



How do we diagnose infection after UKA ?

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Risk Factors for Infection After Knee Arthroplasty

A Register-Based Analysis of 43,149 Cases

By Esa Jämsen, BM, Heini Huhtala, MSc, Timo Puolakka, MD, PhD, and Teemu Moilanen, MD, PhD

Investigation performed at Coxa, Hospital for Joint Replacement, Tampere, Finland

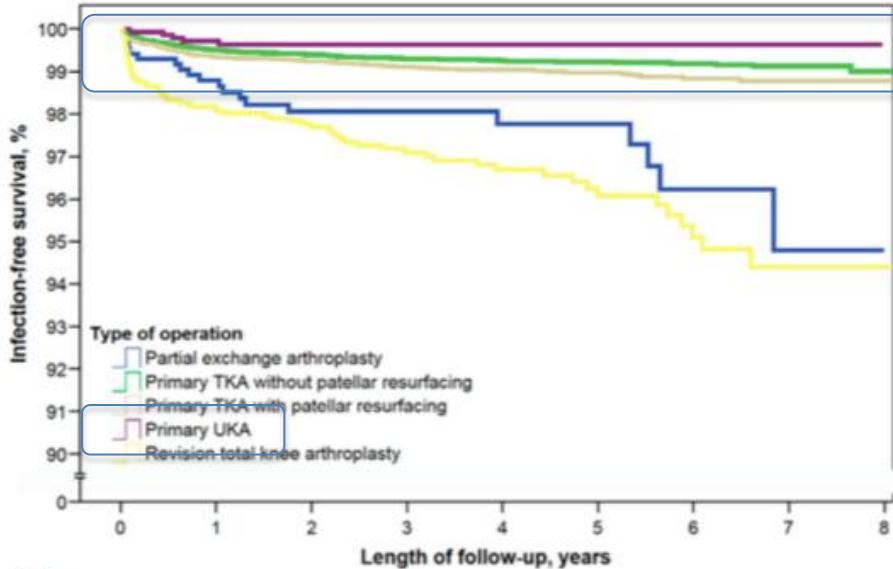


Fig. 1

Kaplan-Meier curves illustrating crude prosthetic survival, with reoperation for the treatment of infection as the end point, after primary unicompartmental knee arthroplasty (UKA), total knee arthroplasty (TKA), partial revision arthroplasty, and revision total knee arthroplasty.

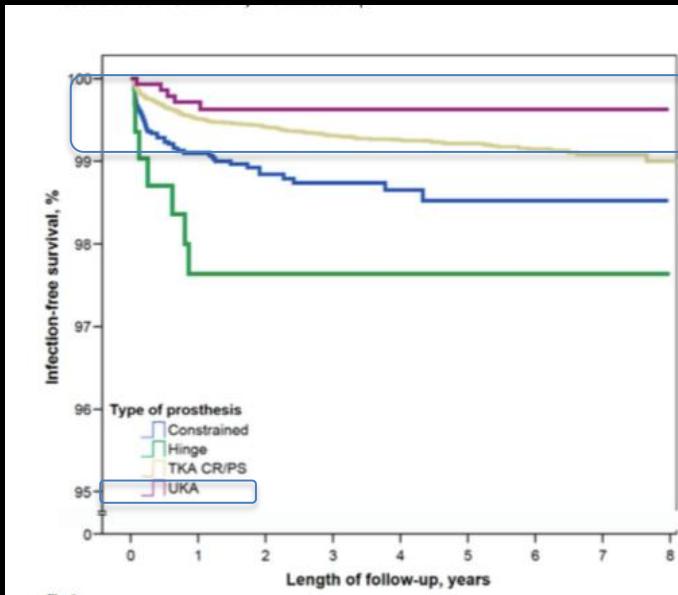


Fig. 3

Kaplan-Meier curves illustrating crude prosthetic survival, with reoperation for the treatment of infection as the end point, after primary knee replacement performed with different types of prostheses. TKA = total knee arthroplasty; CR/PS = cruciate-retaining or cruciate-substituting; and UKA = unicompartmental knee arthroplasty.

