

## ACL tear in kids: serious injury with high risk of osteoarthritis

Rainer Siebold<sup>1,2</sup> · Romain Seil<sup>3,4,5,6</sup> · Lars Engebretsen<sup>7,8,9</sup>

Published online: 19 December 2015

© European Society of Sports Traumatology, Knee Surgery, Arthroscopy (ESSKA) 2015



Rainer Siebold



Romain Seil



Lars Engebretsen

✉ Rainer Siebold  
rainer.siebold@atos.de

Romain Seil  
rseil@yahoo.com

Lars Engebretsen  
lars.engebretsen@medisin.uio.no

- <sup>1</sup> HKF - Center for Hip-Knee-Foot Surgery, ATOS Hospital, Heidelberg, Germany
- <sup>2</sup> Institute for Anatomy and Cell Biology, Ruprecht-Karls University of Heidelberg, Heidelberg, Germany
- <sup>3</sup> European Society of Sports Traumatology, Knee Surgery and Arthroscopy (ESSKA), Luxembourg, Luxembourg
- <sup>4</sup> Chef du Département de l'Appareil, Locomoteur, Centre Hospitalier de Luxembourg - Clinique d' Eich, Luxembourg, Luxembourg
- <sup>5</sup> Department of Orthopaedic Surgery, Luxembourg Olympic Medical Center, University of Saarland, Homburg, Saar, Germany
- <sup>6</sup> University of Saarland, Homburg, Saar, Germany
- <sup>7</sup> Department of Orthopaedic Surgery, Faculty of Medicine University of Oslo, Oslo University Hospital, Oslo, Norway
- <sup>8</sup> Cochair Oslo Sports Trauma Research Center, Oslo, Norway
- <sup>9</sup> International Olympic Committee (IOC), Lausanne, Switzerland

Paediatric ACL tears are rare, accounting for <5 % of all ACL injuries, and do rarely occur under the age of 9. It is considered as a serious injury to the knee, which cannot be repaired back to normal. The current evidence for treatment is low [12]. Some 15–20 years ago, the injury was mainly managed nonoperatively or by suture repair, which did too frequently result in unsuccessful outcomes. At that time, the diagnostic possibilities were inferior to current standards and the risk of paediatric ACL reconstruction had not been deeply evaluated yet. Therefore, many of these injuries were diagnosed late and orthopaedic surgeons were often confronted to a negative selection of ACL-injured children, presenting with secondary meniscus tears and cartilage lesions. Nowadays, we have learned that paediatric ACL reconstruction is a safe procedure with low complication rates, provided that surgery was correctly performed.

Does that mean that all paediatric ACL reconstructions should be treated operatively from the beginning? Well, the situation seems to be more complex.

In recent years, studies have emphasized the importance of prevention (10) and there are also studies showing that a high activity level may be kept with correct training without meniscal and cartilage injury the first 2 years after the

injury [14]. However, clinical studies found concomitant injuries in kids and adolescents in as high as 50–65 % of ACL tears [1, 4, 10] although the quality of these studies can be questioned. Caused by the early damage, osteoarthritis may already be manifest at the age of 30–40 years. Therefore, the primary objective must be to protect kids and adolescents from such a severe injury. Schools and sports clubs have to be educated. Existing prevention programmes have to set in place and practice [15, 18, 19]. Children and adolescents should be educated that prevention is not just a boring thing, but of importance for their future sports ability and health.

An acute ACL tear usually stops most sports practice. The injured child and his/her parents often feel insecure about the situation and afraid of permanent damage. To put their mind on ease, it is very important to take some time for consulting. The specialist physician has to check for additional injuries and has to establish an exact diagnosis. Therefore, a gentle examination and an MRI are necessary. A decision for conservative or operative treatment has to be taken [13]. This is usually very emotional for the young patient and parents and needs a proper medical advice. If not available a specialist has to be found for the child.

In case of an isolated ACL tear without concomitant meniscus or cartilage injury, initial conservative treatment may be chosen [17]. The knee should be protected in a brace for 6–8 weeks, and active, secondary preventive physiotherapy is recommended. The focus is on stabilizing the knee and on regaining coordination and strength. A certain number of patients may benefit from a conservative approach and may not need surgery. If there is no meniscal or additional damage, which needs surgery early on, the surgical decision can be postponed. The final treatment decision should be made in discussion with the child and the family after a proper rehabilitation programme has been undertaken for at least 6 months.

The rate of subsequent meniscal or cartilage injury in this young group of active patients is high [6] and may be more devastating as the ACL injury itself. Therefore, there is an international consensus that in case of concomitant damage to the meniscus (bucket handle type of injury) and/or persistent knee instability, an ACL reconstruction should be performed. The goal is to stabilize the knee, improve its function, repair the meniscus and protect the knee from future episodes of giving way and injuries [9, 10].

The most accepted technique in case of open physis is an ACL reconstruction with a soft tissue graft, usually autologous doubled semitendinosus and gracilis tendons [2, 5, 8]. Recently, the use of living donor allografts has been reported [7]. Bone plugs or fixation material should not cross the physis to minimize the risk of growth disturbances, and the use of permanent artificial grafts is prohibited. If all precautions are taken [16], the risk of a growth

disturbance is very low [3], but it may be underreported [11, 16]. It may be comparable to the risk of a bacterial infection, which is approximately 0.5 %. These possible side effects and complications of surgery should be thoroughly discussed with the family.

A monitored rehabilitation programme after ACL reconstruction is essential for a safe return to sports. A close cooperation between the patient, parents, physiotherapist, coach and school is necessary. A thorough rehabilitation is also an important secondary preventive measure for early re-injury.

