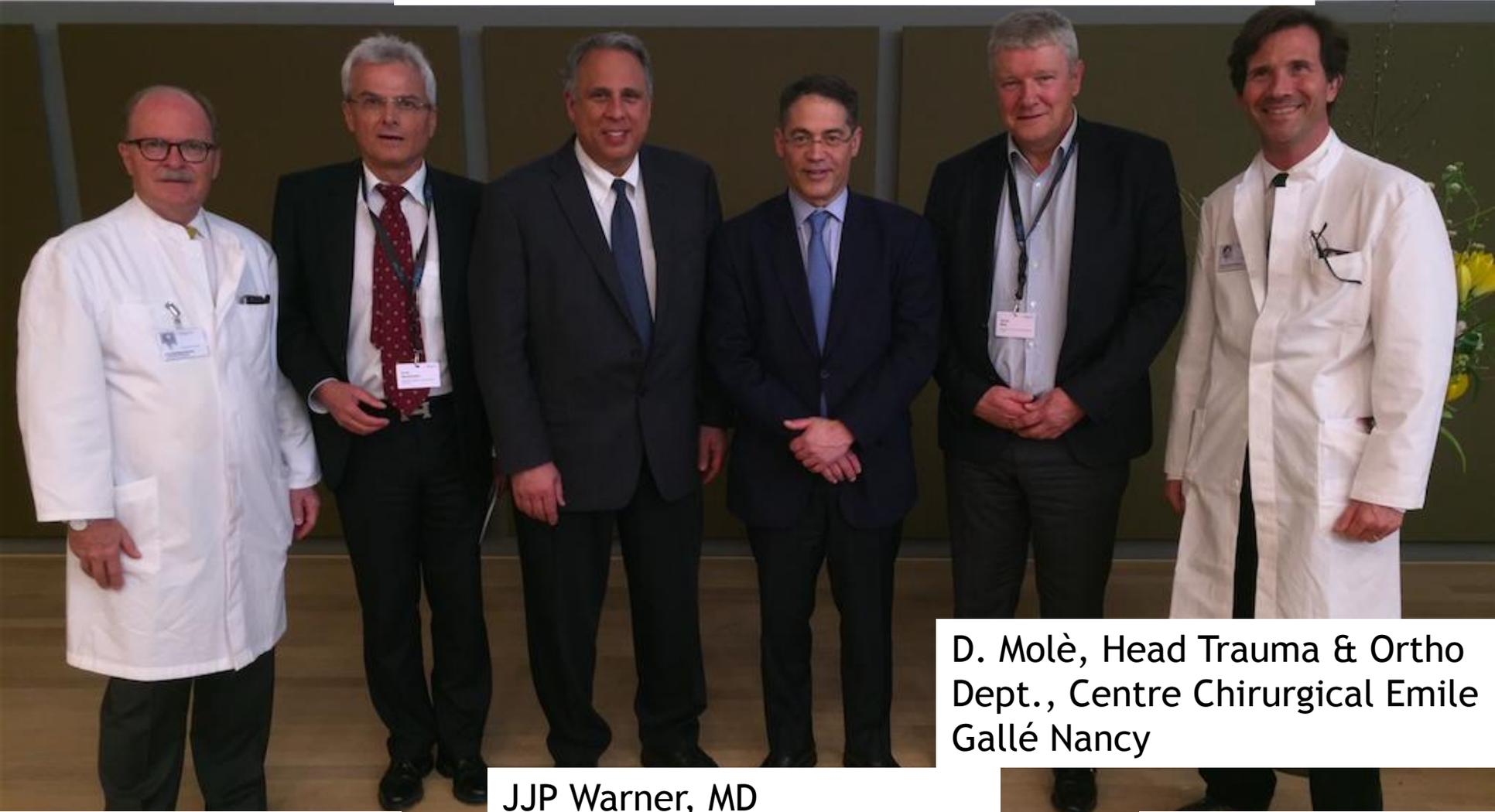


30 - 31 March 2017
Balgrist University Hospital, Zurich

Balgrist Shoulder Course

Indication and Surgical Technique of Revision Shoulder Arthroplasty





C. Gerber
Chairman &
Medical Director,
Balgrist Univ. Hospital

JJP Warner, MD
Chief, MGH Shoulder Service

E. Wiedermann, MD,
OCM Ortho Surg., Munich

D. Molè, Head Trauma & Ortho
Dept., Centre Chirurgical Emile
Gallé Nancy

D. Meyer
Head Shoulder &
Elbow Surgery,
Balgrist Univ. Hosp.



Thursday, March 30th, 2017

08:00	Registration / Commercial Exhibit in the Lobby	
08:30	Welcome	Gerber
08:40	Clinical assessment of failed shoulder arthroplasty	Meyer
09:00	Imaging assessment of failed shoulder arthroplasty	Hardy
09:20	Preoperative planning of revision for prosthetic failure	Gerber
09:45	<i>Coffee Break</i>	
10:15	Live Surgery: Glenoid revision	OP 3
12:00	<i>Lunch</i>	
13:00	Live Surgery: Stem revision	OP 4
15:00	<i>Coffee Break</i>	
15:30	Failure for infection	Hardy
15:50	Management of deltoid deficiency	Meyer
16:10	Indications for tendon transfer	Warner
16:30	Interactive case presentation & discussion	Gerber
17:00	<i>End of Day 1</i>	
19:00	Evening Program	

Hosts/Faculty

Christian Gerber, MD, Chairman and Medical Director, Balgrist University Hospital

Philippe P. Hardy, MD, Chairman of the Orthopaedic Department, Paris Hospitals

Joseph P. Iannotti, MD, Chairman of Orthopaedic and Rheumatologic Institute, Cleveland Clinic

Dominik Meyer, MD, Head of Shoulder & Elbow Surgery, Balgrist University Hospital

Daniel Molé, MD, Head of Trauma and Orthopedic Surgery Department, Centre

Chirurgical Emile Gallé Nancy

Jon J.P. Warner, MD, Chief, Harvard Shoulder Service, Massachusetts General Hospital

Ernst Wiedemann, MD, OCM Orthopaedic Surgery Munich

**Friday, March 31st, 2017**

08:00	Commercial Exhibit in the Lobby	
08:30	Stem failure	Warner
08:50	Glenoid component failure	Iannotti
09:10	The role of patient specific instruments	Iannotti
09:30	<i>Coffee Break</i>	
10:00	Live Surgery: Revision	OP 3
12:00	<i>Lunch</i>	
13:00	Live Surgery: Revision	OP 4
15:00	<i>Coffee Break</i>	
15:30	My approach to failed hemi-prothesis	Wiedemann
15:50	My approach to failed reverse TSR	Molé
16:10	Q&A	Gerber
16:30	<i>End of Course</i>	

Credits

The Swiss Society of Orthopaedic Surgery and Traumatology grants 16 points.

Course Fee

CHF 800 (approx. EUR 660) including mentioned meals, no accommodation.

Sponsors

This is an industry-sponsored course.

Registration/Information

www.balgrist.ch/congresses

Stefanie Pfister, Coordinator Congresses & Events

+41 44 386 38 33, kongresse@balgrist.ch



Lake Zurich



*uniklinik
balgrist*



Administrative Board

The highest supervisory and organisational body of the corporation is the six-member Administrative Board.



The members of the Administrative Board are



Dr. Eric Honegger
Chairman



Robert Zingg
Deputy Chairman



Prof. Christian Gerber
Medical Director
Balgrist University Hospital



Rita Fuhrer
Chairman of the
Swiss Balgrist Association

Strategy

Researchers, medical practitioners, developers and industry collaborate at the Balgrist Campus in order to alleviate and to resolve the problems of patients suffering from musculoskeletal conditions. This interdisciplinary approach is fostered by a unique architecture.



UNIKLINIK BALGRIST



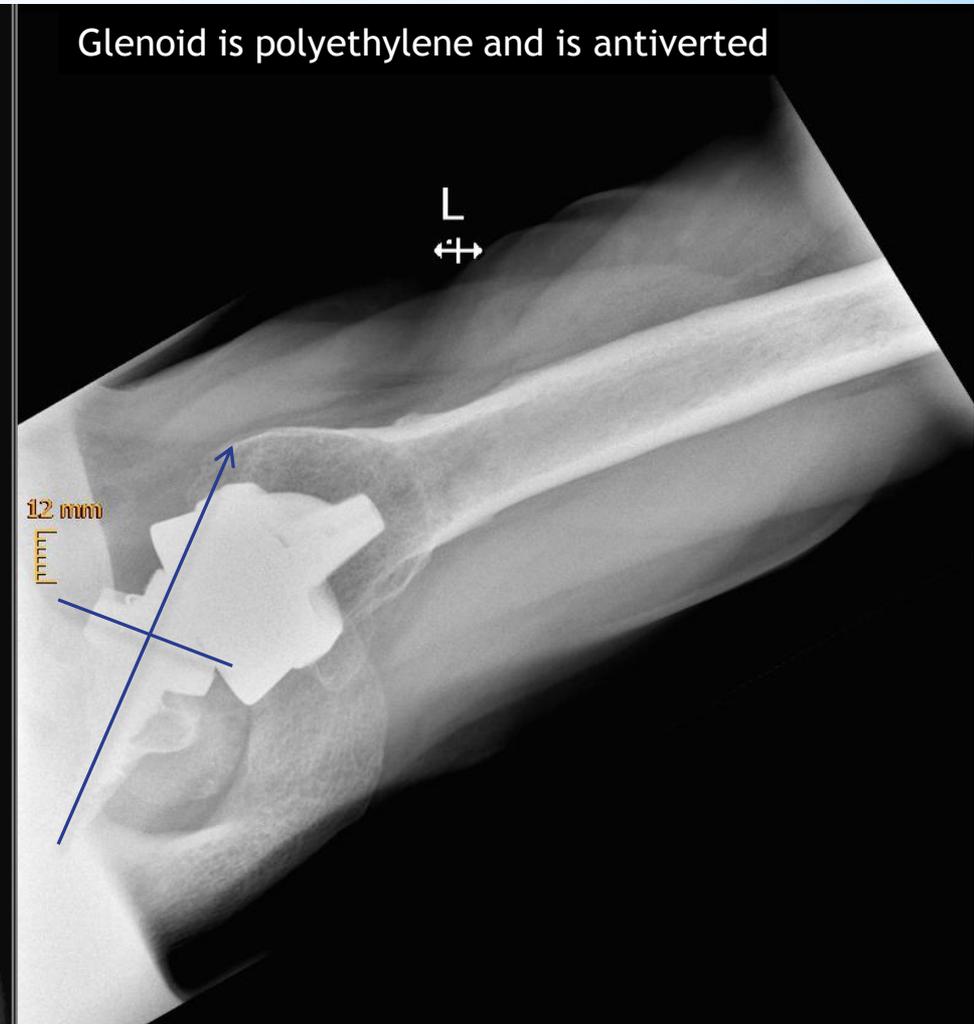
Balgrist



- 73yo man with painful reverse Prosthesis
- Stemless implant
- Limited Active ROM
- Infection work-up negative



