

# SHOULDER COURSE FOR RESIDENTS AND YOUNG SURGEONS 2º MÓDULO

VILA FRANCA DE XIRA

**16 de novembro de 2018**

Plaza Ribeiro Telles - Vila Franca de Xira



## FRACTURAS DA EXTREMIDADE PROXIMAL DO ÚMERO

COMPLICAÇÕES E SEQUELAS

## Complicações e Sequelas

- **Complicações**

- Perfuração (“cut-out”) dos parafusos
  - Complicação mais frequente após osteossíntese com placa (até 14%)
- Necrose avascular
  - Factores de risco
  - Melhor tolerado do que na extremidade inferior
  - Sem relação com o tipo de osteossíntese
- Lesão Nervosa
  - Nervo Axilar
    - Mais frequente (até 58% em alguns estudos usando EMG)
    - Abordagem lateral (“deltoid-splitting”) maior risco
    - Normalmente encontrado +- 7cm distal ao bordo lateral do acrómio
  - Nervo Suprascapular (até 48%)

## Complicações e Sequelas

- **Complicações**

- **Consolidação viciosa**

- Normalmente em *varus* ou consolidação viciosa da grande tuberosidade
- Quando se converte consolidação viciosa em *varus* para PTO há inferiorização da prótese
  - Utilizar PTO invertida

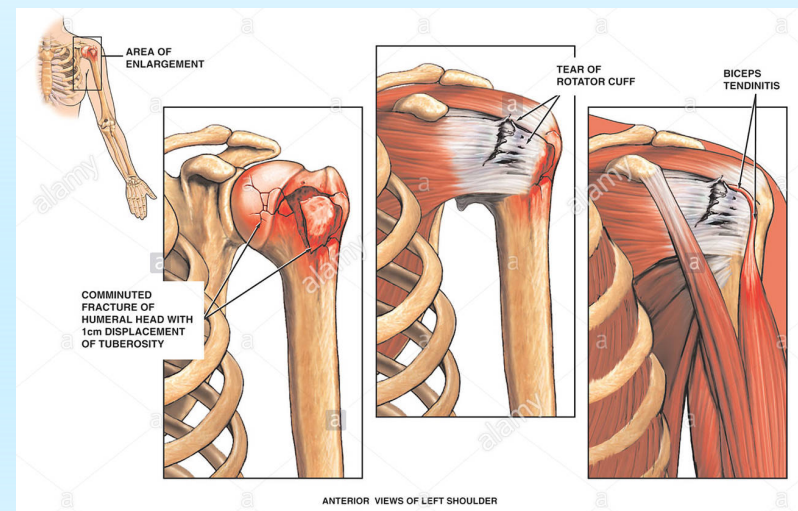
- **Pseudartrose**

- Normalmente associada a fractura das tuberosidades / colo cirúrgico
- Tratamento da pseudartrose/consolidação viciosa nos idosos deve passar por uma Artroplastia
- Pseudartrose do troquino leva a falência da RI com teste lift-off +
- Pseudartrose troquiter leva a perda da EAA
- Factores de risco para pseudartrose: Idade / Tabaco

## Complicações e Sequelas

- **Complicações**

- Lesões da coifa dos rotadores / disfunção
- Luxação posterior não diagnosticada (sobretudo em casos de fractura do troquino)
- Capsulite Adesiva
- Artrose pós-traumática
- Sub-luxação / Luxação
- Impingement subacromial
- Infecção





## Complicações e Sequelas

## Complicações e Sequelas

- Complicações osteossíntese

- perda redução (varó)
- perfuração/“cutout” parafusos
- necrose cabeça
- complicações até ~40%
- taxas de

Técnica cirúrgica  
Redução e suporte cortical medial  
Implante / fixação

J Shoulder Elbow Surg (2012) ■ 1-8



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### Locking plate fixation of fractures of the proximal humerus: analysis of complications, revision strategies and outcome

Bernhard Jost, MD\*, Christian Spross, MD, Holger Grehn, MD, Christian Gerber, MD, FRCSEd(Hon)

Department of Orthopaedics, University Hospital Balgrist, Zürich, Switzerland

**Background:** Locking plates for open reduction-internal fixation (ORIF) of proximal humeral fractures are widely used. We observed an unusually high number of patients with complications referred to our institution. It was the purpose of this study to report these complications, as well as their treatment and outcome.

**Materials and methods:** From 2003 to 2010, all patients treated for complications after ORIF with locking plates for proximal humeral fractures were prospectively collected and retrospectively analyzed. Patients were followed up clinically and radiographically.

**Results:** In total, 121 patients (67 women and 54 men; mean age, 59 years) were referred after primary locking plate ORIF; 80% had a 3- or 4-part fracture. A mean of 3 complications occurred per patient, including malreduction, primary screw cutout, malunion, nonunion, avascular necrosis, and infection. Secondary screw cutout was found in 57% of patients, causing glenoid destruction in 33% of patients. A mean of 1.5 revision surgeries were needed. Hemiarthroplasty, total shoulder arthroplasty, and reverse shoulder arthroplasty improved the mean Constant score (24 to 55 points,  $P < .05$ ; 29 to 54 points,  $P = .3$ ; and 25 to 48 points,  $P < .05$ , respectively) after a mean of 24 months. In 6 patients, glenoid implantation was no longer possible because of the destruction by perforated head screws.

**Conclusion:** In this negatively selected series, complications resulted in secondary arthroplasties in over 50% of the patients. Shoulder function, though improved, remained substantially restricted even after revision surgery. Glenoid destruction by locking screws was the most devastating and previously almost unseen complication, which limited the options of treatment.

**Level of evidence:** Level IV, Case Series, Treatment Study.  
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**Keywords:** Angular stable implant; locking plate; complications; revision surgery; glenoid destruction; proximal humerus; revision arthroplasty

This retrospective study did not require approval of the institutional review board.

More than 80% of fractures of the proximal humerus are nondisplaced or minimally displaced and can be treated conservatively. For displaced and unstable fractures, various techniques of closed or open reduction and fixation are used.

Fracture reduction and anatomic healing become more difficult with a higher number of fragments, with greater

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## Complicações e Sequelas

- Complicações osteossíntese

## Tratamento complicações

- Artroplastia secundária em 1/2 dos pacientes com complicações
- Melhoria mobilidade (restrição substancial)
- 5% infecção após Artroplastia

J Shoulder Elbow Surg (2012) ■ 1-8



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This retrospective study did not require approval of the institutional review board. All patients gave informed consent to have their data published anonymously.

Dr Jost and Spross equally contributed to the manuscript.

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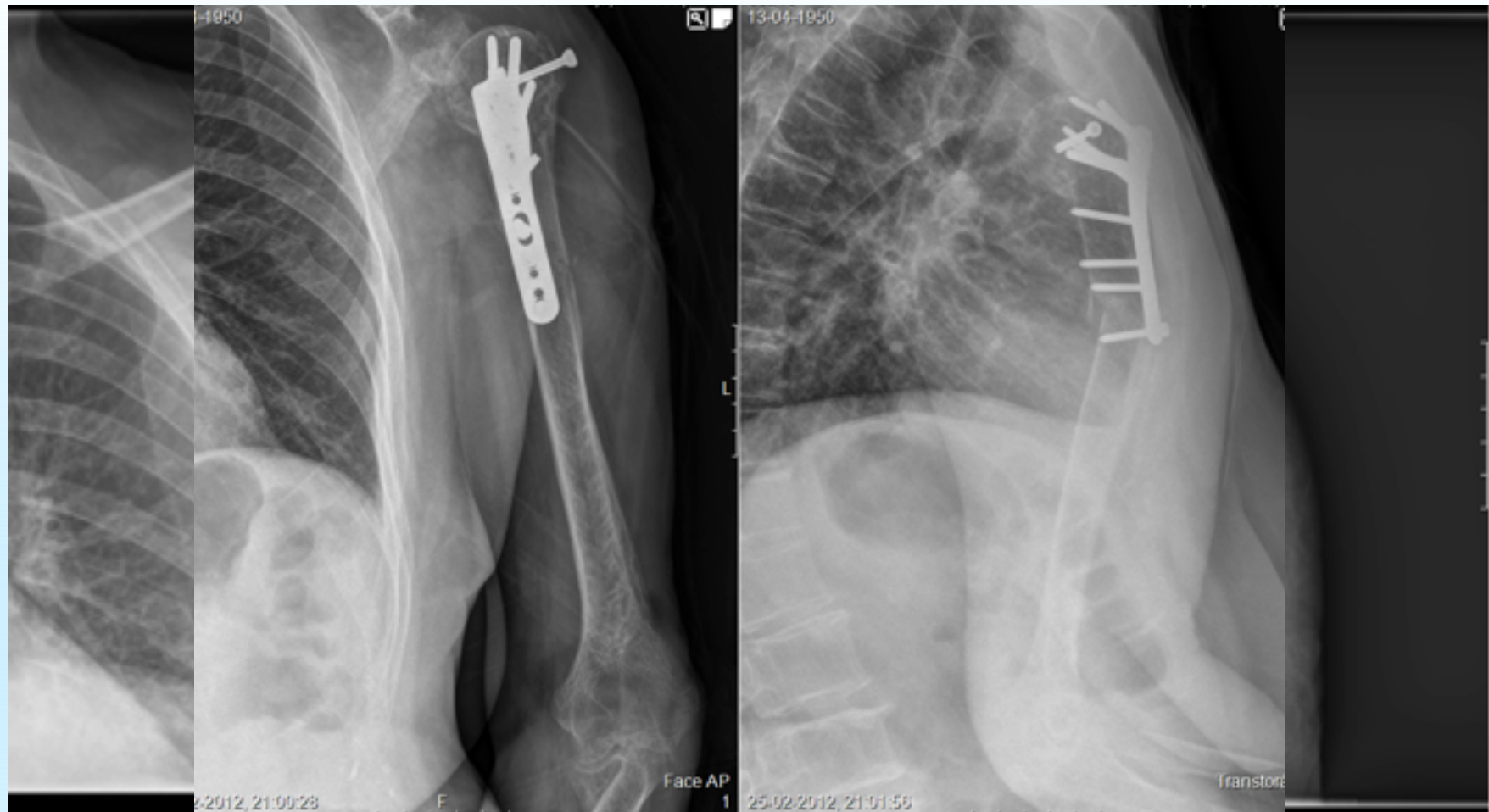
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<http://dx.doi.org/10.1016/j.jse.2012.06.008>