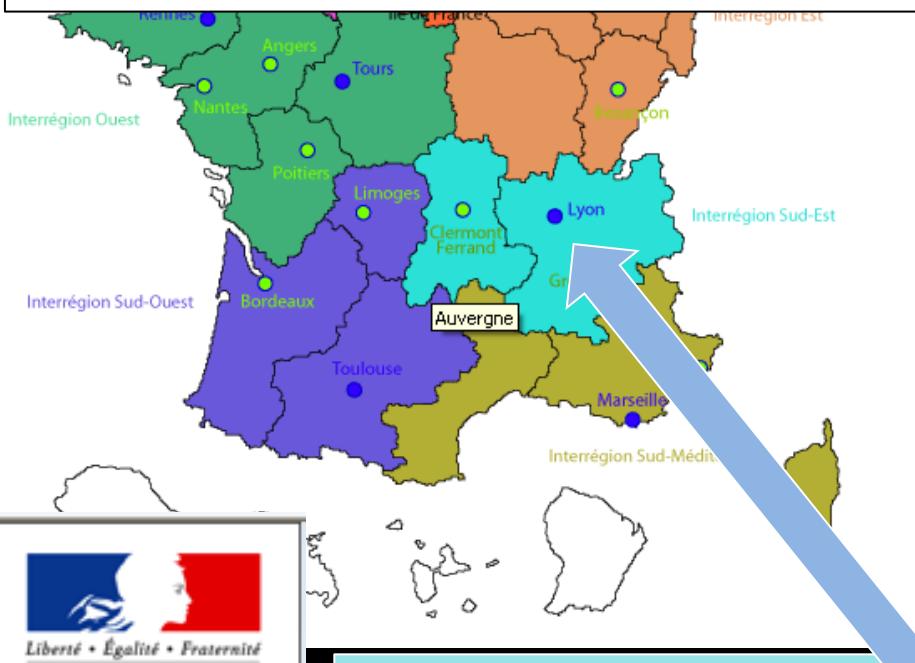
TABLE II Risk Factors for Reoperation Because of Infection After Primary and Revision Knee Arthroplasty, According to Cox Regression Model Adjusted for Sex, Age, Diagnosis, and Type (Constraint) of Implanted Prosthesis*



	Primary Knee Arthroplasty			Revision Total Knee Arthroplasty†		
	No. of Knees	No. of Reoperations for Infection per 100 Knees	Adjusted Hazard Ratio (95% Confidence Interval)	No. of Knees	No. of Reoperations for Infection per 100 Knees	Adjusted Hazard Ratio (95% Confidence Interval)
Age group						
<65 years	10,155	0.83	1	510	3.14	1
Type of implanted prosthesis						
Unicondylar		1425	0.35		0.59 (0.24 to 1.43)	
Cruciate-retaining/ posteriorly stabilized		34,456	0.70		1	
Constrained		3938	1.17		1.74 (1.27 to 2.40)	
Hinged		316	2.22		2.93 (1.34 to 6.40)	
Other illness	328	0.92	0.93 (0.29 to 3.04)	28	3.57	1.05 (0.15 to 7.62)
Type of implanted prosthesis						
Unicondylar	1425	0.35	0.59 (0.24 to 1.43)	4	0	—
Cruciate-retaining/ posteriorly stabilized	34,456	0.70	1	574	2.44	1
Constrained	3938	1.17	1.74 (1.27 to 2.40)	1167	3.60	1.75 (0.95 to 3.21)
Hinged	316	2.22	2.93 (1.34 to 6.40)	421	3.09	1.54 (0.72 to 3.28)

Our experience

2%
*of our revision knee arthroplasties
for infection*



Lyon metropolis
2,000,000 inhabitants

2011 – 2015

Revision
Arthroplasty for
infection
Database

n=240 revision THA
n =232 revision TKA

n=5 revision UKA

Rhône-Alpes Auvergne region
7,500,000 inhabitants

Different situations

I. *Early infection*

- 4 weeks post op

II. *Acute hematogenous infection*

- 4 weeks after onset of symptoms

III. *Late infection*

- Everything after 4 weeks





Consensus definition of PJI

Major Criteria

Two periprosthetic cultures with phenotypically identical organism,

Or

A sinus tract communicating with the joint,

No « sterile » Sinus





Consensus definition of PJI

Having 4 of the following 6 ***Minor criteria*** :

- Elevated serum ESR and CRP,
- Elevated synovial fluid WBC count
 - or ++ change on leucocyte esterase test strip,
- Elevated synovial fluid neutrophil percentage (PMN%),
- Presence of purulence in the affected joint,
- Positive histological analysis of periprosthetic tissue,
- A single positive culture.