Case #1:

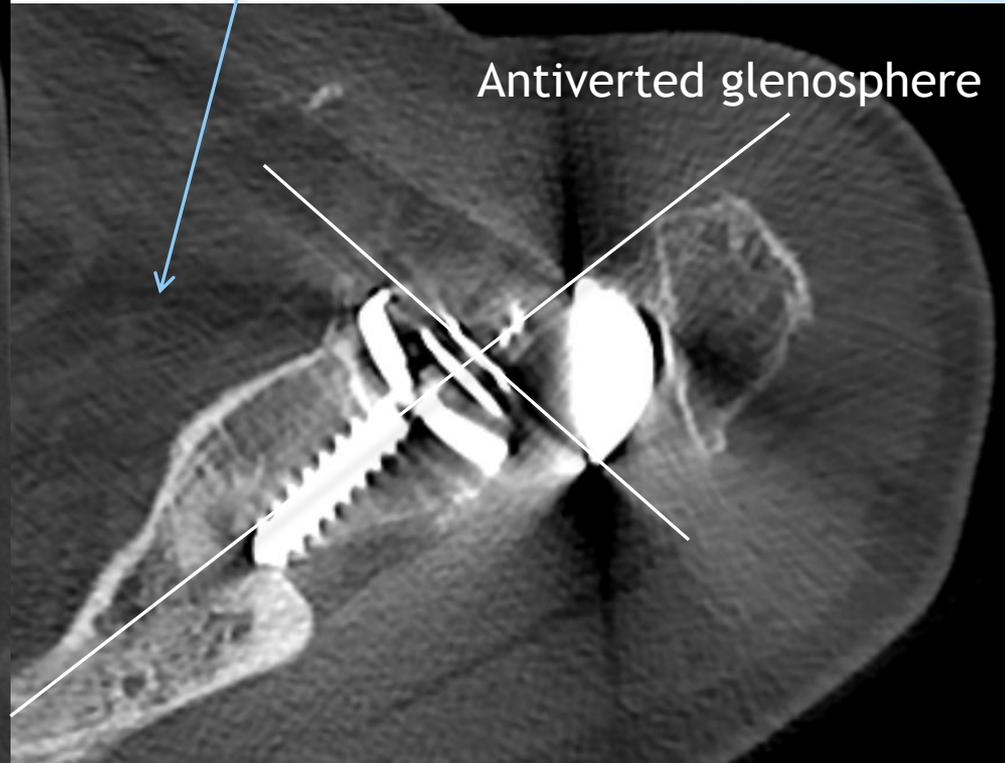


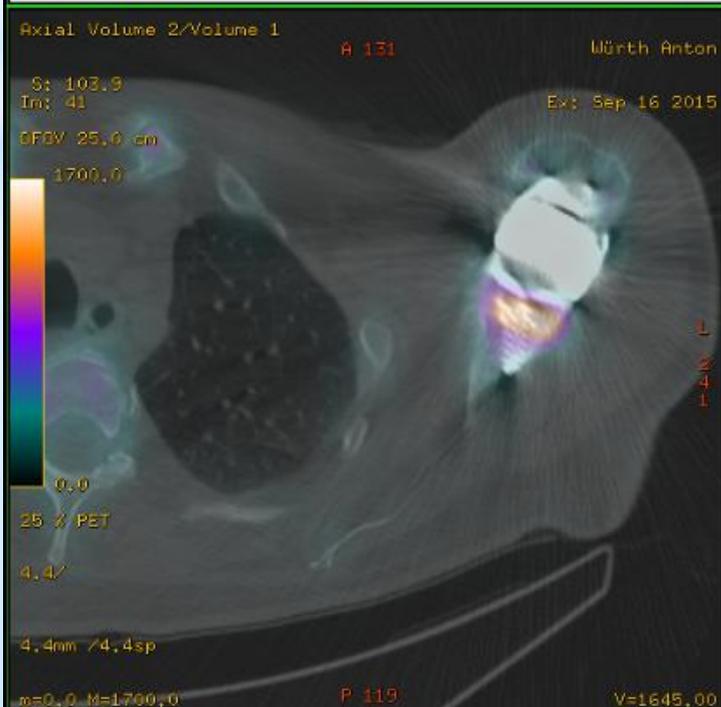
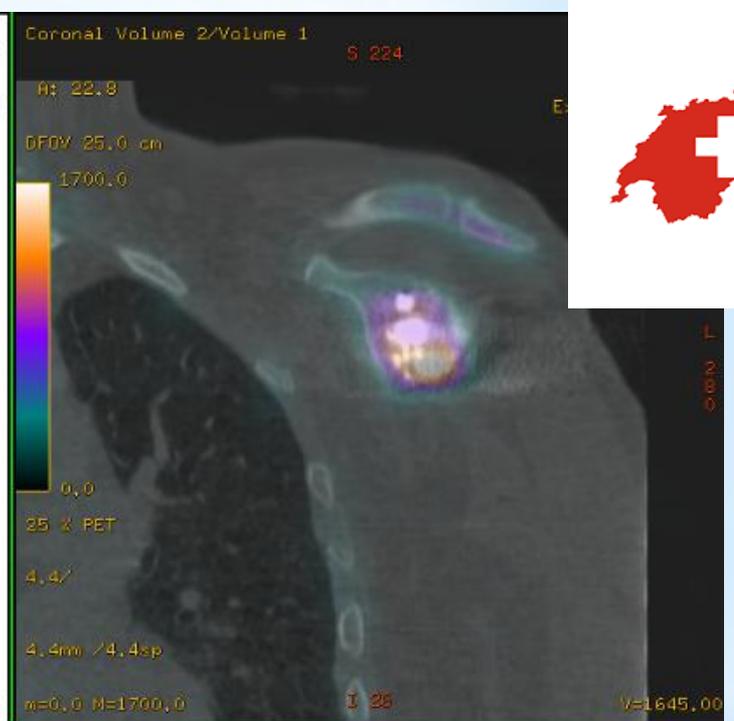
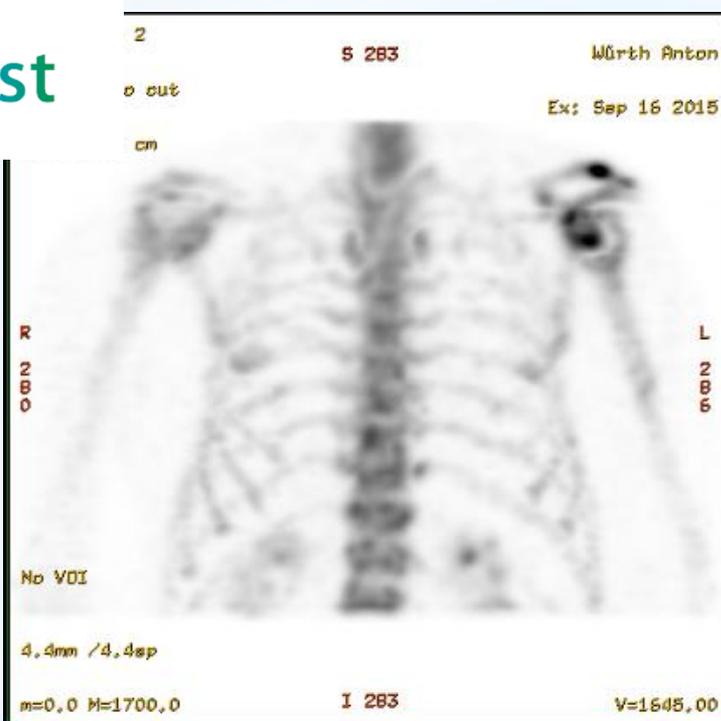


Lima Company Stemless Reverse Prosthesis has
A polyethylene glenoid sphere and metal humeral side



Stage 4 Fatty Atrophy of Subscapularis







CRP = 0.6 ml/l
ESR = 3 mm/hr
Aspiration = No Growth



What will you do doctor?.....

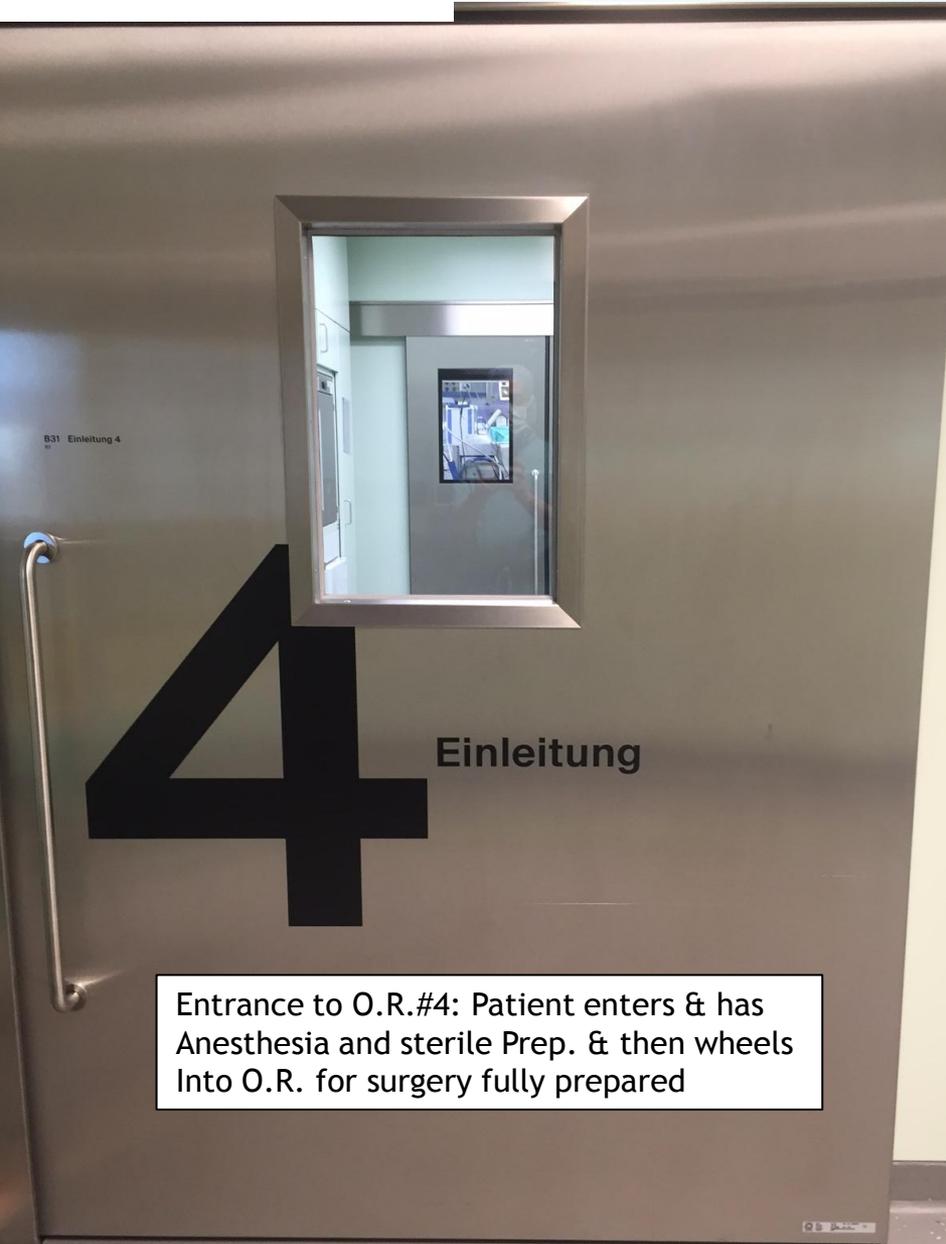




 **Balgrist**

Welcome to
Balgrist Shoulder Course 2017
March 30 - 31, 2017
Balgrist University Hospital
Zurich