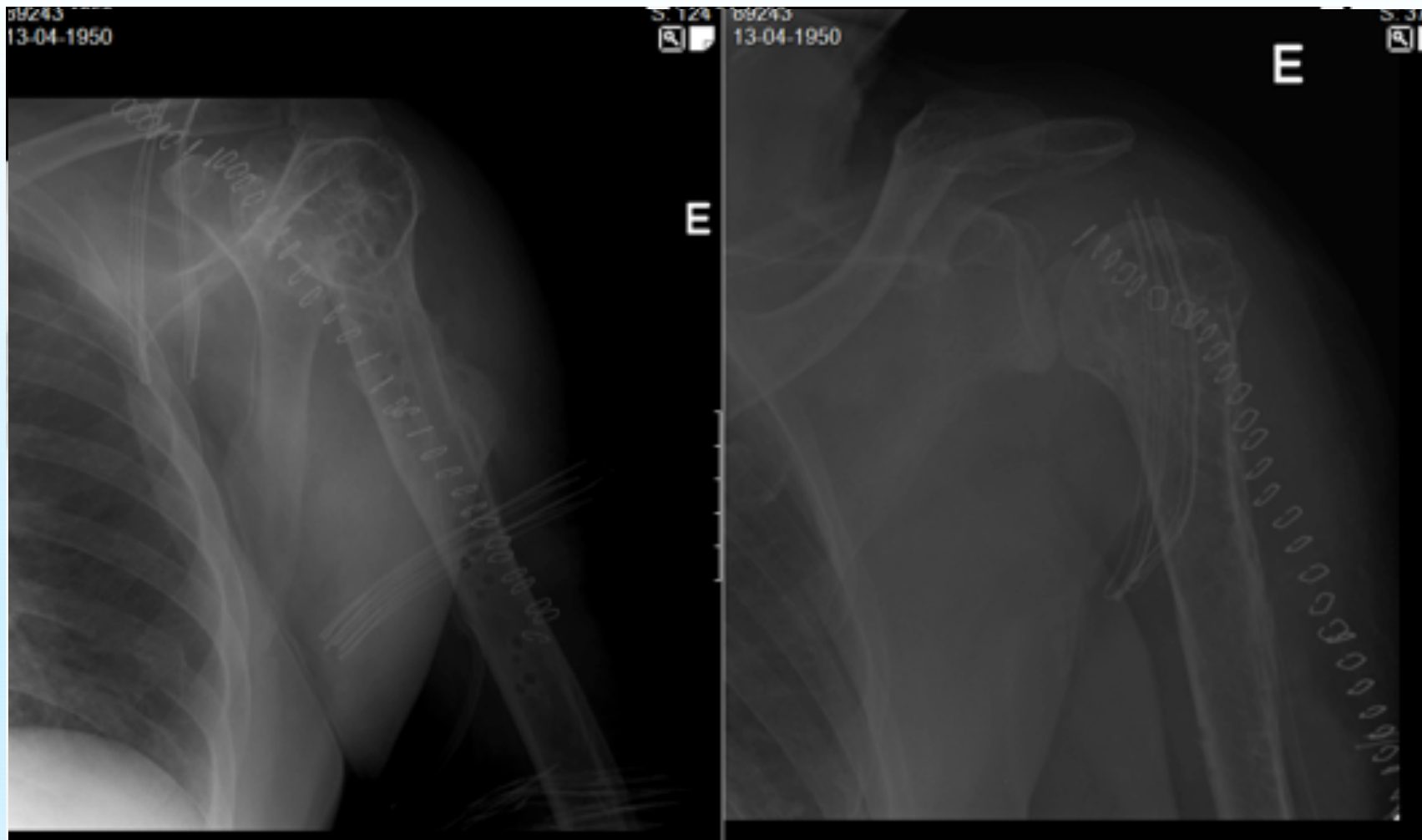
# Fraturas da extremidade proximal do úmero

## Complicações e Sequelas



# Fraturas da extremidade proximal do úmero

## Complicações e Sequelas



## Complicações e Sequelas

### Sequelas

- Beredjiklian et al., 1998, 39 doentes

J Bone Joint Surg Am. 1998 Oct;80(10):1484-97.

#### **Operative treatment of malunion of a fracture of the proximal aspect of the humerus.**

Beredjiklian PK<sup>1</sup>, Iannotti JP, Norris TR, Williams GR.

Beredjiklian	
Type I	• Malposition of the greater or lesser tuberosity ( e.g. >1 cm from native anatomical position)
Type II	• Articular incongruity ( e.g. intra-articular fracture extension, osteoarthritis)
Type III	• Articular surface malalignment ( e.g. >45° of deformity with respect to the humeral shaft in the coronal, sagittal, or axial planes)

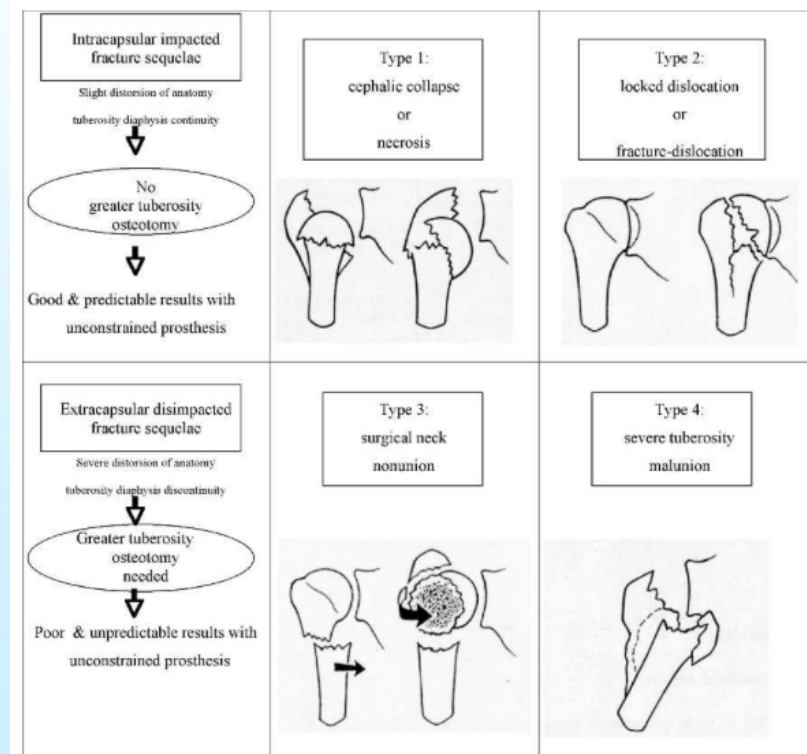
## Complicações e Sequelas

CLINICAL ORTHOPAEDICS AND RELATED RESEARCH  
Number 442, pp. 121-130  
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### Sequelas

- Colapso/necrose da cabeça (tipo 1)
- Fratura-luxação/luxação crónica (tipo 2)
- Pseudartrose colo cirúrgico (tipo 3)
- Má ou não-união tuberosidades (tipo 4)

### Proximal Humerus Fracture Sequelae



Boileau P, Chuinard C, Le Huec JC, Walch G, Trojani C. Proximal humerus fracture sequelae: impact of a new radiographic classification on arthroplasty. Clin Orthop Relat Res. 2006 Jan;442:121-30.  
DOI: 10.1097/01.blo.0000195679.87258.6e

number of institutions with 205 sequelae or proximal humeral fractures treated with a nonconstrained shoulder prosthesis and with a minimum of 2 years of followup (range 24-96 months; mean followup, 42 months).

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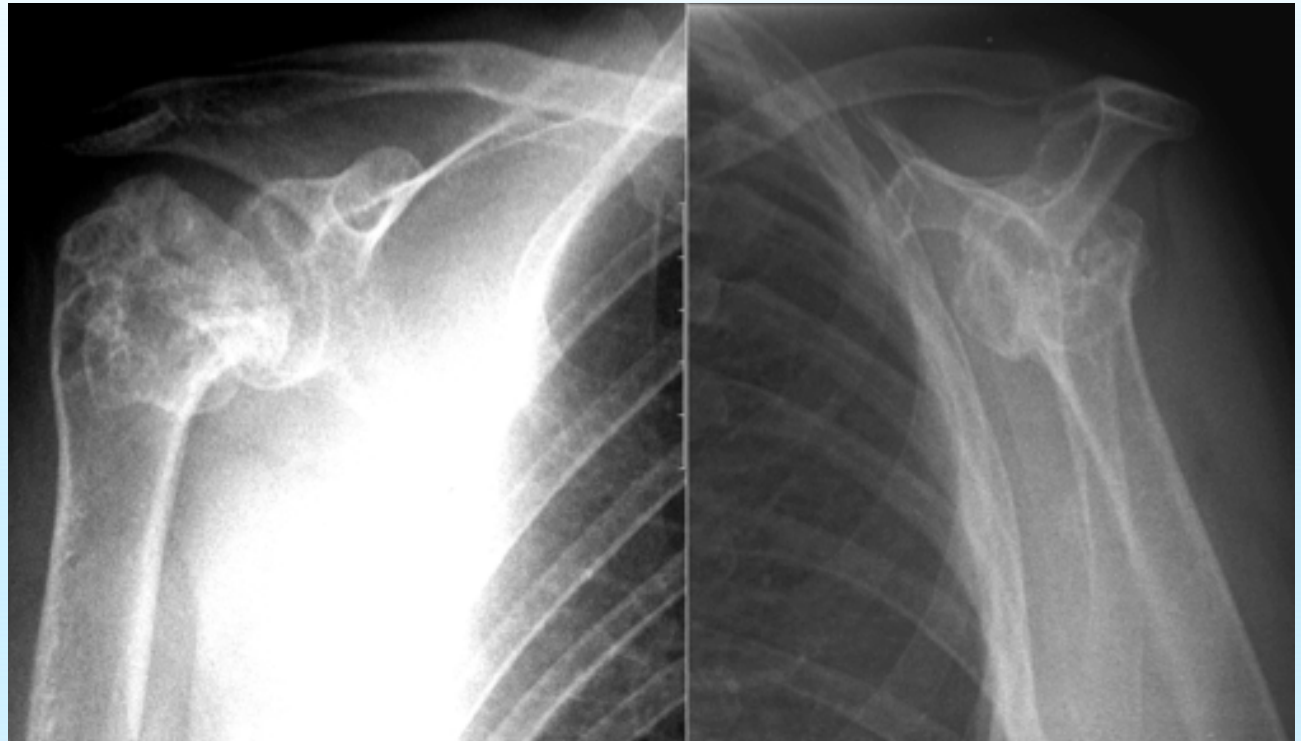
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# Fraturas da extremidade proximal do úmero

