La revisione della protesi infetta

Roberto Castricini

Magna Græcia University Catanzaro (Italy)

VILLA DEI PINI

Casa di cura privata VILLA VERDE

VILLA IGEA CASA DI CURA

VILLA MARIA CECILIA HOSPITAL
Gruppo Villa Maria

Definition

J Shoulder Elbow Surg (2019) 28, S8–S12

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Journal of Shoulder and Elbow Surgery
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Proceedings from the 2018 International Consensus Meeting on Orthopedic Infections: the definition of periprosthetic shoulder infection

Grant E. Garrigues, MD[a,*], Benjamin Zmistowski, MD[b], Alexus M. Cooper, BS[b], Andrew Green, MD[c], ICM Shoulder Group[1]

INTERNATIONAL CONSENSUS MEETING (ICM)

2018

MAJOR CRITERIA

- Presence of a sinus tract from the skin surface to the prosthesis;
- Gross intra-articular pus ;
- Two positive tissue cultures with phenotypically identical virulent organisms

Definition

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Proceedings from the 2018 International Consensus Meeting on Orthopedic Infections: the definition of periprosthetic shoulder infection

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INTERNATIONAL CONSENSUS MEETING (ICM) 2018

MINOR CRITERIA

Criteria	Weight
Unexpected wound drainage	4
Single positive tissue culture with a virulent organism	3
Single positive tissue culture with a low-virulent organism	1
Second positive tissue culture (identical low-virulence organism)	3
Humeral loosening	3
Positive frozen section (5 neutrophils in ≥ 5 high-power fields)	3
Positive pre-operative aspirate culture	3
Synovial neutrophil percentage > 80%	2
Synovial white blood cell count > 3000 cells/μL beyond 6 weeks from surgery	2
ESR > 30 mm/h	2
CRP > 10 mg/L	2
Elevated synovial alpha-defensin	2
Cloudy synovial fluid	2

Definition

INTERNATIONAL CONSENSUS MEETING (ICM) 2018

Category	Definition
Definite infection	Presence of a sinus tract from the skin surface to the prosthesis ORGross intra-articular pus ORTwo positive tissue cultures with identical virulent organisms
Probable infection	Presence of ≥6 minor criteria with an identified organism
Possible infection	Presence of ≥6 minor criteria without an identified organism OR< 6 minor criteria with one culture with a virulent organism OR< 6 minor criteria with 2 positive cultures with a low-virulence organism
Unlikely infection	< 6 minor criteria with negative cultures OR< 6 minor criteria with 1 positive culture with a low-virulence organism

''Contreras ES, Frantz TL, Bishop JY, Cvetanovich GL. Periprosthetic Infection After Reverse Shoulder Arthroplasty: a Review. Curr Rev Musculoskelet Med. 2020 Dec;13''

Epidemiology

- Infection is an uncommon complication after TSA, with the reported incidence ranging between 0,4% and 2,9%

- The rate is higher after revision surgery than after a primary procedure and reaches close to 5% in cases of RSA

- Patients undergoing primary RSA are found to have a six times greater risk of infection compared with patients having primary unconstrained total shoulder arthroplasty

Bonnevialle N, Dauzères F, Toulemonde J, Elia F, Laffosse JM, Mansat P. Periprosthetic shoulder infection: an overview. EFORT Open Rev. 2017 Apr 27;2(4):104-109''
Singh JA, Sperling JW, Schleck C, Harmsen WS, Cofield RH. Periprosthetic infections after total shoulder arthroplasty: a 33-year perspective. J Shoulder Elbow Surg. 2012 Nov;21(11):1534-41''

Risk factors

- Male gender (from 1.5 to 3.5 times more compared with female), young age;
- History of recent steroid injection;
- Higher burden of C. acnes at various sites around the shoulder;
- HCV, HIV, Parkinson's disease , smoke, BMI > 40 kg/m2, Hemoglobin A1c > 8 mg/dL;
- Ipsilateral shoulder steroid injection 3 months prior to their arthroplasty (2 times increased risk);
- Revision arthroplasty.

''Morris BJ, O'Connor DP, Torres D, Elkousy HA, Gartsman GM, Edwards TB. Risk factors for periprosthetic infection after reverse shoulder arthroplasty. J Shoulder Elbow Surg. 2015 Feb;24(2):161-6''

Classification

Type of infection	Time period of infection
Type I	Positive cultures at time of revision
Type II	Acute infection within 30 days of surgery
Type III	Acute hematogenous infection > 30 days
Type IV	Chronic infection

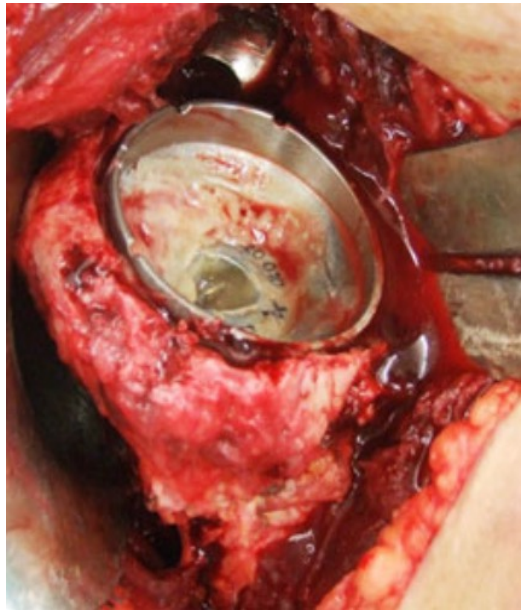
''Marcheggiani Muccioli GM, Guerra E, Roberti di Sarsina T, Alesi D, Fratini S, Cammisa E, Rinaldi VG, Lullini G, Rotini R, Zaffagnini S. Diagnosis and Treatment of Infected Shoulder Arthroplasty: Current Concepts Review. Joints. 2018 Dec 10;6(3):173-176''

Clinical presentation

- Symptoms of acute infection, such as redness, swelling, or drainage;
- Systemic symptoms of fevers, chills, and even sepsis ;
- Indolent nature, with pain, stiffness, or limitations in function (possibly being the only symptoms).

Diagnosis

- C. acnes was implicated in 38.9% of all shoulder PJI, followed by Staph aureus at 14.8% and Staph epidermidis at 14.5%
- Serum labs (CRP)
- Synovial Fluid Analysis (synovial WBC > 3000 cells/µL and synovial neutrophil percentage > 80%, presence of Synovial fluid alpha-defensin, synovial fluid biomarkers such as leukocyte esterase, Il-2, IL-6, and TNF-α)
- Pre-revision Tissue Culture
- Intra-operative Evaluation



''Nelson GN, Davis DE, Namdari S. Outcomes in the treatment of periprosthetic joint infection after shoulder arthroplasty: a systematic review. J Shoulder Elb Surg. 2016;25(8):1337–45''

''Fink B, Sevelda F. Periprosthetic Joint Infection of Shoulder Arthroplasties: Diagnostic and Treatment Options. Biomed Res Int. 2017''

