



6th Advanced Course on Knee Surgery

January 31st – February 5th, 2016 Val d'Isère - France

Long term failure: natural evolution of the ACL-R knee: Prognostic factors

Mike Carmont



Val d'Isère

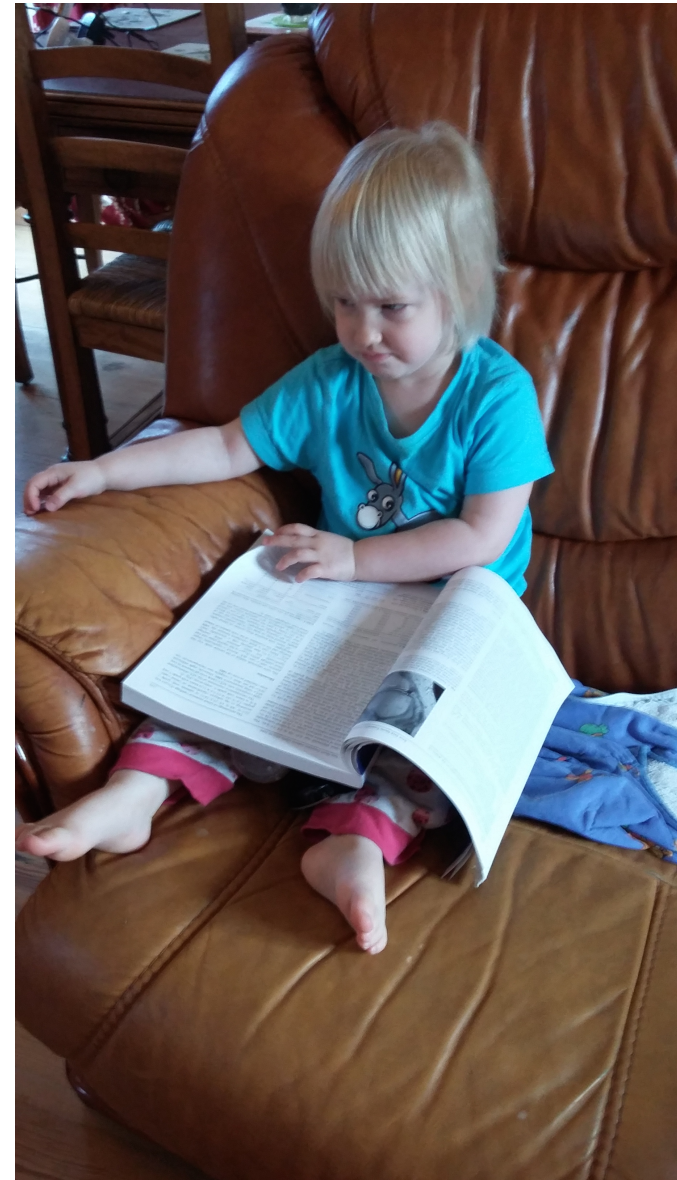
Long term evaluation

- Short term/early 2 years
- Mid term 5 years
- Long term 10 up to 20 years

Natural history

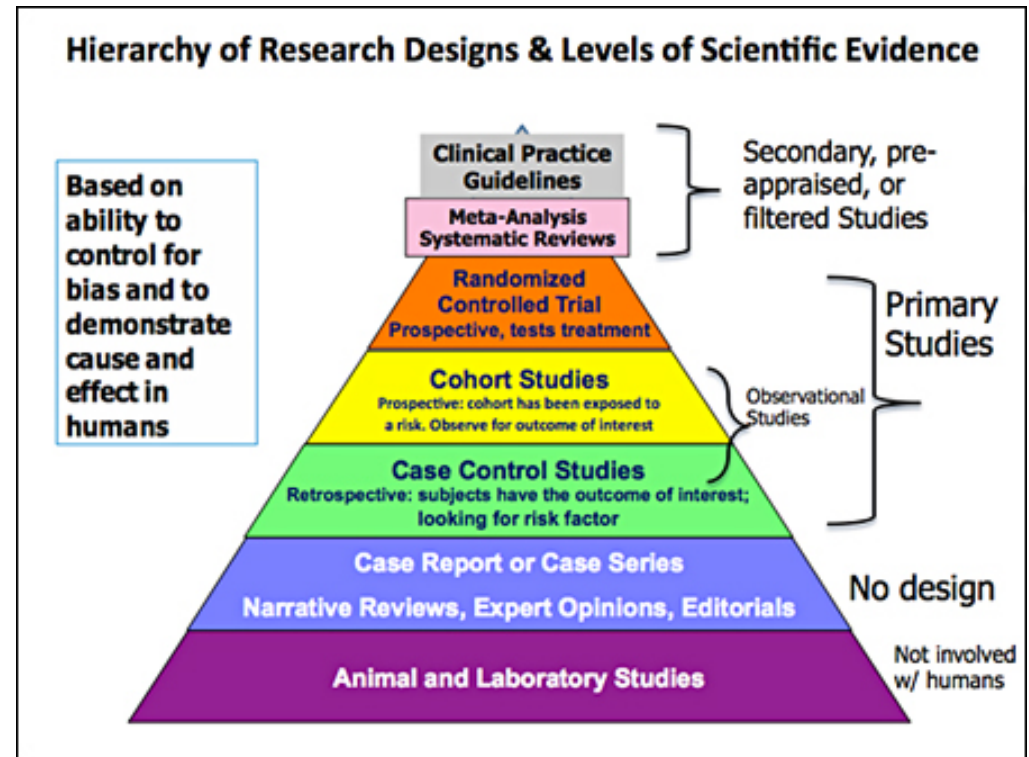
- Function
- Return to play
- Osteoarthritis

- Other factors
 - Graft rupture
 - Contra-lateral knee ligament injury



Literature

- Meta-analysis
(Outcomes of PRCT)
- Randomized controlled trial (Sample Y/N)
- Systematic review
- Cohort series (Registry)
- Case series (Registry)
- Level 5 experience