Clinical suspicion

Local symptoms

- wound drainage,
- pain,
- erythema,
- swelling,
- induration,
- cellulitis.

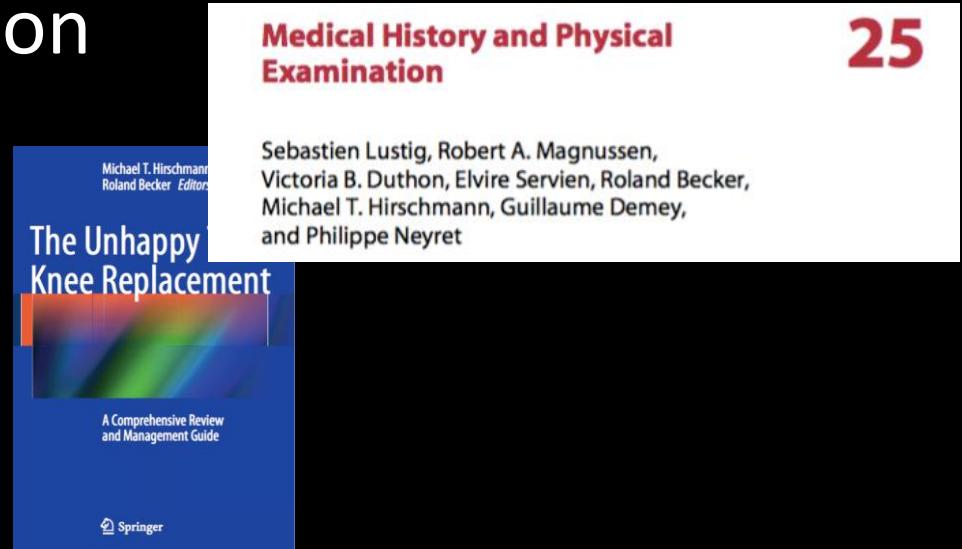
Acute
post-operative infection



Clinical suspicion

Risk factors for infection

- Age (old)
- Malnutrition
- Obesity (?)
- Corticotherapy
- Skin lesions



Recent dental, digestive or urinary invasive procedure

Clinical suspicion

Risk factors for infection



Contents lists available at [ScienceDirect](#)

The Journal of Arthroplasty

journal homepage: www.arthroplastyjournal.org



Original article

Barbed Suture Is Associated With Increased Risk of Wound Infection After Unicompartmental Knee Arthroplasty

Harshvardhan Chawla, BS ^{a,*}, Jelle P. van der List, MD ^a, Nicole B. Fein, PA-C ^a, Michael W. Henry, MD ^b, Andrew D. Pearle, MD ^a

^a Computer Assisted Surgery Center, Department of Orthopedic Surgery, Hospital for Special Surgery, Weill Cornell Medical College, New York, New York

^b Division of Infectious Disease, Department of Medicine, Hospital for Special Surgery, Weill Cornell Medical College, New York, New York

Pain characteristics

Location,
Duration,
at rest or at night...

No pain-free period

No Honey moon

Serologic studies

CRP < 10

+

Sedimentation
Rate < 30 mm/h

No (chronic) infection (94 %)

no evidence

supporting the role of white blood cell count
and/or white blood cell differential in diagnosis of PJI

1. Workgroup T, Society I. New definition for periprosthetic joint infection. J Arthroplasty. 2011;26(8):1136–8.
2. Piper KE, PlosOne 2010

Diagnosis of Periprosthetic Joint Infection After Unicompartmental Knee Arthroplasty

- *Multicenter study,*
- *259 patients undergoing revision of a failed UKA,*
- *28 (10.8%) PJI,*

CRP < 14

+

**Sedimentation
Rate < 27 mm/h**

XRays

- Loosening of previously well-fixed components (< 5y postop),
- Osteolysis or bone resorption around the prosthetic components,
- Subperiosteal elevation,
- Transcortical sinus tracts.