## Complicações e Sequelas

### Sequelas tipo 1 (colapso/necrose cabeça)



Boileau P, Chuinard C, Le Huec JC, Walch G, Trojani C. Proximal humerus fracture sequelae: impact of a new radiographic classification on arthroplasty. Clin Orthop Relat Res. 2006 Jan;442:121-30

# Fraturas da extremidade proximal do úmero

## Complicações e Sequelas



# Fracturas da extremidade proximal do úmero

## Complicações e Sequelas



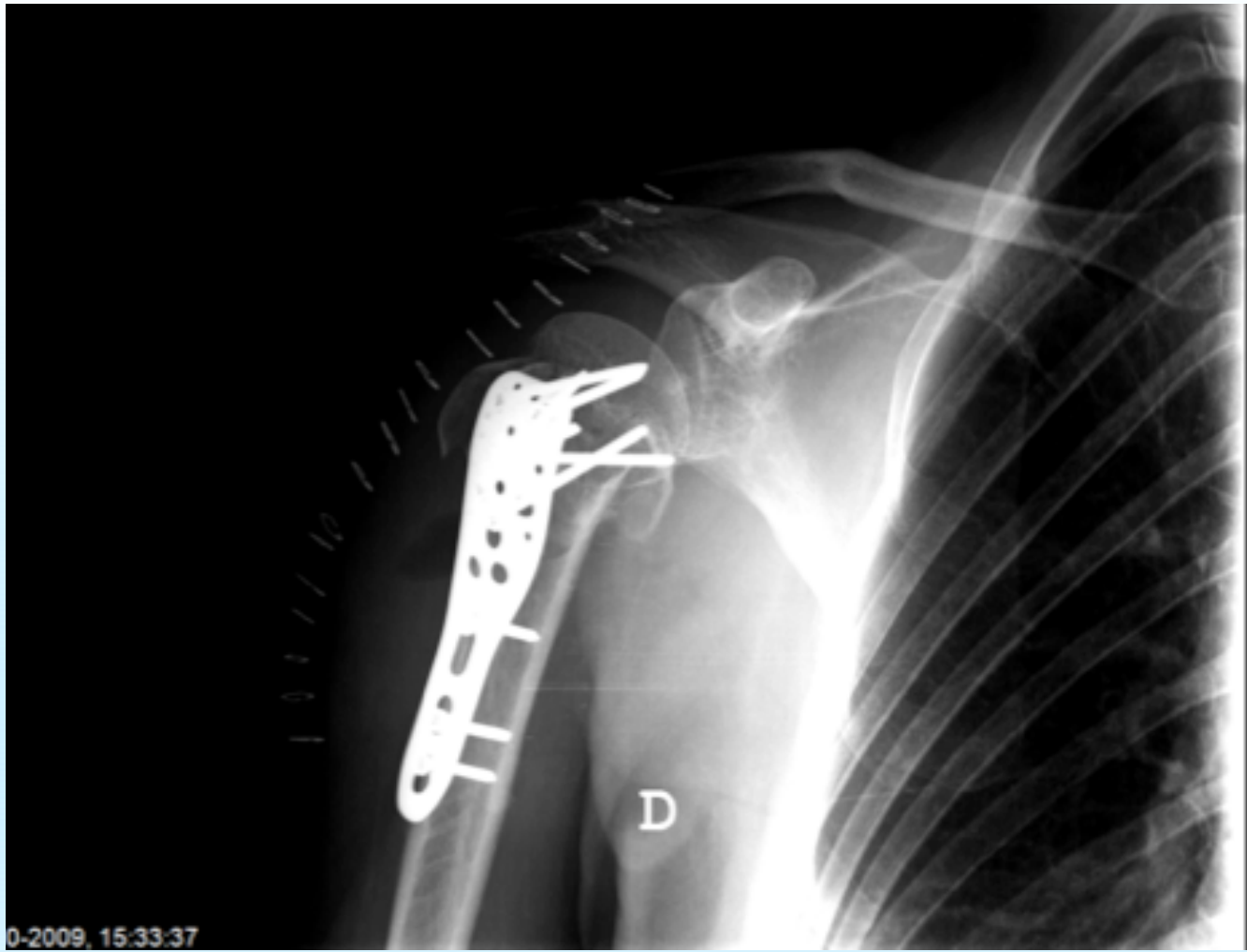
# Fraturas da extremidade proximal do úmero

## Complicações e Sequelas



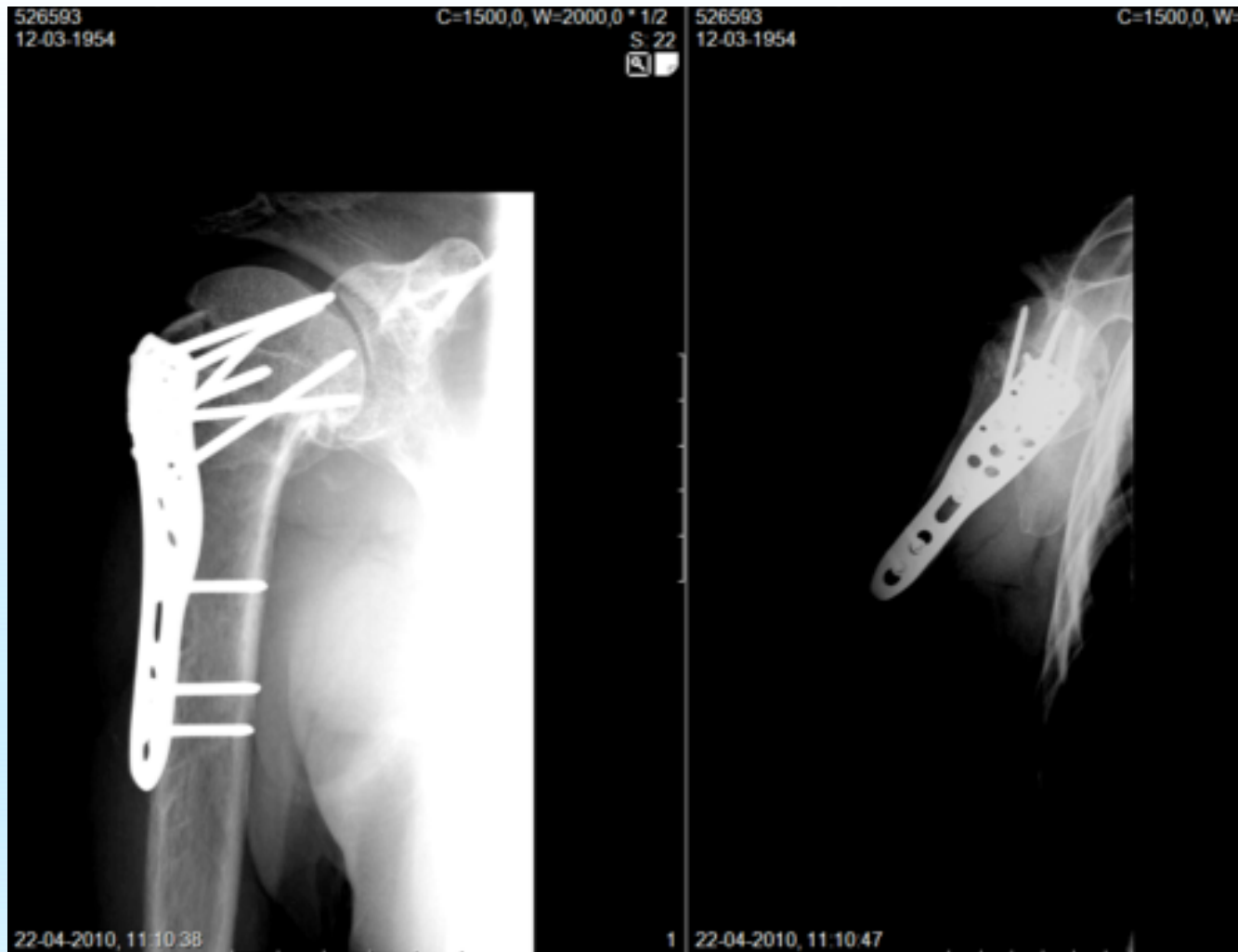
# Fraturas da extremidade proximal do úmero

