# Spacer as a source of re-infection?

## Comparison of cultures and 16s r-RNA sequencing for identification for bacteria in 2-stage revision knee arthroplasty

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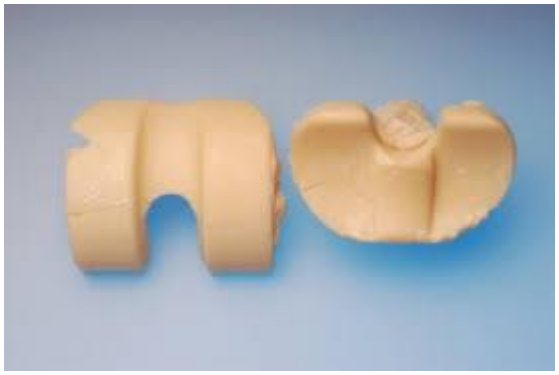
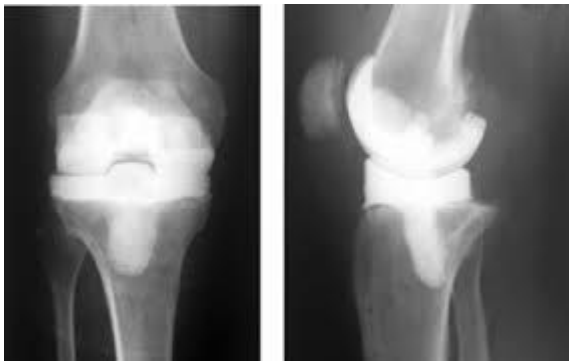
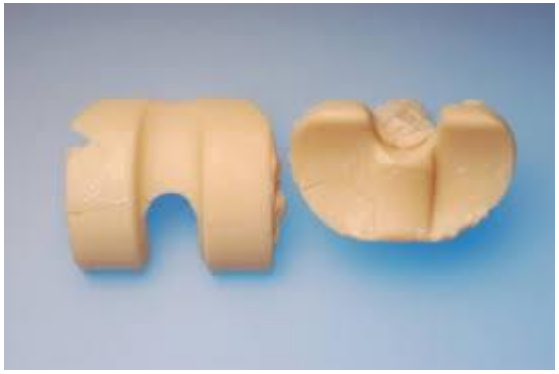


# Spacer



- The risk of PJIs occurs in 3.2–7 % of patients after **revision arthroplasties**
- The two-stage exchange arthroplasty is the preferred method of treating chronic PJI
- The use of a prefabricated spacer in two-stage revision arthroplasty remains one of the best strategy for infected-joint arthroplasty treatment,
- Many unidentified microorganisms (2–36 %)in the infected joint replacements



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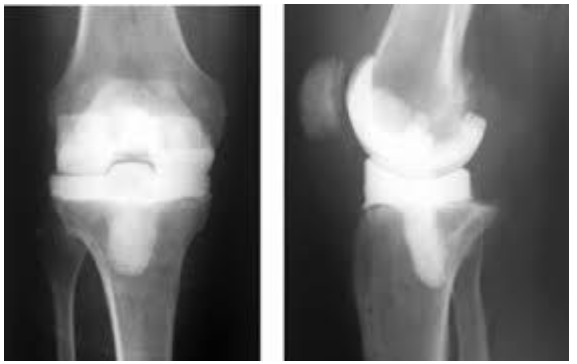

- Studies of bacteria eradication after two-stage revision revealed **10% to 30 %** identified microorganism on spacer surface using sonication cultures

(Sorli L. et al. JBJS 2012; Marin M et al. JClinMicrobiol.2012; Mariconda.et al. BMC MscDis.2013)Kurd MF et al. Clin Orthop Res.2010; Kubista et al. Int.Orthop. 2012)

# Aim of the study

1. Show that sonication followed by PCR can improve bacterial identification

2. Prove that the normalisation of laboratory markers does not exclude silent persistent infection and the presence of bacteria on spacer surfaces

3. Determine if laboratory markers of infection and culture results were related to failure at 2-years follow-up

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# Methods

•9 patient with diagnosed  knee joint infection attending the Department of Orthopaedic and Traumatology, Medical University of Silesia, School
of Medicine in Katowice, Poland

•The average period between the first and second stage of revision arthroplasty was calculated at about
5 months)

•Minimum follow-up was 2 years (mean, 32 months;range, 25–36 months).

