Sana Dreifaltigkeits-Krankenhaus Köln

universität Witten/Herdecke

Sportklinik360°

Could low-grade infections be the cause of graft failure in ACL reconstruction? A microbiological comparison of native ACL and graft ruptures.

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Faculty Disclosure Information

Nothing to disclose

Background

In 2012, Vertullo et al. introduced a technique of presoaking the hamstring tendon graft in vancomycin before it is implanted into the knee joint. Clinical studies subsequently have shown that the postoperative infection rate after ACL reconstruction can be significantly reduced to almost 0% by this technique, but concerns have been raised regarding possible vancomycin toxicity to the graft, resulting in early graft failure. Contrary to expectation, a previous study of our group showed a significantly reduced re-rupture rate after ACLR with the use of vancomycin

Background

KNEE

Vancomycin pre-soaking of the graft reduces postoperative infection rate without increasing risk of graft failure and arthrofibrosis in ACL reconstruction

Christoph Offerhaus[1] · Maurice Balke[1] · Juliane Hente[2] · Mats Gehling[2] · Simon Blendl[2] · Jürgen Höher[1]

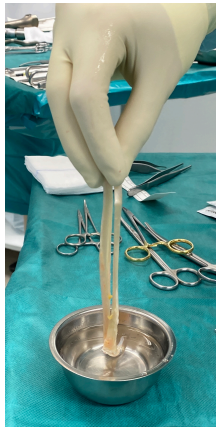
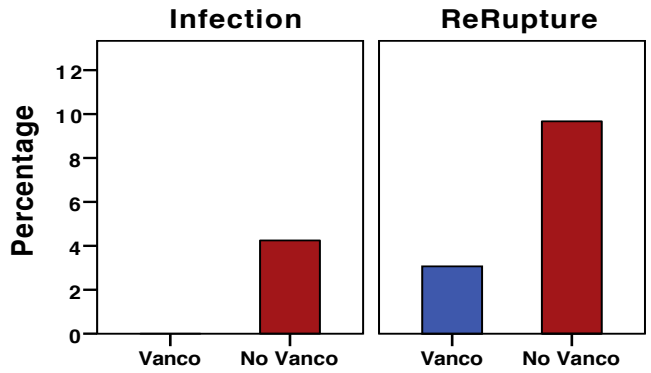


Table 1 Demographics of groups 1 and 2

	Period of study (months)	No. of patients	Mean age at surgery	Male	Female	No. of infections
no vancomycin	32	926	32,4 ± 11,4	569 (61,4%)	357 (38,6%)	22 (2,4%)
vancomycin	28	853	31,2 ± 15,2	528 (61,9%)	325 (38,1%)	0 (0,0%)

Table 4a Complications and outcome of groups 1 and 2 (random sample primary HS ACLR only)

	No. of complications	No. of infections	No. of ReRuptures	No. of arthrofibrosis	IKDC score
no vancomycin	34 (20,4%)	7 (4,2%)	16 (9,6%)	11 (6,6%)	85,6 ± 14,1
vancomycin	35 (8,8%)	0 (0,0%)	8 (3,1%)	27 (10,5%)	84,9 ± 12,1



→Significant reduction of knee infections and graft failure with the use of vancomycin

Background

A possible explanation for this observation could be a reduced number of low-grade infections as a cause for graft failure. The problem of clinically occult infections is well known in other areas of orthopedics. For example, delayed or late infection, which is often characterized by lack of clinical and laboratory signs of infection are of high relevance in the pathogenesis of septic fracture nonunion

Purpose of the study

To investigate whether bacterial presence in a primary ruptured native ACL differs from that in a ruptured hamstrings ACL graft and whether low-grade infections cumulatively can be detected in the case of graft failure.

Furthermore, synovial fluid aspiration and polymerase chain reaction (PCR) of the biopsies were investigated for possible future biomarkers for a low-grade infection.