## Complicações e Sequelas



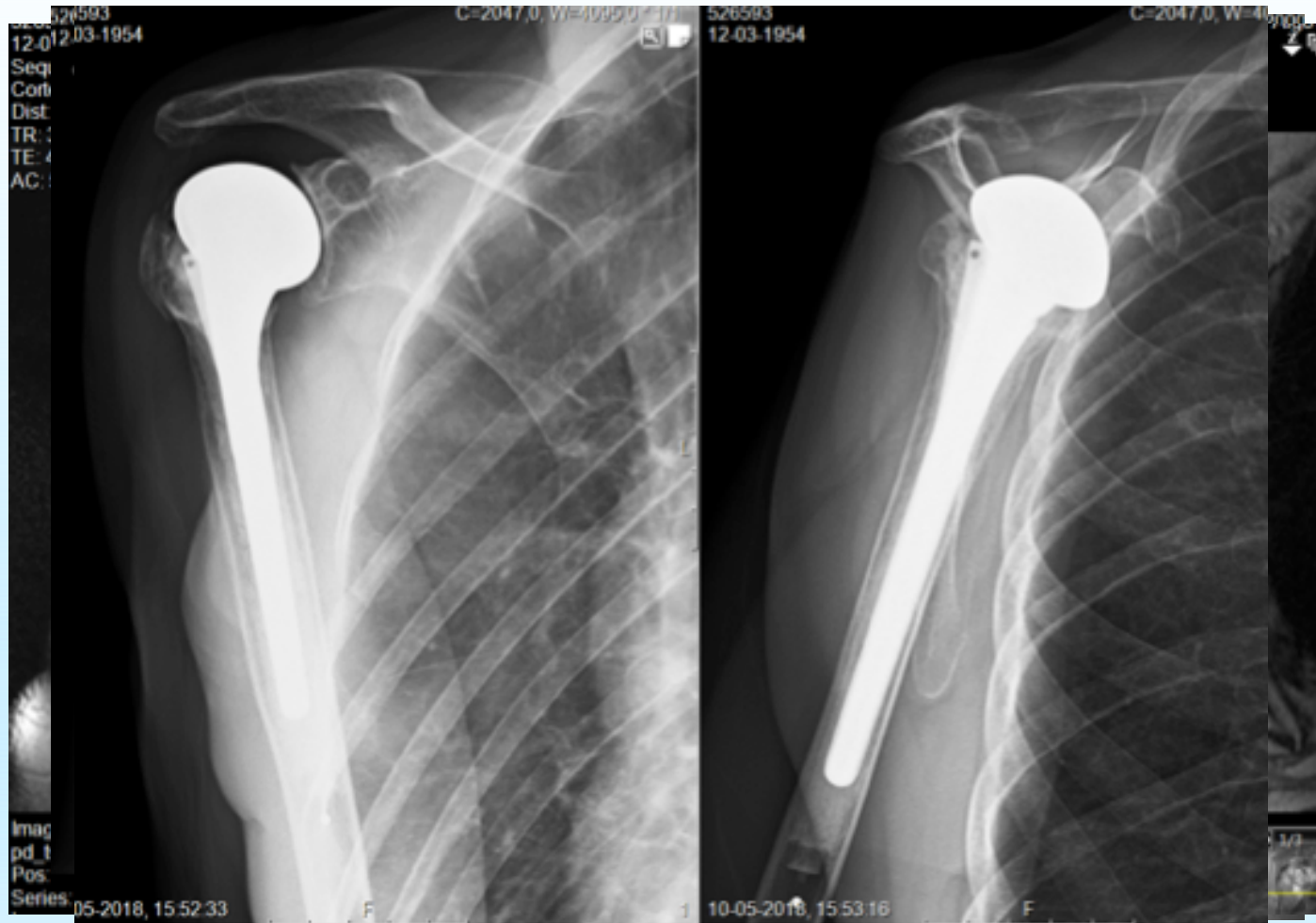
# Fraturas da extremidade proximal do úmero

## Complicações e Sequelas



# Fraturas da extremidade proximal do úmero

## Complicações e Sequelas





## Complicações e Sequelas

### Sequelas tipo 1

### (colapso/necrose cabeça)



#### ■ SHOULDER AND ELBOW

### Reverse shoulder arthroplasty for type 1 sequelae of a fracture of the proximal humerus

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T. Bruckner,  
P. Magosch,  
P. Habermeyer,  
P. Boileau,  
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#### Aims

The aim of this study was to analyze the results of reverse shoulder arthroplasty (RSA) in patients with type 1 sequelae of a fracture of the proximal humerus in association with rotator cuff deficiency or severe stiffness of the shoulder.

#### Patients and Methods

A total of 38 patients were included: 28 women and ten men. Their mean age at the time of arthroplasty was 73 years (54 to 91). Before the RSA, 18 patients had been treated with open reduction and internal fixation following a fracture. A total of 22 patients had a rotator cuff tear and 11 had severe stiffness of the shoulder with  $< 0^\circ$  of external rotation. The mean follow-up was 4.3 years (1.5 to 10). The Constant score and the range of movement of the shoulder were recorded preoperatively and at final follow-up.

Preoperatively, radiographs in two planes were performed, as well as CT or arthro-CT scans; radiographs were also performed at final follow-up.

#### Results

The mean Constant score improved from 25 points (5 to 47) preoperatively to 57 points (15 to 81) postoperatively. The mean forward elevation of the shoulder increased from  $73^\circ$  ( $10^\circ$  to  $130^\circ$ ) preoperatively to  $117^\circ$  ( $15^\circ$  to  $170^\circ$ ) postoperatively. Previous surgery did not influence the outcome. Patients with rotator cuff tears had lower Constant scores than patients without ( $p = 0.037$ ). Those with preoperative stiffness of the shoulder had lower postoperative external rotation compared with patients without stiffness ( $p = 0.046$ ). There was no radiographic evidence of loosening. Three complications occurred, leading to revision surgery in two patients. In all, 17 patients rated their result as very good (45%), another 17 as good (45%), two as satisfactory (5%), and two as unsatisfactory (5%).

#### Discussion

RSA is an effective form of treatment for patients with type 1 sequelae of a fracture of the proximal humerus associated with rotator cuff deficiency or stiffness of the shoulder, with high rates of satisfaction. Rotator cuff tears and stiffness of the shoulder had an adverse effect on the clinical outcome.

Cite this article: *Bone Joint J* 2018;100-B:318-23.

Both anatomical and reverse arthroplasty are effective in the management of degenerative pathology of the shoulder.<sup>1-5</sup> However, the treatment of the sequelae of trauma is more challenging, regardless of the initial treatment.<sup>6-8</sup> Boileau et al<sup>7,8</sup> differentiated the post-traumatic sequelae of fractures of the proximal humerus in 2001<sup>7</sup> and 2006<sup>8</sup> into four types. Type 1 lesions are caused by intra-articular fractures leading to osteonecrosis of the humeral head or cephalic collapse in possible combination with varus or valgus malalignment. In patients in whom conservative

treatment has failed, anatomical shoulder arthroplasty has shown promising midterm outcomes.<sup>2-9</sup> However, worse results have been reported in patients with varus malunion and fatty infiltration of the rotator cuff.<sup>9</sup> Moreover, the treatment of this condition becomes more difficult in patients with associated rotator cuff deficiency or severe limitation of movement of the shoulder related to the main pathology.<sup>9</sup> An anatomical arthroplasty is not suitable for the treatment of these patients. Although it has been suggested that reverse shoulder arthroplasty (RSA) may be

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Raiss P, Alami G, Bruckner T, Magosch P, Habermeyer P, Boileau P, et al. Reverse shoulder arthroplasty for type 1 sequelae of a fracture of the proximal humerus. *Bone Joint J*. 2018 Mar 1;100-B(3):318-23.

# Fraturas da extremidade proximal do úmero

## Complicações e Sequelas

### Sequelas tipo 2 (fratura-luxação / luxação crónica)



CLINICAL ORTHOPAEDICS AND RELATED RESEARCH  
Number 442, pp. 121-130  
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#### Proximal Humerus Fracture Sequelae

Impact of A New Radiographic Classification on Arthroplasty

Pascal Boileau, MD<sup>a</sup>; Christopher Chuinard, MD<sup>a</sup>; Jean-Charles Le Huec, MD<sup>a</sup>;  
Gilles Walch, MD<sup>b</sup>; and Christophe Trojani, MD<sup>a</sup>

Our goal was to analyze the results of unconstrained shoulder replacement in a large series of sequelae of proximal humeral fractures in order to validate a previously described surgical classification. In a multicenter study, we retrospectively evaluated 203 patients with sequelae of proximal humeral fractures who were treated with a nonconstrained modular and adaptable prosthesis. The mean followup was 42 months (range, 24-96 months). We identified 137 impacted fractures with humeral head collapse or necrosis (Type 1 sequelae), 25 unreducible dislocations or fracture-dislocations (Type 2), 22 nonunions of the surgical neck (Type 3), and 19 severe tuberosity malunions (Type 4). Results of nonconstrained shoulder arthroplasty for the treatment of Type 1 and Type 3 sequelae were predictably good because no greater tuberosity osteotomy was performed. The distorted anatomy was accepted, and both the prosthesis and technique were modified accordingly. Total shoulder arthroplasty yielded better results than hemiarthroplasty. Patients with Type 3 or Type 4 sequelae had poor functional results with nonconstrained arthroplasty because greater tuberosity osteotomy was needed. This study validates our fracture sequelae classification. We no longer use unconstrained prostheses in Type 3 and Type 4 fracture sequelae and propose peg bone grafting or low-profile fracture prosthesis for patients with Type 3 sequelae and reverse arthroplasty for those with Type 4 sequelae.

Level of Evidence: Prognostic study, level IV (case series). See Guidelines for Authors for a complete description of levels of evidence.

From the <sup>a</sup>Hôpital Archet 2, Nice, France; the <sup>b</sup>Hôpital Pellegrin, Nice, France; and the Clinique Ste Anne de Laurore, Lyon, France. One or more of the authors (PB, GW, CC) has received funding from Tornier, Inc. Each author certifies that his or her institution has approved or waived approval for the human protocol for this investigation and that all investigations were conducted in conformity with ethical principles of research. Correspondence to: Pascal Boileau, MD, Professor and Chairman, Department of Orthopaedic Surgery, Medical University of Nice—Hôpital de L'Archet, 151, Route de Saint Antoine de Ginestière—06202, Nice, France. Phone: 334-9203-6497; Fax: 334-9203-6311; E-mail: boileau.p@chu-nice.fr. DOI: 10.1097/01.blo.0000195679.87258.6e

Sequelae of fractures of the proximal humerus, as first described by Neer,<sup>24,25,26</sup> represent some of the most difficult situations to treat in shoulder reconstruction. Historically, a good functional result has been difficult to achieve because of the complexity of the bone loss and deformity. Furthermore, because of the pathoanatomy, shoulder arthroplasty is an unpredictable treatment for sequelae of proximal humerus fractures.<sup>2,3,10,17,26,27,35</sup> Because patients usually are younger and more active than patients treated for osteoarthritis (OA), an accurate preoperative prognosis is crucial when deciding on potential treatment.<sup>3,36,37</sup>

There is disappointingly little consensus on treatment in the literature, which contains case series with heterogeneous patient populations and dissimilar anatomic lesions.<sup>2,3,10,13,14,16,17,19,21,26,28-30,32</sup> Lack of a valid classification for the sequelae of proximal humerus fractures has delayed decision making regarding surgical treatment. If a classification correlated with outcome were developed, treatment reliably should be improved. Patient-related factors that influence outcome could be identified and, if not controlled, at least be recognized and addressed.