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# Methods

Exclusion criteria:

- antibiotics administration 2 weeks before revision arthroplasty
- other established infection sites in the organism,
- rheumatoid arthritis
- Immunosuppression and/or chemotherapy,
- lack of patient approval for the study

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# Methods

Cultures:

- Intraoperative tissue during the 1st stage
- Intraoperative tissue during 2nd stage
- Sonicate fluid obtained from components of prosthesis

The cultures were prolonged up to 14 days for slow-growing and fastidious microorganisms

- Molecular detection of bacterial DNA on spacer surface

- Clinical evaluation and CRP

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# Results

- Tissue cultures in 2nd stage revision arthroplasty revealed in **2 cases** CNS
- After sonication - **3 positive cultures** (CNS and *Ralstonia picketti* )
- Bacterial DNA was found in most cases (89%) and revealed potential pathogenic species and/or environmental microflora with low virulence *(Klebsiella pneumoniae, Pseudomonas aeruginosa, Lactobacillus spp., Brevibacterium spp., Corynebacterium spp)*
- **Clinical failure were recorded in 2 cases (22%)**


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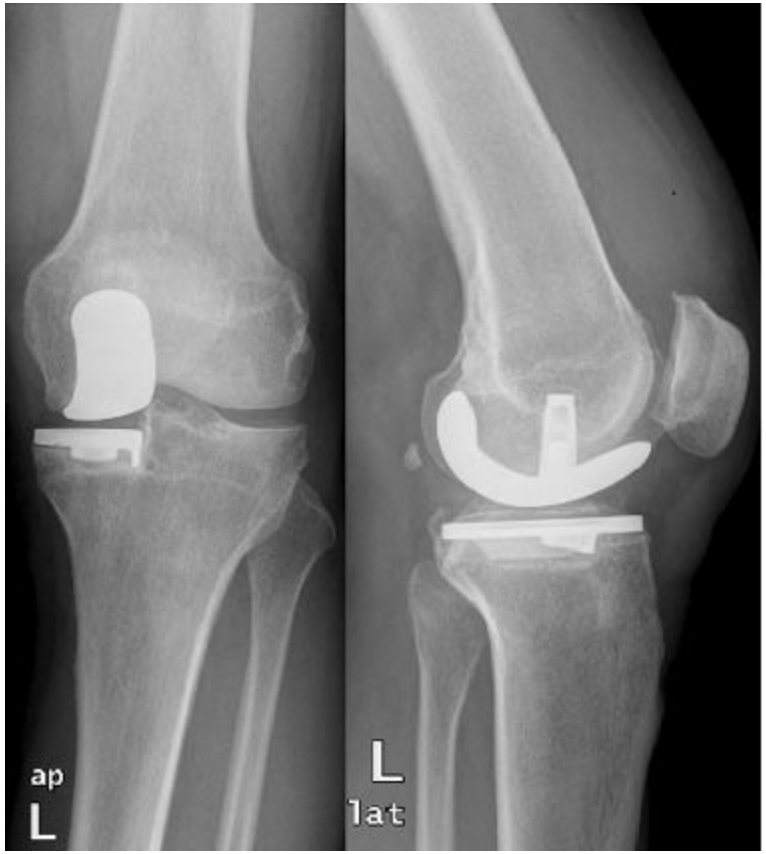
| | CRP before 2nd stage | Time between stages (days) | 2nd stage | 1st stage culture | 2nd stage culture | 2nd stage cultere after sonication | Molecular identification by 16S rRNA gene sequencing | Clinical outcomes |
|---|---|---|---|---|---|---|---|---|
| 1 | <5 | 146 | Scorpio TS | negative | negative | negative | Pseudomonas aeruginosa, P. resinovorans | healed |
| 2 | <5 | 90 | Scorpio TS | negative | negative | *Ralstonia picketti* | Novosphingobium nitrogenifigens, N. hassiacum, Bradyrhizobium japonicum, B. liaoningense, | healed |
| 3 | <5 | 145 | Scorpio TS | negative | negative | negative | Klebsiella pneumoniae | healed |
| 4 | 6 | 184 | Scorpio TS | *Micrococcus sp.* | negative | negative | S. lugdunensis, S. hominis | healed |
| 5 | <5 | 88 | Scorpio TS | *Streptococcus viridans* | *S. epidermidis* | negative | Corynebacterium ureicelerivorans, | healed |
| 6 | <5 | 150 | Scorpio TS | *E.coli* | negative | *Ralstonia picketti* | Rubrobacter xylanophilus, Clostridium saccharoperbutylacetonicum | healed |
| 7 | <5 | 150 | Scorpio TS | *Enterococcus feacalis* | negative | negative | Tuberibacillus calidus, Bacillus algicola | healed |
| 8 | 27 | 140 | Scorpio TS | *Acinetobakter baumani Enterobakter cloacae* | negative | negative | negative | recurrent joint effusion |
| 9 | <5 | 180 | Arthrodesis | *Staph. aureus* | *S. epidermidis* | *S.epidermidis* | Acinetobacter johnsonii, A. parvus | prolonged wound healing) |