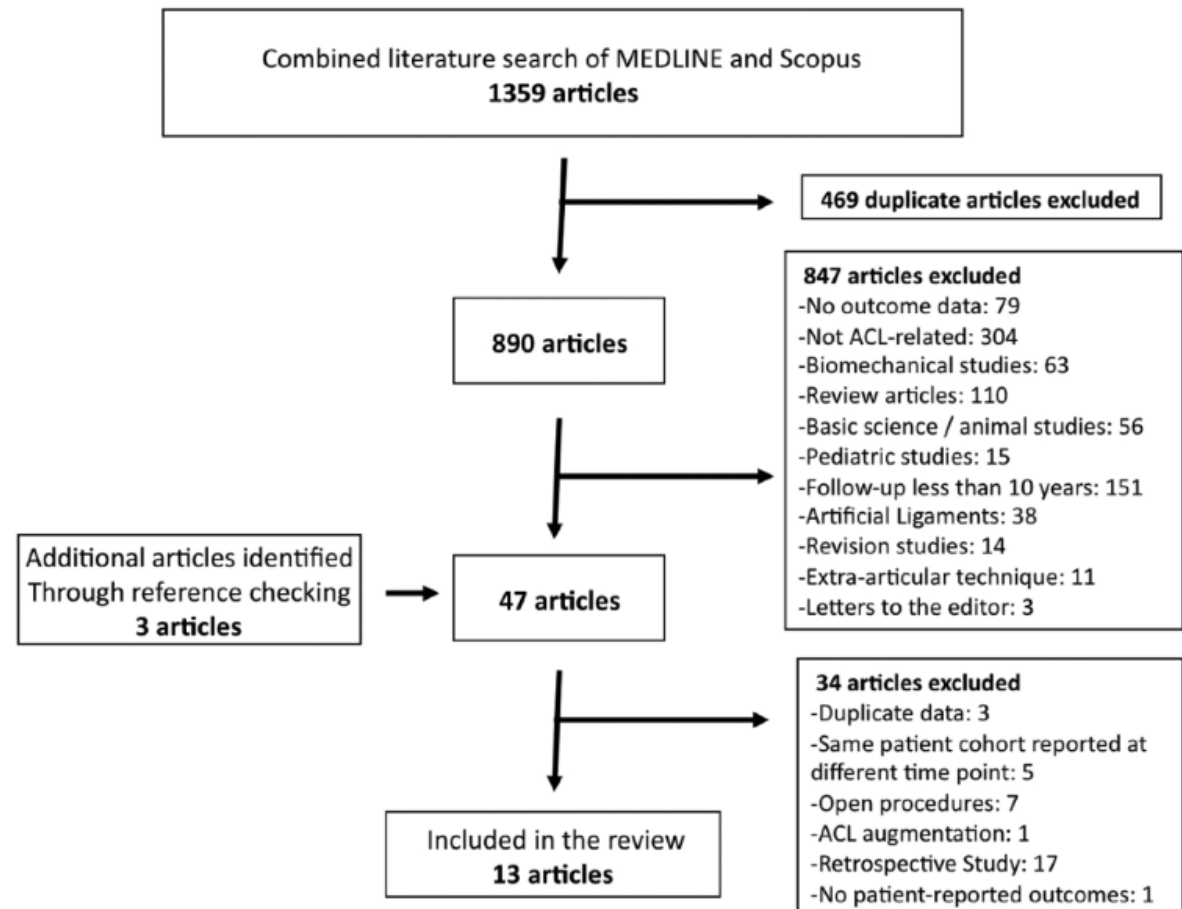
Patient-Reported Outcomes and Their Predictors at Minimum 10 Years After Anterior Cruciate Ligament Reconstruction

A Systematic Review of Prospectively Collected Data

Robert A. Magnussen,^{*†‡} MD, Megan Verlage,^{†‡} AB, David C. Flanigan,^{†‡} MD, Christopher C. Kaeding,^{†‡} MD, and Kurt P. Spindler,[§] MD

- 13 studies
- 4 RCTs
 - 3PT vs. Hams
 - 1 effect bracing
- 6 prospective cohort studies
- 3 prospective data series

Magnussen OJSM 2015



Patient-Reported Outcomes and Their Predictors at Minimum 10 Years After Anterior Cruciate Ligament Reconstruction

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Robert A. Magnussen,^{*†‡} MD, Megan Verlage,^{†‡} AB, David C. Flanigan,^{†‡} MD, Christopher C. Kaeding,^{†‡} MD, and Kurt P. Spindler,[§] MD

- 3486 patients
- Mean age 26.9 years
- 66.8% Male

Score	No. Studies	Score	% patients
Lysholm	6	91.7	78.1
IKDC	5	84.2	66.1
Cincinnati	3	87.4	73.5
Tegner	8	5.1	79.6

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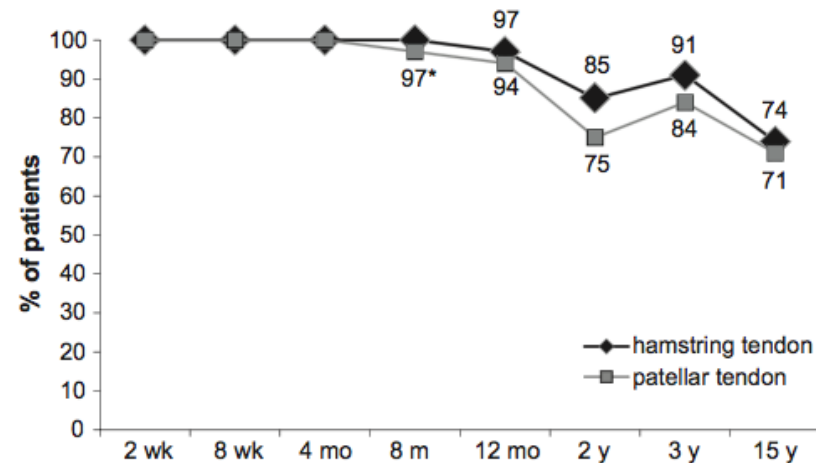
- Meniscectomy & articular cartilage damage > poorer outcomes – **mixed evidence**
 - Shelbourne & Gray/Oeistad
- Gender- **no effect**
 - Barenius, Holm, Sajovic, Bourke
- Graft Choice- **no effect**
- Other factors
 - Restoration ROM

Comparison of Patellar Tendon and Hamstring Tendon Anterior Cruciate Ligament Reconstruction

A 15-Year Follow-up of a Randomized Controlled Trial

Kate E. Webster,^{*†} PhD, Julian A. Feller,[‡] FRACS, Nigel Hartnett,[‡] FRACS,
Warren B. Leigh,[‡] FRACS, and Anneka K. Richmond,[‡] BSc(Hons)

- 65 patients randomized
- 47 reviewed 15.3yrs
- 4 graft ruptures & 6 contra
- Similar incidence AKP & Kneeling pain both groups
- Weekly sporting activity
- PT 73% HS 48%



Webster AJSM epub

Clinical Results and Risk Factors for Reinjury 15 Years After Anterior Cruciate Ligament Reconstruction

