

**Hemiarthroplasty or  
Reverse Shoulder Arthroplasty  
For Proximal Humerus Fractures**

Pascal Boileau, MD  
France

---

---

---

---

---

---

---

**Charles S. Neer, 1955**



"... results of hemiarthroplasty for acute proximal humerus fractures are good ..."

---

---

---

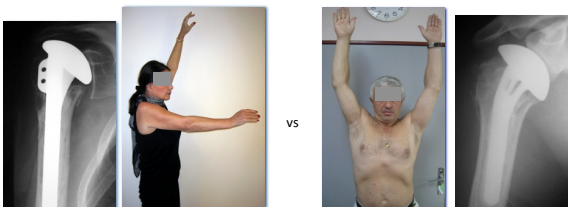
---

---

---

---

**HA for Fx = Unpredictable Results**



**No average results (Rule of 'all or nothing')**

Boileau et al., JSES 2002

---

---

---

---

---

---

---

**Tuberosity malposition and migration: Reasons for poor outcomes after hemiarthroplasty for displaced fractures of the proximal humerus**

JOURNAL OF SHOULDER AND ELBOW SURGERY

P. Boileau, S. G. Krishnan, L. Tinsi, G. Walch, J. S. Coste, and D. Molé, Nice, France **2002**

GT displacement → Poor functional outcomes

---

---

---

---

---

---

---

---

**Tuberosity Complications**

**= 50% !!**

- Initial Malposition 35%
- Migration 24%
- Nonunion / Malunion 53%

Boileau et al., JSES 2002

---

---

---

---

---

---

---

---

**The Problems**

- Improper Prosthesis Positioning
- Poor Prosthetic Design
- Poor Suture Fixation Technique
- Improper Post-op Management

---

---

---

---

---

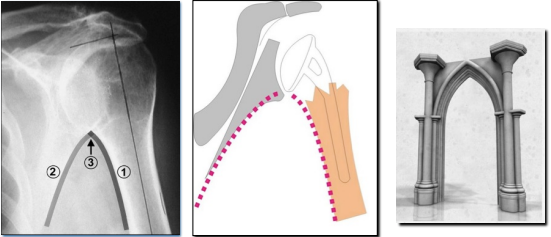
---

---

---

### Prosthesis Malpositioning

Too Proud → GT pull out / migration



The image contains three sub-panels: 1) A lateral X-ray of a shoulder with a humeral head prosthesis, showing a dashed line representing the 'Gothic arch' and three numbered points (1, 2, 3) indicating key landmarks. 2) A schematic diagram of the shoulder joint with a dashed red line forming an arch over the humeral head, with an orange arrow pointing to the arch's peak. 3) A photograph of two metal Gothic arches, one taller than the other, used as a visual metaphor for the desired arch height.

Restoration of the Gothic arch

*Krishnan et al., JSES 2005*

---

---

---

---

---

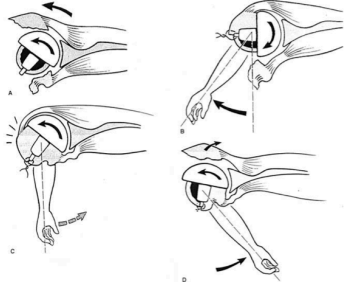
---

---

---

### Prosthesis Malpositioning

Too Retroverted → GT pull out / migration



The image contains four schematic diagrams of a shoulder joint. The top two diagrams (A and B) show the humeral head in a retroverted position relative to the glenoid. The bottom two diagrams (C and D) show the humeral head in a more anatomically aligned position. Arrows indicate the direction of movement and the resulting changes in the glenohumeral joint space.

*Boileau et al, JSES 2002*

---

---

---

---

---

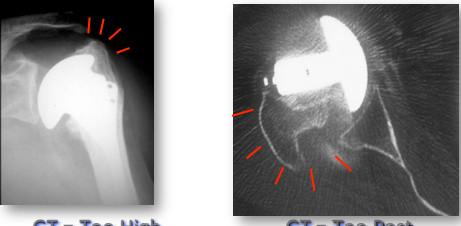
---

---

---

### Tuberosity Malpositioning

→ GT pull out / migration



The image contains two X-ray images of a shoulder. The left image shows a humeral head prosthesis with red dashed lines indicating the tuberosity is positioned too high or too low. The right image shows a humeral head prosthesis with red dashed lines indicating the tuberosity is positioned too posteriorly.

GT = Too High  
...or too Low

GT = Too Post ...

*Boileau et al JSES 2002*

---

---

---

---

---

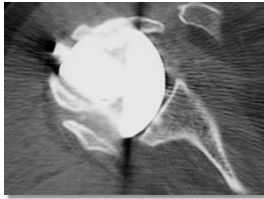
---

---

---

## Bulky Prostheses Don't Help!

Excess of Metal+++



= Obstacle to  
GT positioning



= Barrier for  
bone healing! ...