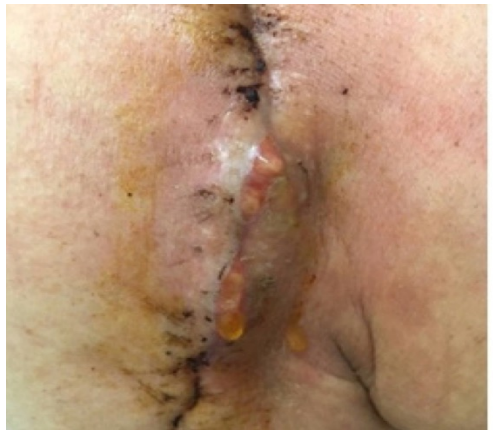
Imaging

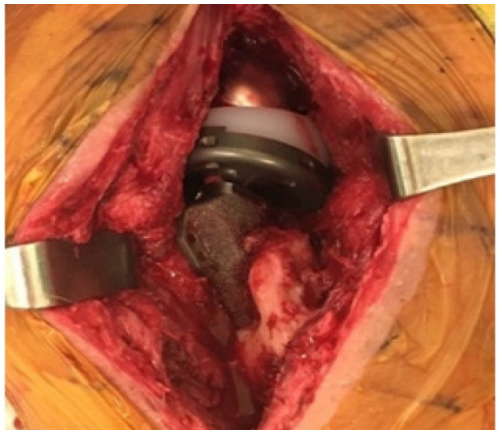
- Radiographs and CT images show the overall alignment of the prosthesis and can show signs of loosening or osteolysis

- PET, Leucocyte-scintigraphy , MRI

Irrigation and debridement (I&D)

- With or without modular component exchange (DAIR)
- Open or arthroscopic
- Current indications for I&D with component retention are unknown
- Associated with high failure rates in chronic infection





«2018 ICM currently concluded that there is not enough evidence to support or discourage the use of I&D with implant retention for acute or chronic shoulder PJI, but it may play a role in select patients»

''Contreras ES, Frantz TL, Bishop JY, Cvetanovich GL. Periprosthetic Infection After Reverse Shoulder Arthroplasty: a Review. Curr Rev Musculoskelet Med. 2020 Dec;13''

'' Bastard C, Aïm F, Meyssonnier V, Kerroumi Y, Marion B, Zeller V, Marmor S. One-stage revision for infected shoulder arthroplasty: prospective, observational study of 37 patients. JSES Int. 2023 Jul 24;7(6):2433-2439''

Clinical Case



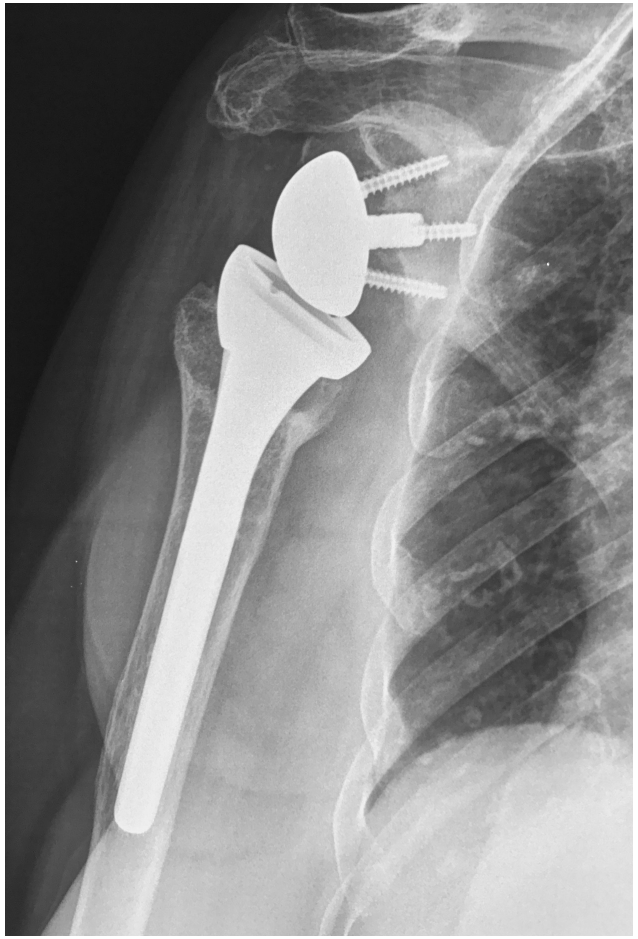

One-Stage Revision

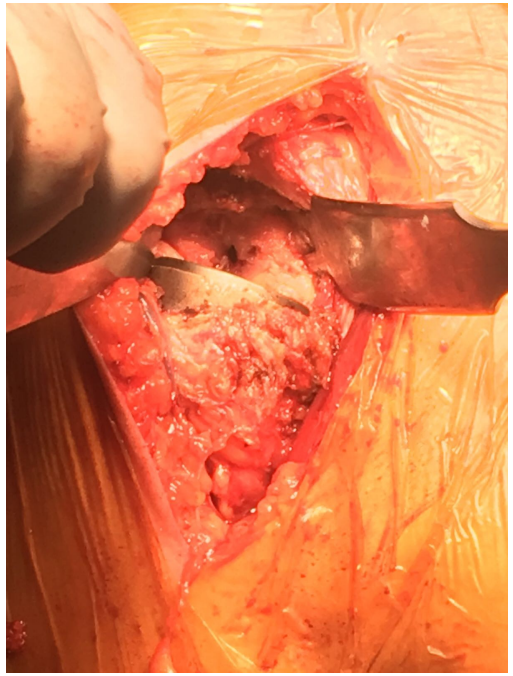
- One-stage exchange consists of extensive synovecomy, removal of all implant components and cement, followed by reimplantation during the same procedure;
- Prerequisites for single-stage exchange are identification of a specific microorganism and determination of its antibiotic susceptibilities;
- In most cases, antibiotic-impregnated cement is used for the reimplantation whereby the antibiotic that is added to the cement or is already contained in it is specific for the pathogen concerned;
- Benefits: bone stock preservation, immediate reconstruction, less patient anxiety, and lower hospital costs.

Two-Stage Revision

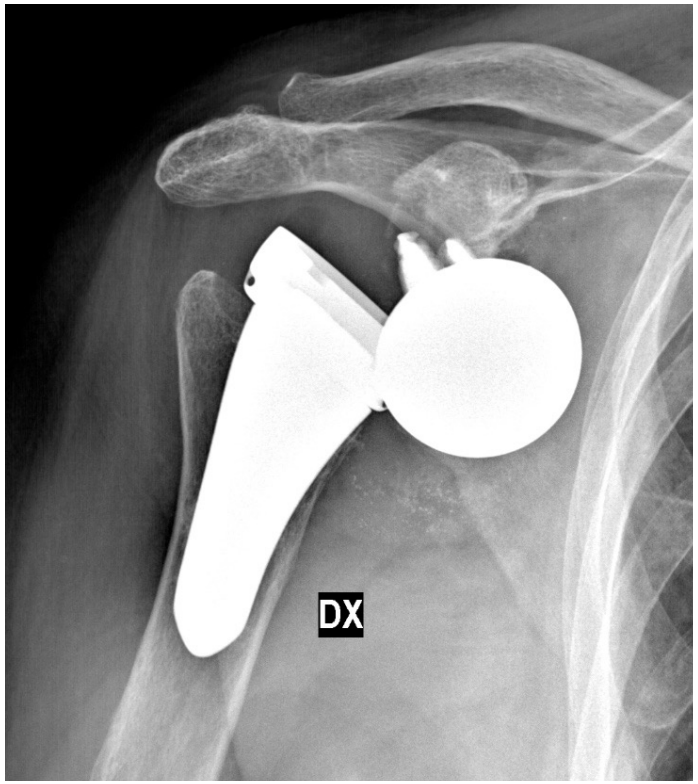
- Highly recommended when the microrganism responsible for the infection is unknown;
- The first step consists of debridement and infection eradication after prosthetic removal: an antibiotic-loaded cement spacer is often implanted and general antibiotics are administrated(6-8 weeks);