A Prospective Study of Hamstring and Patellar Tendon Grafts

Toby Leys,* MBBS, FRACS, Lucy Salmon,* BAppSci(Physio), PhD,
Alison Waller,* BAppSci(Physio), James Linklater,[†] FRANZCR, and Leo Pinczewski,^{‡§||} MBBS, FRACS
Investigation performed at North Sydney Orthopaedic and Sports Medicine Centre

- Prospective non randomized
- 90 Hams & 90 PT autograft
- Hams
 - Less ROM deficit P 0.03
 - Less OA changes XR P 0.04
 - Improved Single Leg Hop P 0.001
 - Kneeling pain P 0.04
- Re-rupture ns (8 vs.4)

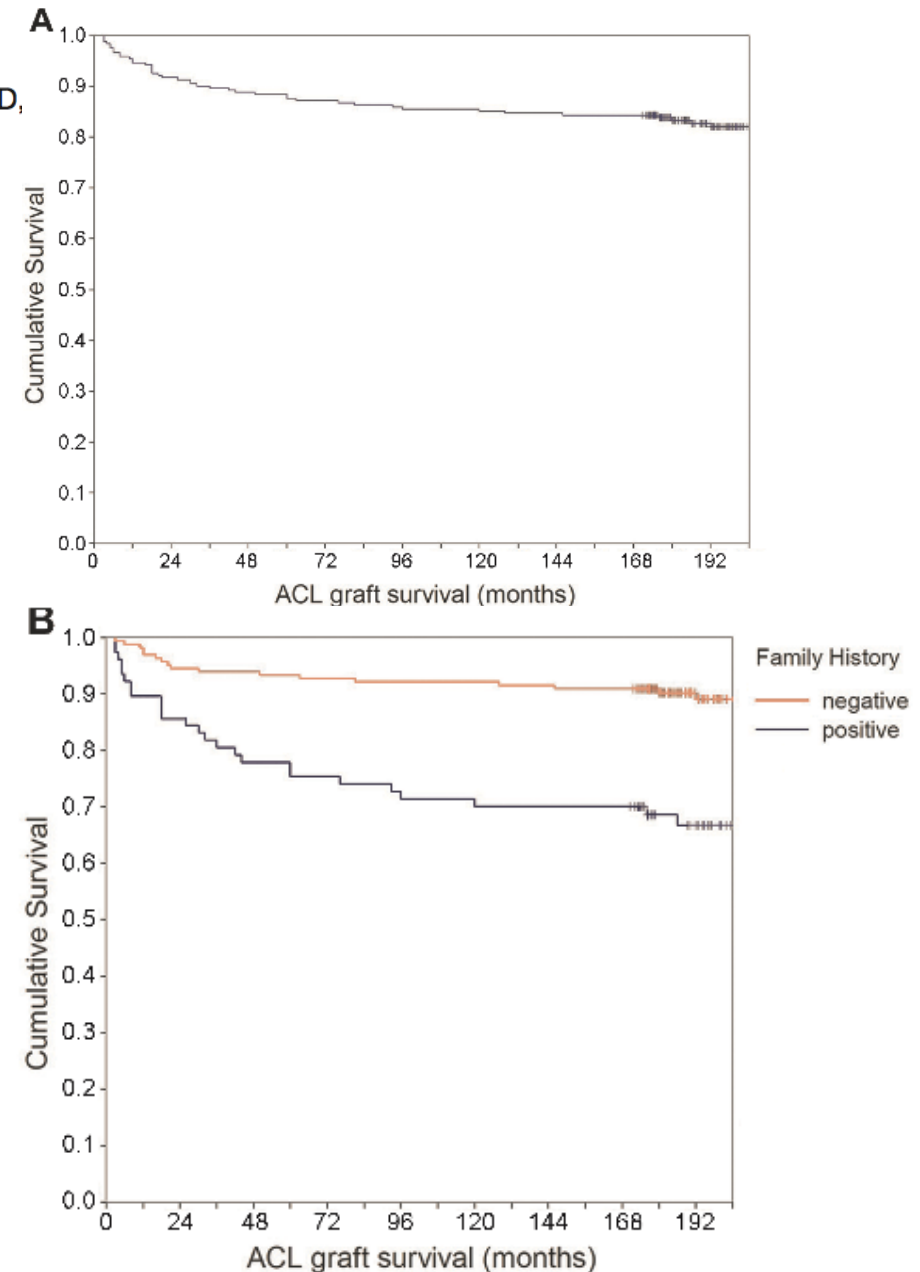
Fifteen-Year Survival of Endoscopic Anterior Cruciate Ligament Reconstruction in Patients Aged 18 Years and Younger

Matthew D. Morgan,* BAppSci(HMS), MBBS, Lucy J. Salmon,^{†‡} BAppSci(Physio), PhD, Alison Waller,[†] BMedSci(Hons), BAppSci(Physio), Justin P. Roe,[†] MBBS, FRACS, and Leo A. Pinczewski,^{*†} MBBS, FRACS

Investigation performed at North Sydney Orthopaedic and Sports Medicine Centre, Sydney, Australia

- 84% reviewed 16.6yrs
- 31% further ACL injury
 - 11% graft rupture
 - 13.6% contra ACLR
- Factors
 - FHx ACL 69% vs. 99%
 - Males 75% vs. 88%
 - Return sports 78% vs. 89%
 - Most vulnerable 5yrs post ACLR