Entrance to O.R.#4: Patient enters & has Anesthesia and sterile Prep. & then wheels Into O.R. for surgery fully prepared



After surgery, patient exits out this Door while next patient enters in Door to left and undergoes preparation While room is cleaned. This leads to Efficient sequencing and process for Shorter turnover



Operating room set-up: Staff & Equipment strategically positioned to allow Access for boom camera as well as cameras in the light and also at Perimeters of room. Control center manages each camera and transmission To Auditorium



JPW

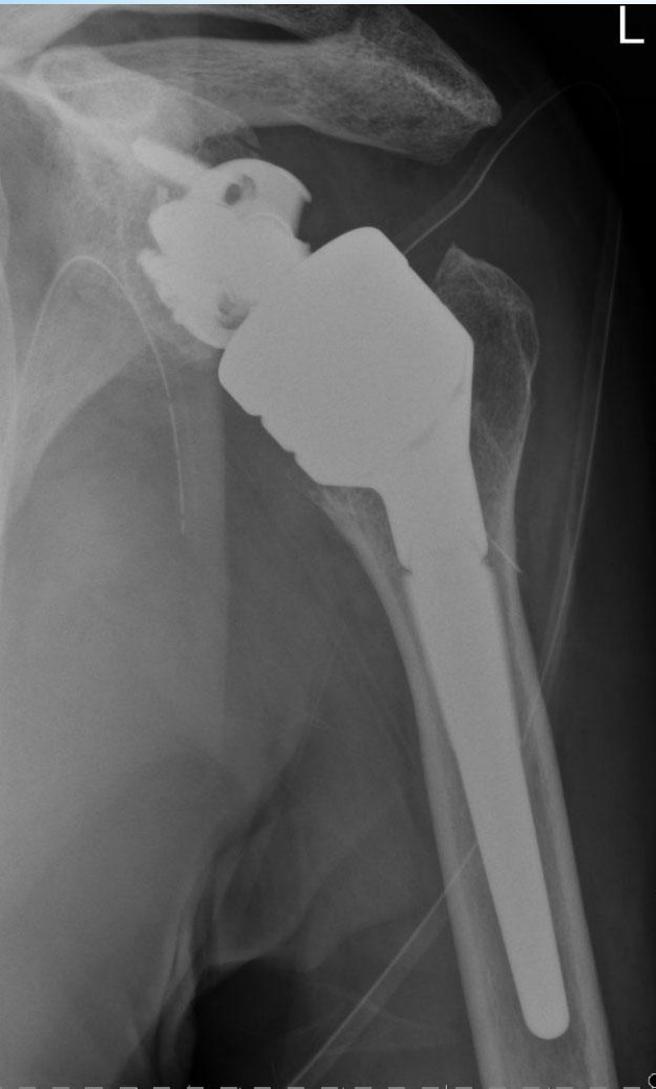
C. Gerber





Intraop findings:

- Markedly lateralized humerus
- No subscapularis
- Well fixed glenoid component



- Converted to stem reverse with Medialization & antiverion correction using company prosthesis
- Left glenosphere in place (d/t Concerns to destroy glenoid)



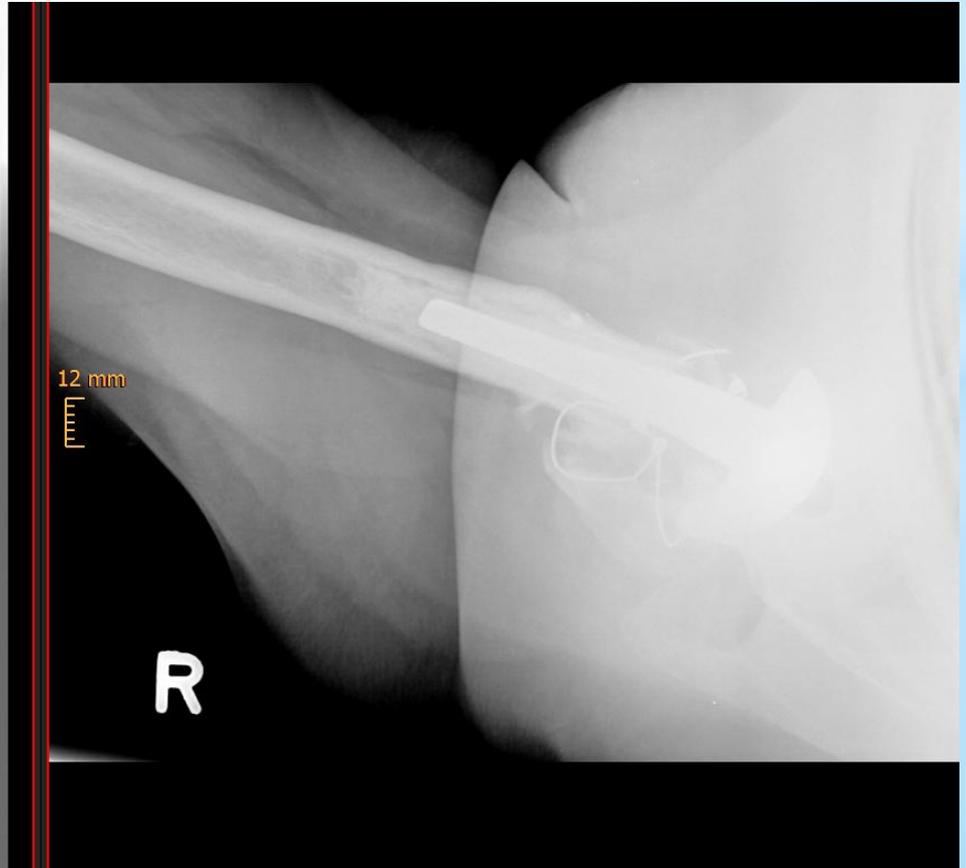
Case #2:

- 66yo male
- 2001 Shoulder Hemiarthroplasty right side
- 2002 Revision to Inverse shoulder prosthesis
- 10y follow-up he was very happy
- 2014 he fell & had periprosthetic Fx
- Initially no surgery (pt. went abroad)
- Now presents with PAIN



Story Continues

2003





2003



0 mAs
S-Wert: 100
^möl
LUT NK5



2015

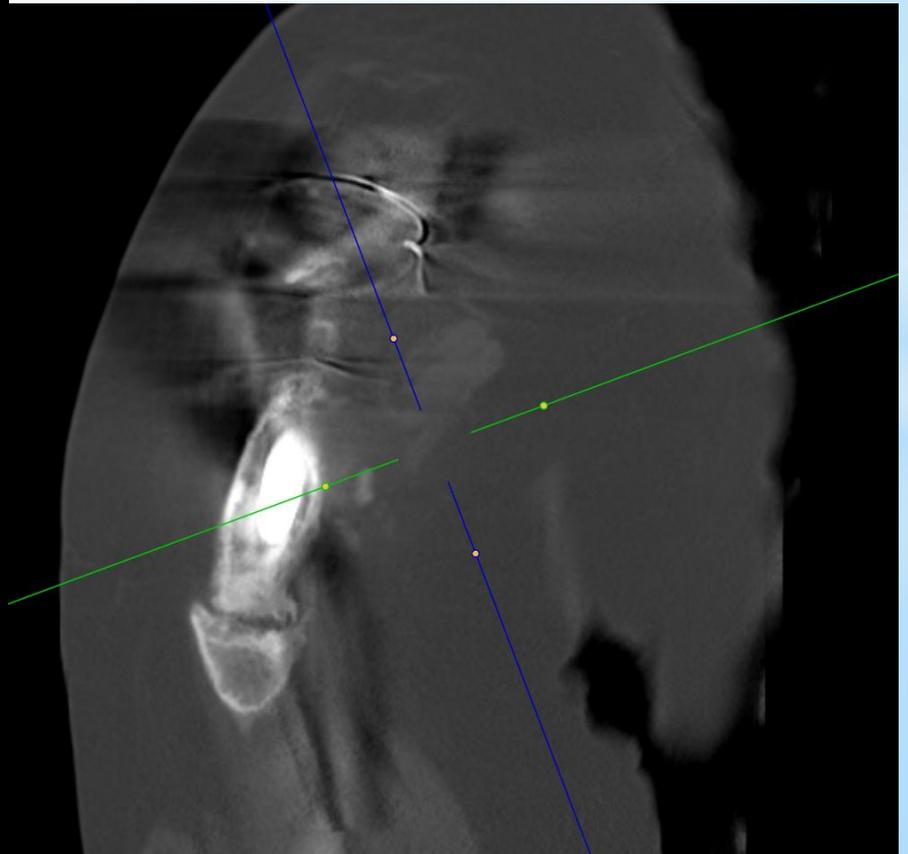
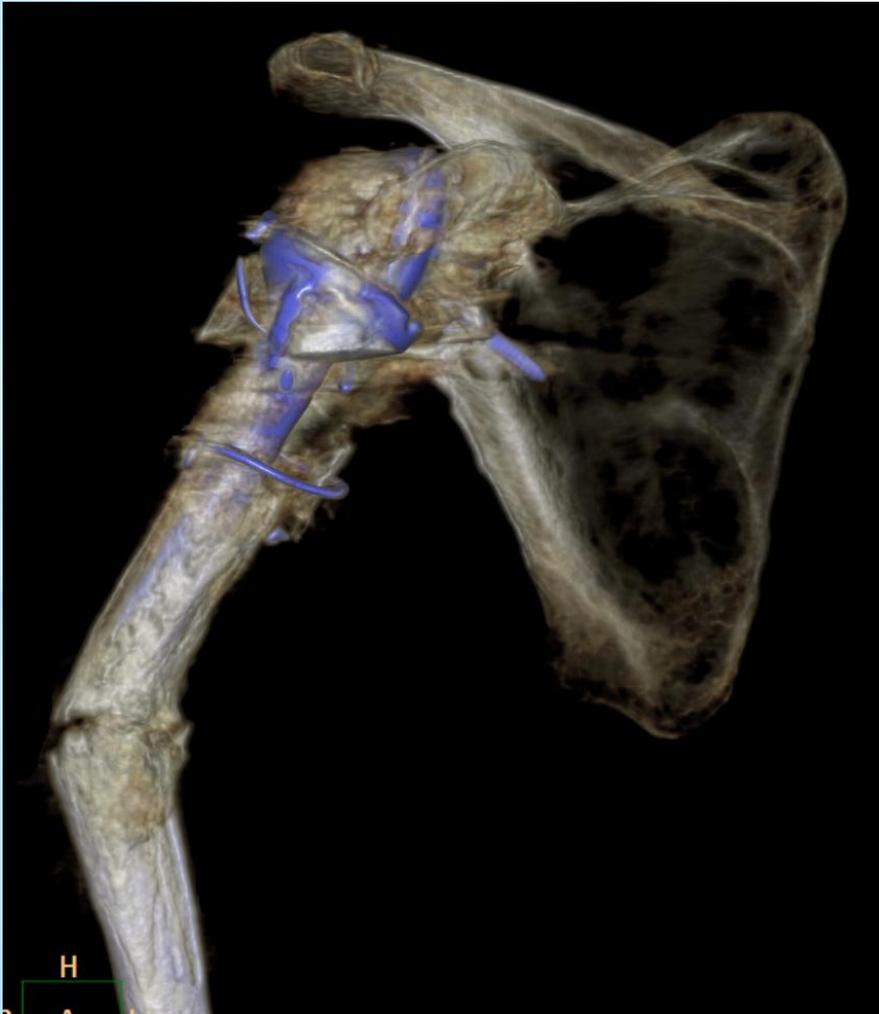