Clinical Case





Clinical Case

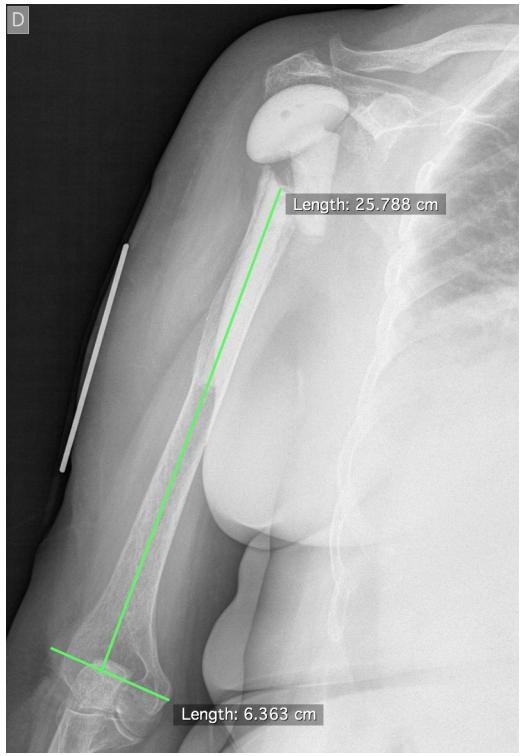


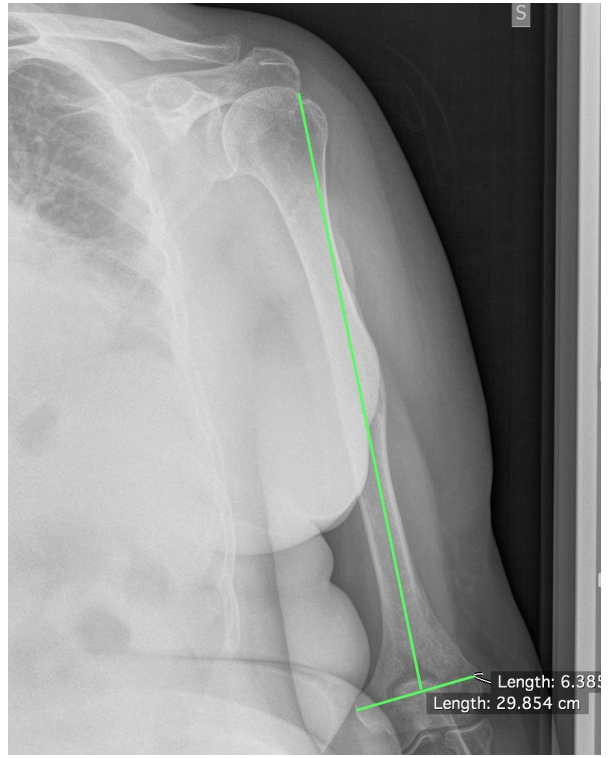
Clinical Case

Two-Stage Revision

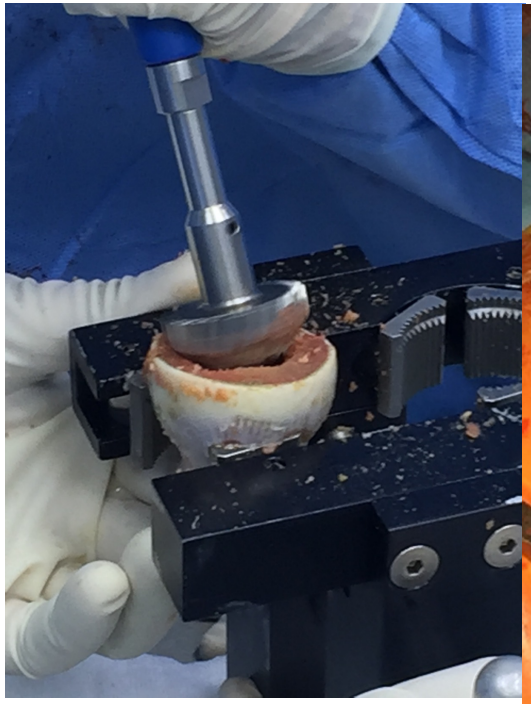
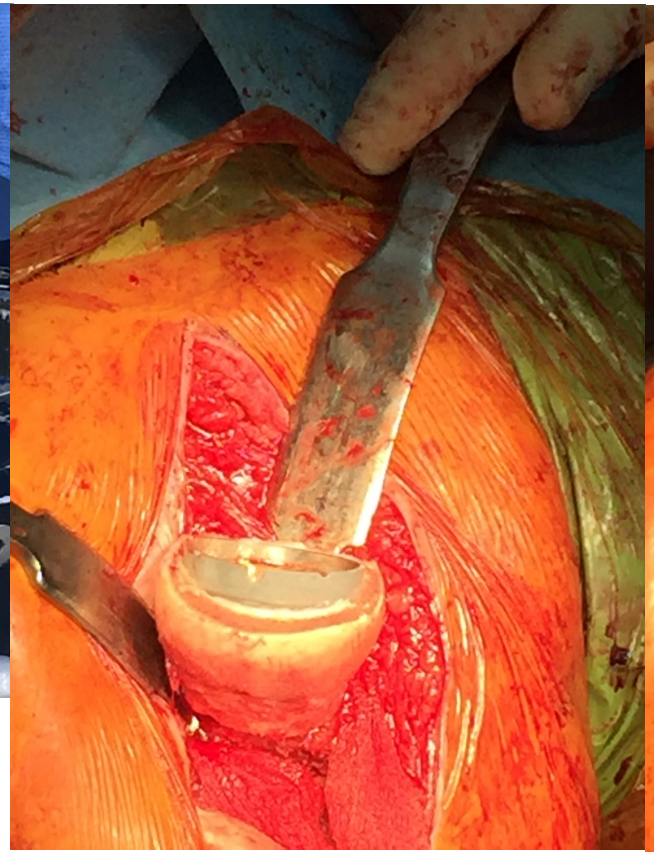
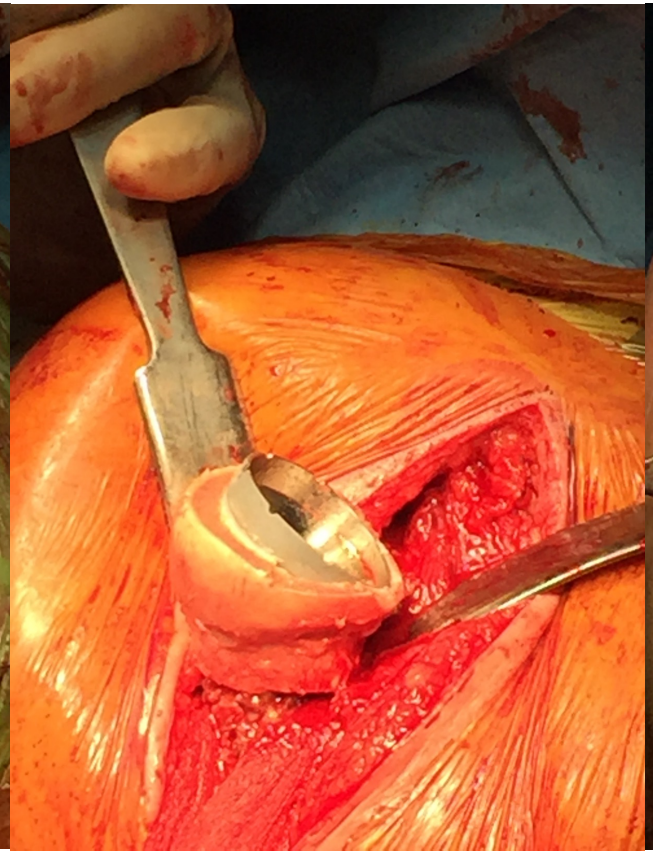
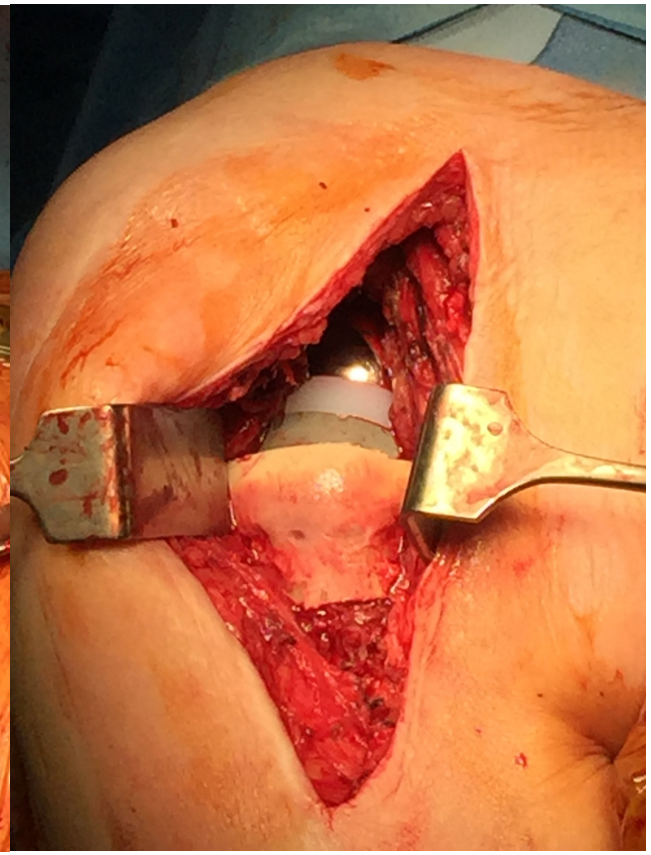
- The second step consists of antibiotic-loaded cement spacer removal, debridement and re-implantation(RSA as the implant of choice → offers the possibility of addressing the glenoid or humeral bone defect with or without bone graft).