Morgan AJSM epub

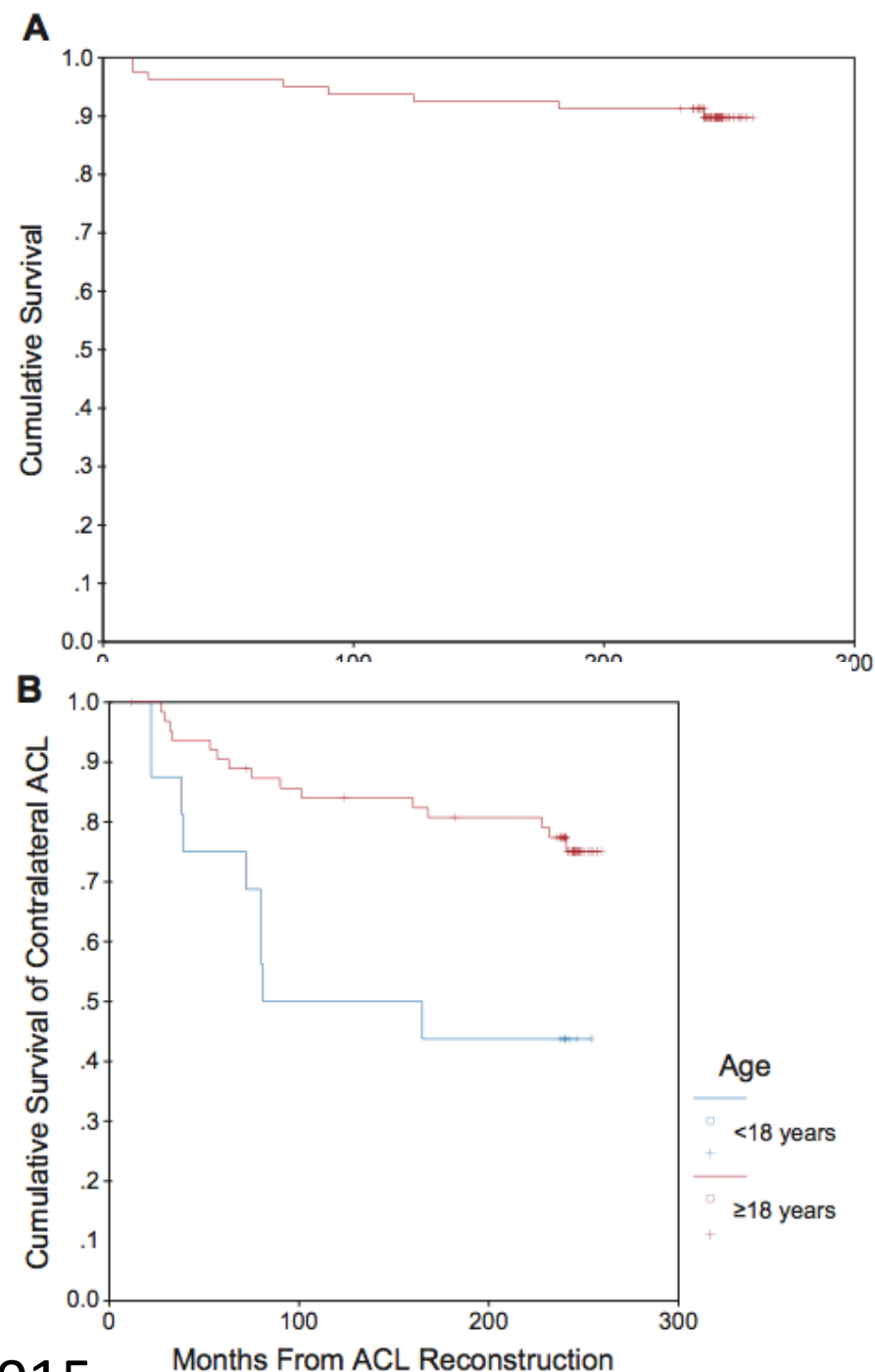


Twenty-Year Outcomes of a Longitudinal Prospective Evaluation of Isolated Endoscopic Anterior Cruciate Ligament Reconstruction With Patellar Tendon Autografts

Simon Thompson,* BSc(Hon), MBBS, MSc, MD(Res), FRCS(Tr&Orth),
Lucy Salmon,* BAppSci(Physio), PhD, Alison Waller,* BMedSci(Hons), BAppSci(Physio),
James Linklater,† FRANZCR, Justin Roe,*‡ MBBS, FRACS,
and Leo Pinczewski,*§|| MBBS, FRACS

- 1993-1994 90 patients
- 36% another ACL
 - 9% same side
 - 30% contra side
- IKDC 86
- 50% strenuous/ v strenuous
- 61% OA changes but symptoms rare
- Graft rupture not related age

Thompson AJSM 2015

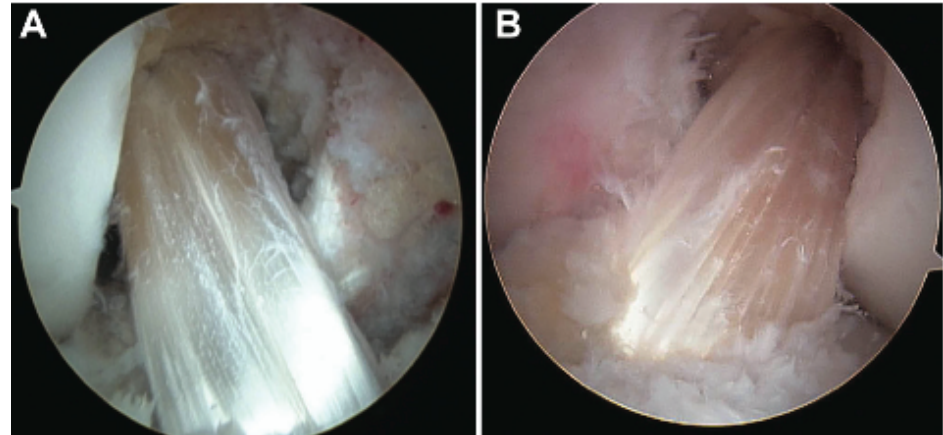


Autograft Versus Allograft Anterior Cruciate Ligament Reconstruction

A Prospective, Randomized Clinical Study With a Minimum 10-Year Follow-up

Craig R. Bottoni,^{*†} MD, Eric L. Smith,[‡] MD, CPT James Shaha,[†] MD, Steven S. Shaha,[§] PhD,
Sarah G. Raybin,[†] BA, John M. Tokish,[†] MD, and CDR(Ret) Douglas J. Rowles,[†] MD
*Investigation performed at the Sports Medicine Section, Orthopaedic Surgery Service,
Tripler Army Medical Center, Honolulu, Hawaii, USA*

- 2002-3, 99 patients 86M
- Randomized Hams vs. Fresh frozen tibialis posterior allograft
- Identical fixation & rehab
- @10yrs Revision
 - 8.3% Autograft
 - 26.5% Allografts
- 80% intact