---

---

---

---

---

---

---

---

## Type of Prosthesis Does matter!

• *Loew et al., JBJS Br 2006*

**Tuberosity healing:**  
50% with a *Fracture Prosthesis* vs  
29% with a *Standard prosthesis*



• *Krishnan et al., CORR 2011*

**58 Conventional Prostheses**  
**112 Fracture Prostheses**

→ Use of fracture-specific stems did improve  
shoulder function and tuberosity healing  
compared with conventional stems



---

---

---

---

---

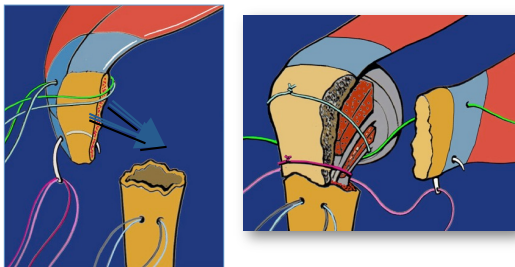
---

---

---

## Poor Tuberosity Fixation

→ Separate fixation of GT & LT +++



*Boileau et al, TSES 2002*

---

---

---

---

---

---

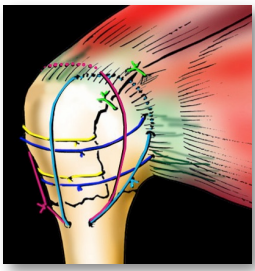
---

---

### Poor Tuberosity Fixation

→ Cerclages + Tension-Band

4 Horizontal Cerclages



2 Vertical Tension Band Sutures

*Boileau et al, TSES 2002*

---

---

---

---

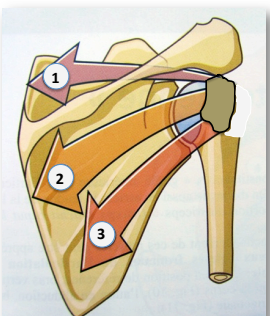
---

---

---

---

### Over Aggressive Rehabilitation



→ GT fragment Detachment!!

---

---

---

---

---

---

---

---

### Protection of GT Repair

→ Neutral Rotation brace++



Pendulum exercises ONLY  
for the first 4 weeks

---

---

---

---

---

---

---

---

# HA for Fractures

How to maximize outcomes?...

Does the prosthesis matter?...

---

---

---

---

---

---

---


---

Can surgeons predict what makes a good hemiarthroplasty for fracture?

JOURNAL OF SHOULDER AND ELBOW SURGERY 2013

Pascal Boileau, MD<sup>a,\*</sup>, Matthias Winter, MD<sup>b</sup>, Alec Cikes, MD<sup>c</sup>, Yung Han, MD<sup>d</sup>, Michel Carles, MD, PhD<sup>e</sup>, Gilles Walch, MD<sup>e</sup>, Daniel G. Schwartz, MD<sup>a</sup>

61 Fractures  
Two Types of Implants



**Standard stem**  
N = 31  
(1991-1997)

**Fracture stem**  
N = 30  
(1998-2006)

---

---

---

---

---

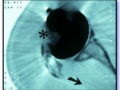
---

---

---

## Type of implant does matter!

Use of a Standard (bulky) Implant



- decreased GT adequate positioning 52% vs 97% p=0.0001
- decreased GT healing+++ 45% vs 87% p=0.0001
- decreased Functional outcome++ AAE 113° vs 136° CS 58 vs 68 p=0.0001

---

---

---

---

---

---

---

---

**Patient's age & gender also matter!**

**Patients over 75 years & Women have:**

- Higher rate of tuberosity complications
- Lower functional results

(Regardless of the type of implant used)

Reverse prosthesis is probably a better option in the elderly (> 75yo) female patients

---

---

---

---

---

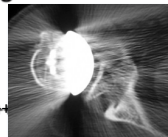
---

---

---

*In Summary* **HA for Acute Fractures**

- Still unpredictable results  
"All or Nothing"
- Prosthesis / GT malpositioning
- Poor technique & prosthetic design  
"Low Profile" fracture Prosthesis+++
- Influence of patient's age & Gender  
poor results in the elderly women+++



---

---

---

---

---

---

---

---

**Can RSA be an  
alternative to HA  
in elderly patients?...**

---

---

---

---



---

---

---

---

### Prospective Randomized Study

|   |   |
|---|---|
| <b>RSA</b>  | <b>HA</b>   |
|  |  |
| 28 cases<br>79 yo   | 28 cases<br>76 yo   |

