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Risk factors of reoperative post anterior cruciate ligament reconstruction

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ABSTRACT

Background: Anterior Cruciate Ligament (ACL) injury is a knee injury that generally occurs in individuals who are active in sports and can be the end of a career for athletes. ACL injuries usually require surgery. After performing ACL reconstruction (ACLR), it is possible that the newly grafted ligament may fail so further surgery can be ensured by reoperative after ACLR surgery or ACLR revision. Looking at the present, the causes of revision ACL injury after surgery i.e., graft selection, graft fixation, tunnel placement, previous meniscal repair, female gender, older age, and sport type. At this time, there is still a lack of information regarding the level and risk factors for reoperative post-ACLR. Especially in Indonesia, the incidence of reoperative post-ACLR is difficult to ascertain because it is less commonly studied and measured.

Objective: To identify the reoperation risk factors following ACLR.

Methods: The literature review of articles in the form of a study of research journals using secondary data that is related to risk factors of reoperative post ACLR.

Results: Allograft (HR, 1.7-1.90), previous meniscal repair (HR, 4.19), female gender (HR, 1.75), older age (≤17 vs 26 years) (HR, 0.32), cortical suspensory fixation (HR, 1 ,24), non-anatomical tunnel position, and sport type as risk factors for reoperative after ACLR.

Conclusion: Possible risk factors for reoperative after ACLR are graft selection (allograft or autograft), graft fixation, previous meniscal repair, female gender, older age, tunnel placement, and sport type.

Keywords: ACL reconstruction, risk factors, reoperative, revision

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Background

Anterior Cruciate Ligament (ACL) injury is a knee injury that generally occurs in individuals who are active in sports and can be the end of a career for athletes.[1,2] The ACL is located in the middle of the knee joint which originates posteromedial from the lateral femoral condyle and inserts at the intercondyle of the tibial eminence which functions to maintain knee joint stability and connects the tibia to the femur.[2] An injured ACL carries a significant risk of functional instability.[3] Every year, about 175,000 ACL repairs are carried out in the US. According to references, 1.7% to 7.7% of ACL reconstruction (ACLR) patients will have a second or subsequent ACLR.[4] ACLR is an operative procedure to restore knee stability and reduce the risk of subsequent knee injuries so that you can return to sports and perform daily activities.[3,5]

After performing ACLR, there is a possibility that the newly grafted ligament may fail so further surgery may be recommended with reoperative post-ACLR or revision.[4] Currently known causes of recurrent ACL injury after surgery include graft selection, graft fixation, tunnel placement, previous meniscal repair, female gender, older age, and exercise.[6–9] Autograft has a better outcome than allograft in ACLR revision with lower laxity, complication rate, and postoperative repeat surgery.[10] It has been determined that the most frequent risk factor for reoperative post-ACLR is graft placement. [11]

Following ACLR, the musculoskeletal system undergoes several alterations. Loss of range of motion (ROM), which can affect functional activities, is one of the alterations that occur both after an injury and after surgery.[12] It is also associated with postoperative problems such as

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osteoarthritis, arthrofibrosis, quadriceps inhibition, abnormal gaits, and pain in the patellofemoral and tibiofemoral joints.[13] It is well known that a loss in the size and strength of the muscle groups around the knee following an ACL injury and ACLR leads to a reduction in muscle strength.[14] When compared to cases of primary ACL surgery, patients who underwent ACL revision had worse clinical results, patient reports, and lower rates of return to sport.[15]

At this time, there is still a paucity of information regarding the rates and risk factors for reoperative post-ACLR.[16] Particularly in Indonesia, the number of recurrent operations is difficult to ascertain because they are less commonly studied and measured.[17] So that there is also a lack of information regarding the risk factors for reoperative post-ACLR.[18] Therefore, this study wanted to find risk factors for reoperative post-ACLR.[19] By looking for risk factor of reoperative post-ACLR, it is hoped that this research can promote medium to long-term clinical and functional outcomes after ACL reconstruction.[20]

