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Early Operative Versus Delayed or Nonoperative Treatment of Anterior Cruciate Ligament Injuries in Pediatric Patients

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Clinical Questions: In pediatric patients, does early operative treatment of an anterior cruciate ligament (ACL) injury result in decreased knee instability compared with delayed or nonoperative treatment?

Data Sources: This review focused on the PubMed/MEDLINE and EMBASE databases. The following query searches were used: *ACL* or *anterior cruciate ligament* and *young* or *child* or *children* or *pediatric* or *immature*. Dates searched were not specified. A separate search was also conducted of abstracts published between 2009 and 2011 from the American Academy of Orthopaedic Surgeons; American Orthopaedic Society for Sports Medicine; International Society of Arthroscopy, Knee Surgery, and Orthopaedic Sports Medicine; European Society of Sports Traumatology, Knee Surgery, and Arthroscopy; American Orthopaedic Association; Arthroscopy Association of North America; Pediatric Orthopaedic Society of North America; and American Academy of Pediatrics conferences.

Study Selection: Available studies were included only if they were written in English; were of level 1, 2, or 3 evidence (grading taxonomy not stated); were cohort designs that compared nonoperative and operative treatments; involved an early versus delayed ACL reconstruction that could be prospective or retrospective; and reported primary outcome interest measures. Animal studies, basic science studies, case series, reviews, commentaries, and editorials were excluded from the review.

Data Extraction: A systematic assessment tool, Guide to Community Preventive Services: Systematic Reviews and Evidence-Based Recommendations, was used by 2 of the authors to independently grade the quality of each study that met the inclusion criteria. The tool focused on 6 areas: intervention and study description, sampling, measurement, analysis, interpretation of results, and other execution factors. This tool helped to ensure consistency, reduce bias, and improve the validity and reliability of preventive health care studies. Eleven studies met the inclusion criteria. Six studies compared nonoperative with operative treatment, and 5 studies compared early reconstruction (open physes) with delayed reconstruction (closed physes). Studies in this meta-analysis consisted of the following: four level-3 prospective studies, four level-3 retrospective studies, one level-2 retrospective study, one level-3 case-control study, and one level-3 study with both prospective and retrospective data collection. All of the studies included data related to patient demographics, treatment interventions, follow-up duration, presence of any meniscal symptoms, time to return to sport participation, patient-reported outcomes (International Knee Documentation Committee [IKDC], Lysholm, or Tegner scores), the need for a second surgical procedure, and any posttreatment problems.

Main Results: Of those who chose the nonoperative route, 75% reported instability, whereas only 13.6% of those who had surgery reported instability. These data also showed that nonoperative or delayed-operative patients were 33.7 times more likely to report instability than the early operative group. Those who chose the nonoperative route had a 12 times greater risk (odds ratio = 12.2, 95% confidence interval = 1.55, 96.3) of developing a meniscal tear after the initial injury. Three studies included in the meta-analysis reported return to sport status, but only 2 studies provided adequate data for both operative and nonoperative patients. In 1 study, 92% of operative patients were able to return to sport, but only 43.75% of nonoperative patients were able to do so. The second study reported that all operative and nonoperative patients were able to return to the same level of sport after injury. Of those in the early operative group, 6% required a repeat surgical intervention for either an ACL rerupture or a meniscal tear, and 19% of those who initially chose nonoperative treatment eventually needed surgery to repair the ACL or meniscus. Findings favor the early operative group over the delayed operative and nonoperative groups based on IKDC scores. One study reported a significant difference in operative patients, with an IKDC mean score of 95 compared with 87 in the nonoperative group. Similarly, a different study reported a mean score of 94.6 in the early operative group compared with 82.4 in the delayed operative group and was stated to have met the minimal clinically important difference (MCID). The MCID was not met for the Lysholm and Tegner scores between operative and nonoperative patients.

Conclusions: The results of this meta-analysis favor early operative treatment for pediatric patients with ACL tears over delayed or nonoperative treatment. Early operative treatment is initiated shortly after the injury, while the patient is still skeletally immature and the growth plates are open. Current evidence suggests that early ACL reconstruction will result in less knee instability and a more likely return to the preinjury activity level without affecting the growth plates or causing growth disturbances.