In previous studies,<sup>5,6</sup> we analyzed the results of shoulder arthroplasty in 71 patients with late sequelae from proximal humeral fractures. Furthermore, we described a new surgical classification that has improved our ability to anticipate postoperative arthroplasty results and provided us with improved treatment algorithms. To validate this new surgical classification, we analyzed the results of unconstrained shoulder replacement in a larger series of sequelae of proximal humeral fractures.

#### MATERIAL AND METHODS

We retrospectively reviewed consecutive 203 patients from a number of institutions with 203 sequelae of proximal humeral fractures treated with a nonconstrained shoulder prosthesis and with a minimum of 2 years of followup (range 24-96 months; mean followup, 42 months).

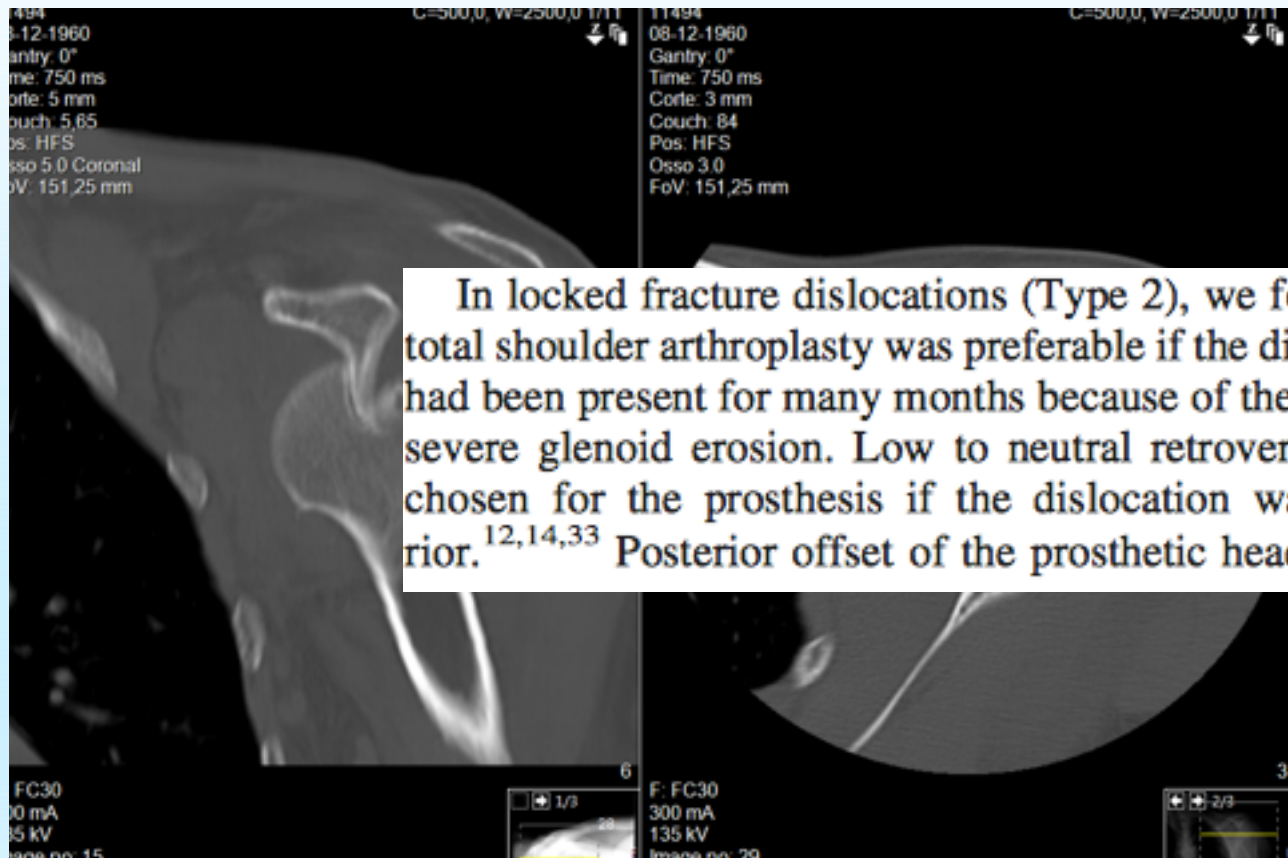
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# Fraturas da extremidade proximal do úmero

## Complicações e Sequelas

### Sequelas tipo 2 (fratura-luxação / luxação crónica)



In locked fracture dislocations (Type 2), we found that total shoulder arthroplasty was preferable if the dislocation had been present for many months because of the frequent severe glenoid erosion. Low to neutral retroversion was chosen for the prosthesis if the dislocation was posterior.<sup>12,14,33</sup> Posterior offset of the prosthetic head may be

#### Proximal Humerus Fracture Sequelae

Impact of A New Radiographic Classification on Arthroplasty

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of unconstrained shoulder of sequelae of proximal fracture of the humerus. The mean follow-up was 12 years. We identified 137 im-

by, level IV (case series).

From the <sup>a</sup>Hôpital Archet 2, Nice, France; the <sup>b</sup>Hôpital Pasteur, Nice, France; and the <sup>c</sup>Clinique Ste Anne de Laurore, Lyon, France. One or more of the authors (PB, GW, CC) has received funding from Tornier, Inc. Each author certifies that his or her institution has approved or waived approval for the human protocol for this investigation and that all investigations were conducted in conformity with ethical principles of research. Correspondence to: Pascal Boileau, MD, Professor and Chairman, Department of Orthopedic Surgery, Medical University of Nice—Hôpital de L'Archet, 151, Route de Saint Antoine de Ginestière—06202, Nice, France. Phone: 334 9203 6497; Fax: 334 9203 6411; E-mail: boileau.p@chu-nice.fr. DOI: 10.1097/01.blo.0000195679.87258.6e

Sequelae of fractures of the proximal humerus, as first described by Neer,<sup>24,25,26</sup> represent some of the most difficult situations to treat in shoulder reconstruction. Historically, a good functional result has been difficult to achieve because of the complexity of the bone loss and deformity. Furthermore, because of the pathoanatomy, shoulder arthroplasty is an unpredictable treatment for sequelae of proximal humerus fractures.<sup>2,3,10,17,26,27,29</sup> Because patients usually are younger and more active than patients treated for osteoarthritis (OA), an accurate preoperative prognosis is crucial when deciding on potential treatment.<sup>3,26,27</sup>

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# Fracturas da extremidade proximal do úmero

## Complicações e Sequelas

### Sequelas tipo 3 (Pseudartrose)



Boileau P, Chuinard C, Le Huec JC, Walch G, Trojani C. Proximal humerus fracture sequelae: impact of a new radiographic classification on arthroplasty. Clin Orthop Relat Res. 2006 Jan;442:121-30



## Complicações e Sequelas

### Sequelas tipo 3 (Pseudartrose)

- 1.1% (todas as # úmero proximal)
  - 8% (cominuição metafisária)
  - 10% (translação colo cirúrgico)
- Tratar precocemente (máx. 6 meses)
- > fraturas consolidaram aos 3 meses



Court-Brown CM, McQueen MM. Nonunions of the proximal humerus: their prevalence and functional outcome. J Trauma. 2008 Jun;64(6):1517-21

# Fraturas da extremidade proximal do úmero

## Complicações e Sequelas

### Sequelas tipo 3 (Pseudartrose)

- RSA
- Opção terapêutica
- Taxa muito alta de luxação (34%)

### Reverse Shoulder Arthroplasty for the Treatment of Nonunions of the Surgical Neck of the Proximal Part of the Humerus (Type-3 Fracture Sequelae)

Patric Raiss, MD, T. Bradley Edwards, MD, Manuel Ribeiro da Silva, MD, Thomas Bruckner, PhD, Markus Loew, MD, and Gilles Walch, MD

Investigation performed at the Centre Orthopédique Santy, Lyon, France, and the Klinik für Orthopädie und Unfallchirurgie, Universität Heidelberg, Germany

**Background:** Fracture sequelae of the proximal part of the humerus are challenging conditions, and various treatment options have been described. The purpose of this multicenter study was to analyze the clinical and radiographic outcomes as well as the complications following semiconstrained reverse total shoulder arthroplasty for the treatment of nonunion of a surgical neck fracture of the proximal part of the humerus.

**Methods:** Thirty-two patients with a mean age of sixty-eight years (range, forty-eight to eighty-three years) managed with a reverse shoulder arthroplasty for the treatment of nonunion of a proximal humeral fracture were analyzed clinically and radiographically. The mean duration of follow-up was four years (range, two to twelve years). The Constant score, active shoulder mobility, all complications, and revision procedures were recorded.

**Results:** The mean Constant score increased from 14.2 points (range, 2 to 35 points) to 46.6 points (range, 6 to 75 points) ( $p < 0.001$ ). The mean shoulder flexion increased from 42.9° (range, 0° to 160°) to 109.7° (range, 0° to 170°) ( $p < 0.001$ ), and the mean external rotation increased from 0.5° (range, -40° to 60°) to 13.1° (range, -30° to 60°) ( $p < 0.005$ ). No component loosening occurred, but 50% (sixteen) of the patients had radiographic evidence of scapular notching. There were thirteen complications (41%) leading to nine revision surgical procedures (28%). The most common complication was a dislocation following reverse shoulder arthroplasty, which occurred in 34% (eleven) of the patients. An intraoperative resection of the humeral head fragment and the tuberosities was associated with increased risk of dislocation ( $p < 0.007$ ).

**Conclusions:** Nonunions of the proximal part of the humerus can be treated with reverse shoulder arthroplasty. Although clinical outcomes improved significantly, we found an unacceptably high rate of dislocations associated with intraoperative resection of the tuberosities. The tuberosities and the attached rotator cuff should be preserved if possible to reduce the risk of dislocation after reverse total shoulder arthroplasty.