2016



Notching...
Will you
Revise glenoid
Side?





**What will you
Do, doctor?**





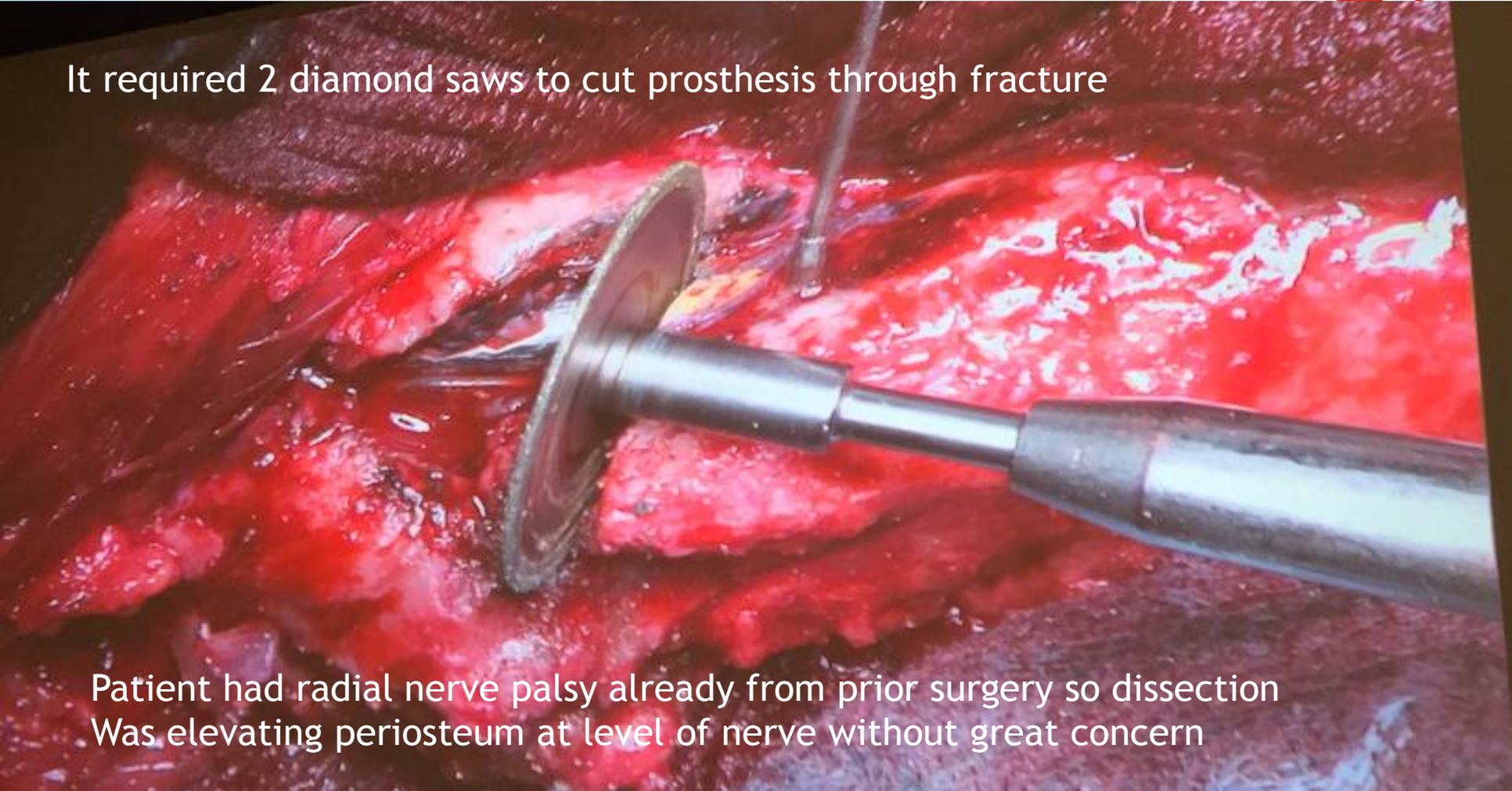
J. Iannotti

C. Gerber



It required 2 diamond saws to cut prosthesis through fracture

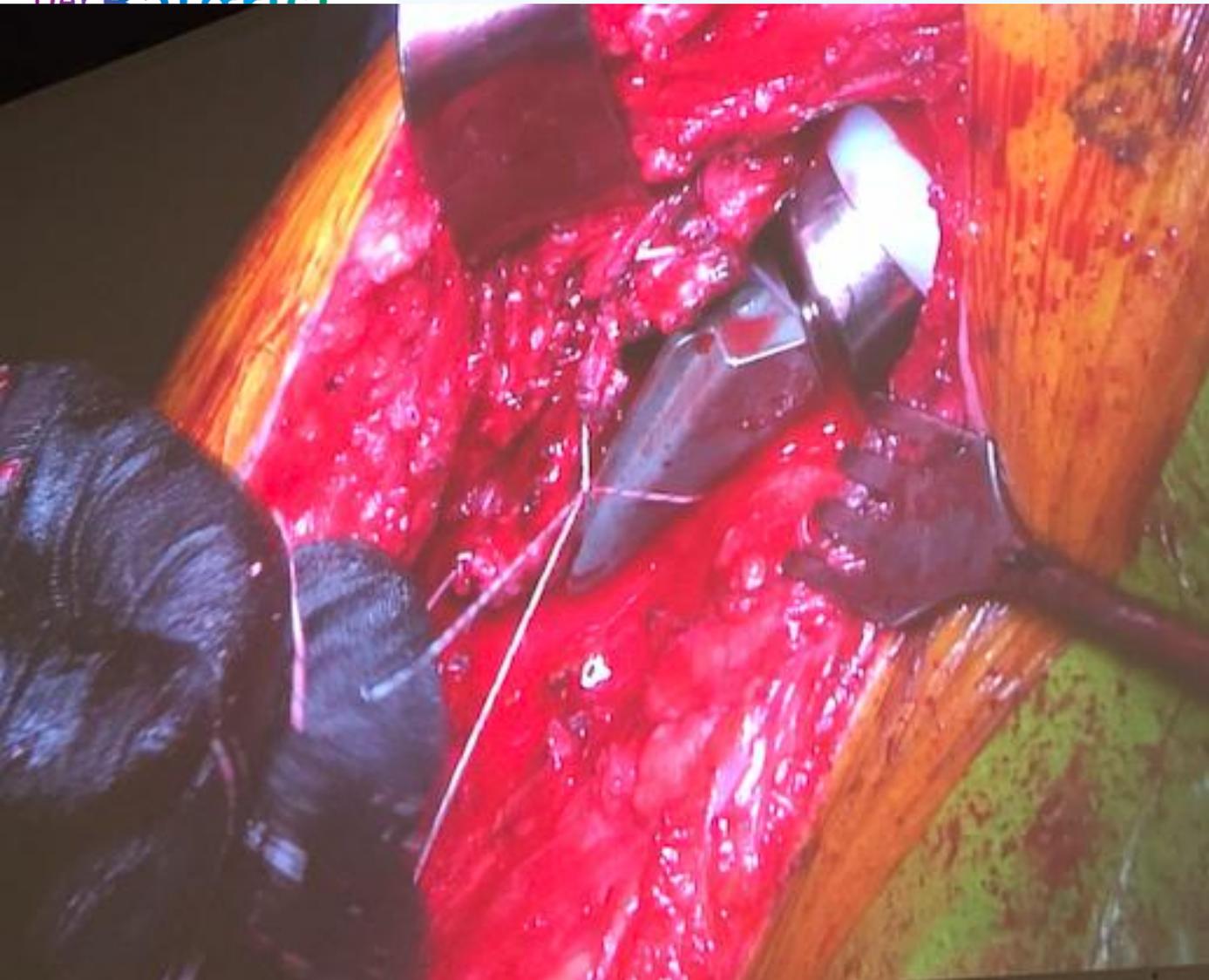
Patient had radial nerve palsy already from prior surgery so dissection
Was elevating periosteum at level of nerve without great concern





Proximal component
Removed with broken
Greater tuberosity and prox.
Humerus in soft tissue to
Be subsequently circlaged.