**Patients > 70 y**  
**Reverse / Aequalis-Fx**  
**> 12 months FU**  
**38 cases**

*Sirveaux & Molé, Nice Shoulder Course 2008*

---

---

---

---


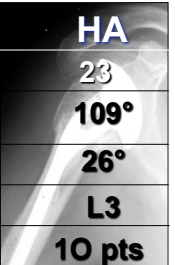
---

---

---

---

### Functional Outcomes

|   |   |   |
|---|---|---|
| <b>RSA</b>  | <b>33 months F.U</b>                                    | <b>HA</b>   |
|  | <b>Cases</b>  |  |
| 20<br>122°<br>18°<br>Sacrum<br>12 pts   | 23<br>AFE<br>(p=0,07)<br>Active ER<br>Active IR<br>Pain | 23<br>109°<br>26°<br>L3<br>10 pts   |

*Sirveaux & Molé, Nice Shoulder Course 2008*

---

---

---

---

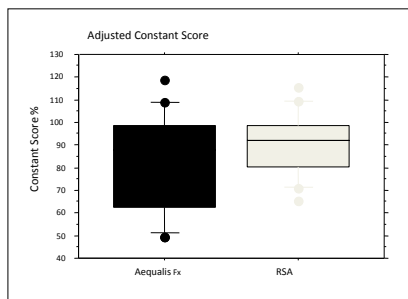
---

---

---

---

### RSA: More Predictable Results



*Sirveaux & Molé, Nice Shoulder Course 2008*

---

---

---

---

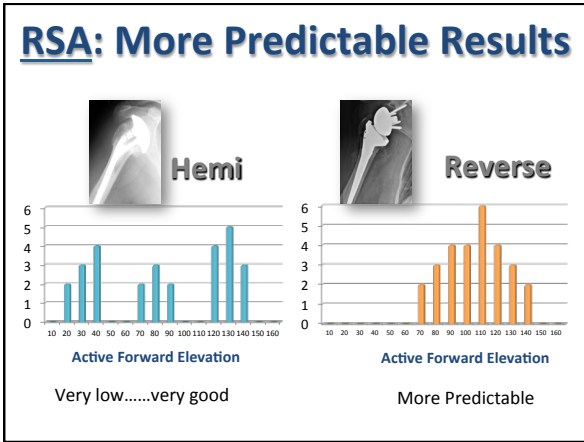
---

---

---

---





---

---

---

---

---

---

---

---

## Do Tuberosities Heal better in RSA?...

---

---

---

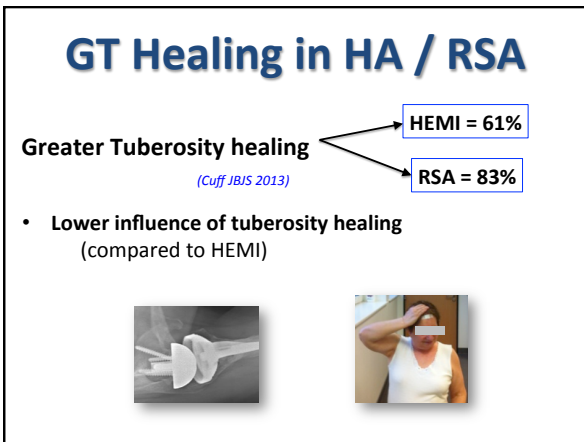
---

---

---

---

---



---

---

---

---

---

---

---

---

## Comparative Study: HA vs RSA

Hemiarthroplasty versus reverse shoulder arthroplasty in 4-part displaced fractures of the proximal humerus: Multicenter retrospective study

OTSR 2016

N. Bonneville<sup>a,\*</sup>, C. Tournier<sup>b</sup>, P. Clavert<sup>c</sup>, X. Ohl<sup>d</sup>, F. Sirveaux<sup>e</sup>, D. Saraglia<sup>f</sup>, et la Société française de chirurgie orthopédique et traumatologique

|               | HA (N=57) | RSA (N=41) | P    |
|---------------|-----------|------------|------|
| Constant      | 54        | 57         | NS   |
| Adj. Constant | 73%       | 83%        | 0.02 |
| AFE           | 112°      | 130°       | 0.01 |
| AER           | 28°       | 23°        | NS   |
| AIR           | L3        | Sacrum     | 0.03 |
| GT Healing    | 70%       | 70%        | NS   |
| Complications | 24%       | 10%        | 0.01 |
| SSV           | 66%       | 75%        | NS   |