**Level of Evidence:** Therapeutic Level IV. See Instructions for Authors for a complete description of levels of evidence.

**Peer Review:** This article was reviewed by the Editor-in-Chief and one Deputy Editor, and it underwent blinded review by two or more outside experts. The Deputy Editor reviewed each revision of the article, and it underwent a final review by the Editor-in-Chief prior to publication. Final corrections and clarifications occurred during one or more exchanges between the author(s) and copyeditors.

**Disclosure:** One or more of the authors received payments or services, either directly or indirectly (i.e., via his or her institution), from a third party in support of an aspect of this work. In addition, one or more of the authors, or his or her institution, has had a financial relationship, in the thirty-six months prior to submission of this work, with an entity in the biomedical arena that could be perceived to influence or have the potential to influence what is written in this work. No author has had any other relationships, or has engaged in any other activities, that could be perceived to influence or have the potential to influence what is written in this work. The complete **Disclosures of Potential Conflicts of Interest** submitted by authors are always provided with the online version of the article.



A commentary by Steve Klepps, MD, is linked to the online version of this article at [jbsj.org](http://jbsj.org).

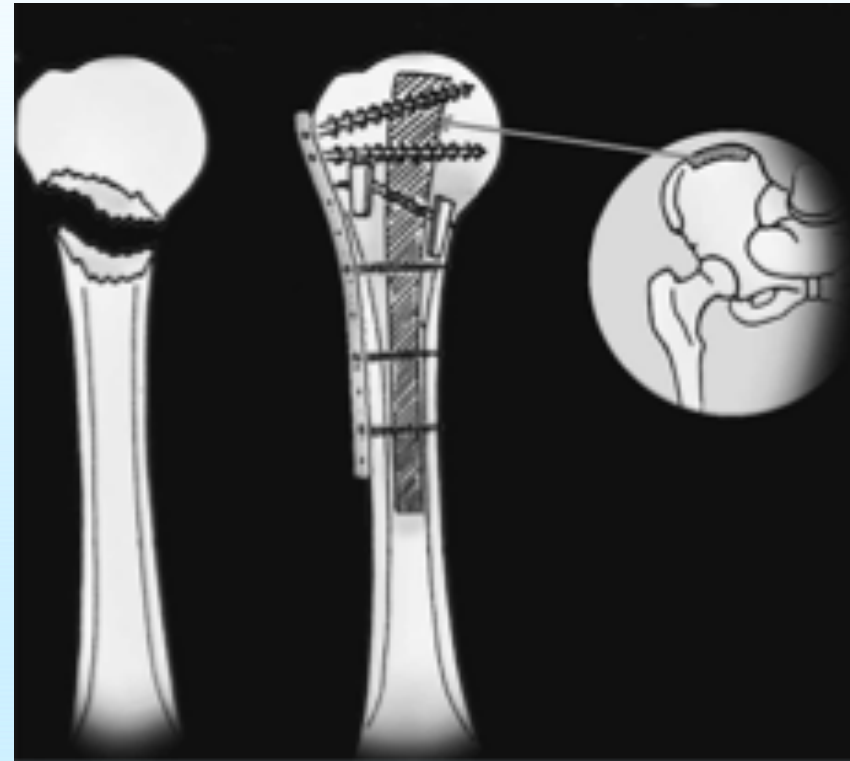
Raiss P, Edwards TB, da Silva MR, Bruckner T, Loew M, Walch G. Reverse shoulder arthroplasty for the treatment of nonunions of the surgical neck of the proximal part of the humerus (type-3 fracture sequelae).

J Bone Joint Surg Am. 2010 Dec 17;96(24):2070-6.

## Complicações e Sequelas

### Sequelas tipo 3 (Pseudartrose)

- “Peg” ósseo intra-medular
- Fixação interna
- Enxerto ósseo esponjoso



Walch G, Badet R, Nove-Josserand L, Levigne C. Nonunions of the surgical neck of the humerus: surgical treatment with an intramedullary bone peg, internal fixation and cancellous bone grafting. *J Shoulder Elbow Surg.* 1996;5:161-168



## Complicações e Sequelas

### Sequelas tipo 4

#### (má união tuberosidades)

- Tuberoplastia @ (casos seleccionados)
  - intra e extra-articular
- Desvio ligeiro (conflito)
- Deformidades >
  - osteotomia e redução anatómica

Knee Surg Sports Traumatol Arthrosc (2010) 18:988–991  
DOI 10.1007/s00167-009-0939-1

SHOULDER

#### Arthroscopic tuberooplasty for subacromial impingement secondary to proximal humeral malunion



e-mail: ecalvo@fjd.es

mial space from the posterior portal. Once cleared, the

Calvo E, Merino-Gutierrez I, Lagunes I. Arthroscopic tuberooplasty for subacromial impingement secondary to proximal humeral malunion. Knee Surg Sports Traumatol Arthrosc. 2010 Jul;18(7):988-91.

# Fraturas da extremidade proximal do úmero

## Complicações e Sequelas

### Sequelas tipo 4

### (má união tuberosidades)

#### Reverse Shoulder Arthroplasty for Malunions of the Proximal Part of the Humerus (Type-4 Fracture Sequelae)

Patric Raiss, MD, T. Bradley Edwards, MD, Philippe Collin, MD, Thomas Bruckner, PhD, Felix Zeifang, MD, Markus Loew, MD, Pascal Boileau, MD, and Gilles Walch, MD

Investigation performed at the Centre Orthopédique Santy/Hôpital Privé Jean Mermoz, Lyon, France, and the Zentrum für Orthopädie und Unfallchirurgie, Universität Heidelberg, Heidelberg, Germany

**Background:** The treatment of fracture sequelae of the proximal part of the humerus in combination with posttraumatic arthritis is challenging. The reported results of treatment with anatomic shoulder arthroplasty are disappointing. The aim of this multicenter study was to analyze the clinical and radiographic results of reverse shoulder arthroplasty for treatment of posttraumatic sequelae of the proximal part of the humerus with malunion of the tuberosities.

**Methods:** This was a retrospective, multicenter study of 42 patients (42 shoulders) with the diagnosis of posttraumatic sequelae of the proximal part of the humerus with malunions of the tuberosities who were treated with reverse shoulder arthroplasty between 2000 and 2010. The mean age at the time of arthroplasty was 68 years (range, 27 to 83 years; median, 70 years). The dominant side was treated in 24 cases. The mean clinical and radiographic follow-up was 4 years (range, 2 to 13 years; median, 3.5 years). The Constant score including subgroups, shoulder flexion, rotation motion, and radiographs of the affected shoulders were analyzed before the surgical procedure and at the time of the latest follow-up. Patients categorized their postoperative results as very good, good, satisfactory, or unsatisfactory.

**Results:** The mean Constant score increased from 19.7 points (range, 0 to 52 points) preoperatively to 54.9 points (range, 21 to 83 points) postoperatively ( $p < 0.0001$ ). All of the subgroups of the Constant score also increased, as did active shoulder flexion and external rotation (all  $p < 0.0001$ ). In one case, loosening of the humeral and glenoid components occurred. Scapular notching was present in 22 shoulders (52%) and was grade 1 in 12 cases, grade 2 in 4 cases, grade 3 in 2 cases, and grade 4 in 4 cases. Complications occurred in 4 patients (9.5%). Eighteen patients (43%) rated their result as very good, 19 (45%) rated their result as good, 4 (10%) rated their result as satisfactory, and one (2%) rated the result as unsatisfactory.

**Conclusions:** Reverse shoulder arthroplasty is a viable treatment option for type-4 proximal humeral fracture sequelae that cannot otherwise be treated with anatomic shoulder replacement.

**Level of Evidence:** Therapeutic Level IV. See Instructions for Authors for a complete description of levels of evidence.

**Peer Review:** This article was reviewed by the Editor-in-Chief and one Deputy Editor, and it underwent blinded review by two or more outside experts. It was also reviewed by an expert in methodology and statistics. The Deputy Editor reviewed each revision of the article, and it underwent a final review by the Editor-in-Chief prior to publication. Final corrections and clarifications occurred during one or more exchanges between the author(s) and copyeditors.

Fractures of the proximal part of the humerus are a common condition that can be treated operatively or nonoperatively. Regardless of the initial treatment, nonanatomic healing with malunion of the tuberosities and glenohumeral joint incongruity can occur<sup>1,2</sup>. Boileau et al. classified fracture sequelae of the proximal part of the humerus into 4 different pathologies<sup>1</sup>.

**Disclosure:** One author of this study (P.R.) received a research grant from the nonprofit research foundation Stiftung Endoprothetik to perform this study. Two authors of this study (T.B.E. and G.W.) received royalties from Tornier for this study. One author of this study (G.W.) also received stock options from Imascap for this study. On the **Disclosure of Potential Conflicts of Interest** forms, which are provided with the online version of the article, one or more of the authors checked "yes" to indicate that the author had a relevant financial relationship in the biomedical arena outside the submitted work and "yes" to indicate that the author had other relationships or activities that could be perceived to influence, or have the potential to influence, what was written in this work.

J Bone Joint Surg Am. 2016;98:893-9 • <http://dx.doi.org/10.2106/JBJS.15.00506>

Raiss P, Edwards TB, Collin P, Bruckner T, Zeifang F, Loew M, et al. Reverse Shoulder Arthroplasty for Malunions of the Proximal Part of the Humerus (Type-4 Fracture Sequelae). J Bone Joint Surg Am. 2016 Jun 1;98(11):893-9.