Distal fragment removed
Through fracture after
Cutting stem



Proper length
Established through
Preoperative
Measurement and
Tensioning during
Surgery....
....bony fragments
Circled around
Stem after cementing
Primarily distally
And then somewhat
Proximally. Care
Taken not to place
Cement near fracture.

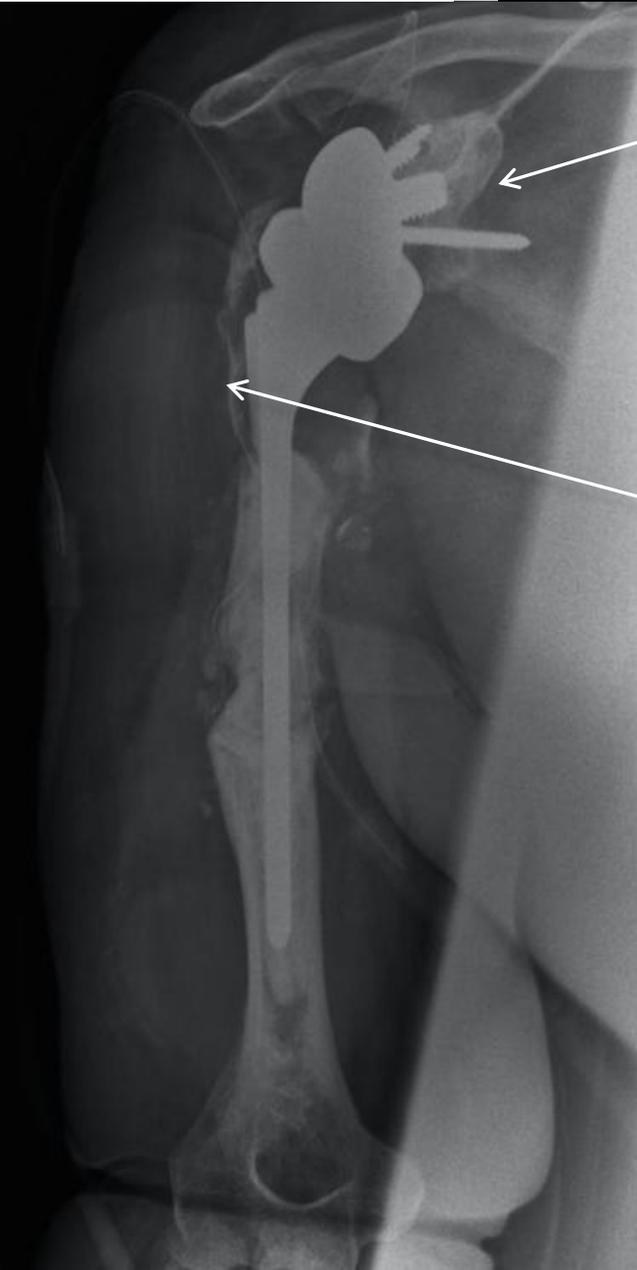


Retroversion humerus 20°

Glenoid
Was stable so
Left in place

Circlage of
Bony fragments

Local bone
Graft from
humerus





“That went well...” (Surgery took < 2 hours.)





Case #3:

- 84yo female
- S/P TSA for osteonecrosis leading to OA in 2002
- Also s/p Reverse Shoulder on other side 2014
- Myelodysplastic syndrome
- Hypertension
- S/P Ovarian Cancer in 2000

Patient complaint:

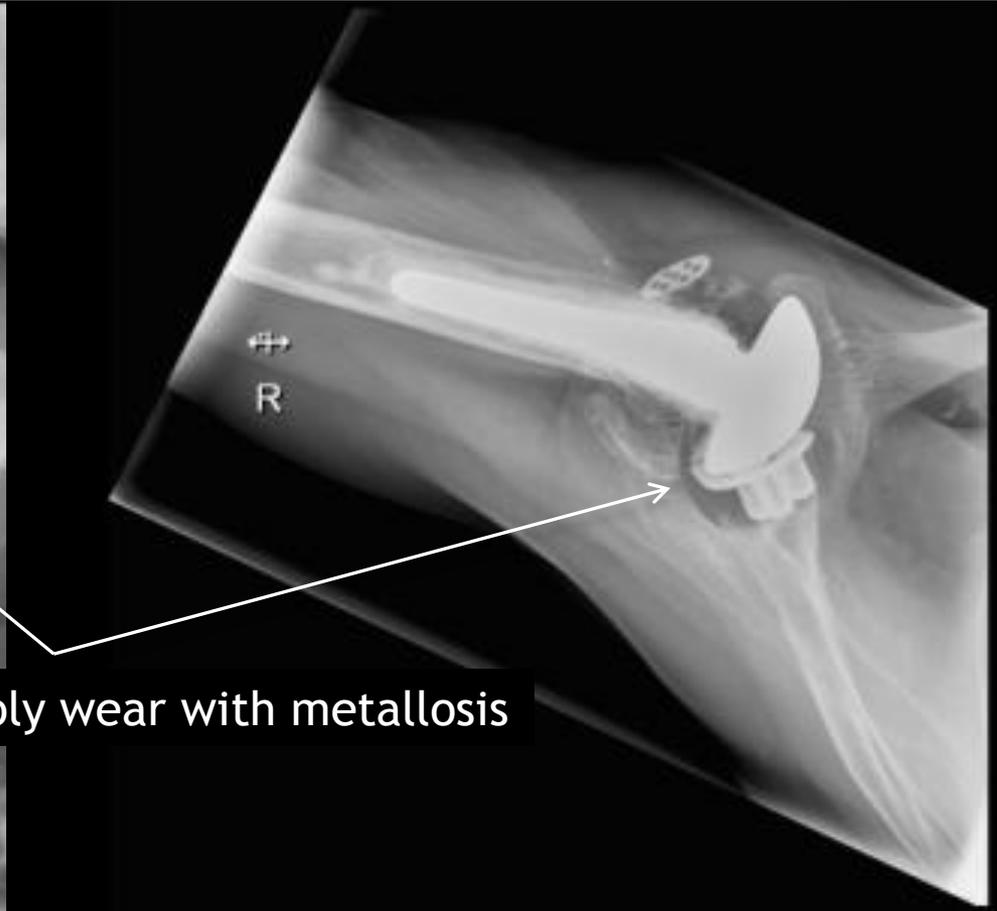
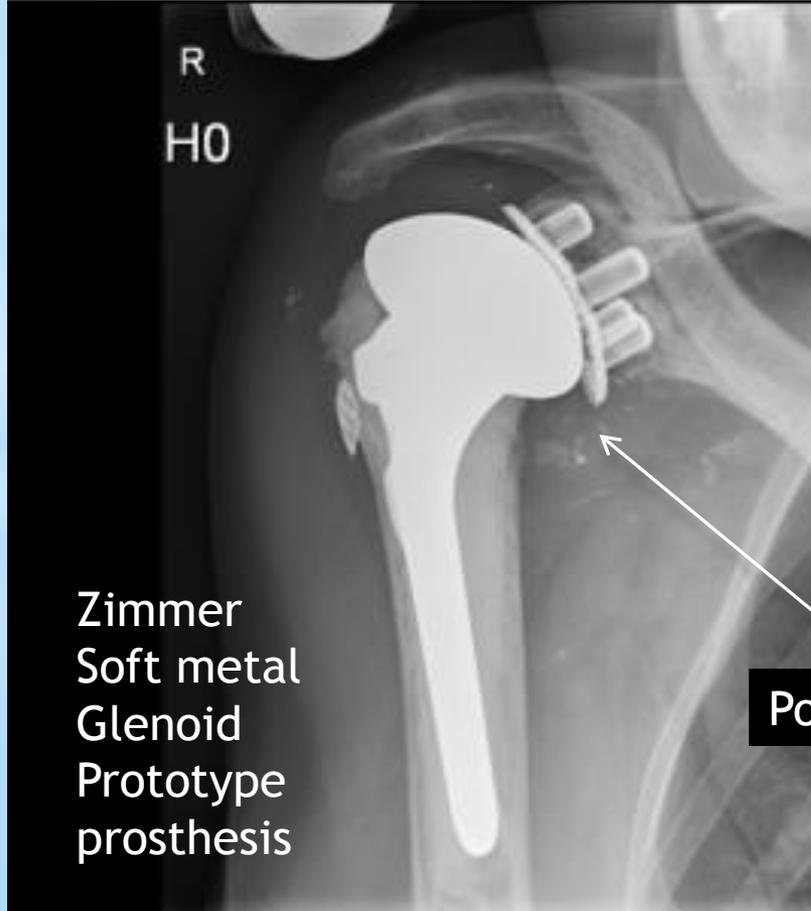
- Painful limitation of ROM since 2016 when she closed a car door.
- PEx:
- AROM: FF = 70° (120°), ABD = 80° (130°)
- ER = 0° (25°); Ext. Rot Lag sign = 20° ,
- IR = T10 (sacrum)

Infection is ruled out:

- CRP = 5.5 mg/l (N < 5.0 mg/l)
- ESR = 30mm/hr (N < 20 mm/hr)
- Joint Aspiration:
 - Synovial Lukocyte = 400 cells/ul
 - (N < 200 cells/ul)
 - Erythrocytes +++
 - Synovial fluid culture negative



1/4/17

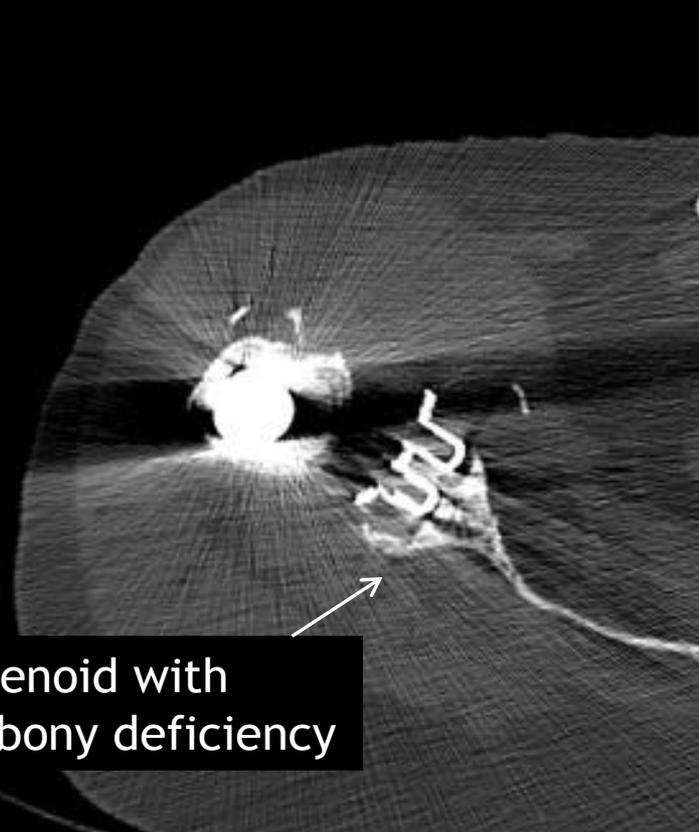


Poly wear with metallosis

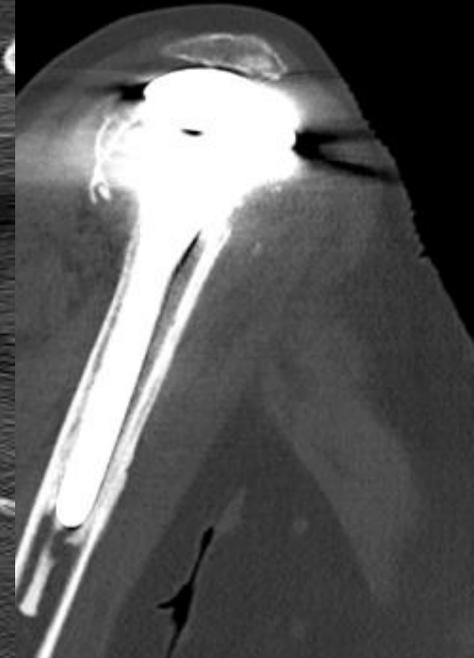
Zimmer
Soft metal
Glenoid
Prototype
prosthesis



