of osteoarthritis after ACL reconstruction. A Cochrane Library and PubMed (MEDLINE) search of systematic reviews and meta-analysis related to ACL reconstruction was performed. The key words were: ACL reconstruction, systematic reviews and meta-analysis. The main criteria for selection were that the articles were systematic reviews and meta-analyses focused on the aforementioned questions. Sixty-nine articles were found, but only 26 were selected and reviewed because they had a high grade (I-II) of evidence. BPTB-R was associated with better postoperative knee stability but with a higher rate of morbidity. However, the results of both procedures in terms of functional outcome in the long-term were similar. The double-bundle ACL reconstruction technique showed better outcomes in rotational laxity, although functional recovery was similar between single-bundle and double-bundle. Autograft yielded better results than allograft. There was no difference between early and delayed reconstruction. 82% of patients were able to return to some kind of sport participation. 28% of patients presented radiological signs of osteoarthritis with a follow-up of minimum 10 years.

Key words: ACL, BPTB, Hamstring, Reconstruction**Introduction**

Anterior cruciate ligament (ACL) injury is very frequent, not only in professional athletes but also-increasingly often- in people who practice sports regularly. Conservative treatment usually fails to eliminate recurrent symptoms during the return to activities. Additionally, with subsequent instability episodes, patients may show an accelerated onset of degenerative joint changes. ACL reconstruction aims to eliminate symptoms and prevent such degenerative joint changes.

There is controversy in the literature regarding a number of topics related to ACL reconstruction (1-5). These topics are the following: 1) Bone-patellar tendon-bone reconstruction (BPTB-R) or hamstring reconstruction (H-R); 2) Double bundle or single bundle; 3) Allograft or autograft; 4) Early or late reconstruction; 5) Rate of return to sports after ACL

reconstruction; 6) Rate of osteoarthritis after ACL reconstruction. The purpose of this article is to try to provide an answer to the aforementioned questions based on a review of previously reported systematic reviews and meta-analyses with a high grade of evidence (grade I-II).

Methods

A review has been performed on the influence of the type of reconstruction, BPTB-R or H-R in patients undergoing ACL reconstruction. The search engines were MEDLINE (PubMed) and the Cochrane Library, and the final date was 18 March 2014. The keywords used were: ACL reconstruction, systematic review, meta-analysis. Sixty-nine articles were found, but only 26 were selected and reviewed because they had a high grade of evidence (grade I-II). The rest of articles were excluded due to their low grade of evidence (III-IV).

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Results***BPTB-R vs H-R***

In 2001 Yunes et al reported good results both with BPTB-R and H-R, but BPTB-R led to higher postoperative activity levels and greater static stability than H-R (1). In 2005 Goldblatt et al found no differences between the BPTB-R and H-R regarding the incidence of instability (2). However, H-R had a lower prevalence of patella-femoral crepitation, kneeling pain, and extension loss. In 2007 Biau et al found no difference in final overall International Knee Documentation Committee (IKDC) score or in the number of patients returning to full activity after BPTB-R and H-R (3). At last follow-up, only 41% and 33% of patients, respectively, had BPTB-R and H-R reported as normal based on the final overall IKDC score. Poolman et al found lower morbidity using H-R than using BPTB-R (4). In another report, postoperative knee instability was less common with BPTB-R than with H-R (5).

A Cochrane review found no differences between BPTB-R and H-R for long-term functional outcome (6). While BPTB-R was more likely to result in statically stable knees, it was also associated with more anterior knee problems. Another systematic review demonstrated no difference in major clinical results between BPTB-R and H-R with the exception of increased anterior knee and kneeling pain (7). Outcomes favouring BPTB-R were found by Li et al (8). In another report of Li et al, H-R and BPTB-R yielded similar results in terms of restoring knee joint function (9). H-R was inferior to BPTB-R in restoring knee joint stability, but was associated with fewer postoperative complications. No differences were found regarding cost difference, donor site morbidity, and rate of infection.

Double-bundle vs single-bundle

Several reports have found no difference between double-bundle reconstruction and single-bundle reconstruction in terms of anteroposterior and rotational knee stability (10-13). However, other authors have found that double-bundle ACL reconstruction shows better results in objective measurements of knee stability and protection against repeat ACL rupture or a new meniscal injury, and yields better clinical outcomes when compared to single-bundle ACL reconstruction (14-17). Li et al meta-analysis demonstrated the superiority of double-bundle over single-bundle anterior cruciate ligament reconstruction (18). The double-bundle ACL reconstruction technique had better outcomes in rotational laxity. However, for functional recovery, there was no significant difference between single-bundle and double-bundle reconstruction techniques.

Allograft vs autograft

In a meta-analysis, BPTB-R with autograft showed better results than BPTB-R with allograft in terms of graft rupture and hop test parameters (19). Hu et al have reported that BPTB-R with autograft might allow patients to return to higher levels of activity (20). In

another report, patients undergoing BPTB-R with autograft showed lower rates of graft rupture (12.7% vs 4.3%) and lower levels of knee laxity compared with patients undergoing BPTB-R with allograft (21).

Early or late reconstruction

Early ACL reconstructions were considered by Smith et al as those undertaken within a minimum of 3 weeks post-injury; delayed ACL reconstructions were those undertaken within a minimum of 6 weeks post-injury (22). The aforementioned authors found no difference in clinical outcome between patients who underwent early compared to delayed ACL reconstruction (22). However, Grant et al have reported that ACL reconstruction should be performed in a subacute time frame once full motion has returned (23). Kowk et al have stated that, provided a modern surgical technique and an accelerated rehabilitation protocol are used, there is no higher risk of knee stiffness if an ACL reconstruction is performed as early as 1 week after injury (24).

Return to sports

In a report, 82% of participants returned to some kind of sports participation, 63% returned to their preinjury level of participation, and 44% returned to competitive sport at final follow-up (25). Approximately 90% of participants achieved normal or nearly normal knee function when assessed postoperatively using impairment-based outcomes such as laxity and strength, and 85% when using activity-based outcomes such as the IKDC knee evaluation form. According to Arndern et al, fear of reinjury was the most common reason mentioned for a postoperative reduction in or cessation of sports participation (25).

Osteoarthritis

In a report that identified all studies concerning radiographic outcome after autologous ACL reconstruction with a follow-up of minimum 10 years, 28% of the knees showed radiological signs of osteoarthritis (IKDC grade C or D) (26). Furthermore, 50% of the patients with meniscectomy had osteoarthritis, compared with 16% of the patients without meniscectomy. Therefore, associated meniscal resection increases the risk of developing osteoarthritis.

Discussion

Regarding the type of reconstruction (BPTB-R or H-R) most authors found that BPTB-R is associated with better postoperative knee stability but with a higher rate of morbidity (1-9).

Concerning double-bundle or single-bundle reconstruction, most authors found better rotational stability with double bundle reconstruction but with similar functional results (10-18). Regarding autograft or allograft, most authors found better results with autograft (19-21).

The reported rate of return to sports after ACL reconstruction is 82% (with 63% of patients returning to their preinjury level of participation, and 44%

returning to competitive sport at final follow-up) (25).

In conclusion, BPTB-R and H-R yield similar functional results. However, BPTB-R results in better knee stability but also in a higher rate of postoperative complications. Double-bundle and single-bundle reconstructions yield similar functional results. Autograft yield better results than allograft. Most patients (82%) can return to sport activities, although 28% of them present radiological

signs of knee osteoarthritis with a follow-up of minimum 10 years.

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