Methods

This study used a literature review study method or literature review from 5 English-language journals that were relevant to the risk factors for reoperative post-ACLR through searches from Google Scholar, PubMed, and Pedro with the keywords "ACL injury", "ACLR", "Risk Factors", "Reoperative", "Revision". The choice of literature is determined using inclusion and exclusion criteria. The inclusion criteria used in the literature review are: 1) Published literature from credible institutions, 2) The literature reviewed is literature published from the last 10 years, 3) Contains two or more variables such as ACL injury, ACLR, and Revision ACLR, 4) The references taken contain the risk factors for reoperative post-ACLR, 5) The samples used for primary ACLR and revision ACLR. The exclusion criteria in the literature review are: 1) The sample has a history of fracture. The literature used in the literature review has met the criteria set by the author.

Results

Based on David Wasserstain et.al (2013)[11] research in Ontario, Canada for 5 years (July 2003 to March 2008) showed that allograft is an independent risk factor for ACLR revision when compared with autograft. The study was conducted on patients aged 15 to 60 years identified through the hospital database. A total of 12,967 ACLR procedures with an average follow-up of 5.2 years fulfilled the established requirements. The revision rate was 2.6% (mean ± SD, 2.91 ± years for revision). In the Cox model, graft selection is a factor influencing the risk of ACLR revision. Allografts performed the ACLR index at a rate of 3.7% against autografts at 2.6% (HR, 1.7; 95% CI, 1.1-2.6; P =.02).

Based on Rick P.CSintalan et.al (2013)[8] research, previous meniscal repair, female gender, allograft, and older age are risk factors for reoperative post-ACLR. Compared to patients without meniscal tears, patients undergoing ACLR with concomitant meniscal repairs have a higher likelihood of needing additional meniscal surgery. It was discovered that the female gender and prior surgery on the index knee were important risk factors for stiffness-related reoperation. Any previous surgery can add to trauma and scar tissue formation thereby placing the knee at additional risk of post-ACLR arthrofibrosis/stiffness. The reoperation rate per 100 people per year of follow-up was 1.1 for meniscal reoperation, 0.3 for cartilage reoperation, 0.4 for hardware removal operation, and 0.4 for arthrofibrosis reoperation. The meniscal repair was a significant risk factor for additional meniscal surgeries in the ACLR index (HR, 4.19; 95% CI, 3.10-5.67). The age of the patient (17 vs. 26 years) was a significant risk factor for cartilage reoperation (HR, 0.32; 95% CI, 0.12-0.81). Risk variables for reoperation hardware removal were the use of allografts (HR, 1.90; 95% CI, 1.10-3.30) and female gender (HR, 1.75; 95% CI, 1.16-2.64). Female gender and prior surgery are risk factors for additional surgery for arthrofibrosis (HR, 2.48; 95% CI, 1.66-3.71) as well as previous surgery (HR, 3.02; 95% CI, 1.39-6.53).

Nichlas H Eysturoy et.al (2018)[14] research, patients undergoing primary ACLR with HT graft or PT graft followed up for 2 to 10 years, cortical suspensory fixation significantly increases the risk of ACLR revision. Cortical suspensory fixation, adjustable cortical suspensory fixation, intratunnel transfixation, and interference screw (aperture) fixation were the four categories into which the femoral fixation structures were grouped based on their functional principles. Information on graft fixation methods and revision rates were supplied by the Danish ACL Reconstruction Registry. In comparison to the mean, the cortical suspensory fixation was linked to a higher probability of revision (HR, 1.24 [95% CI, 1.07-1.44]; P.05). In comparison to the mean, the intratunnel transfixation demonstrated a considerably lower risk of revision (HR,0.83 [95% CI, 0.73-0.94]; P.05).