# Patient nr 8

57 y.o. female after unilateral knee replacement with diagnosed PPI:

- Persistent pain
- Elevated CRP
- Positive pre and intraoperative culture (*Acinetobacter baumani, Enterobacter cloacae*)



# Patient nr 8

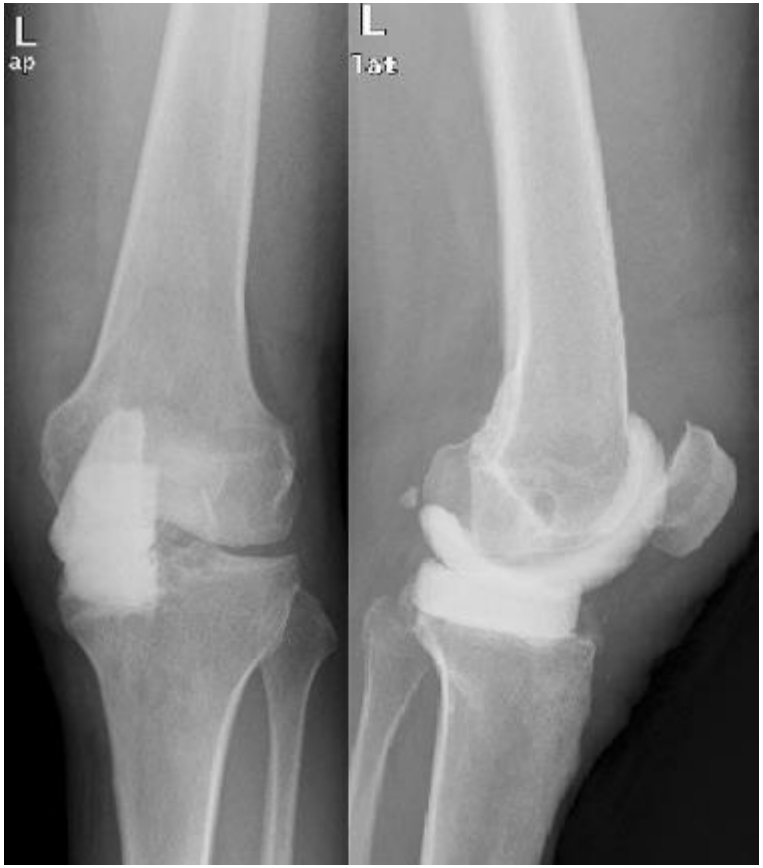
Before 2nd stage:

- Elevated CRP - 27
- Culture:

  Preoperative – **negative**

  Intraoperative– **negative**

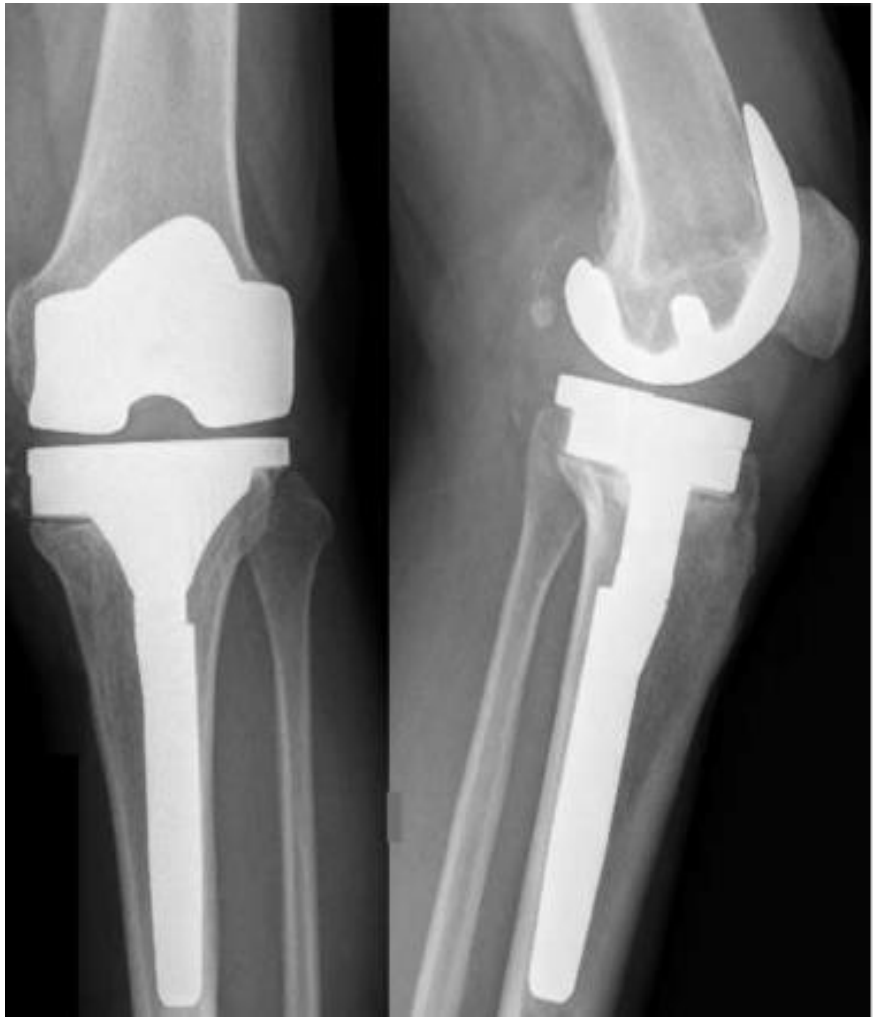
  Spacer specimen culture– **negative**
- Sonicated culture– **negative**
- Bacterial DNA PCR- **NEGATIVE**



# Patient nr 8

Failure in 3-years follow-up:

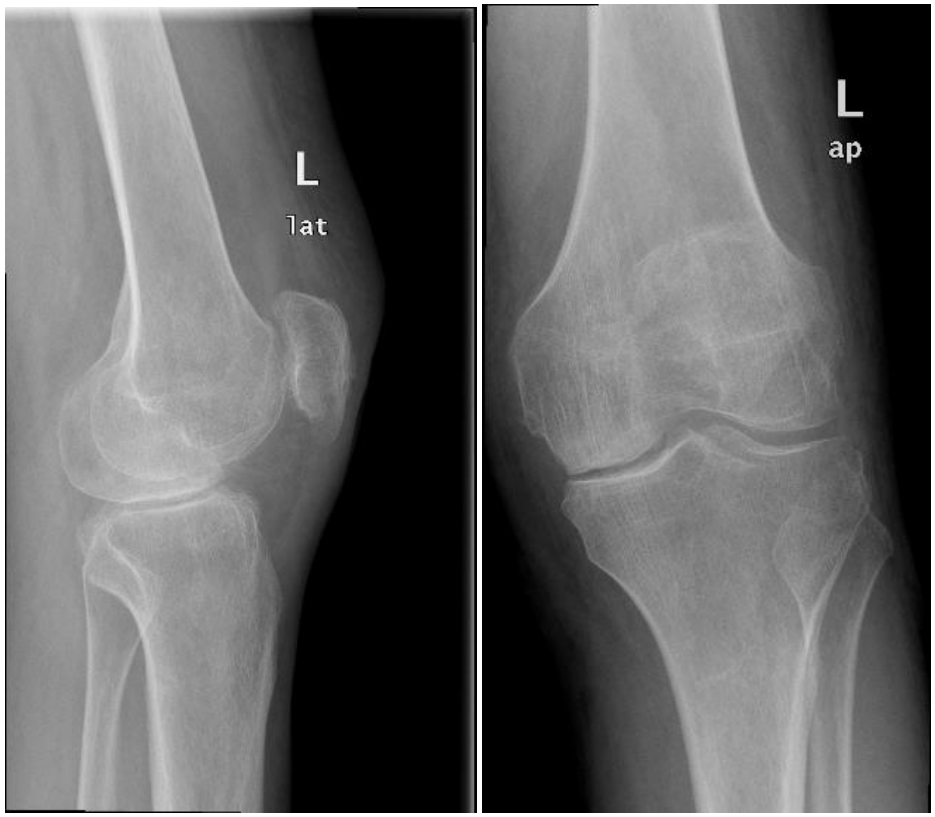
- periodic effusion **without persistent pain**
- presence of MSSE in 1 of 3 arthrocentesis performed in the early postoperative period
- minimal radiolucency under the tibial component, not assessed as implant loosening