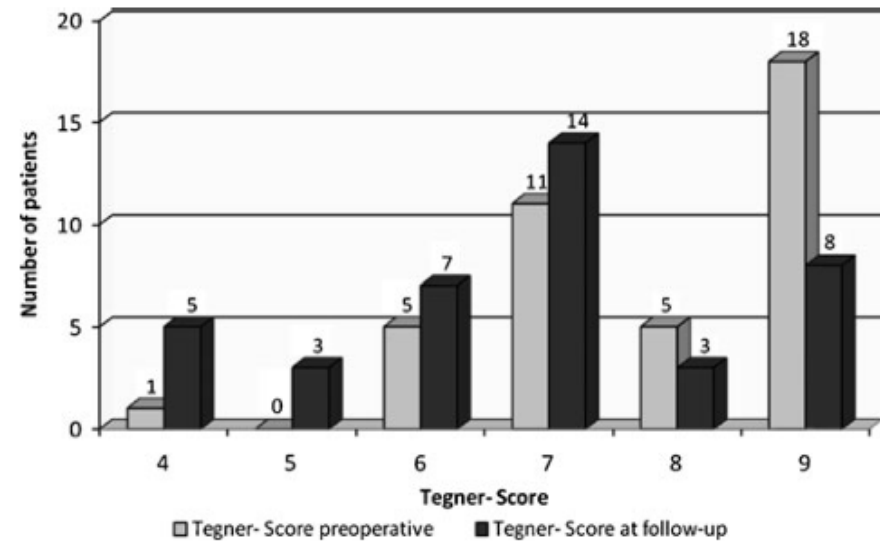


Bottoni AJSM 2015

Long-term outcome of anterior cruciate ligament reconstruction with an autologous four-strand semitendinosus tendon autograft

Nikolaus A. Streich • Sebastian Reichenbacher •
Alexander Barié • Matthias Buchner • Holger Schmitt

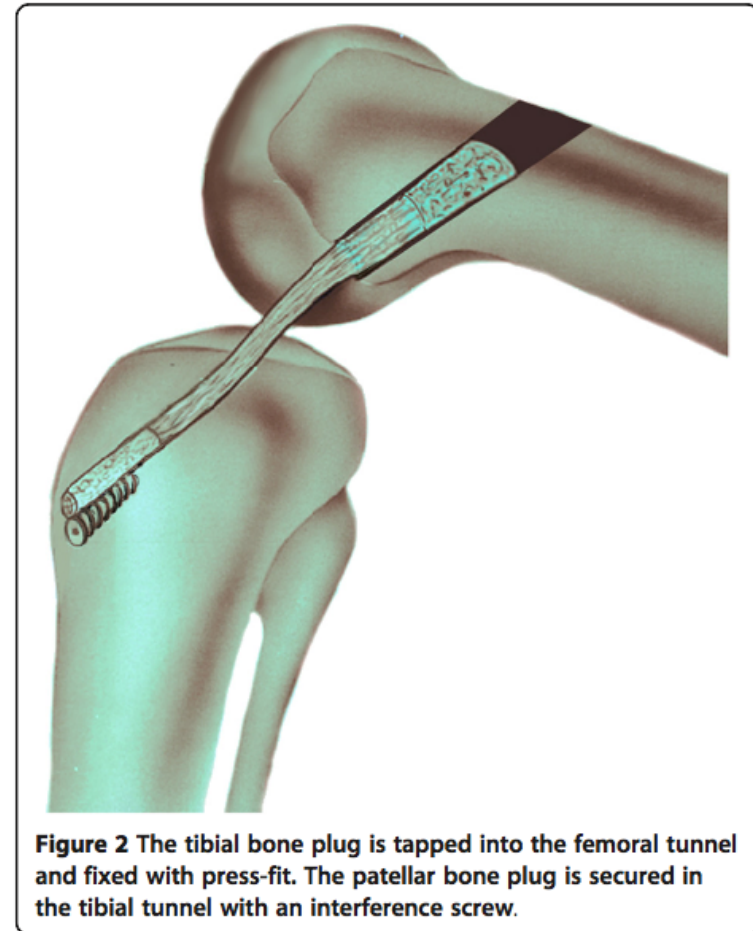
- 40 patients HT
- Lysholm 93.2
- IKDC 90.5
- Tegner 6
- 8% re-ruptures revision PT



Femoral press-fit fixation in ACL reconstruction using bone-patellar tendon-bone autograft: results at 15 years follow-up

Wojciech Widuchowski^{1*}, Malgorzata Widuchowska^{2†}, Bogdan Koczy^{1†}, Szymon Dragan^{3†}, Andrzej Czamara^{4†}, Wieslaw Tomaszewski^{4†} and Jerzy Widuchowski^{1†}

- 52 patients 15yrs
- IKDC 80
- Lysholm 86
- Tegner 6
- 75% normal/near normal
- 67% degenerative changes

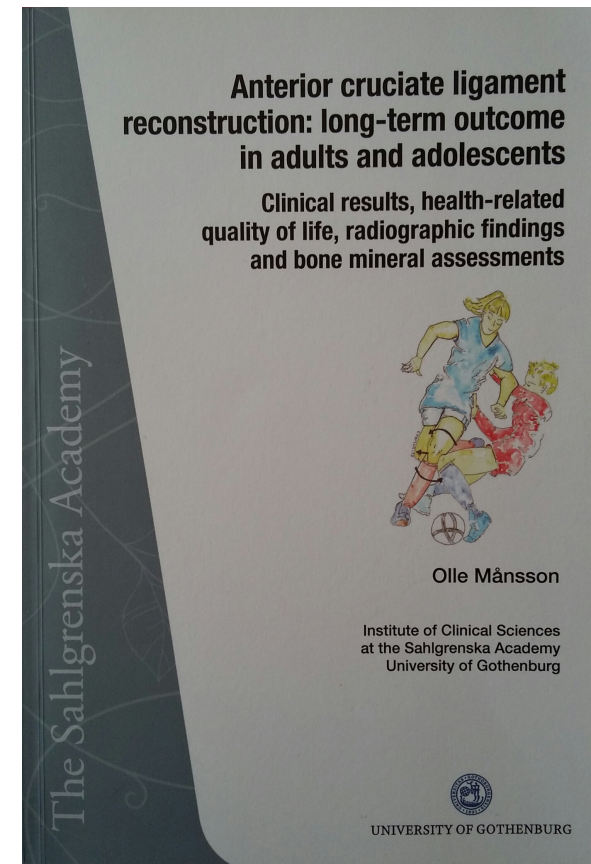


Long-term Clinical and Radiographic Results After Delayed Anterior Cruciate Ligament Reconstruction in Adolescents

Olle Månsson,^{*†‡} MD, Ninni Sernert,^{‡§} RPT, PhD, Lars Rostgard-Christensen,^{||} MD, and Jüri Kartus,^{†‡§} MD, PhD

Investigation performed at the Department of Orthopaedics, NU-Hospital Group, Uddevalla, Sweden