Timing ?



2 months FU

Radiolucent line doesn't always mean Loosening or infection

Orthopaedics & Traumatology: Surgery & Research (2009) 95, 12–21



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www.em-consulte.com

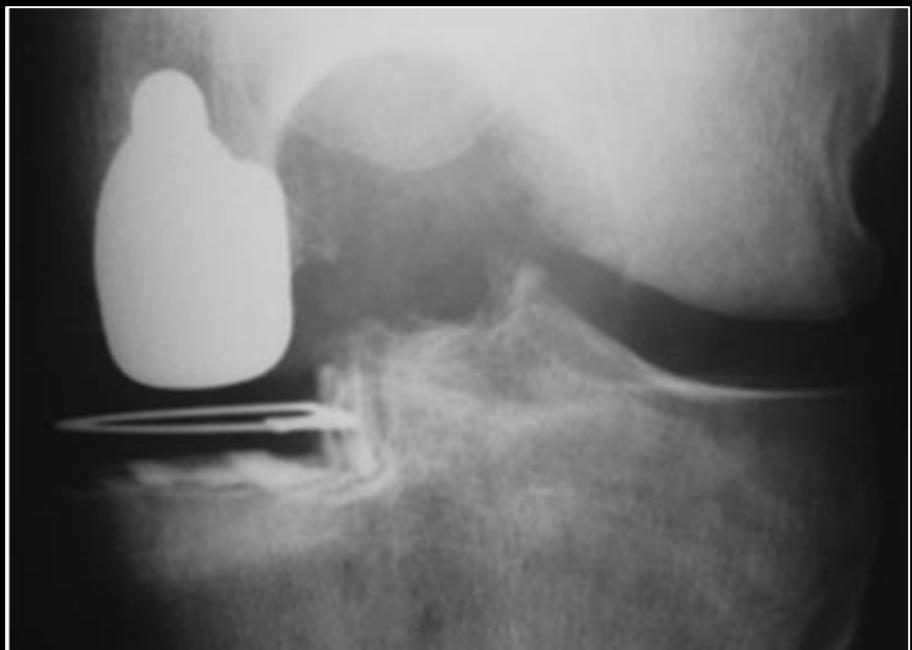


ORIGINAL ARTICLE

**Cemented all polyethylene tibial insert unicompartmental knee arthroplasty:
A long term follow-up study**

S. Lustig, J.-L. Paillot, E. Servien, J. Henry, T. Ait Si Selmi, P. Neyret*

A radiolucency in 26.5% of the cases (...) noted in the first postoperative year (...) non progressive at 5y and 10y FU



CT Scan – MRI ?



Nuclear Imaging

Cost +++

- **Bone scintigraphy**
 - Screening test
 - Accuray 65-80%
- **Leukocyte/marrow imaging**
 - Accuracy 90%



AAOS Clinical Practice Guideline: diagnosis and treatment of periprosthetic joint infections of the hip and knee. J Am Acad Orthop Surg

Aspiration +++

- OR conditions
- Antibiotics withdrawn 14 days prior to aspiration
- Cultures for at least 14 days
- No local anaesthetics
- No saline rinsing



5 diagnosis tools

- Leukocyte-esterase (LE) – Urinary Strips
- Alpha Defensin
- Cell count (WBC)
- Granulocyte percentage (PMN)
- Culture and susceptibility

Leukocyte esterase – Urinary Strips



- Cheap
- Quick
- Easy to carry out

Sensitivity : 85,7 %

Specificity : 88,3 %

Bedair H, Ting N, Jacovides C, Saxena A, Moric M, Parvizi J, Della Valle CJ. Diagnosis of early postoperative TKA infection using synovial fluid analysis. Clin Orthop Relat Res. 2011;469:34–40.