Kevin J. Byrne et.al (2021)[15] research, 315 individuals who underwent ACLR Anterior and proximal (high) femoral tunnels in ACLR were discovered to be separate risk factors for ACL revision between January 2012 and January 2017. Each patient's location for the femoral tunnel was identified using lateral radiographs taken following ACLR using the quadrant approach. The posterior-anterior (PA) and proximal-distal (PD) dimensions of the femoral tunnel center are measured and expressed as a percentage of the overall distance (mid-normal anatomic footprint: PA 25% and PD 29%). In terms of the PA dimension, the revision group placed anterior femoral tunnels substantially more frequently than the control group (38%-11% vs. 28%-6%, p=0.01).

Discussions

One of the most frequent orthopedic surgery procedures in sports medicine is ACLR.[16] To return to sports as soon as possible, surgery can be done. However, it is not uncommon for ACL operations to fail, so repeat operations are recommended. Failure of an ACL surgery can be influenced by the type of graft, meniscal repair, gender, age, graft fixation, and tunnel.[8,15]

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The selection of graft type is a risk factor for ACLR revision. The various types of grafts for ACLR include autografts, allografts, and synthetic grafts (very rarely used). The ideal graft for the ACLR is biomechanically similar to the original ligament, easy to remove, and well attached to the bone. Autografts are more commonly used than allografts or synthetic grafts. The three most frequently used autograft alternatives are the hamstring, quadriceps, and patellar tendon. However, in recent decades the use of allografts has increased. Synthetic grafts are rarely used because of poor medium-term outcomes.[17] The use of allograft has been shown to increase ACLR revision compared to autograft which is supported by research by David Wasserstein et.al and Rick P. Csintalan et.al.

Meniscal repair, gender, and age are risk factors for ACLR revision. Research by Rick P. Csintalan et.al. discovered that individuals who received ACLR with concomitant meniscal repairs had a higher chance of undergoing a second meniscal surgery than those who did not have torn meniscal. It was found that elderly patients had a higher probability of undergoing further surgery for cartilage lesions. Compared to male patients, female patients are more likely to require additional surgeries for stiffness and arthrofibrosis.[18]

Revision of the ACLR is reportedly at risk due to graft fixation. Research conducted by Nichlas H Eysturoy et.al. in patients undergoing primary ACLR with HT graft or PT graft that cortical suspensory fixation significantly increases the risk of ACLR revision. Based on their functional principles, we classified the femoral fixation constructs into four groups: adjustable cortical suspensory fixation, cortical suspensory fixation, intratunnel transfixation, and interference screw (aperture) fixation. The risk of revision following cortical suspensory fixation was shown to be 21% higher overall, whereas the risk of revision following intratunnel transfixation was 17% lower.[14]

When compared to individuals who did not require ACL revision, patients who underwent ACL revision had their femoral tunnels positioned more anteriorly, more proximally, or both. Anterior and proximal (high) femoral tunnels in the ACLR were discovered to be an independent risk factor for ACL revision, according to research by Kevin J. Byrne et al. The posterior-anterior (PA) and proximal-distal (PD) dimensions of the femoral tunnel center are measured and expressed as a percentage of the overall distance (mid-normal anatomic footprint: PA 25% and PD 29%). In the PA dimension, patients who received revision had femoral tunnels that were significantly more anterior than those who did not. In the PD dimension, patients who underwent revision had femoral tunnels that were significantly more proximal (high) than those who did not.

In addition to the above factors, the type of exercise can affect re-rupture ACL post-ACLR. In the study of Itai Gans et al. explained that of the 12 types of sports (men's and women's basketball, men's and women's ice hockey men's and women's lacrosse, men's and women's soccer, women's gymnast, women's volleyball, women's field hockey, football) that football , women's gymnasts, and Women's soccer has a high rate for re-rupture ACL. Women's soccer significantly increases rerupture compared to men's soccer. According to the Multicenter ACL Revision Study (MARS), non-contact mechanisms of rupture were present in 55% of patients who underwent revision ACLR. Female athletes tend to have deficiencies in neuromuscular control, imbalances in flexibility, coordination, and muscle strength which may predispose them to rerupture ACL.[19]

Conclusion

The above results indicate that the possible risk factors for ACLR revision are graft selection (allograft or autograft), graft fixation, previous meniscal repair, female gender, older age, tunnel placement, and type of sport.

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