Clinical Case





Clinical Case

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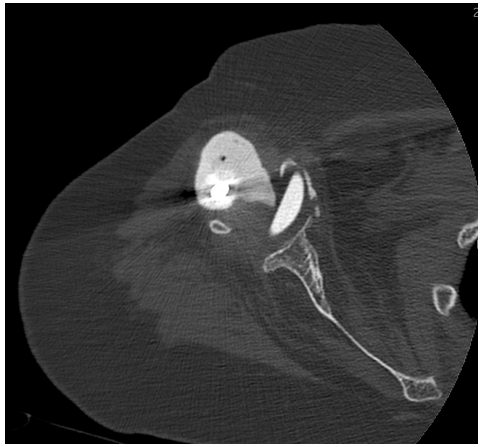

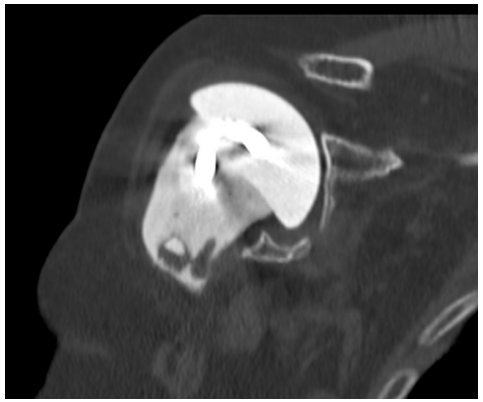

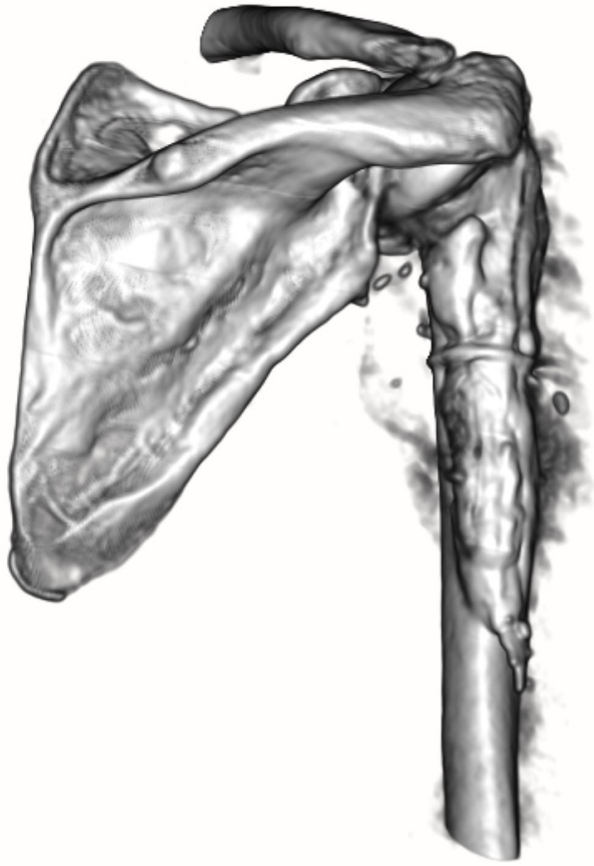

Clinical Case

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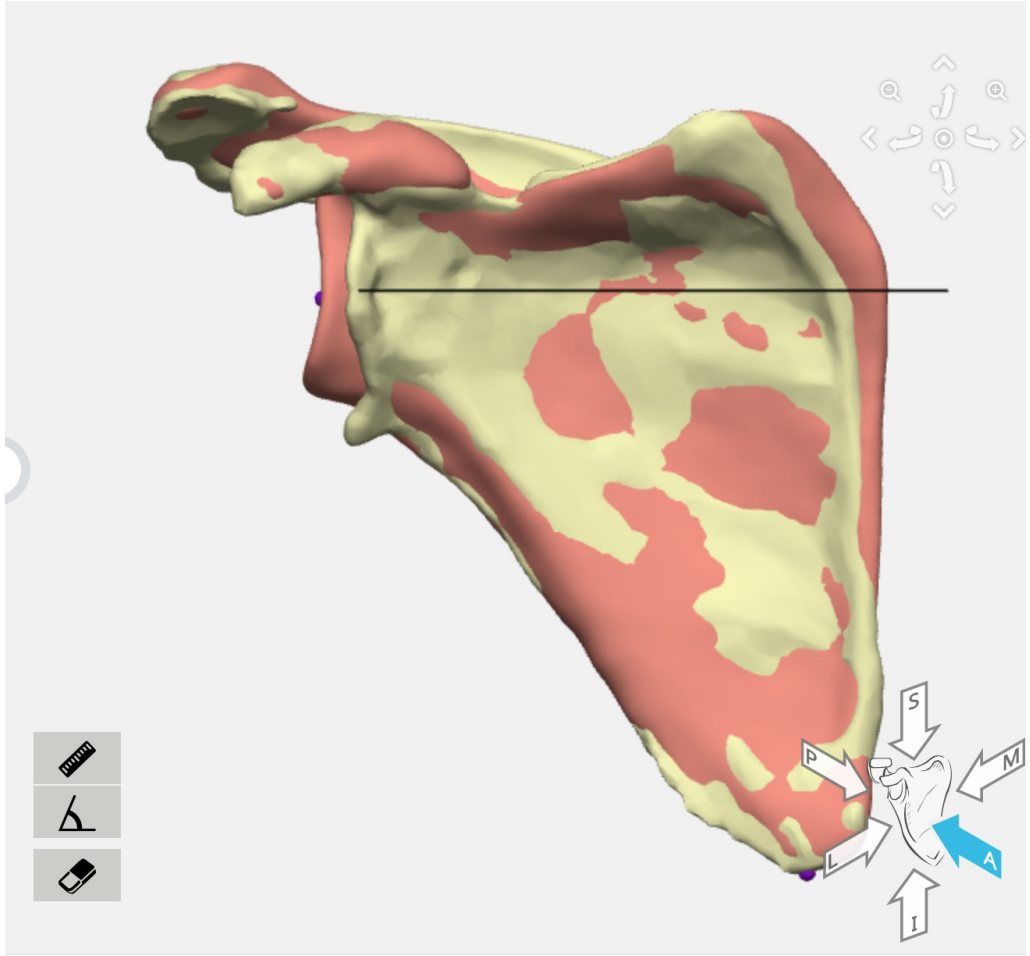