Alpha Defensin

Clin Orthop Relat Res (2015) 473:198–203
DOI 10.1007/s11999-014-3722-7

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and Related Research®
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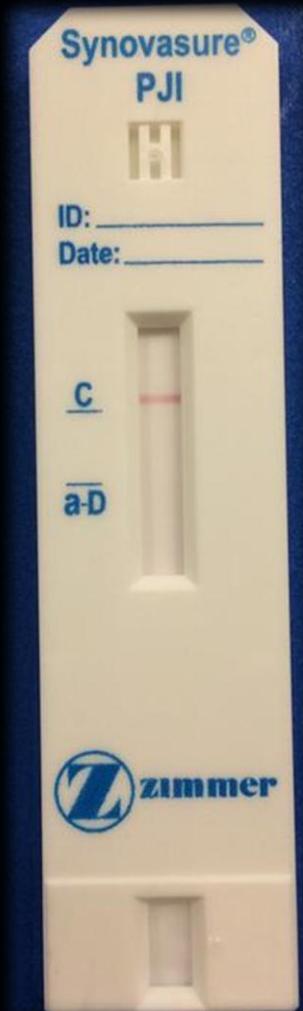
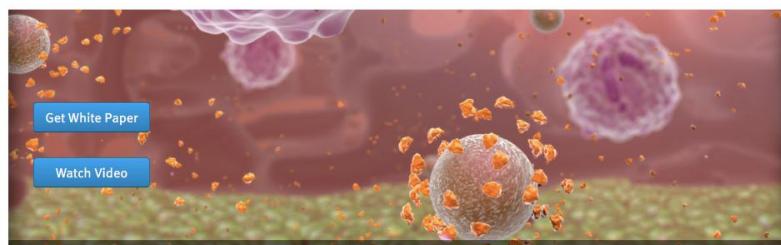
SYMPOSIUM: 2014 KNEE SOCIETY PROCEEDINGS

The Alpha-defensin Test for Periprosthetic Joint Infection Outperforms the Leukocyte Esterase Test Strip

Carl Deirmengian MD, Keith Kardos PhD, Patrick Kilmartin MS,
Alexander Cameron BS, Kevin Schiller BS, Robert E. Booth Jr MD,
Javad Parvizi MD, FRCS

Synovasure PJI

Alpha Defensin Test for Periprosthetic Joint Infection



Cutoff levels for CRP in serum and leukocytes in synovial fluid

- Acute infection :
 - CRP → 100mg/l
 - WBC → 10.000 / μ L
 - PMN → 90 %
- Chronic infection :
 - CRP → 10mg – 14mg/l
 - WBC → 3.000 – 6.200 / μ L
 - PMN → 80 – 60 %

Proceedings of the International
Consensus Meeting on
Periprosthetic Joint Infection

Chairmen:

Thorsten Gehrke MD

Javad Parvizi MD, FRCS

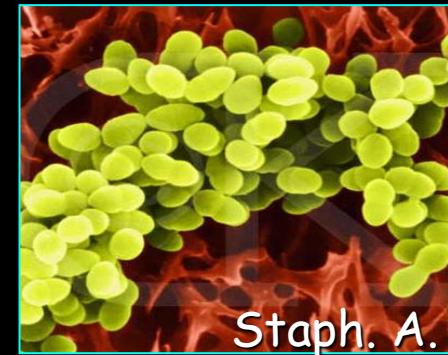


The Journal of Arthroplasty Vol. 27 No. 8 Suppl. 1 2012

**Diagnosis of Periprosthetic Joint Infection After
Unicompartmental Knee Arthroplasty**



Culture

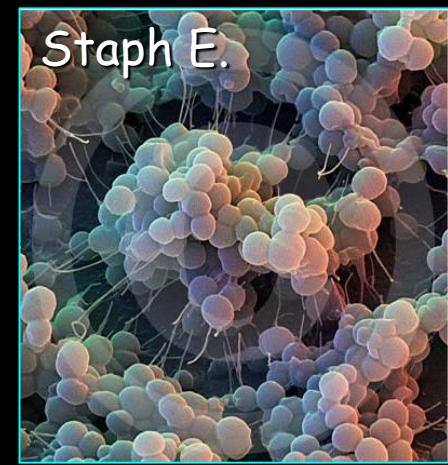


Original article

Chronic infection of unicompartmental knee arthroplasty: One-stage conversion to total knee arthroplasty