- Case series 32 adolescents
- 10 PT, 22 Hams, @10yrs follow up
 - More OA than control knee
 - Lysholm 84
 - Single leg hop 93%
 - SF 36 comparable
 - EQ5D 0.86
 - KOOS lower all dimensions
 - 14% revision rate



Long-Term Outcomes of Allograft Reconstruction of the Anterior Cruciate Ligament

Eric A. Lenehan, MD, W. Barrett Payne, MD, Brad M. Askam, MD, William A. Grana, MD, MPH,
and Lutul D. Farrow, MD

- Retrospective Review 8yrs
- Re-operation (30.8%) & Revision (20.5%)
- Higher those ≤ 25 yrs
- Division 1 athletes 62% revision rate allograft

Registry studies



Dansk Korsbånds Rekonstruktions Register

Årsrapport 2015

Rapporten dækker perioden fra 1. juli 2005 til 31. december 2014
Sidste opgørelsesperiode er fra 1. januar 2014 til 31. december 2014



Comparison of Hamstring Tendon and Patellar Tendon Grafts in Anterior Cruciate Ligament Reconstruction in a Nationwide Population-Based Cohort Study

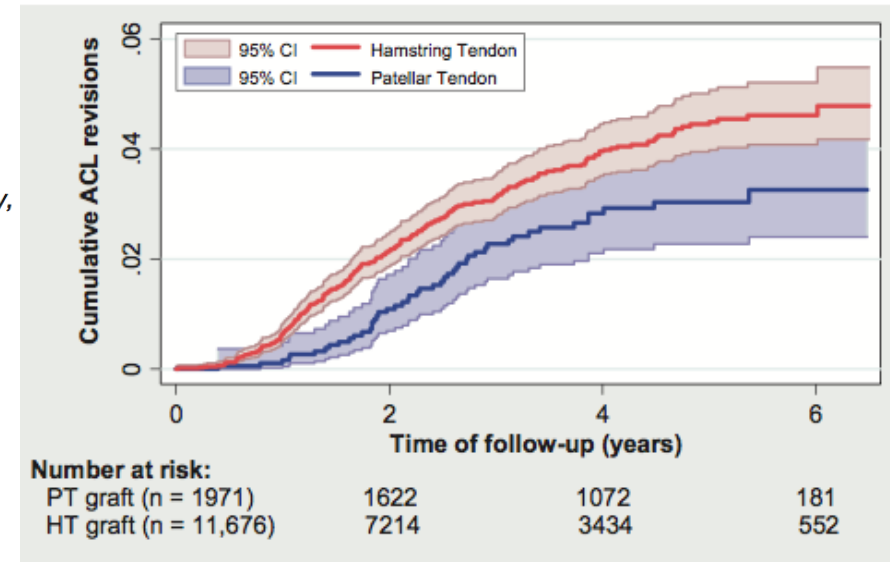
Results From the Danish Registry of Knee Ligament Reconstruction

Lene Rahr-Wagner,^{*†‡} MD, Theis Muncholm Thillemann,[†] MD, PhD,
Alma Becic Pedersen,[‡] MD, PhD, and Martin Lind,[†] MD, PhD
Investigation performed at the Departments of Clinical Epidemiology and Orthopaedic Surgery,
Aarhus University Hospital, Aarhus, Denmark

- N=13647 2005-11
- PT Revision rate 0.16%
1yr & 3% 5yr
- HT Revision rate 1.9%
1yr & 3.8% 5yr
- Relative Risk HT 1.4

Rahr-Wagner AJSM 2013

Registry studies



Causes of Revision Surgery Recorded in the Danish Knee Ligament Reconstruction Registry

Cause	Graft Choice, %	
	Hamstring Tendon	Patellar Tendon
New trauma	41.0	46.8
Tunnel widening	2.3	0
Suboptimal placement of the graft in the tibia	8.3	8.5
Suboptimal placement of the graft in the femur	15.6	19.2
Infection	3.6	0
Unknown reason for instability	22.2	12.7
Other ligament failure	4.3	8.5
Other	2.7	4.3
Total ^a	100	100

Increased Risk of Revision With Hamstring Tendon Grafts Compared With Patellar Tendon Grafts After Anterior Cruciate Ligament Reconstruction

A Study of 12,643 Patients From the Norwegian Cruciate Ligament Registry, 2004-2012

Andreas Persson,^{*†} MD, Knut Fjeldsgaard,[†] MD, Jan-Erik Gjertsen,[†] MD, PhD, Asle B. Kjellsen,[†] MD, Lars Engebretsen,^{‡§} MD, PhD, Randi M. Hole,[†] MD, and Jonas M. Fevang,[†] MD, PhD
Investigation performed at the Department of Orthopaedic Surgery, Haukeland University Hospital, Bergen, Norway