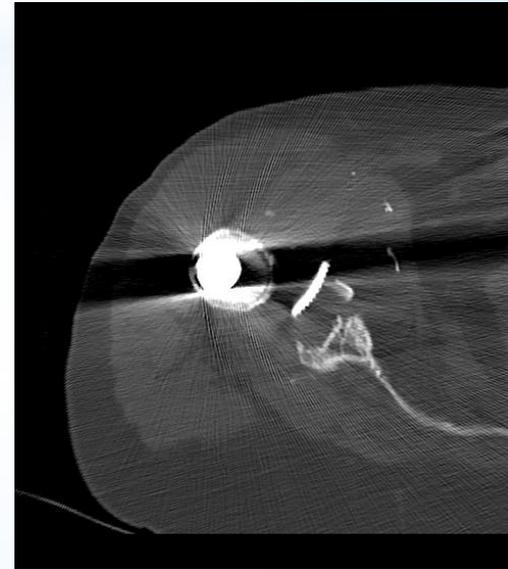
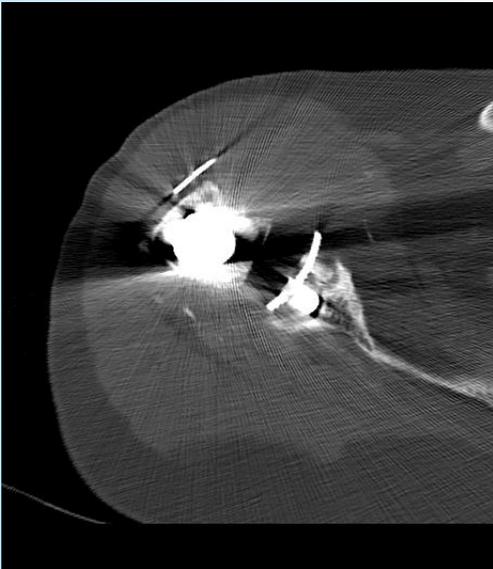
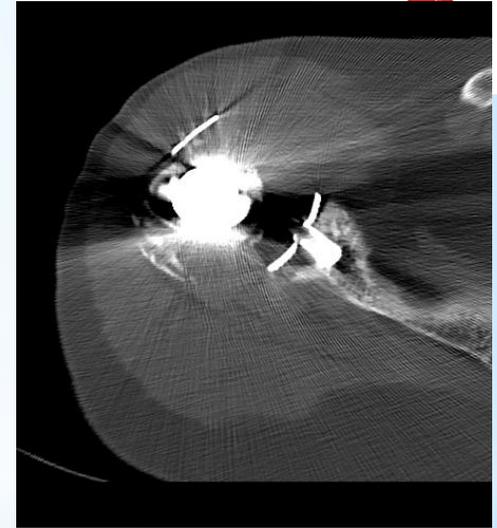
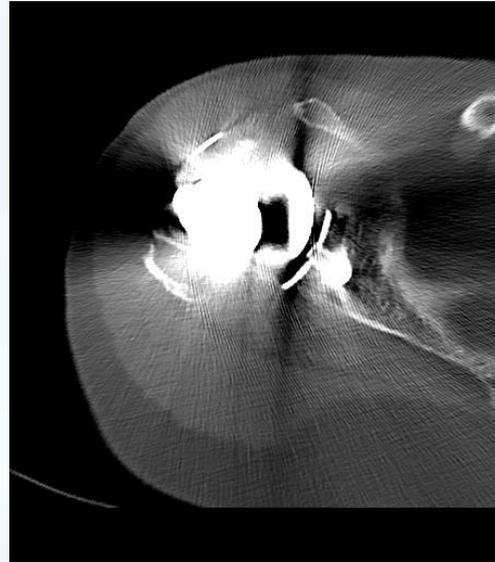
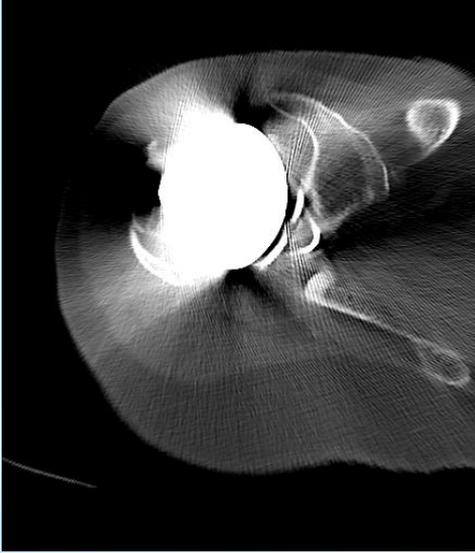
2/1/17



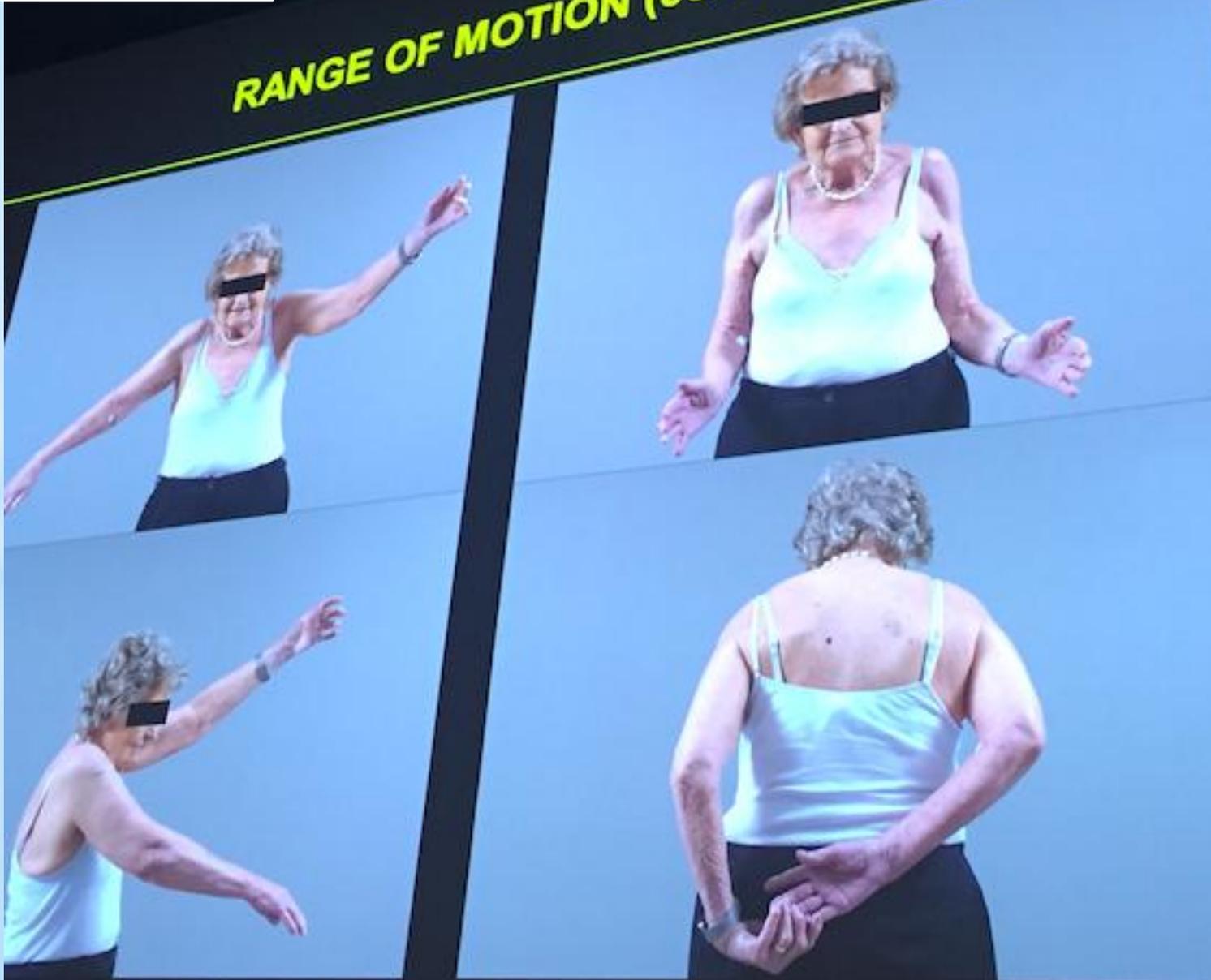
Loose glenoid with
Marked bony deficiency