Material and Methods

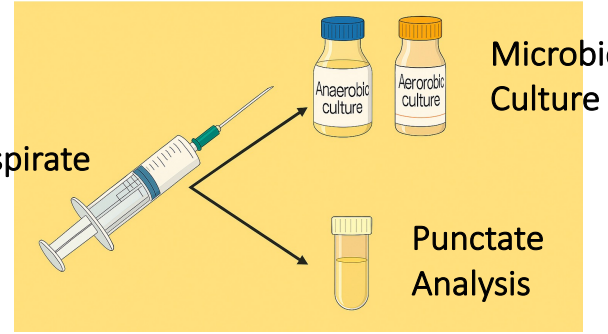
Prospective
Monocentric

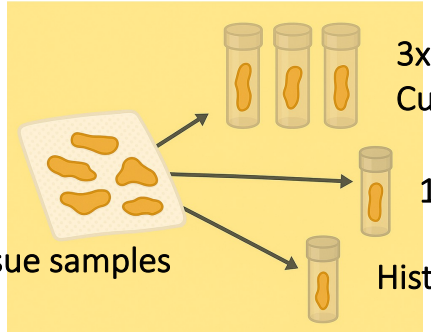
Overall Cohort
112 patients

Graft-Group
53 patients
Graft Failure

ACL-Group
59 patients
Primary ACL rupture

Exclusion criteria
Signs or History of knee joint infection
Antibiotic intake in the last 3 months
ACL-group: Previous knee surgery





In a case-control study with prospectively collected data, synovial fluid aspirates and tissue samples of failed ACL grafts were examined for evidence of bacterial colonization and compared to samples of the native ACL in primary ACL reconstruction (ACLR) using microbiological culture, 16S rRNA-PCR and histopathological examination. Furthermore, synovial fluid aspiration was investigated for possible future biomarkers for a low-grade infection.

Results

Table 3. Comparison of Microbiologcial and Laboratory Results of Native ACL and Graft Samples

	All Patients (n = 112)				ACL Graft (n=53)				Native ACL (n = 59)				
	n	%	mean	SD	n	%	mean	SD	n	%	mean	SD	P
Low-Grade Infection													
no	111	99.1%			52	98.1%			59	100.0%			0.285
yes	1	0.9%			1	1.9%			0	0.0%			

MN, mononukclear leukocytes; PMN, polymorphonuclear leukocytes.

Definition of low-grade infection (Infectious Diseases Society of America)

- At least 2/3 samples show the same bacteria → Low-grade Infection
- Growth in 1 sample or different germs → contamination
- Unless clear signs of infection in histopathology → Low-grade infection

A total of 389 samples were analyzed by microbiological culture. Bacteria were detected in 9.4% of patients with a graft rupture (n = 5/53) compared to 3.4% of patients with a primary ACL rupture (n = 2/59). GLMM-based comparison of patient groups revealed an odds ratio of 2.32 indicating a trend towards twice the likelihood of bacterial growth in the graft rupture group (n.s.; p = .192). One patient with a “true” low-grade infection according to the IDSA-definition was found in the study population, resulting in a prevalence of 1.9% (1/53) in the graft group.

Results

Table 3. Comparison of Microbiologcial and Laboratory Results of Native ACL and Graft Samples

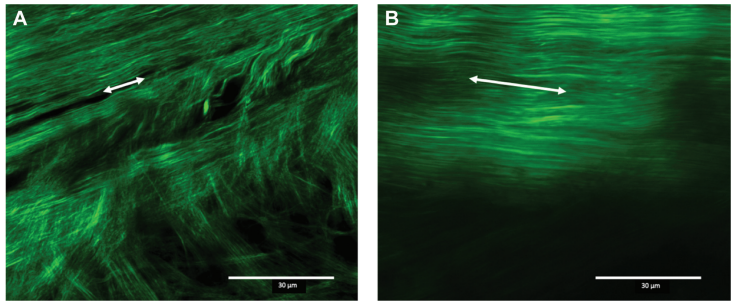
	All Patients (n = 112)				ACL Graft (n=53)				Native ACL (n = 59)				
	n	%	mean	SD	n	%	mean	SD	n	%	mean	SD	P
Synovial fluid analysis (others than culture)													
Glucose mg/dL	63		85	1	31		83	2	32		88	2	**0.04**
Lactate mg/dL	62		2.7	0.1	30		2.9	0.2	32		2.6	0.1	0.166
Protein g/dL	63		3.9	0.1	31		3.5	0.1	32		4.4	0.2	**<0.001**
Leukocytes/µL	64		467	160	31		583	326	33		359	61	0.124
PMN (%)	63		24	3	31		27	3	32		20	4	**0.03**
MN (%)	64		77	3	31		73	3	33		80	4	**0.020**