C. Labruyère, V. Zeller, L. Lhotellier, N. Desplaces, P. Léonard, P. Mamoudy, S. Marmor*

Centre de référence en infection ostéoarticulaire, Groupe Hospitalier Diaconesses Croix Saint-Simon, 125, rue d'Avron, 75020 Paris, France



Aspiration	Intraoperatively
<i>S. epidermidis</i>	<i>S. epidermidis</i>
-	<i>Enterococcus durans</i>
<i>S. epidermidis</i>	<i>S. epidermidis</i>
<i>S. epidermidis</i>	<i>S. epidermidis</i>
<i>E. coli</i>	<i>E. coli</i>
<i>S. lugdunensis</i>	<i>S. lugdunensis</i>
<i>S. capitis</i>	<i>S. capitis</i>
<i>S. epidermidis</i>	<i>S. epidermidis</i> Nutritionally deficient <i>Streptococcus</i>
-	

100% correlation
between aspiration
and intraoperative
samples



E. Coli

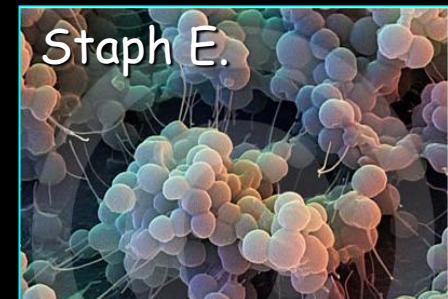


Culture



The Journal of Arthroplasty Vol. 27 No. 8 Suppl. 1 2012

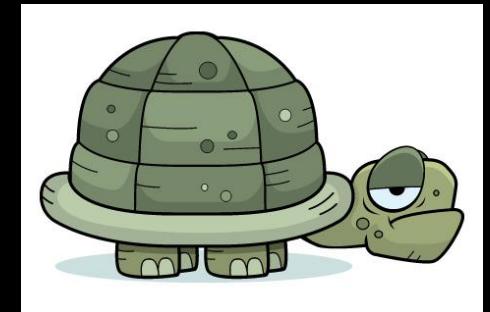
Diagnosis of Periprosthetic Joint Infection After Unicompartmental Knee Arthroplasty



Microorganism	Frequency [%]
Coagulase-negative <i>Staphylococcus</i>	11 [39.2]
<i>S. aureus</i>	8 [28.6]
Group B <i>Streptococcus</i>	3 [10.7]
<i>Escherichia coli</i>	2 [7.1]
<i>Propionibacterium acnes</i>	1 [3.6]
Negative culture	3 [10.7]



Sonication



The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Sonication of Removed Hip and Knee Prostheses for Diagnosis of Infection

Andrej Trampuz, M.D., Kerryl E. Piper, M.S., Melissa J. Jacobson, A.S., Arlen D. Hanssen, M.D., Krishnan K. Unni, M.D., Douglas R. Osmon, M.D., Jayawant N. Mandrekar, Ph.D., Franklin R. Cockerill, M.D., James M. Steckelberg, M.D., James F. Greenleaf, Ph.D., and Robin Patel, M.D.