In summary, a paediatric ACL tear is a severe injury and is considered a permanent damage to the young knee joint. A stable knee is important to protect the meniscus and cartilage from secondary injury and early osteoarthritis. Return to high-level cutting and pivoting sports bears a high risk of re-injury and additional damage. The child and the family must be made aware of the danger of pivoting sports regardless of surgical or nonsurgical treatment. As mentioned above, current evidence for treatment of paediatric ACL injuries is low. Finding the right treatment for each child is a matter of balance, patience and thorough follow-up.

In order to look for answers to some of the open questions, the ESSKA Foundation established the “Pediatric ACL Monitoring Initiative” (PAMI), a combined, multicentric project on these relatively rare lesions. It started with a survey among ESSKA members and is published in the current issue (Moksnes et al.). Current efforts will be presented at the next ESSKA Congress in Barcelona. This KSSTA journal will give a closer insight in the challenging topic from prevention, conservative and operative treatment, risk of growth disturbance and clinical results. Enjoy reading!

## References

1. Aichroth PM, Patel DV, Zorrilla P (2002) The natural history and treatment of rupture of the anterior cruciate ligament in children and adolescents. A prospective review. *J Bone Joint Surg Br* 84(1):38–41
2. Calvo R, Figueroa D, Gili F, Vaisman A, Mococain P, Espinosa M, Leon A, Arellano S (2015) Transphyseal anterior cruciate ligament reconstruction in patients with open physes: 10-year follow-up study. *Am J Sports Med* 43(2):289–294
3. Chotel F, Seil R (2013) Growth disturbances after transphyseal ACL reconstruction in skeletally immature patients: who is more at risk? Young child or adolescent? *J Pediatr Orthop* 33(5):585–586
4. Cohen M, Ferretti M, Quarteiro M, Marcondes FB, de Hollanda JP, Amaro JT, Abdalla RJ (2009) Transphyseal anterior cruciate ligament reconstruction in patients with open physes. *Arthroscopy* 25(8):831–838
5. Frosch KH, Stengel D, Brodhun T, Stietenron I, Holsten D, Jung C, Reister D, Voigt C, Niemeier P, Maier M, Hertel P,

- Jagodzinski M, Lill H (2010) Outcomes and risks of operative treatment of rupture of the anterior cruciate ligament in children and adolescents. *Arthroscopy* 26(11):1539–1550
6. Funahashi KM, Moksnes H, Maletis GB, Csintalan RP, Inacio MC, Funahashi TT (2014) Anterior cruciate ligament injuries in adolescents with open physis: effect of recurrent injury and surgical delay on meniscal and cartilage injuries. *Am J Sports Med* 42(5):1068–1073
  7. Goddard M, Bowman N, Salmon LJ, Waller A, Roe JP, Pinczewski LA (2013) Endoscopic anterior cruciate ligament reconstruction in children using living donor hamstring tendon allografts. *Am J Sports Med* 41(3):567–574
  8. Lemaitre G, Salle de Chou E, Pineau V, Rochcongar G, Delforge S, Bronfen C, Haumont T, Hulet C (2014) ACL reconstruction in children: a transphyseal technique. *Orthop Traumatol Surg Res* 100(4 Suppl):S261–S265
  9. Millett PJ, Willis AA, Warren RF (2002) Associated injuries in pediatric and adolescent anterior cruciate ligament tears: does a delay in treatment increase the risk of meniscal tear? *Arthroscopy* 18(9):955–959
  10. Mizuta H, Kubota K, Shiraiishi M, Otsuka Y, Nagamoto N, Takagi K (1995) The conservative treatment of complete tears of the anterior cruciate ligament in skeletally immature patients. *J Bone Joint Surg Br* 77(6):890–894
  11. Moksnes H, Engebretsen L (2015) It takes more than timing: letter to the editor. *Am J Sports Med* 43(6):Np14–Np15
  12. Moksnes H, Engebretsen L, Risberg MA (2012) The current evidence for treatment of ACL injuries in children is low: a systematic review. *J Bone Joint Surg Am* 94(12):1112–1119
  13. Moksnes H, Engebretsen L, Risberg MA (2012) Management of anterior cruciate ligament injuries in skeletally immature individuals. *J Orthop Sports Phys Ther* 42(3):172–183
  14. Moksnes H, Engebretsen L, Risberg MA (2013) Prevalence and incidence of new meniscus and cartilage injuries after a nonoperative treatment algorithm for ACL tears in skeletally immature children: a prospective MRI study. *Am J Sports Med* 41(8):1771–1779
  15. Myklebust G, Engebretsen L, Braekken IH, Skjølberg A, Olsen OE, Bahr R (2003) Prevention of anterior cruciate ligament injuries in female team handball players: a prospective intervention study over three seasons. *Clin J Sport Med* 13(2):71–78
  16. Seil R, Weitz FK, Pape D (2015) Surgical-experimental principles of anterior cruciate ligament (ACL) reconstruction with open growth plates. *J Exp Orthop* 2:11
  17. Wilfinger C, Castellani C, Raith J, Pilhatsch A, Hollwarth ME, Weinberg AM (2009) Nonoperative treatment of tibial spine fractures in children—38 patients with a minimum follow-up of 1 year. *J Orthop Trauma* 23(7):519–524
  18. Wilk KE (2015) Anterior cruciate ligament injury prevention and rehabilitation: let's get it right. *J Orthop Sports Phys Ther* 45(10):729–730
  19. Zebis MK, Andersen LL, Brandt M, Myklebust G, Bencke J, Lauridsen HB, Bandholm T, Thorborg K, Holmich P, Aagaard P (2015) Effects of evidence-based prevention training on neuromuscular and biomechanical risk factors for ACL injury in adolescent female athletes: a randomised controlled trial. *Br J Sports Med* [Epub ahead of print](PMID: 26400955)