The percentage of polymorphonuclear leukocytes (PMN%) as a highly sensitive marker for joint infections was significantly higher in aspirated synovial fluid of graft ruptures (27% ± 3% vs. 20% ± 4%, p=0.032), as well as glucose levels were significantly lower (83 mg/dl ± 2 mg/dl vs. 88 mg/dl ± 2 mg/dl, p=0.042).

Discussion / Clinical Relevance

Influence of *Staphylococcus epidermidis* on Collagen Crimp Patterns of Soft Tissue Allograft

Koral M. Blunt,* BA, Brett N. Bentkowski,* BA, Eric Milliron,† MD, Parker Cavendish,† MD, Charles Qin,† MD, Robert A. Magnussen,†‡ MD, MPH, Paul Stoodley,§ PhD, and David C. Flanigan,†‡‖ MD
Investigation performed at The Ohio State University, Columbus, Ohio, USA



Influence of *Staphylococcus epidermidis* biofilm on the mechanical strength of soft tissue allograft

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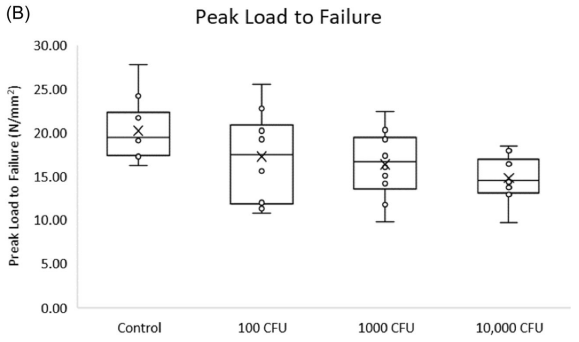

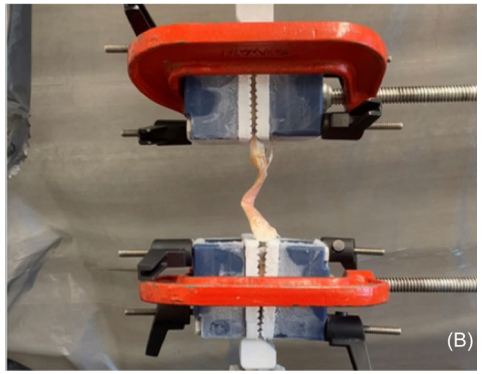

In summary we could not demonstrate a causal relationship between low-grade infection and graft failure. This may be due to the limitations of current diagnostic tools, which are unable to reliably differentiate between clinically inapparent bacterial occupation from contamination during and/or after surgery. However, we detected evidence of bacterial presence and its metabolism in patients undergoing revision ACLR. Based on these findings, we hypothesize that chronic indolent bacterial growth, bacterial metabolism and the associated human immune responses creates a chronic inflammatory environment that compromises graft integrity and may contribute to significant weakening of the graft. This hypothesis is further supported by recent studies showing that *Staphylococcus epidermidis* can significantly alter the crimp pattern of soft tissue allografts, potentially reducing their mechanical strength.

Conclusion

Synovial fluid obtained before revision ACLR showed a higher percentage of polymorphonuclear leukocytes and lower glucose levels compared with primary ACLR, suggesting bacterial metabolism and demonstrating that the intra-articular milieu changes significantly after ACLR. Tissue samples of ACL grafts revealed a low-grade infection in one case, although overall cultivable bacterial presence did not differ significantly when compared to samples of a native ACL.

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Thank you for your interest!

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