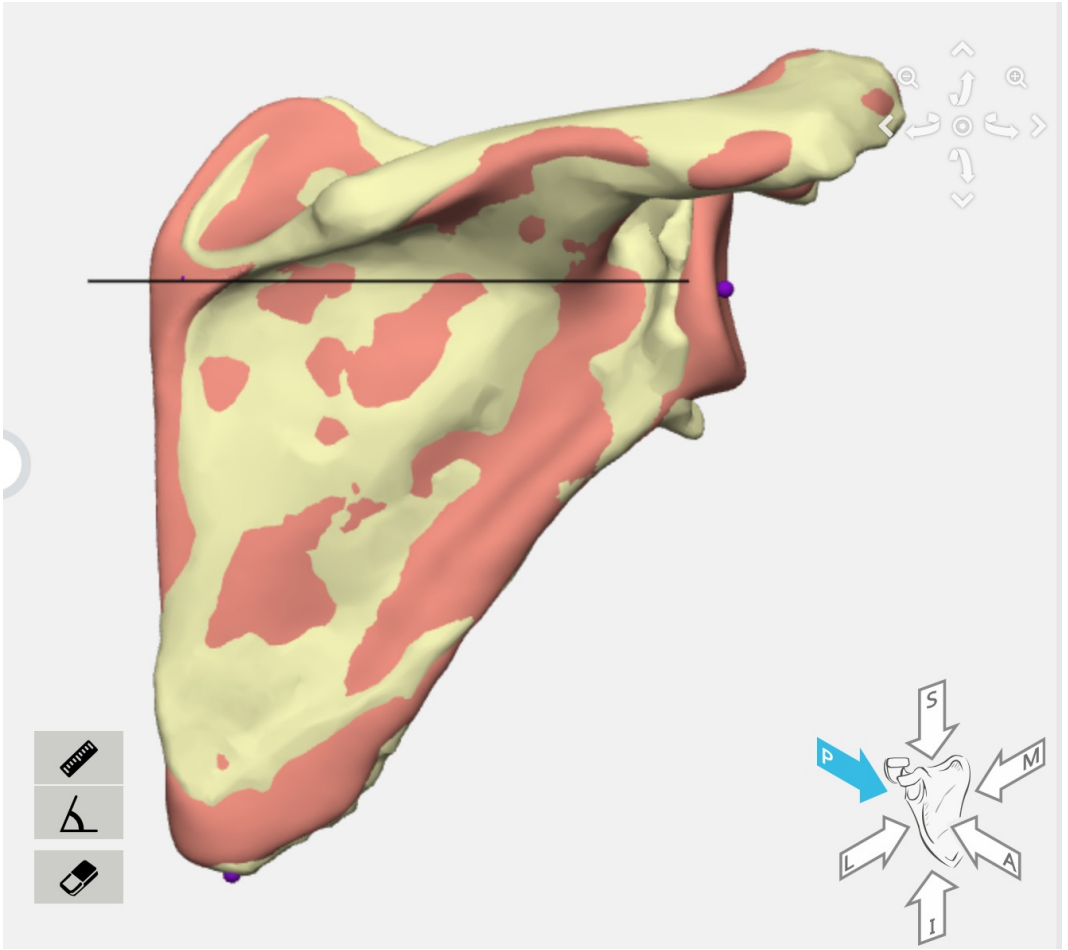

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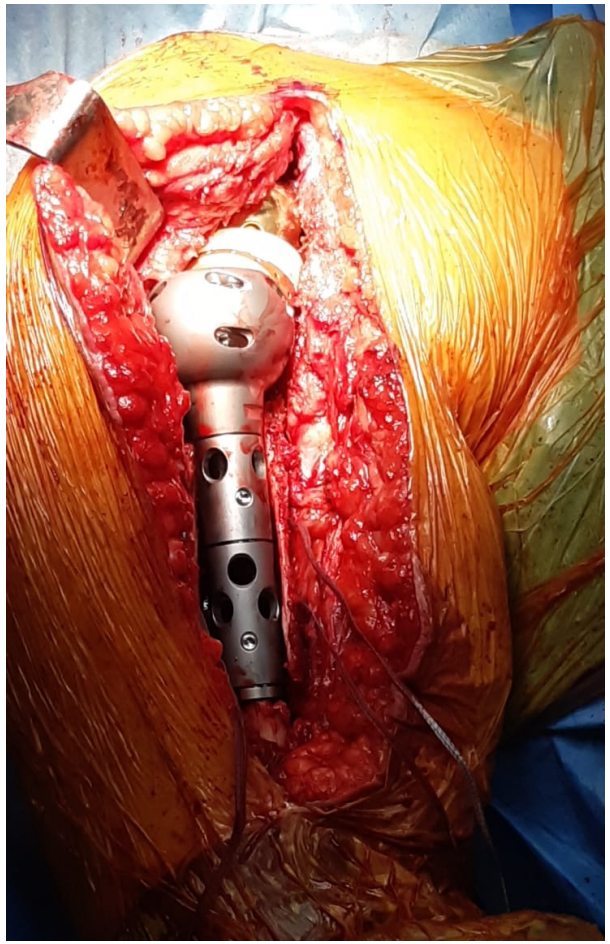
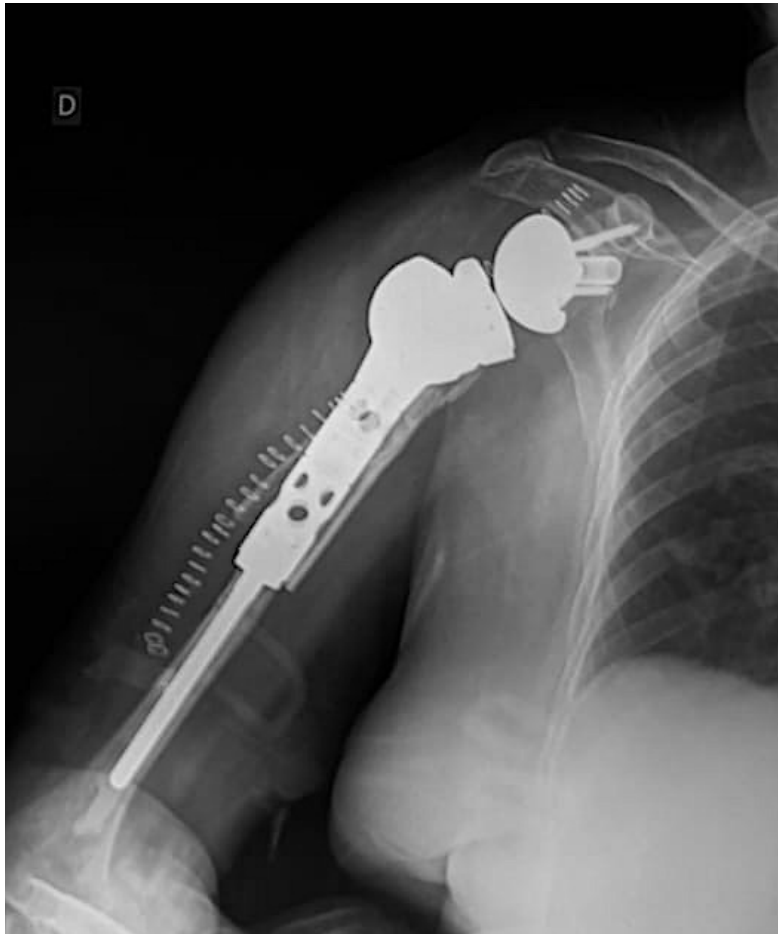
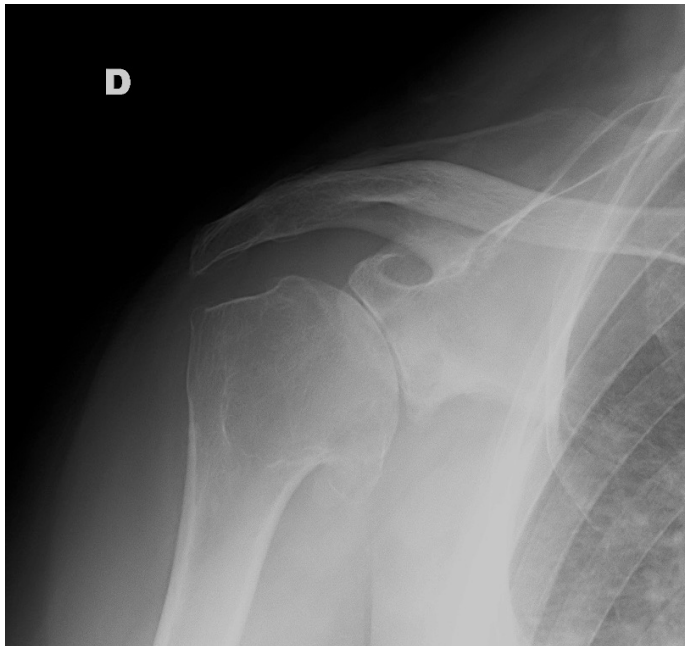
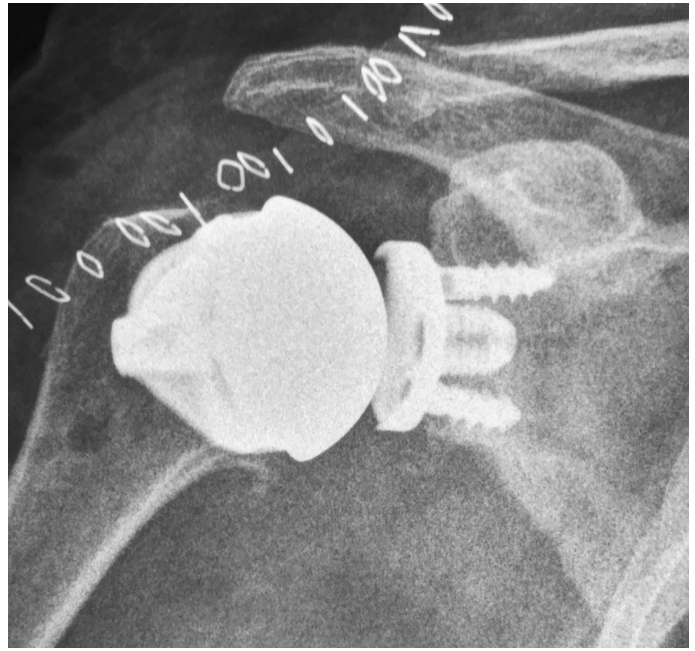