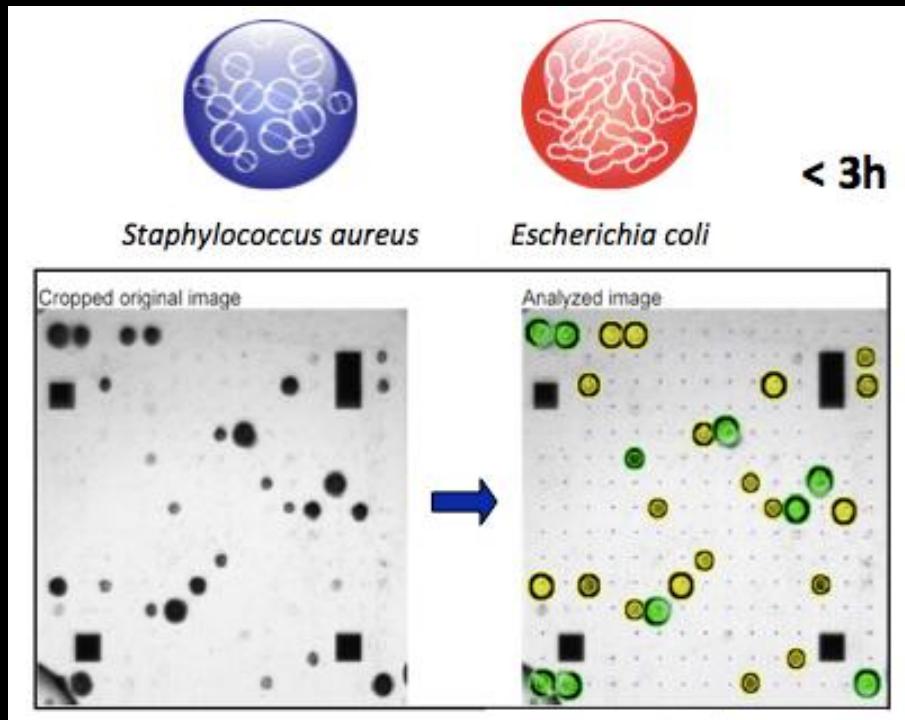
Molecular Biology



Diagn Microbiol Infect Dis. 2014 Mar;78(3):313-5. doi: 10.1016/j.diagmicrobio.2013.11.026. Epub 2013 Dec 6.

Rapid detection of *Staphylococcus aureus* and methicillin resistance in bone and joint infection samples: evaluation of the GeneXpert MRSA/SA SSTI assay.

Valour F¹, Blanc-Pattin V², Freydière AM³, Bouaziz A⁴, Chanard E⁵, Lustig S⁶, Ferry T⁷, Laurent F⁸; Lyon Bone Joint Infection Study Group.



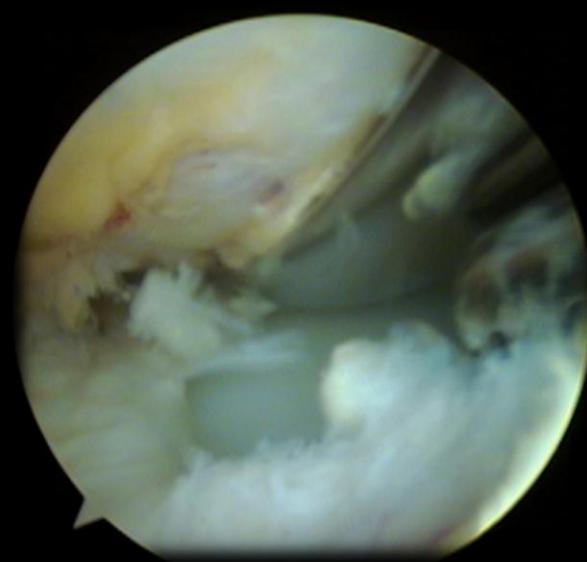
Histology

Arthroscopy of the knee after unicompartmental arthroplasty

S. Hannaoui^b, S. Lustig^a, E. Servien^a, T. Aït Si Selmi^a, P. Neyret^{a,*}

^a Centre Albert-Trillat, groupement hospitalier Nord, 69004 Lyon, France

^b Al-Hayat hospital, Shayah, Liban



Histology

- Part of the gold standard for diagnosis of PJI,
- Low sensitivity,
- ***Periprosthetic interface membrane ++***