## Complicações e Sequelas

Sequelas tipo 4

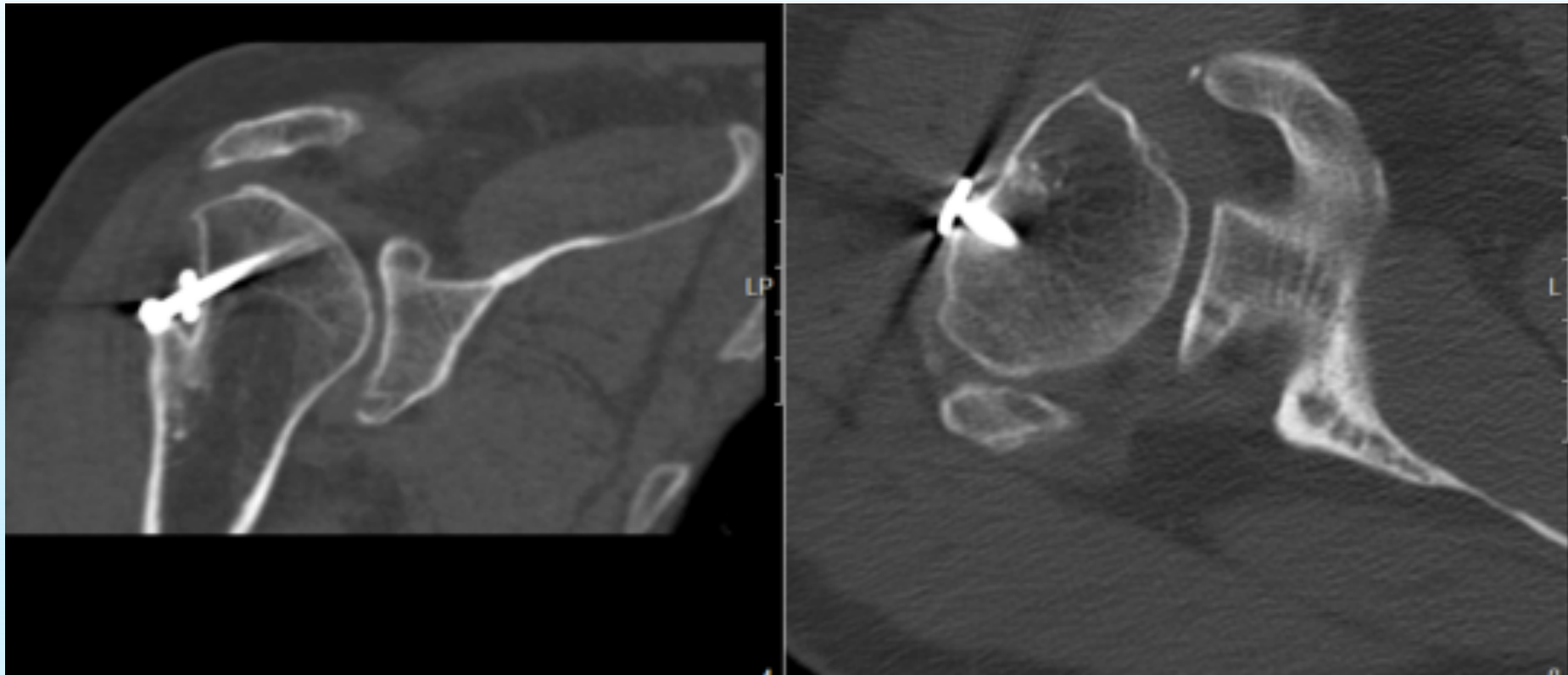
(má união tuberosidades)



# Fraturas da extremidade proximal do úmero

## Complicações e Sequelas

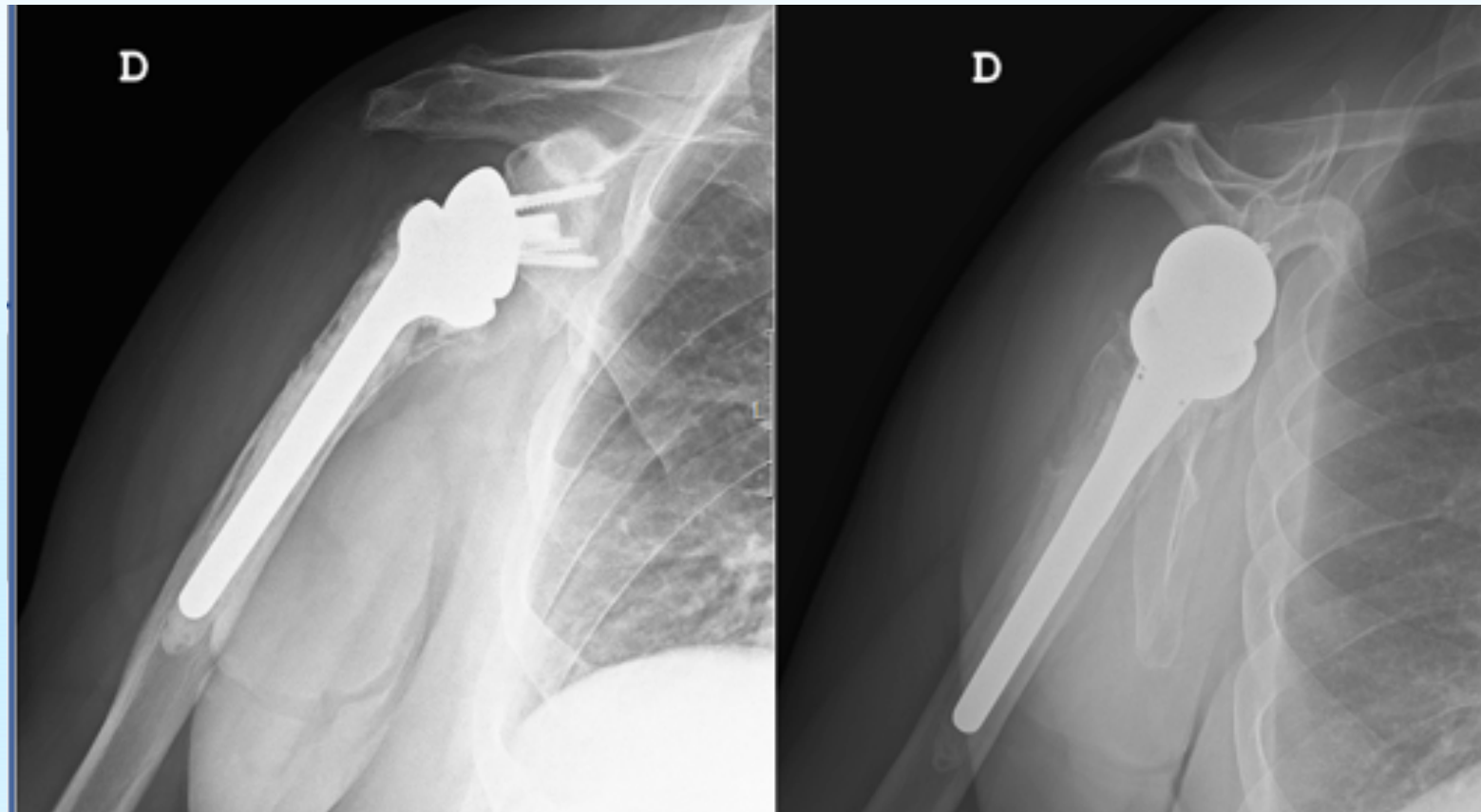
Sequelas tipo 4 (má união tuberosidades)



# Fraturas da extremidade proximal do úmero

## Complicações e Sequelas

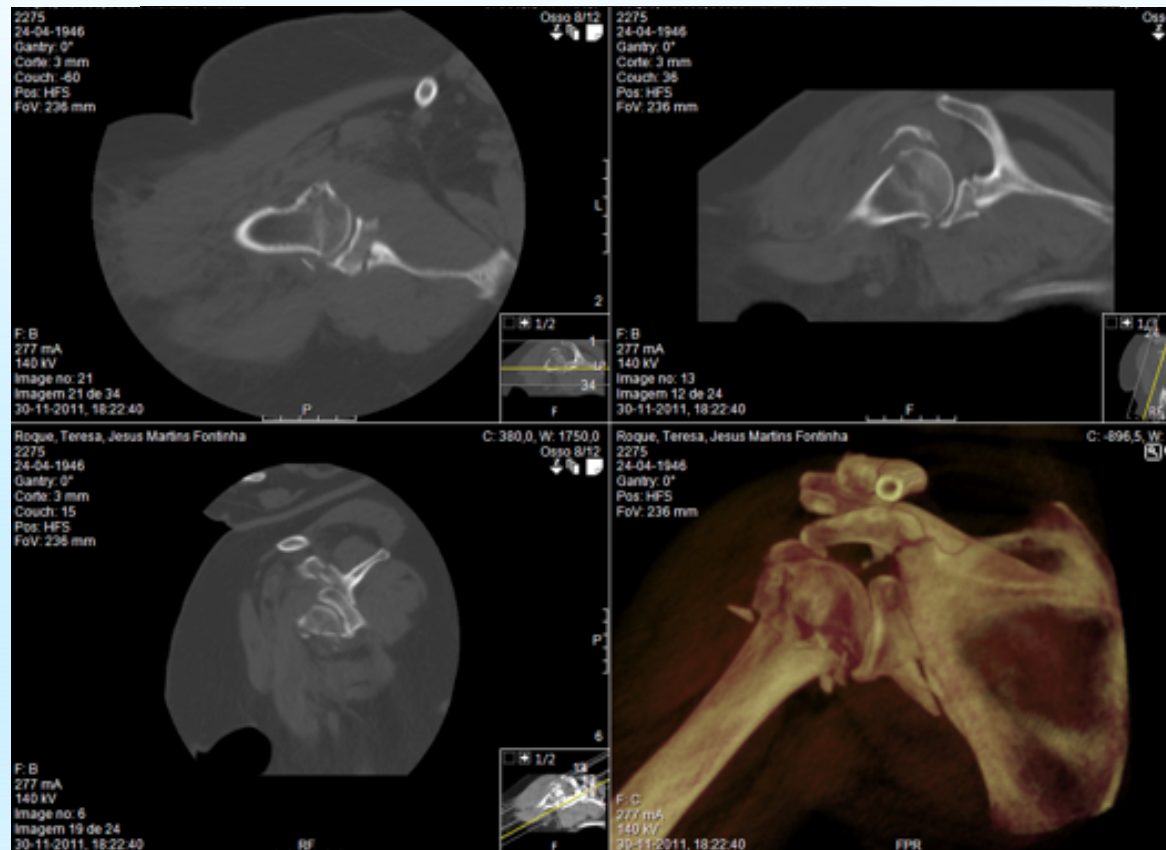
Sequelas tipo 4 (má união tuberosidades)