Clinical Case

- Female 70 y old, retired
- First surgery (2018):
  TSA stemless LIMA



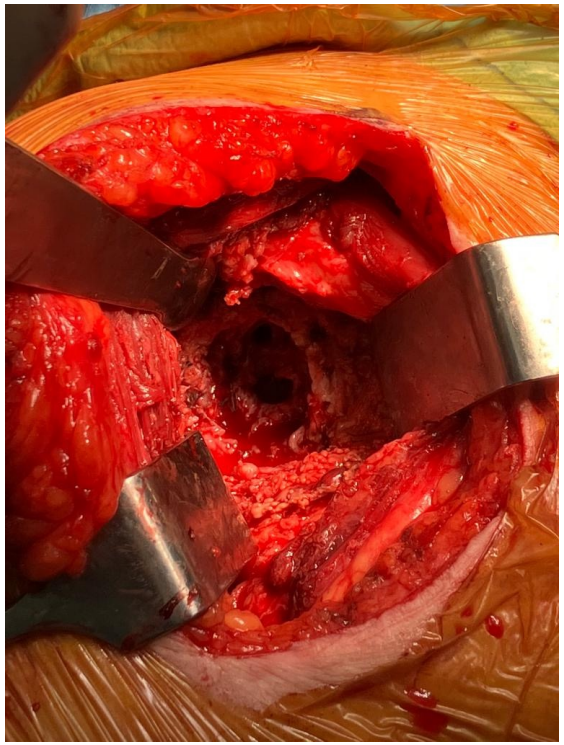


Clinical Case

Second surgery (2018): failure subscap → RSA stemless LIMA

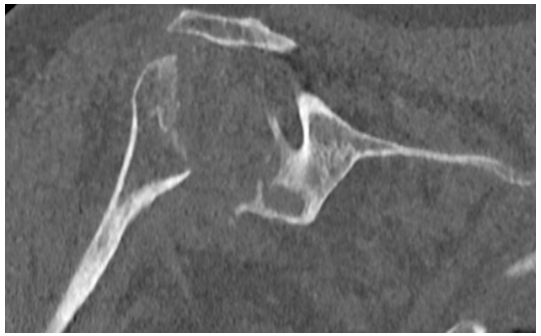
Clinical Case

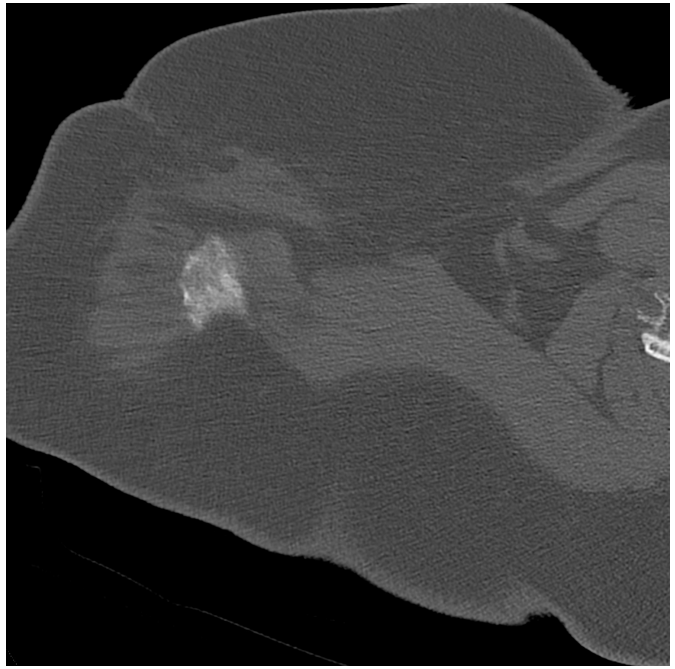
Third surgery (2022): infection ➡ prosthetic removal



Clinical Case

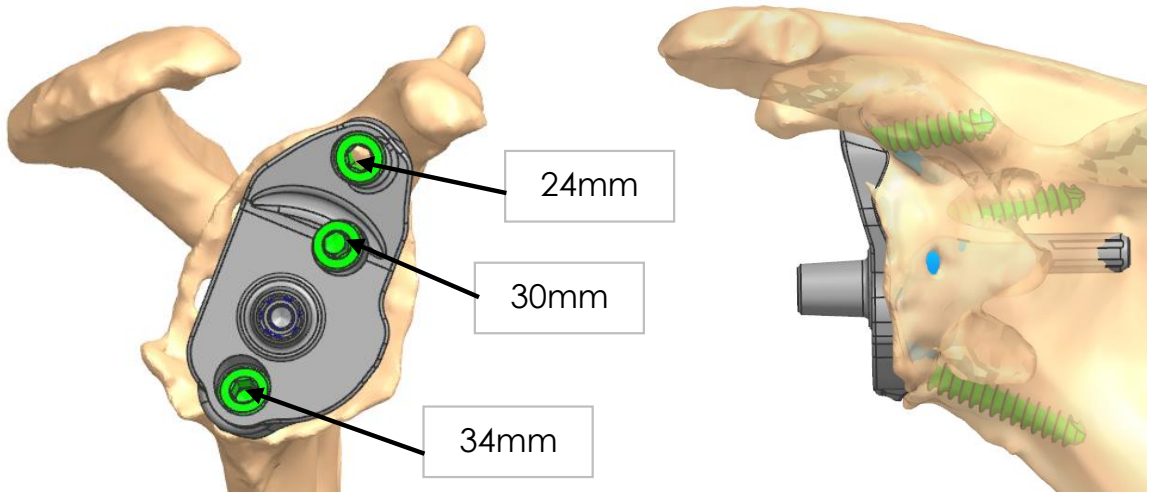
Fourth surgery (2023): re-implantation RSA

