

Introduction

There have been alarming reports on the increased risk of knee osteoarthritis (OA) in both ACL-deficient and ACL-reconstructed (ACLR) knees. The development of OA is multifactorial. Factors that might be of influence are the degree of initial trauma to the knee, inflammatory responses, meniscal and chondral lesions at time of ACL rupture, age, gender, genetics, range of motion, type of surgery and activity level after ACLR. Few reports have been presented on long-term results of OA after ACLR with hamstring grafts. [1] In the present study, the clinical and radiological long-term results of ACLR with 4-strand hamstring autograft are presented.



Purpose

Analysis of long-term clinical and radiological outcome after hamstring autograft ACLR and accelerated rehabilitation with special attention to knee osteoarthritis and its predictors.

Methods

Prospective, consecutive case series of 100 patients. Arthroscopic transtibial ACLR was performed using a 4-strand hamstring autograft with standardised accelerated rehabilitation. Analysis was preoperatively and 9-11 years postoperatively. Clinical examination included Lysholm and Tegner scores, IKDC, KT-1000 testing (MEDmetric Co., San Diego, CA) and leg circumference measurements. Blinded bilateral radiological evaluation included:

- AP weight bearing X-rays
- 45 degree flexion PA weight-bearing X-rays
- lateral knee X-rays and sky views.

Radiological classifications were according to Ahlbäck and Kellgren & Lawrence (K&L). A combination of Ahlbäck grade 1 and K&L grade 3 was defined as radiographic sign of knee OA.

Statistical analysis included univariate and multivariate logistic regressions.



Bilateral AP weight-bearing X-ray: medial OA of the right knee 10 years after ACLR

Results

The most important finding of the present study is that radiographic knee OA occurred in 53,5% of patients. Predictors for OA were patient age ≥ 30 years at time of ACLR, cartilage status \geq ICRS grade 3 at time of ACLR, history of medial meniscectomy and preoperative one leg hop test C and D. After multivariate logistic regression analysis, the status of the medial meniscus and an ICRS grade 3 cartilage condition at time of ACLR were shown to be significant predictors for knee OA.

	Measurements: preoperative vs. postoperative, specified for the osteoarthritis group and non-osteoarthritis group		P	P
	Osteoarthritis	No osteoarthritis		
	Score or grade*			
Cases per group, n	46 (100.0%)	40 (100.0%)		
Male gender, n	32 (69.6%)	25 (62.5%)	0.5	
Age at ACLR, years	33.1 (± 8.4)	29.3 (± 8.1)	0.038	<0.05
Time to ACLR, years	5.5 (± 4.7)	4.3 (± 4.9)	0.3	
BMI at ACLR, kg/m ²	25.05 (± 3.26)	23.9 (± 2.9)	0.08	
ICRS grade				
All compartments	3 (0-3)	1 (0-3)	0.000	<0.001
Tibiofemoral	2.5 (0-3)	1 (0-3)	0.000	<0.001
Patellofemoral	0 (0-3)	0 (0-3)	0.074	
History of meniscectomy, n	40 (90.9%)	22 (55.0%)		
Lysholm score				
Preoperative	70 (43-95)	67 (31-90)	0.7	
Postoperative	93 (34-100)	96 (57-100)	0.4	
Tegner score				
Preoperative	3 (0-6)	3 (0-6)	0.9	
Postoperative	6 (3-9)	6 (2-9)	0.6	
IKDC Subjective score				
Preoperative	3 (2-4) "grade C"	3 (2-4) "grade C"	0.4	
Postoperative	2 (1-3) "grade B"	2 (1-3) "grade B"	0.004	<0.05
KT-1000 SSD, mm				
Preoperative	8.16 (± 3.24)	7.97 (± 2.86)	0.8	
Postoperative	1.54 (± 3.07)	2.88 (± 2.60)	0.055	
Pivot shift test grade				
Preoperative	3 (1-3) "Clunk (+++)"	3 (2-3) "Clunk (+++)"	0.5	
Postoperative	0 (0-2) "no pivot"	1 (0-3) "Glide (+)"	0.6	
IKDC score, ligament examination				
Preoperative	4 (1-4) "grade D"	4 (1-4) "grade D"	0.8	
Postoperative	2 (1-4) "grade B"	2 (1-4) "grade B"	1.0	
Quadriceps circ. SSD, cm				
Preoperative	0 (-2-3)	0 (-4-4)	0.3	
Postoperative	0 (-5-3)	0 (-2-2)	0.9	
Calf circ. SSD, cm				
Preoperative	0 (-2-3)	0 (-2.5-2)	0.6	
Postoperative	0 (-2-3)	0 (-3-3)	0.8	
Range of motion				
Preoperative	1 (1-2)	1 (1-3)	0.8	
Postoperative	1 (1-2)	1 (1-2)	0.9	
One leg hop test grade				
Preoperative	3 (1-4) "grade C"	2 (1-4) "grade B"	0.029	<0.05
Postoperative	1 (1-3) "grade A"	1 (1-2) "grade A"	0.02	<0.05
IKDC score				
Preoperative	4 (3-4) "grade D"	4 (3-4) "grade D"	0.8	
Postoperative	2 (1-4) "grade B"	2 (1-4) "grade B"	0.3	

Table 1. Main demographic characteristics and all pre- and postoperative measurements specified for the osteoarthritis group and the non-osteoarthritis group

Multivariate regression analysis for predictors of knee OA			
	Odds ratio	95% CI	P
Demographic factors			
Age at ACLR	1.04	0.96 - 1.12	0.3
Preoperative measurements			
One leg hop test (A to D) Grade C or worse	1.43	0.49-4.20	0.5
Perioperative findings			
Medial meniscectomy prior to or during the ACLR	4.03	1.41-11.5	0.009
ICRS grade (0 to 4)			
ICRS grade 0	1.00		
ICRS grade 1	0.88	0.18-4.33	0.9
ICRS grade 2	2.77	0.57-13.6	0.2
ICRS grade 3	5.20	1.09-24.8	0.039
ICRS grade 4	-	-	-

Table 2. Results of the multivariate logistic regression analysis for predictors of knee OA

Conclusion

Transtibial ACLR with 4-strand hamstring autograft and accelerated rehabilitation restored anteroposterior knee stability. Clinical parameters and patient satisfaction improved significantly. At ten year follow-up, radiological signs of OA was present in 53.5% of patients. Risk factors for OA were meniscectomy prior to, or at time of ACLR and chondral lesions at time of ACLR.

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