---

---

---

---

---

---

---

---

## Is Absence of Tuberosity Healing a Problem in RSA for Fracture?...

---

---

---

---

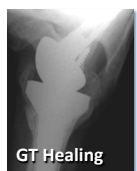
---

---

---

---

## The Importance of GT Healing



|                       | AFE      | AER1    | AER2      |
|-----------------------|----------|---------|-----------|
| GT Healing            | 127°<br> | 25°<br> | 50°<br>   |
| Absence of GT Healing | 114°<br> | 2°*<br> | 15°**<br> |

Sirveaux & Molé, Nice Shoulder Course 2008

---

---

---

---

---


---

---

---

**Absence of GT Tuberosity Healing in RSA**

- Poor External Rotation
- Decreased ADLs
- Decreased patient's satisfaction



---

---

---

---

---

---

---

**Evidence**

- RSA outcomes are more predictable
- Rotator cuff is not essential for proper function of a RSA, the deltoid function is sufficient
- Improved ER when tuberosities reconstructed
- Preservation of the rotator cuff can help maintain stability and ultimately improve shoulder function

Sufficient arguments for NOT Excising tuberosities in RSA

---

---

---

---

---

---

---

**Are Results better  
in RSA?...**

---

---

---

---

---

---

---

### Comparative Study: HA vs RSA

Reverse Total Shoulder Arthroplasty Versus Hemiarthroplasty for Proximal Humeral Fractures: A Systematic Review

Ferrel, Jason R. MD; Trinh, Thai Q. MD; Fischer, Richard A. MD 2015 **JOT**

→ **Meta-analysis** : 30 studies (2004-2014, min. 1y FU)

| HA                   |                       | RSA         |
|----------------------|-----------------------|-------------|
| 63                   | <b>ASES score</b>     | 65          |
| 58                   | <b>Constant score</b> | 55          |
| <b>108°</b>          | <b>Active AE</b>      | <b>118°</b> |
| <b>30°</b>           | <b>Active ER</b>      | <b>20°</b>  |
| <b>30% (26% tub)</b> | <b>Complications</b>  | <b>10%</b>  |
| 5.7%                 | <b>Reoperation</b>    | 5%          |

---

---

---

---

---

---


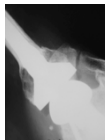
---

---

### In Summary RSA for Acute Fractures

- AFE is more predictable in RSA than in HA, and complication rate is lower
- But, IR is decreased in RSA
- GT healing is needed to restore active ER and improves ADL++

→ **Tuberosities in RSA should NOT be excised, but repaired+++**


---

---

---

---

---

---

---

---

## Take-Home Messages

---

---

---

---

---

---

---

---

### GT Healing is Needed in HA

In order to get good functional outcomes



Preop      3y po

---

---

---

---

---

---

---

---

### Absence of GT Healing in HA

is catastrophic!!....



---

---

---

---

---

---

---

---

### GT Healing is Not Needed in RSA

But, tuberosity healing improves :

- Constant score
- Active ER++
- ADLs



---

---

---

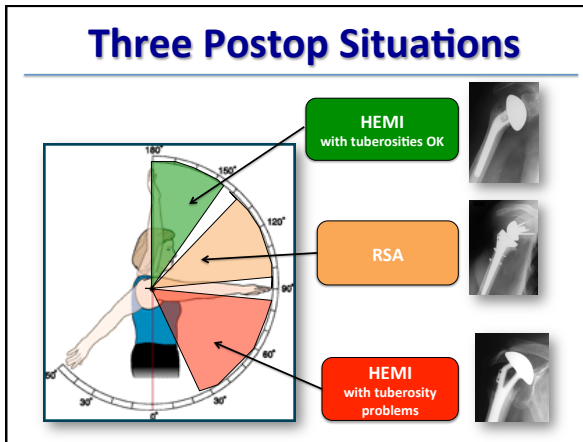
---

---

---

---

---



---

---

---

---

---

---

---

---

### A RSA without ER muscles is a bad RSA!

**Absence of GT fixation/healing:**

- Hornblower sign/ Lag Sign
- Decreased ADLs
- Increased Humeral loosening

→ NO Tuberosity excision+++

---

---

---

---

---

---

---

---

### Prosthesis Design & Surgical Technique Do matter for both HA / RSA

---

---

---

---

---

---

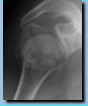
---

---

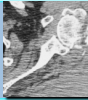
### Indications for RSA in Acute Fractures



**Patient's Age (>75)**  
**Women (osteopenia+++)**  
**Poor blood supply (Diabetes, smoking)**  
**Poor compliance with Rehabilitation (Dementia)**



**Greater Tuberosity comminution**  
**Poor bone quality (cortical thickness)**  
**Combined Humerus & Glenoid fracture**



**Prelisting Rotator Cuff pathology (up to 5%)**  
**Severe Fatty infiltration of RC muscles (Goutallier stage 3 or 4)**

---

---

---

---

---

---

---

---