# Patient nr 9

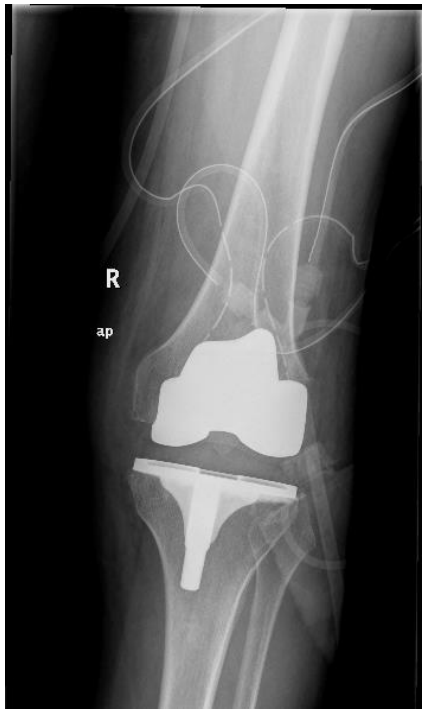
50 y.o. Male (2012r) with history:

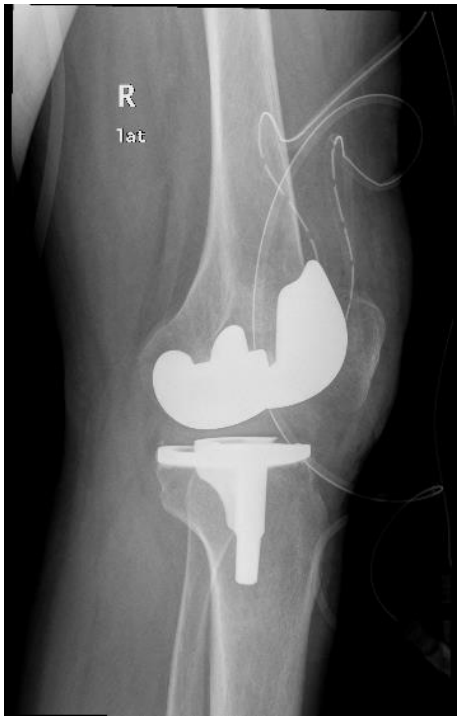
- **Purulent knee infection** treated >20 years ago
- **9 different surgery procedure** including:
  - Feet reconstruction, cholecystectomy, gastrectomy, prostatektomy
  - Arthroscopic debridement of knees
  - **Arthrotomy without arthroplasty due to purulent fluid 8 years before**

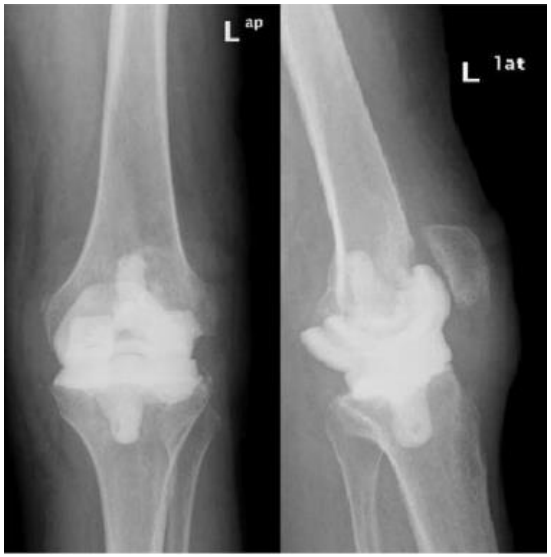


# Patient nr 9

- 2012 TKR after normalized infection parameters
- 6 month later PPI – joint effusion, persistent pain, elevated markers
- **MSSA** in arthrocentesis
- 2-stage revision