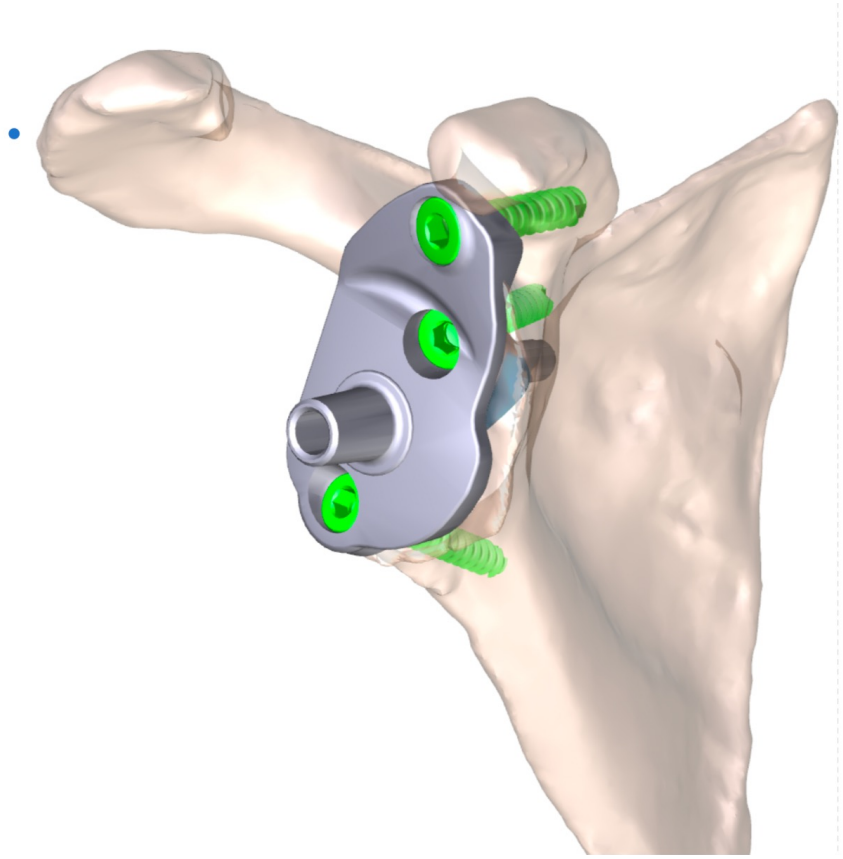




Clinical Case

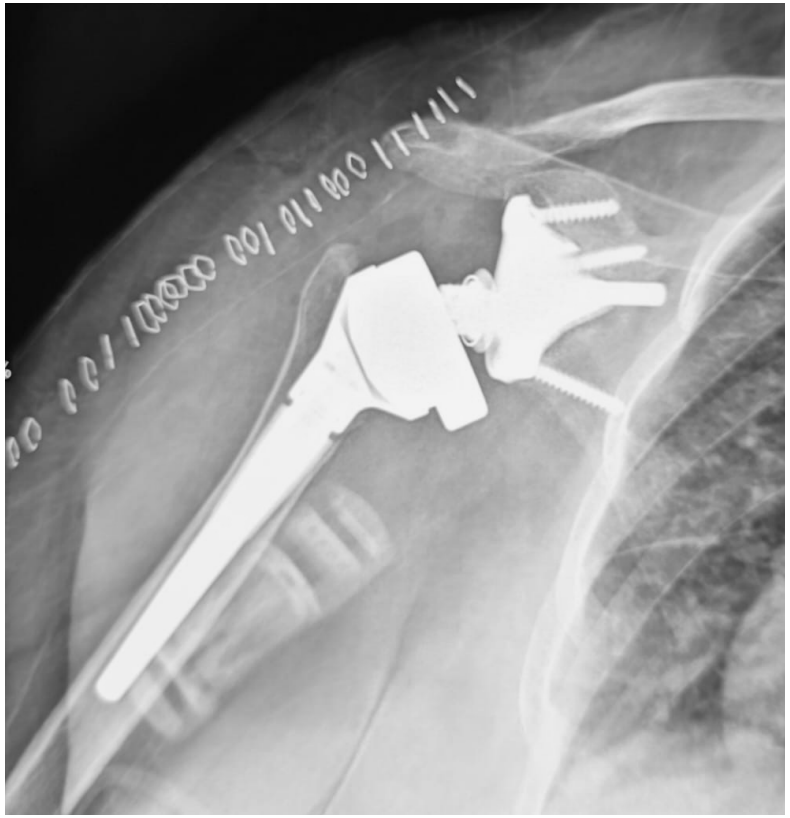
Fourth surgery (2023): re-implantation RSA





Clinical Case

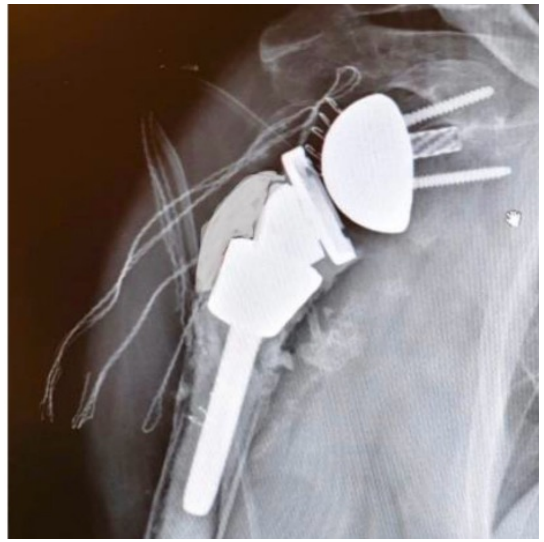
Fourth surgery (2023): re-implantation RSA



Two-Stage Revision

- It can also be used GlassBONE Putty made of bioactive glass. This ceramic is composed of Silicium, Calcium, Sodium and Phosphorous; it is in a ready-to-use format and can be injected through the syringe : it may be used both to increase prosthesis-bone interface stability and fill bone defects in PJIS revision surgeries, also contributing to preventing re-infection.





''Romano AM, Ascione T, Casillo P, Nastrucci G, Susanna M, Di Giunta A, Ascione F. An Evolution of Shoulder Periprosthetic Infections Management: MicroDTTect, Bioactive Glass and Tantalum Cones Employment. J Clin Med. 2020 Nov 16;9(11):3683.''

One VS Two-Stage Revision

- One-stage revisions seemed to provide better outcomes, with fewer reinfections, and complications than two-stage exchanges.
- Reported reinfection rates ranged between 0 and 9.1%, with only one study describing 50% reinfections for one-stage exchange. For two-stage exchange, they found reinfection rates ranged between 3% and 40%.
- One-stage exchange seems to give better results than two-stage exchange, with 3-fold lower reinfection (7% [95% confidence interval (CI), 3.8-12.5%] vs. 21.3% [95% CI, 16-27.9%]) and almost 2-fold fewer complication rates (17% [95% CI, 11.9-23.9%] vs. 32/8% [95% CI, 25.8-40.6%]);
- Pathogen-eradication rate was 96% with one-stage and 86% with two-stage revisions.

''Aïm F, Marion B, Kerroumi Y, Meyssonnier V, Marmor S. One- or two-stage exchange for periprosthetic shoulder infection: systematic review and meta-analysis. Orthop Traumatol Surg Res 2020;106:5-15''

Antibiotic Treatment

- The 2018 ICM recommends prolonged antibiotic treatment in conjunction with surgical management of shoulder PJI including I&D with component retention, 1-stage, and 2-stage revision procedures.

- There is no specific guidance on the optimal antibiotic, route of administration, or duration of treatment (at least 6-8 weeks).

- It's recommend individualized treatment with culture- specific antibiotics in addition to consultation with local infectious disease specialists.

- There also may be a role for chronic suppressive antibiotic therapy in select patients that have retention of components or have failed previous curative attempts.

Others

- Permanent treatment with an antibiotic spacer.

- Resection arthroplasty → salvage procedure for frail or low-demand patients, and recalcitrant infection. Functional results are poor, but pain relief is achieved in more than 50% of cases.