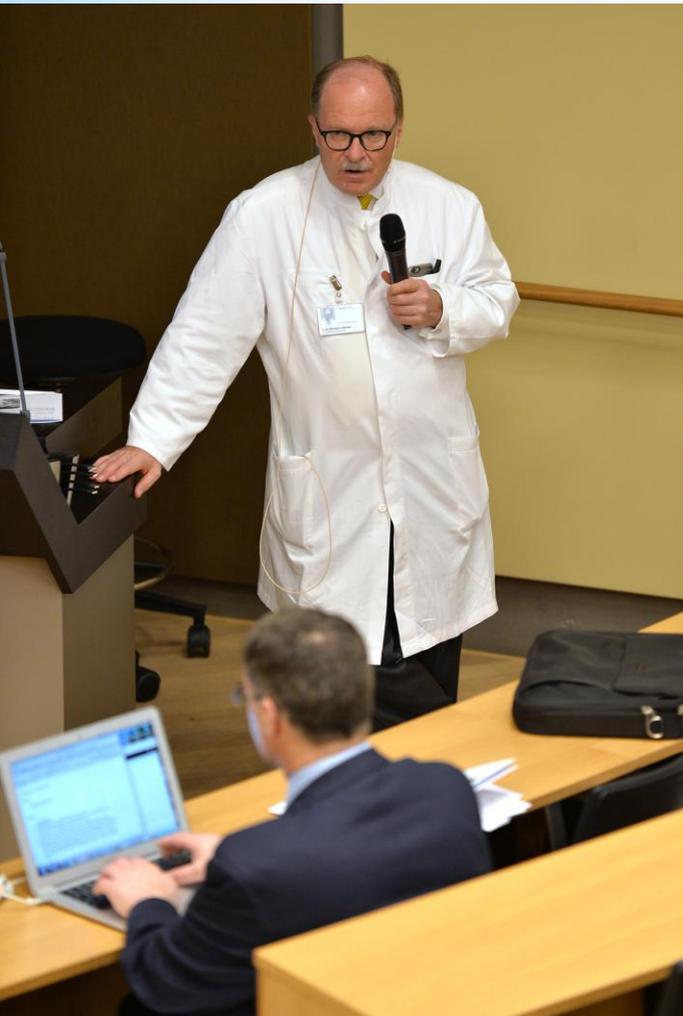
Axial CT images show severe glenoid bone loss
With loose component



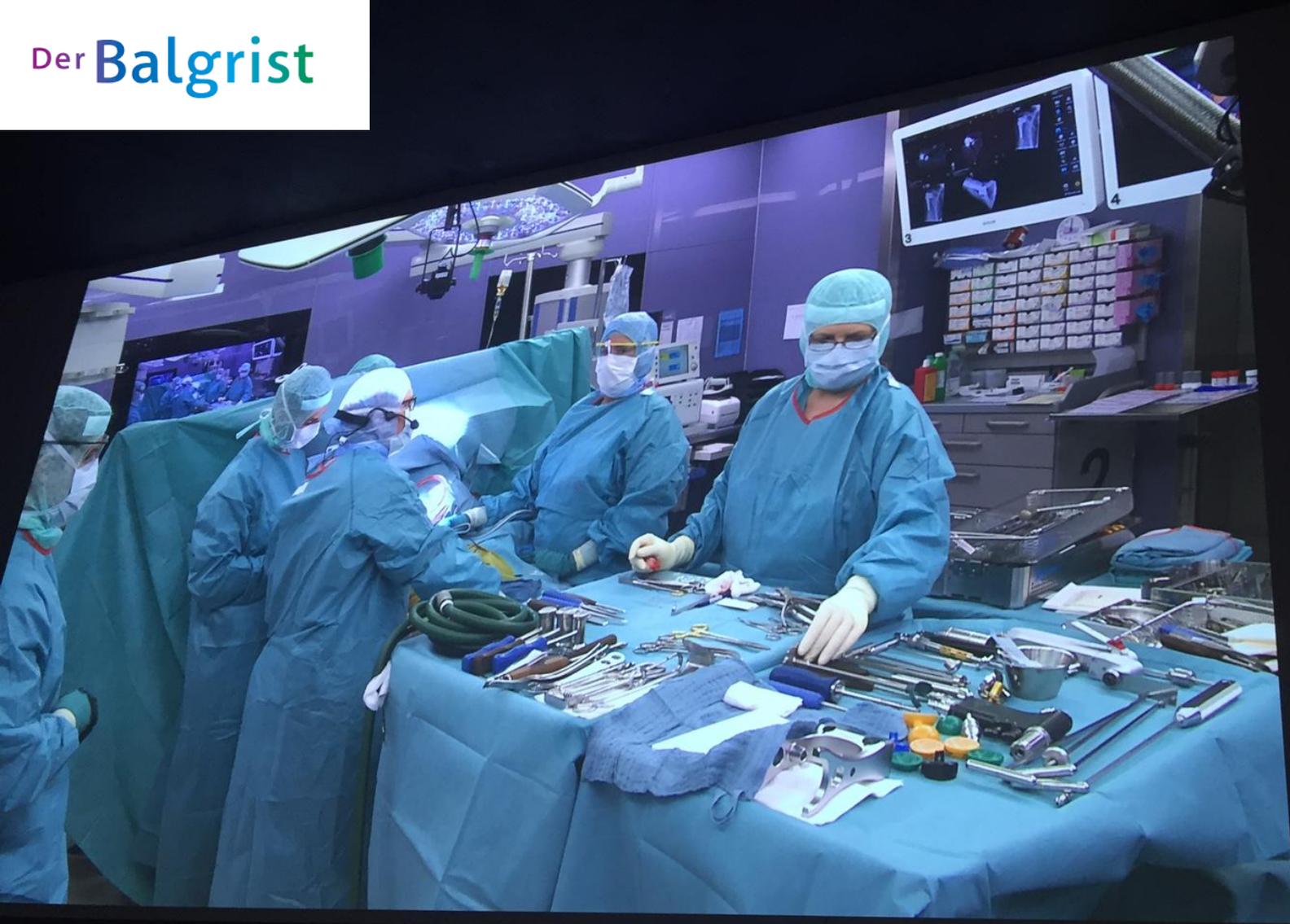
RANGE OF MOTION (03/30/2017)



What is your plan?



- What for the glenoid?
 - Bone graft?
 - Allograft vs autograft (ICBG)
- What for the humerus
 - Remove it or leave it

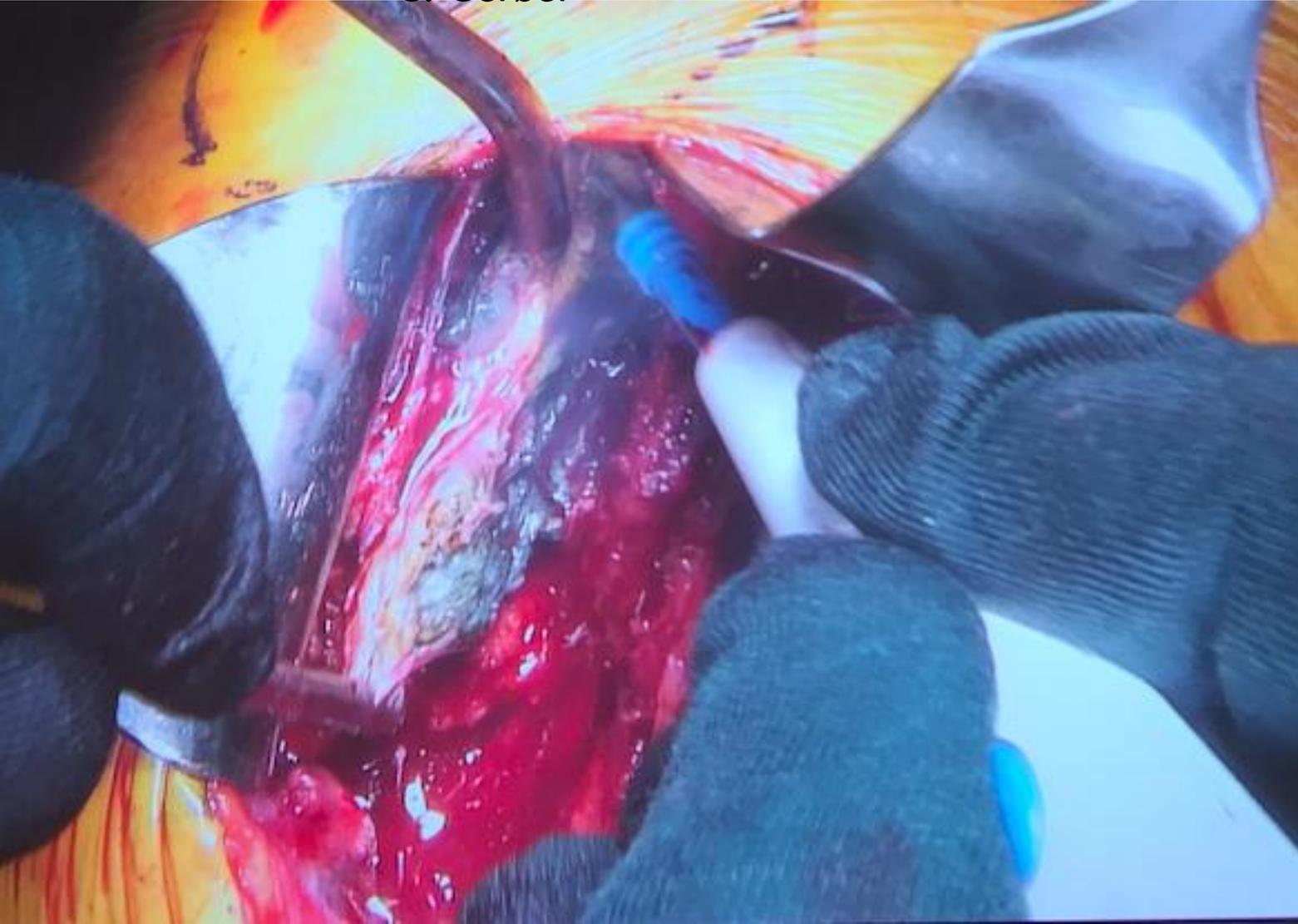


The value of a great team well informed of what will happen in the case!