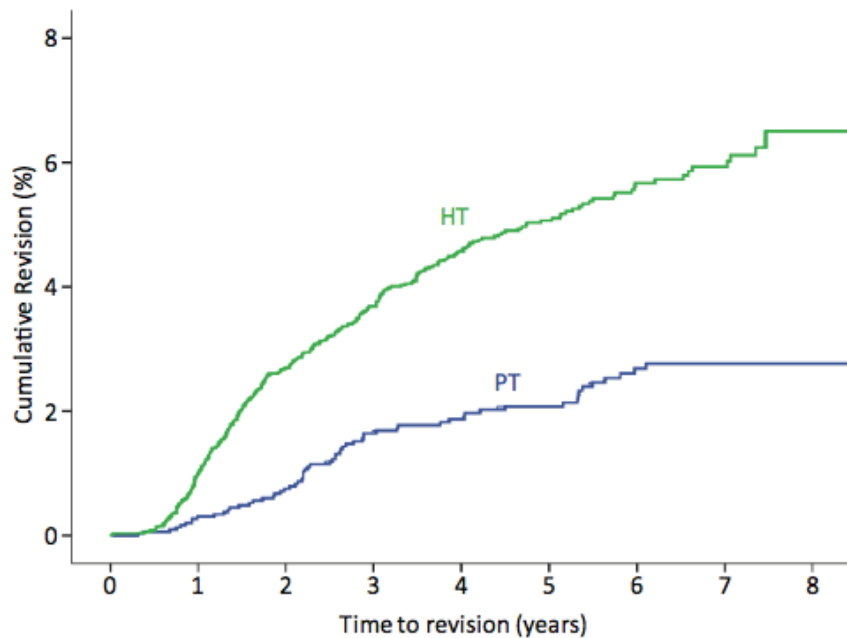


TABLE 3
 Multivariate Cox Regression of Significant Risk Factors for Revision^a

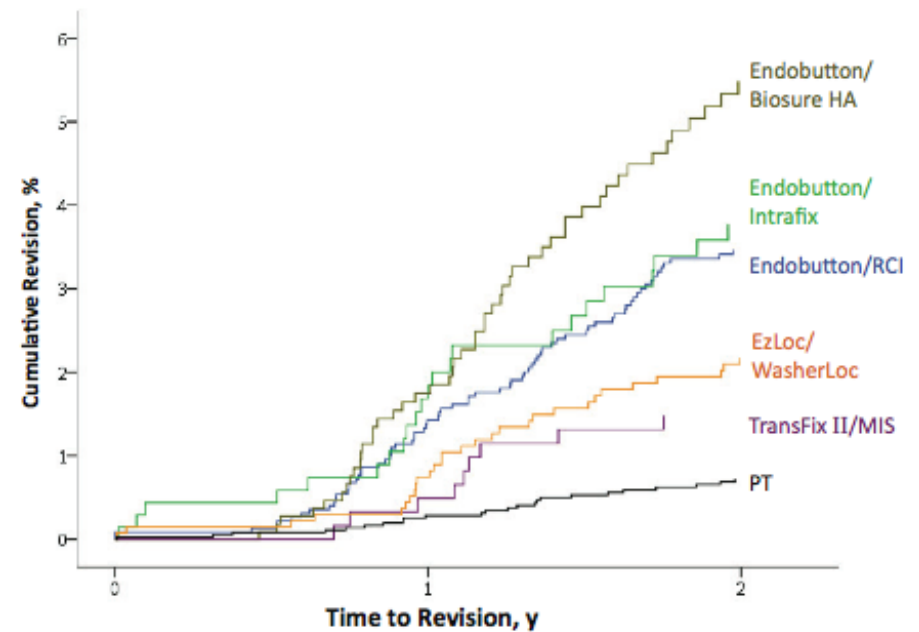
Risk Factor and Category	Hazard Ratio	95% CI	P Value
Age at surgery, y			
15-19	4.0	3.1-5.2	<.001
20-29	2.0	1.5-2.7	<.001
≥30	Reference		
Sex			
Male	1.1	0.9-1.4	.248
Female	Reference		
Graft type			
HT	2.3	1.8-3.0	<.001
PT	Reference		

Registry Data Highlight Increased Revision Rates for Endobutton/Biosure HA in ACL Reconstruction With Hamstring Tendon Autograft

A Nationwide Cohort Study From the Norwegian Knee Ligament Registry, 2004-2013

Andreas Persson,^{*†} MD, Asle B. Kjellsen,[†] MD, Knut Fjeldsgaard,[†] MD, Lars Engebretsen,^{‡§} MD, PhD, Birgitte Espehaug,^{||} MSc, PhD, and Jonas M. Fevang,[†] MD, PhD
Investigation performed at the Department of Orthopaedic Surgery, Haukeland University Hospital, Bergen, Norway

- 3806 PT 10228 HT
- Follow up 4.5yrs
- Crude 2 yr revision rate
 - PT 0.7%
 - Hams 1.5% Transfix
 - Hams 5.5% Endo/BioHA
 - Rev Rate
 - Endo/BioHA 7.3%
 - Endo/Intrafix 5.5%
- Graft choice factor



Persson AJSM 2015

Surgical Predictors of Early Revision Surgery After Anterior Cruciate Ligament Reconstruction

Registry studies

Results From the Swedish National Knee Ligament Register on 13,102 Patients

Daniel Andernord,^{††§} MD, Haukur Björnsson,^{§||} MD, Max Petzold,[¶] PhD, Bengt I. Eriksson,^{§||} MD, PhD, Magnus Forssblad,^{###} MD, PhD, Jón Karlsson,^{§||} MD, PhD, and Kristian Samuelsson,^{§||} MD, PhD
Investigation performed at the Institute of Clinical Sciences, The Sahlgrenska Academy, University of Gothenburg, Göteborg, Sweden

Tibial Graft Fixation and 2-Year Incidence of Revision Surgery

Tibial Graft Fixation Technique	Relative Risk	95% Confidence Interval	P Value
Semitendinosus tendon autograft			
Bioabsorbable interference screw	1.33	0.27-6.48	.727
Metal interference screw	0.32	0.12-0.90	.031
AO screw	1.88	0.95-3.72	.069
Metal interference screw + staple	1.68	0.24-11.69	.601
Intrafix	0.92	0.05-15.51	.951
Semitendinosus-gracilis tendon autograft			
Bioabsorbable interference screw	1.01	0.31-3.32	.987
Metal interference screw	1.69	0.75-3.83	.209
AO screw	1.79	0.73-4.40	.201
Metal interference screw + staple	0.37	0.05-2.69	.324
Intrafix	0.71	0.32-1.57	.401

The use of a **metal interference screw** had lower risk of revision surgery **RR 0.32**

Andernord AJSM 2014

Outcomes After Anterior Cruciate Ligament Reconstruction Using the Norwegian Knee Ligament Registry of 4691 Patients

How Does Meniscal Repair or Resection Affect Short-term Outcomes?

Christopher M. LaPrade,^{*†} BA, Grant J. Dornan,[†] MSc, Lars-Petter Granan,^{*‡§¶¶} MD, PhD, Robert F. LaPrade,^{*#} MD, PhD, and Lars Engebretsen,^{*‡§**} MD, PhD
Investigation performed at the Oslo Sports Trauma Research Center, Oslo, Norway