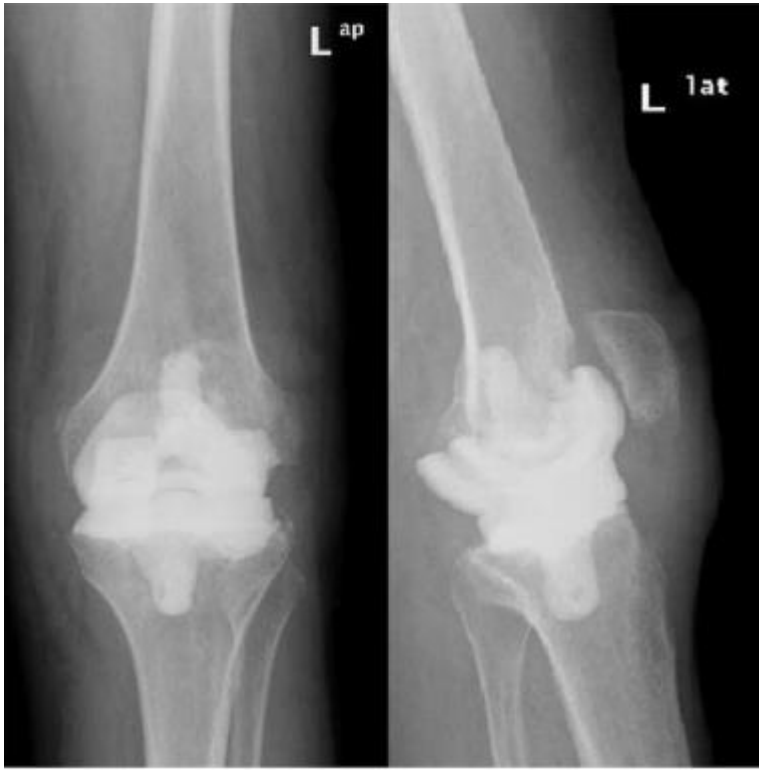



# Patient nr 9

2nd stage:

- CRP <5

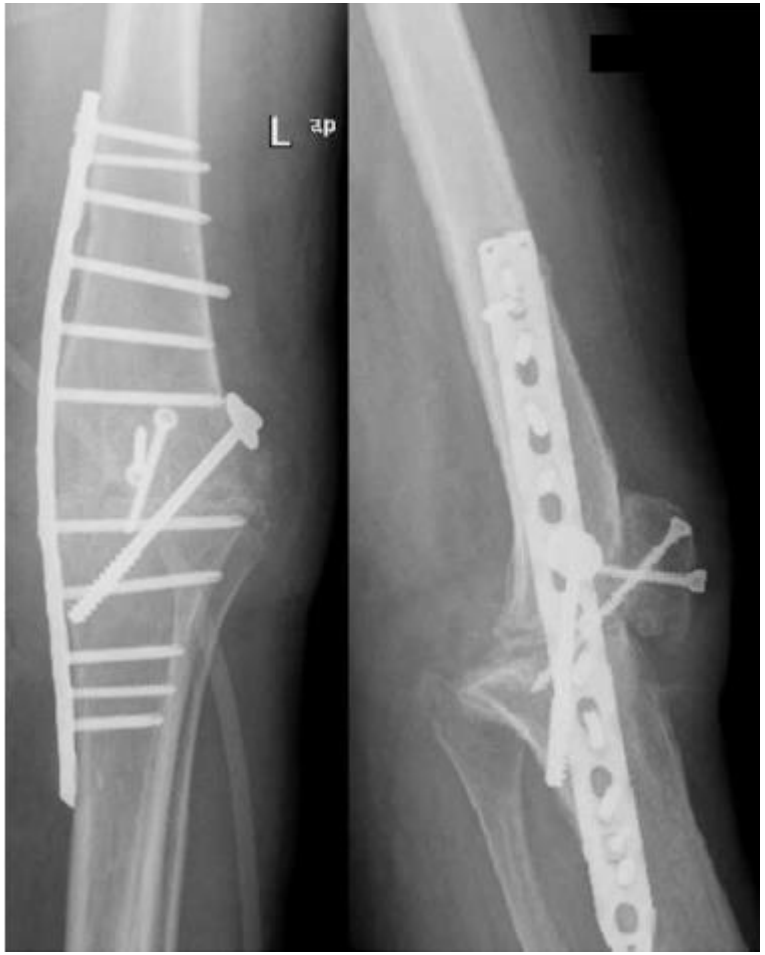
- **MSSE** culture positive on both spacer samples nonsonicated and sonicated