- Arthrodesis.

Treatment

Type of infection	Time period of infection
Type I	Positive cultures at time of revision
Type II	Acute infection within 30 days of surgery
Type III	Acute hematogenous infection > 30 days
Type IV	Chronic infection

Type of infection	Treatment
Type I	Organism specific antibiotic treatment with close observation
Type II	Surgical debridement with retention of prosthesis
Type III	Surgical debridement with retention of implants or two-stage treatment with antibiotic spacer
Type IV	Surgical debridement with implant removal, temporary antibiotic spacer placement and delayed reimplantation

''Marcheggiani Muccioli GM, Guerra E, Roberti di Sarsina T, Alesi D, Fratini S, Cammisa E, Rinaldi VG, Lullini G, Rotini R, Zaffagnini S. Diagnosis and Treatment of Infected Shoulder Arthroplasty: Current Concepts Review. Joints. 2018 Dec 10;6(3):173-176''

Prevention

Summary of recommendations

Preoperative:

1. Chlorhexidine cloth wipes the night before and morning of surgery
2. Standard soap-and-water shower the morning of surgery
3. MRSA screening and treatment (surgeon and institution discretion)
4. No need to clip axillary hair unless hair obscures visualization (surgeon discretion)
5. Chlorhexidine with alcohol-based skin preparation solution

Intraoperative:

1. Intravenous antibiotic prophylaxis within 1 hour of the incision and continued for 24 hours postoperatively (weight-based dosing):
   a. Cefazolin: 2 g (3 g for weight >120 kg)—standard adult surgical prophylaxis
   b. Vancomycin: 15 mg/kg—for penicillin allergic or high risk for MRSA
2. Plastic adhesive drapes around drape edges and axilla

3. Change surgical outer gloves after draping
4. Change knife blade after skin incision
   a. Electrocautery after skin incision
5. Frequent surgical field irrigation with normal saline
6. Antibiotic-impregnated cement (1 g of vancomycin or commercially available tobramycin/gentamicin mixture) if cementation is required during arthroplasty
7. 500 mL of 1.3 g/L povidone-iodine irrigation solution before closure
8. Topical skin adhesive (OCA) for epidermal closure
9. Silver-based postoperative dressing

"Clark JJC, Abildgaard JT, Backes J, Hawkins RJ. Preventing infection in shoulder surgery. J Shoulder Elbow Surg. 2018 Jul;27(7):1333-1341."

Success depends:

- on early identification of microorganisms,
- appropriate surgical procedures,
- efficient antibiotic administration.

- **Work Team**

  Important close collaboration with the orthopedic infectious disease specialist

Thanks for attention

robertocastricini@gmail.com