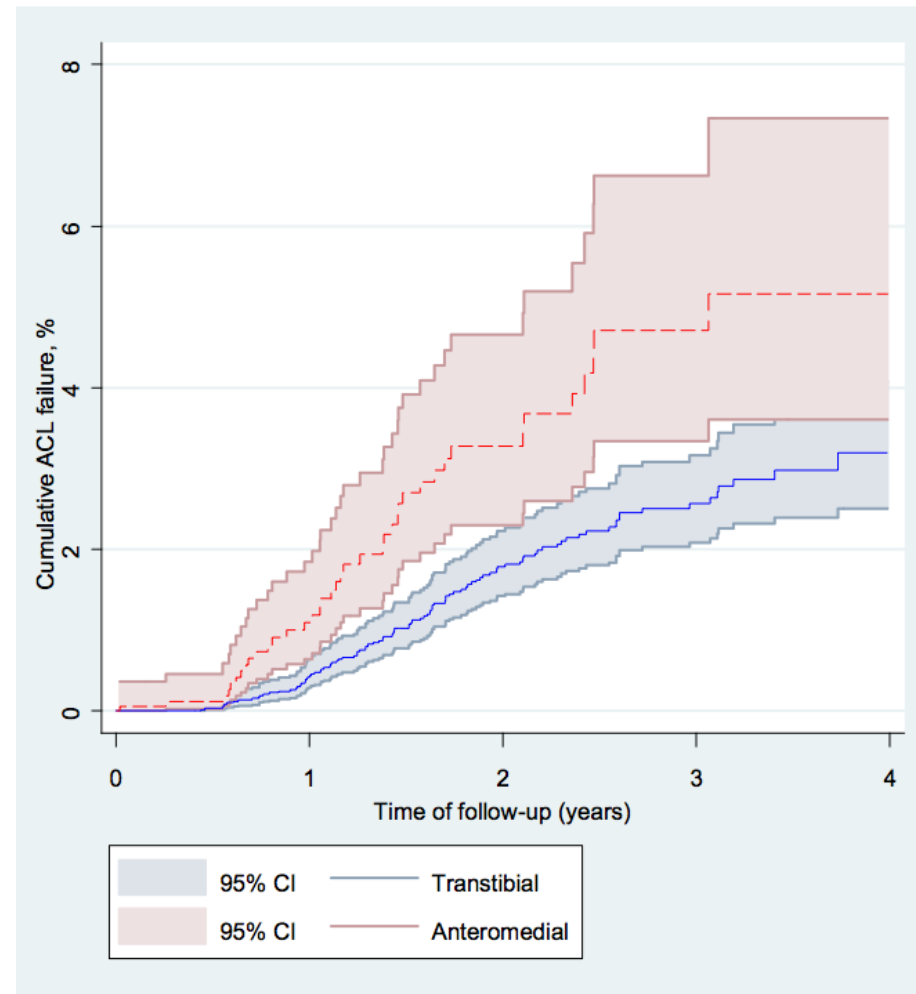
- No significant difference
- ACLR plus
 - Medial Meniscectomy
 - Lateral Meniscectomy
 - Lateral Meniscal Repair
- But significantly lower outcome Other Symptoms & QoL subscales Medial Repair at 2yrs

Increased Risk of Revision After Anteromedial Compared With Transtibial Drilling of the Femoral Tunnel During Primary Anterior Cruciate Ligament Reconstruction: Results from the Danish Knee Ligament Reconstruction Register

Lene Rahr-Wagner, M.D., Theis Muncholm Thillemann, M.D., Ph.D.,
Alma Becic Pedersen, M.D., Ph.D., and Martin Carøe Lind, M.D., Ph.D.

Registry studies

- 9239 ACL
- Outcomes
 - Revision rate
 - Pivot shift test
 - Instrumented objective test
- AM drilling 13% 2007 > 3.2% 2010
- Rate revision AM 5.1% vs. 3.2%
- Rel Risk
 - Pivot shift 2.86
 - Sagittal instability 3.7



Rahr-Wagner Arthroscopy 2013

Lower Risk of Revision With Patellar Tendon Autografts Compared With Hamstring Autografts

A Registry Study Based on 45,998 Primary ACL Reconstructions in Scandinavia

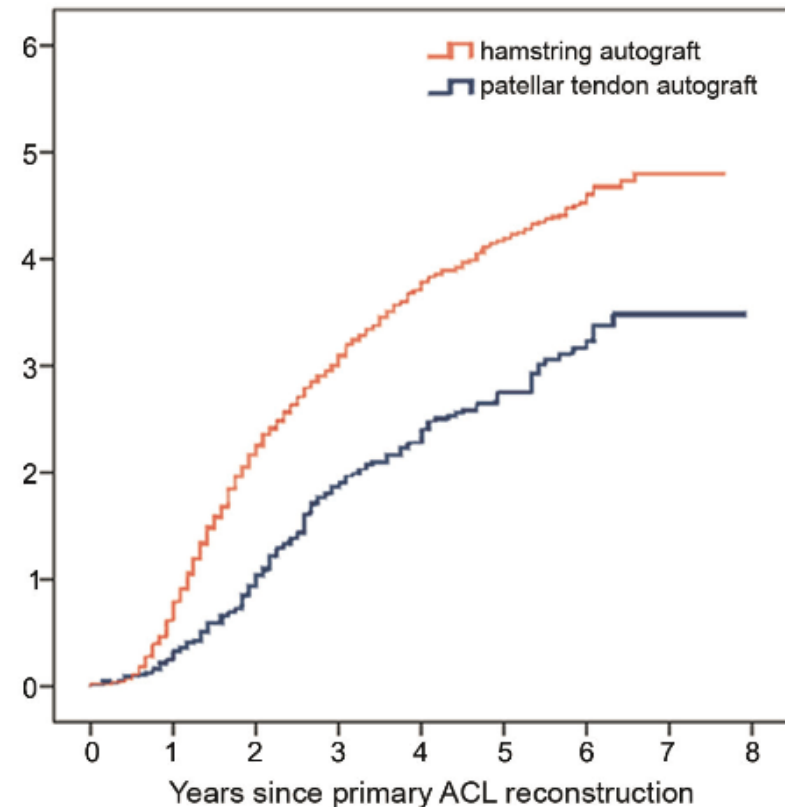
Tone Gifstad,^{*†‡} MD, PhD, Olav A. Foss,^{†‡} MD, PhD, Lars Engebretsen,[§] MD, PhD, Martin Lind,^{||} MD, PhD, Magnus Forssblad,[¶] MD, PhD, Grethe Albrektsen,[‡] PhD, and Jon Olav Drogset,^{†‡} MD, PhD

Investigation performed at Trondheim University Hospital, Trondheim, Norway

- Cohort study
- 45,998 1ry ACLR
- Majority 84.1% PT
- Overall risk revision lower with Patellar tendon HR 0.63
- Decreased with age at surgery
- All subgroups: sex, age cartilage injury, but higher pivoting sports

Registry studies

Gifstad AJSM 2014



Take home messages

- Move forward looking at the evidence
- Predictive factors ACLR
 - Patients good function, worse radiograph
 - Young patients likely require revision or CACLRL
 - Counselling
 - Return to pivoting sports higher risk of Rev but more return than re-rupture
 - Counselling
- Registry warning to direct research-AM drilling
- B-PT-B less risk of revision
 - Consent/Surgeon choice
- Hams-Metal screw less risk of revision
 - Consent/Surgeon choice

Merci de votre
attention

Merci et je l'espère vous
voir la prochaine fois