# Patient nr 9

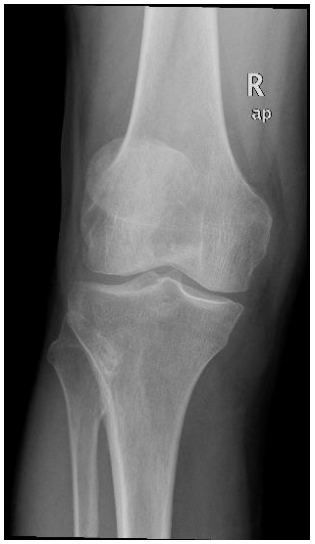
2nd stage - **arthrodesis** of the knee joint due to general medical condition and the high risk of reinfection

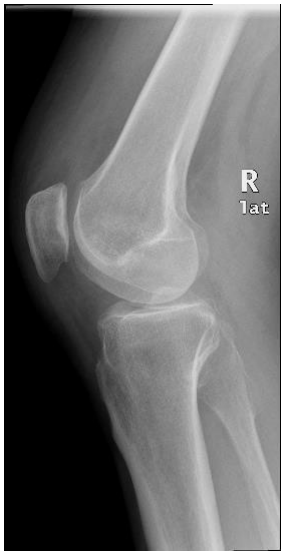
- Prolonged wound healing
- Long-term antibiotic therapy
- Delayed bone union >12months

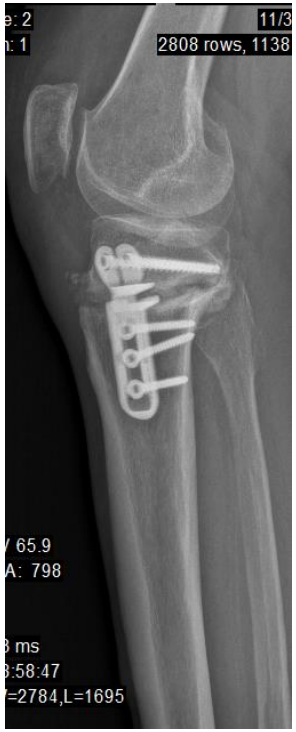


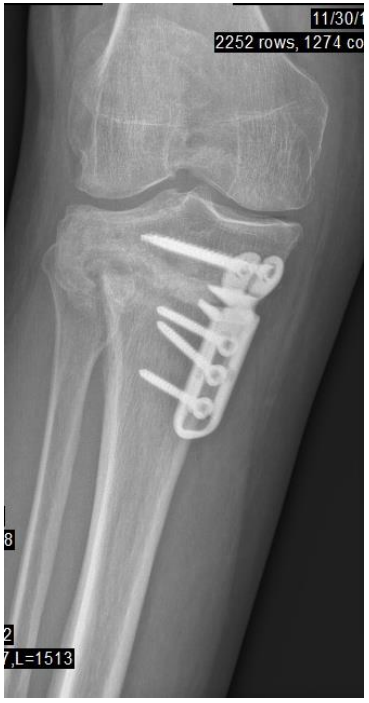
# Patient nr 9 EPILOG

- In 2015 pain and arthrosis of right knee (after 12 surgery procedures)
- „open wedge” osteotomy due to history
- Non-union after 12 months