Key Words: knee, anterior cruciate ligament reconstruction, skeletal immaturity, instability, surgical approaches

COMMENTARY

The incidence of anterior cruciate ligament (ACL) injury in the pediatric population has increased in recent years. Authors[1] investigating pediatric ACL reconstructions over a 20-year period in persons between 3 and 20 years old reported an increase from 17.6 reconstructions per 100 000-person population in 1990 to 50.9 reconstructions per 100 000-person population in 2009.[1] The peak age for ACL reconstruction was 17 years old, and reconstruction rates were 15% higher in adolescent girls than in boys.[1]

Once an ACL tear is confirmed, different treatment options are available to the patient. However, determining which treatment option is most suitable for a pediatric patient is greatly debated among surgeons.[2] The results of this meta-analysis favor early ACL reconstruction in pediatric athletes rather than delayed or nonoperative treatment. Patients who elected to have surgery shortly after injury reported less knee instability, fewer meniscal tears, higher International Knee Documentation Committee (IKDC) scores, and a greater rate of return to the preinjury participation level. Therefore, findings from this meta-analysis suggest that active young persons between the ages of 11 and 16 years (and their parents) should consider early operative treatment for an ACL tear over delayed or nonoperative treatment if the primary goal is to return to competitive levels of physical activity after treatment.

It is essential that a pediatric patient who has an ACL tear be seen by a health care practitioner who specializes in patients of this age group. An ACL injury should be managed based on the physiologic and skeletal age of the patient at the time of injury.[3] One factor to consider is the need to minimize the chance of growth disturbances in patients with significant growth remaining.[3,4] A pediatric patient's knee will typically become skeletally mature and growth plates will close between 15.6 and 17.1 years old in adolescent boys and between 15.0 and 16.9 years old in adolescent girls.[5] Anterior cruciate ligament reconstruction is achieved in those who are skeletally immature with an all-epiphysis technique in which graft tunnels are drilled in a manner that aligns them anatomically but does not disturb the growth plates. Another consideration for a pediatric patient with an ACL tear is management of the postoperative rehabilitation. Tissue-healing characteristics are different between children and adults and are not well understood in children.[6] Experts who specialize in treating the pediatric age group are more likely to understand the intricacies of caring for skeletally and muscularly immature patients and provide the best care possible for the patient. Also needed are critically appraised and evidence-based rehabilitation protocols that include exercises that are age appropriate, are able to retain the young patient's interest, and can facilitate compliance with the rehabilitation program.

It could also be advantageous for clinicians to use outcome measures to address *kinesiophobia*, or fear of movement, in pediatric athletes who typically have not experienced and attempted to return to sport after an injury of this magnitude. An outcome measure such as the Fear of Pain Questionnaire has both child and parental versions, which can help a clinician detect kinesiophobia from 2 perspectives.[7] Recognizing which aspects a patient is struggling with—mentally, physically, or both—and being able to address those concerns will greatly increase the likelihood of patient success in the rehabilitation process and in returning to the same level of physical activity. Patient-rated outcome measures, such as the pediatric version of the IKDC scale[8] and the Pediatric Quality of Life Inventory,[9] may be useful in assessing a pediatric patient. The pediatric version of the IKDC scale can help in addressing the patient's physical functioning, whereas the Pediatric Quality of Life Inventory can capture changes beyond the patient's physical functioning. Using an adult version of an outcomes measure for a pediatric patient may lead to misunderstandings and inaccurate answers.

A major limitation of this meta-analysis was the inconsistency in the treatments and outcomes measures in the individual studies. Though differences existed in some of the methods, similar results showing less favorable outcomes for delayed or nonoperative treatment, including instability, meniscal tears, and inability to return to the preinjury participation level, were noted. The authors of the meta-analysis used the minimal clinically important difference (MCID) value to compare between-groups differences. The MCID value is an indicator of meaningful change in health status from the patient's perspective, but it is intended to be used for within-subject comparisons across time points. Thus, using the MCID value for between-groups comparisons within the meta-analysis may not be the most appropriate approach. In addition, specific timelines to delineate early versus delayed treatment among the included studies were not provided in the summary tables; only generic terms such as *skeletally immature* were used to classify the early-treatment group. Future researchers should focus on studies using similar outcome measures to standardize the patient-report responses.

The meta-analysis by Ramski et al[10] favored early operative treatment for pediatric patients who are still skeletally immature rather than delayed or nonoperative treatment. Patients who opted for ACL reconstruction surgery shortly after injury, as opposed to waiting until the growth plates were closed, generally reported less knee instability, fewer meniscal tears, higher IKDC scores, and better rates of returning to the preinjury activity level.

A patient who experiences less knee instability may have a more active lifestyle and a greater chance of returning to sport and not suffering from knee instability. Experiencing the negative effects of knee instability for an extended time can be both physically and mentally taxing for a pediatric patient. Kinesiobophia from feeling the knee shifting, buckling, or giving way; meniscal tears; and early knee osteoarthritis are just a few of the problems a pediatric patient could face. All of these conditions can negatively affect the patient over time and cause unnecessary suffering, which could result in a decrease in the activity level and potentially lead to an unhealthy lifestyle.

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