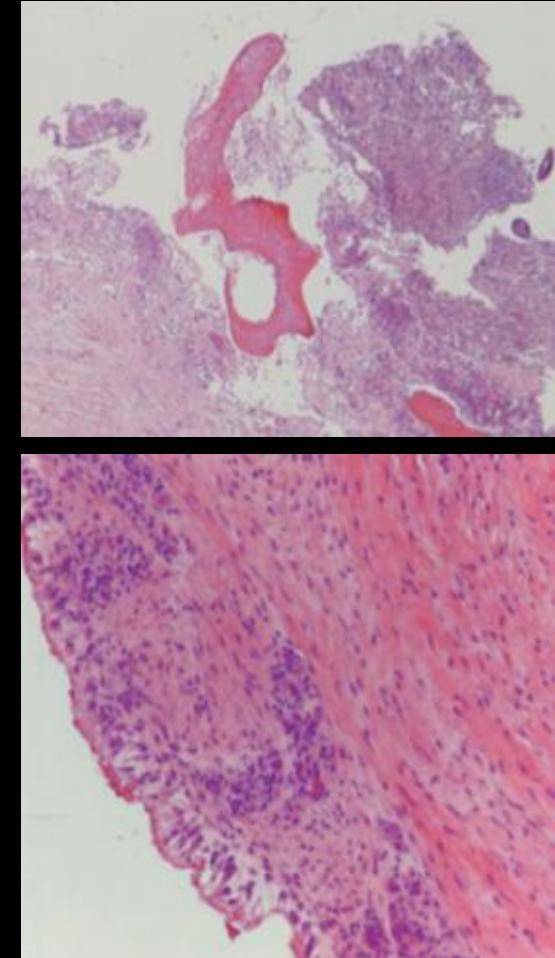


Bori G, Munoz-Mahamud E, Garcia S, Mallofre C, Gallart X, Bosch J, Garcia E, Riba J, Mensa J, Soriano A. Interface membrane is the best sample for histological study to diagnose prosthetic joint infection. Mod Pathol. 2011;24:579–84

Histology

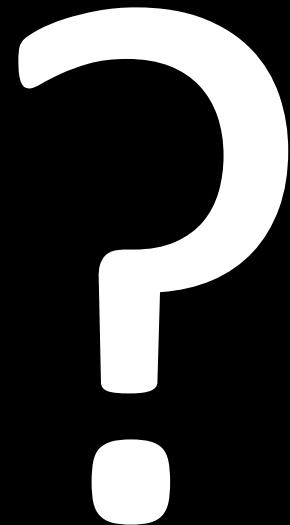
« Positive »

Greater than five neutrophils
per high-power field in five
high-power fields observed
from histologic analysis of
periprosthetic tissue at $\times 400$
magnification



Bori G, Munoz-Mahamud E, Garcia S, Mallofre C, Gallart X, Bosch J, Garcia E, Riba J, Mensa J, Soriano A. Interface membrane is the best sample for histological study to diagnose prosthetic joint infection. Mod Pathol. 2011;24:579–84

Consequence for management
conservative / 1stage / 2 stage



Criteria of *implant preserving*

- Solid implants, no loosening.
- No draining sinus, soft tissues must be intact.
- Maximum 3 weeks post op, or after onset of acute symptoms at haematogenous infection.
- Cemented implant (?).

After 3 weeks (?) biofilm formation on the surface of the implant, therefore no chance to preserve.



1 stage

vs

2 stage

*Bacteriologic
documentation*
+++



Available online at
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www.sciencedirect.com

Elsevier Masson France
EM|consulte
www.em-consulte.com/en

Original article
Chronic infection of unicompartmental knee arthroplasty: One-stage conversion to total knee arthroplasty

C. Labruyère, V. Zeller, L. Lhotellier, N. Desplaces, P. Léonard, P. Mamoudy, S. Marmor*

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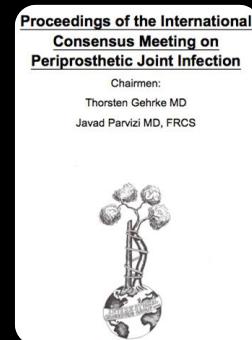
 CrossMark



Take home message

Infection after UKA

- Unusual
- CRP/ESR
- Aspiration +++
 - WBC / Culture / alpha dephensin
- Concensus criteria



Thank You