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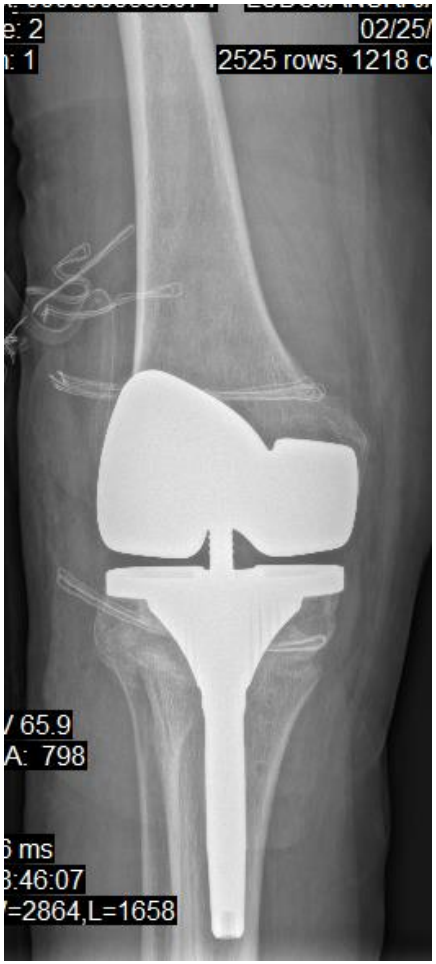
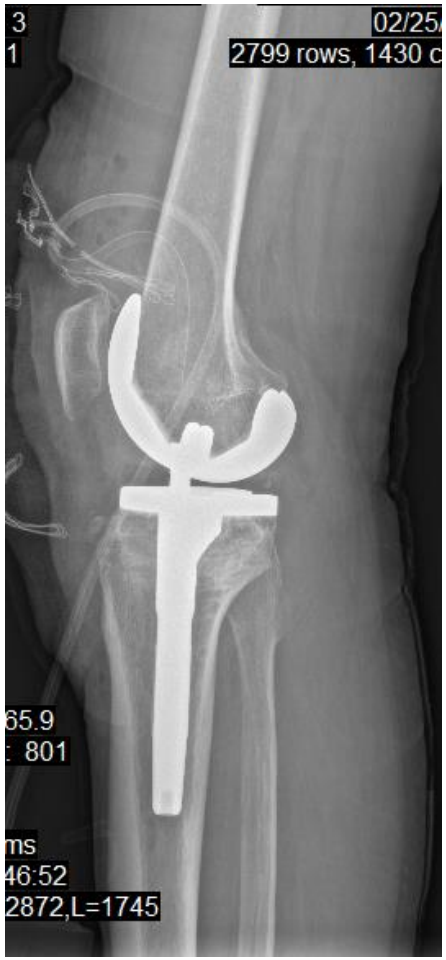
# Patient nr 9 EPILOG

13. Surgery Procedure :

TKR with use of long tibial stem



# Discussion

## Proceedings of the International Consensus Meeting on Periprosthetic Joint Infection


### Question 3 : What is the optimal interval between two stages?

**Consensus: There is no definitive evidence in the literature as to the optimal time interval between the two stages. Reports vary from 2 weeks to several months.**

Positive results have been experienced in situations where implantation is conducted within **2-6 weeks** of resection, the infecting pathogen is not resistant, and systemic antibiotic administration is ongoing.

Intravenous (IV) antibiotic therapy lasting 4 to 6 weeks with subsequent cessation of antibiotics for 2 to 8 weeks prior to reimplantation is most commonly employed in the US and has yielded positive results.

Some evidence suggests **time intervals greater than 6 months** result in suboptimal results in restoring patient function and eradicating infection. Patients who underwent two-stage exchange with greater than 6 months between resection and reimplantation experienced **no improvement in function...**

**The need for serologic evaluation**, synovial fluid analysis, and culture of joint fluid aspirate prior to reimplantation **is unclear.** ESR and CRP are poorly predictive of persistent PJI and studies were unable to define optimal cutoff values for ESR and CRP. **A change in value from those conducted at the time of resection was a helpful indicator though.**

# Discussion

- The samples after sonication in 1 case revealed *S.epidermidis*—a proven etiological agent of infection related with biomaterials, and in the 2 other cases—*R. pickettii* Ryan and Adley described the bacteria from the *Ralstonia* genera as emerging global opportunistic pathogens and considered them to be as important as severe infections causative agents in some cases
- Identification of bacterial DNA in PCR assay does not confirm the presence of live bacteria
- The identification of etiological agents but also contaminating factors is possible due to the high specificity of PCR techniques

# Conclusion

- Lack of clinical sign and negative culture in pre and intraoperative specimen do not exclude the presence of bacteria on the surface of spacers

- Otherwise the positive outcomes of sonication and molecular investigation should be interpreted as real pathogenicity factors considering clinical and laboratory data

# THANK YOU FOR THE ATTENTION

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