# Fraturas da extremidade proximal do úmero

## Complicações e Sequelas

### Sequelas tipo 4 (má união tuberosidades)

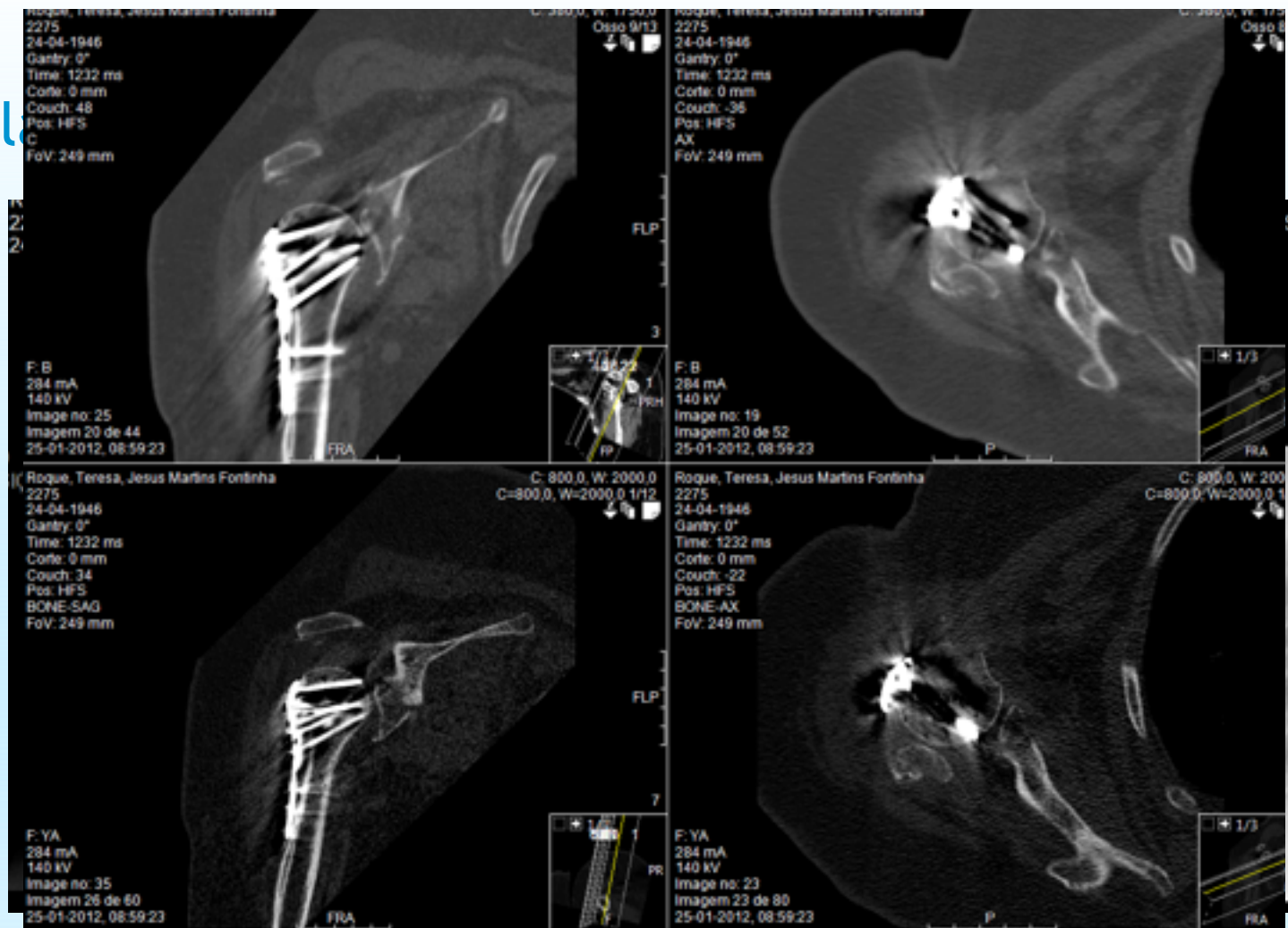




# Fracturas da extremidade proximal do úmero

## Complicações e Sequelas

Sequela

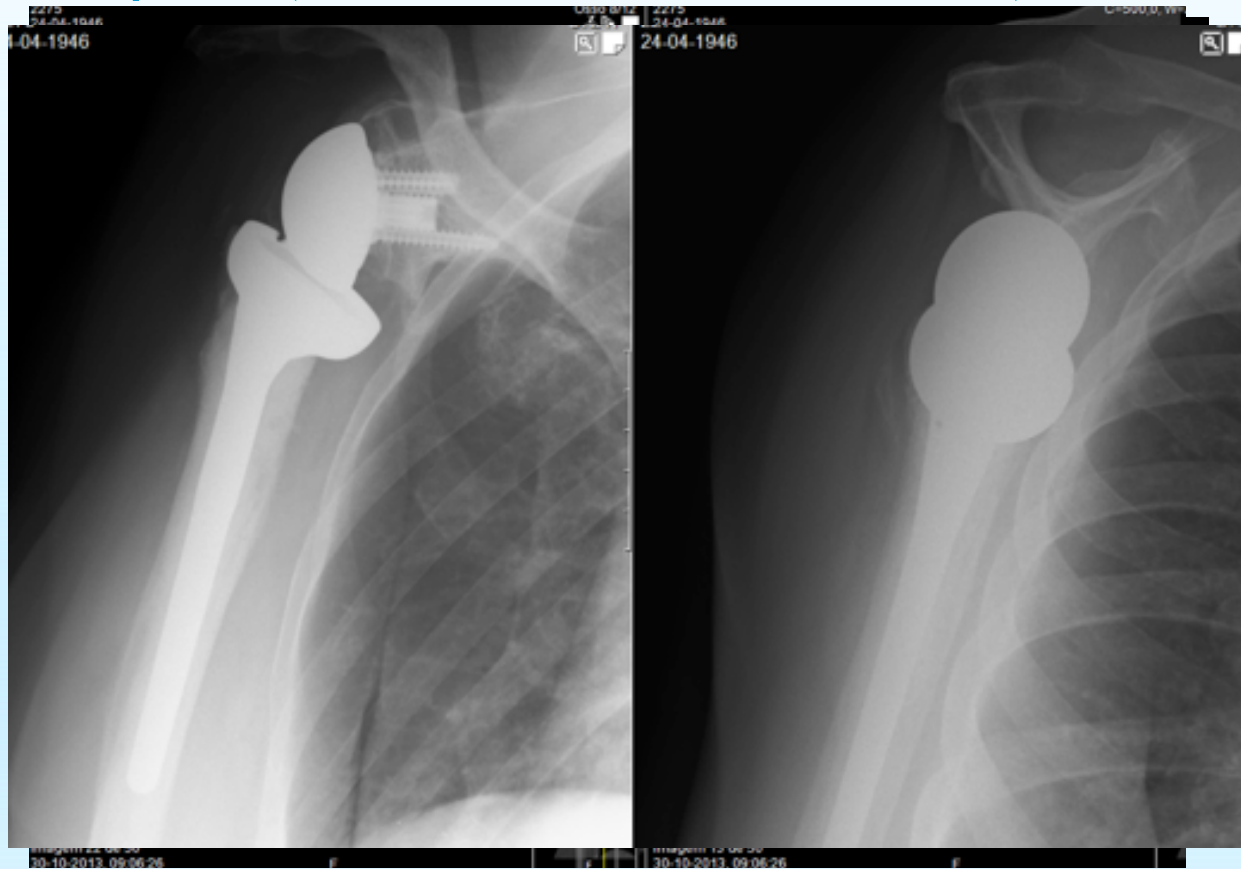




# Fraturas da extremidade proximal do úmero

## Complicações e Sequelas

### Sequelas tipo 4 (má união tuberosidades)



## Complicações e Sequelas

Complicações “intra” e “extra-articulares

I e II

III e IV

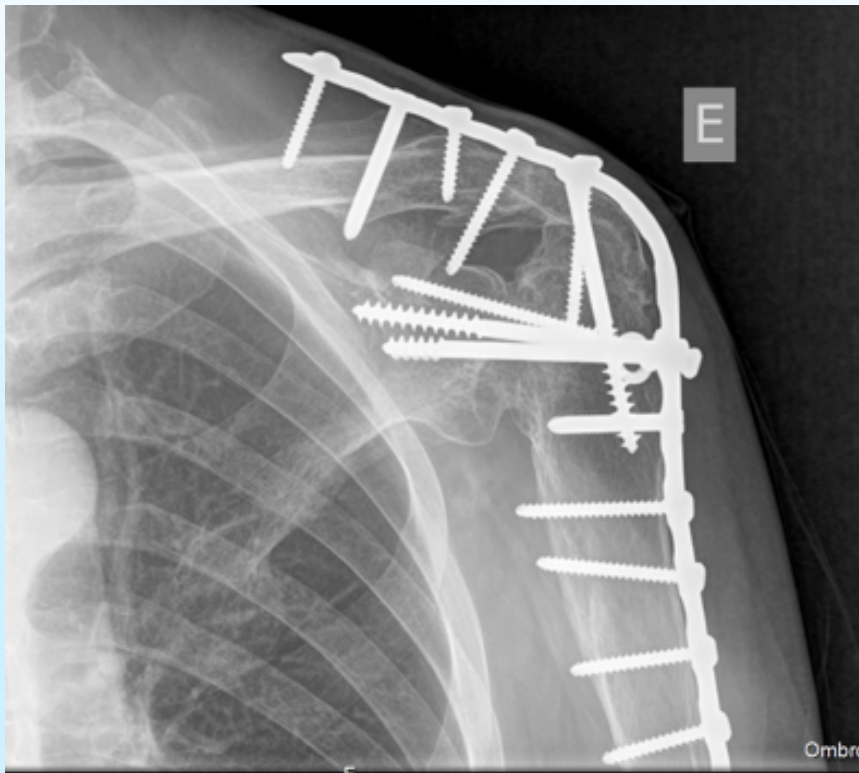
Tratar quando sintomáticas

RSA (boa opção em muitos casos)

Preferir enxerto + fixação nas pseudartroses colo cirúrgico

# Fraturas da extremidade proximal do úmero

## Complicações e Sequelas



Obrigado!