Metallosis and tissue destruction at all levels
Of dissection



“Scar should be considered a benign tumor
And removed in order to establish tissue gliding
Plans and reduce devitalized tissue that may
Contribute to risk of infection”...including all metallosis
- C. Gerber

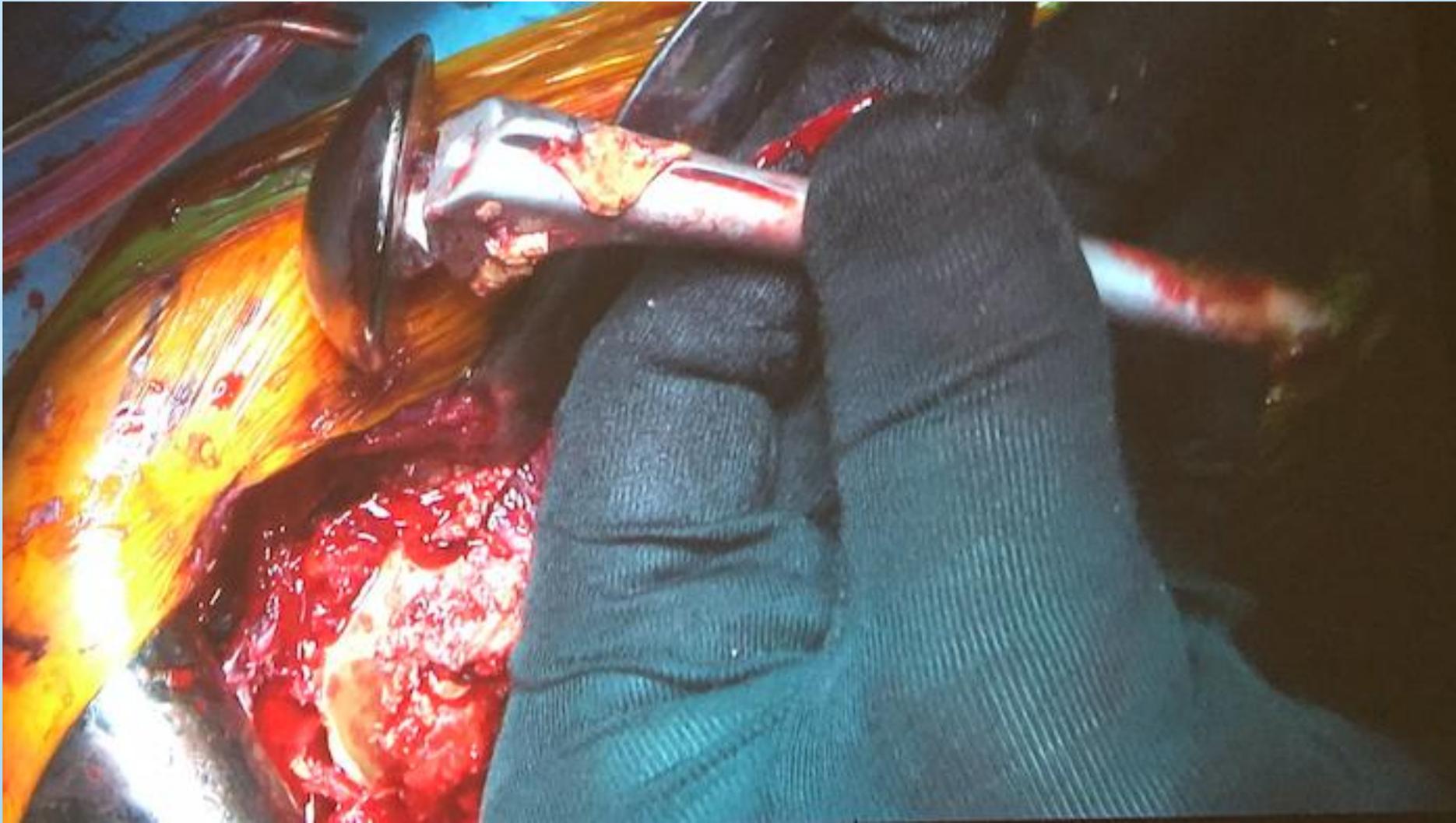


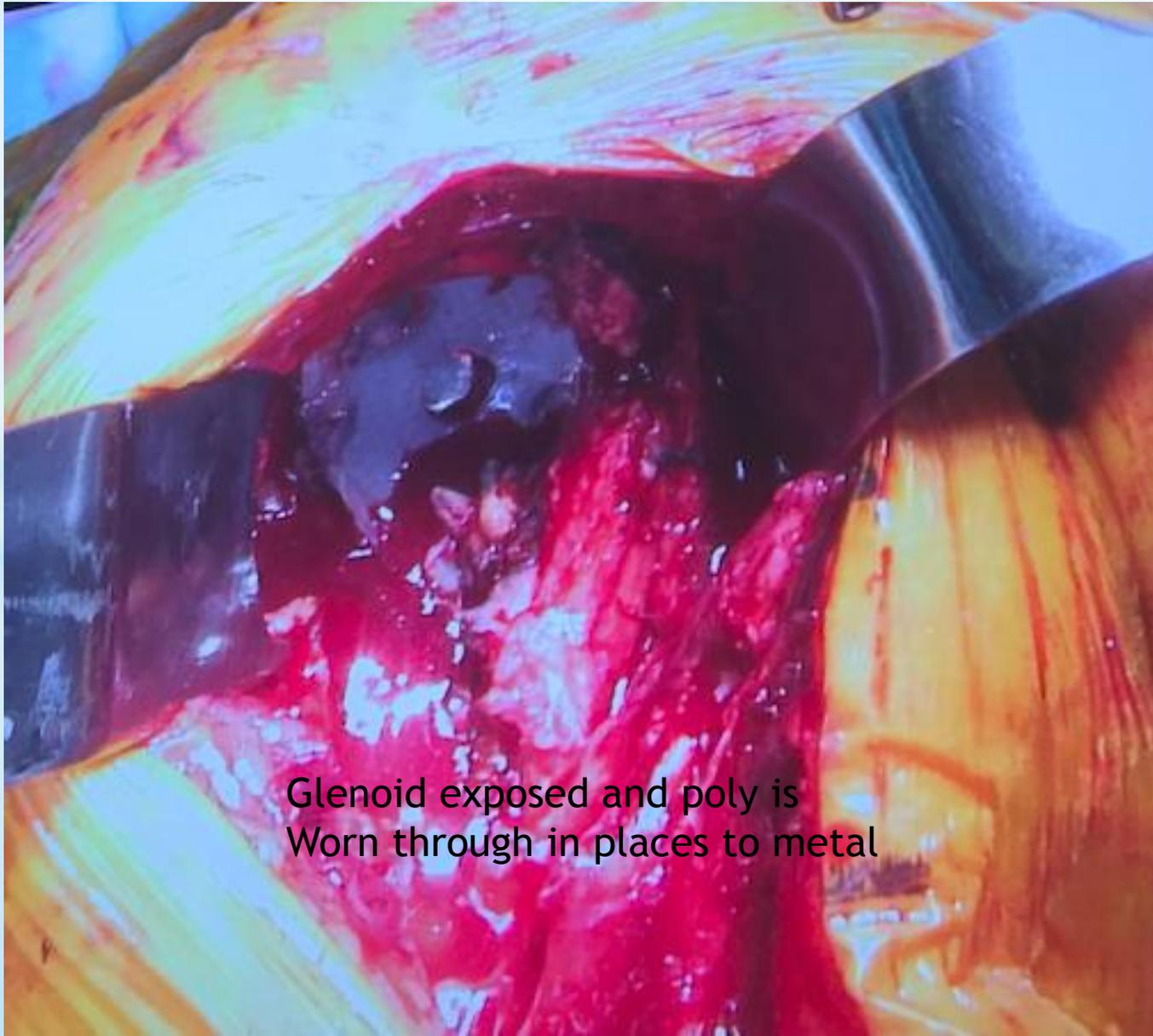


Humerus exposed
Tuberosity deficiency

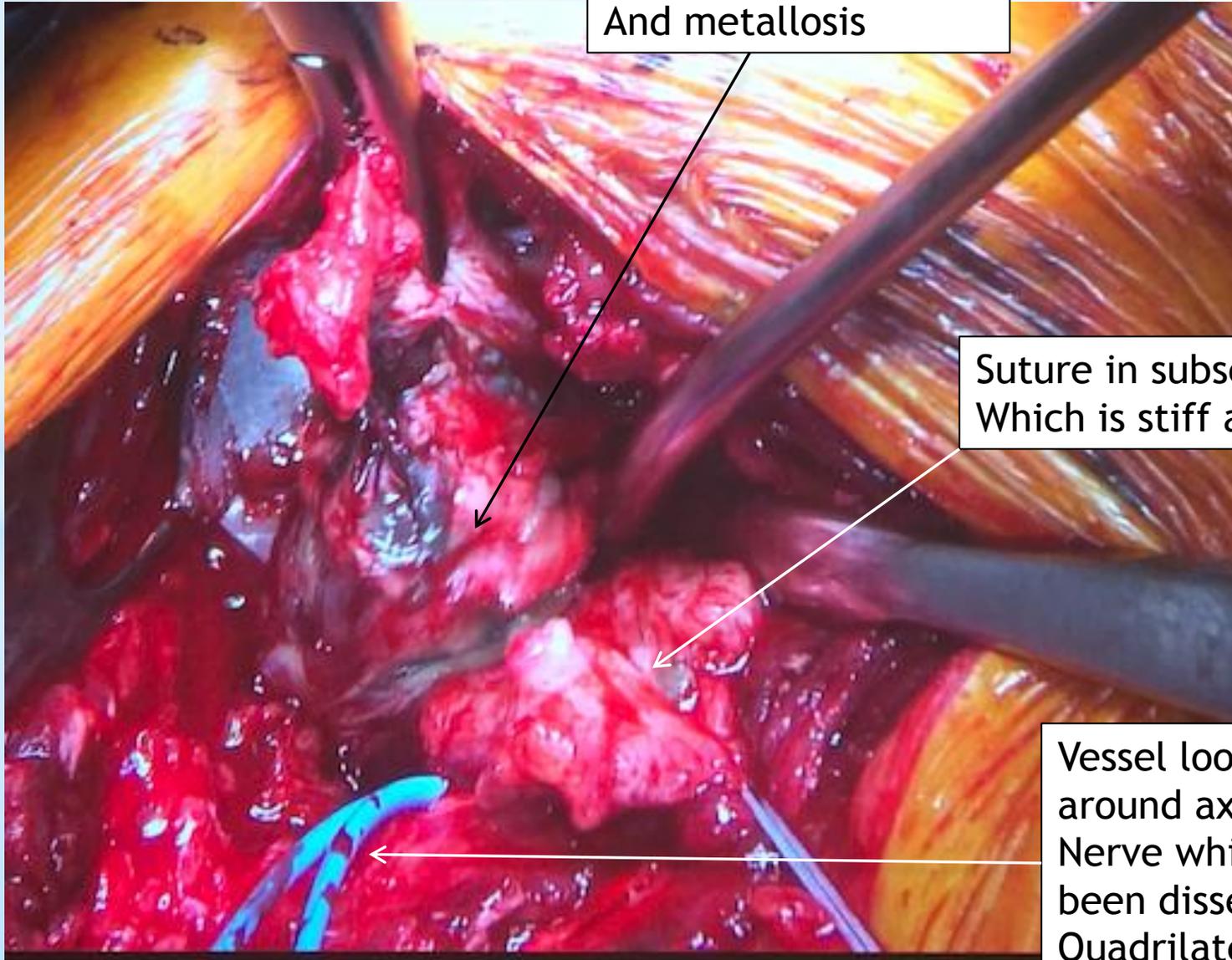


Easy to extract smooth anatomical stem and most cement
Remains inside humeral shaft





Glenoid exposed and poly is
Worn through in places to metal

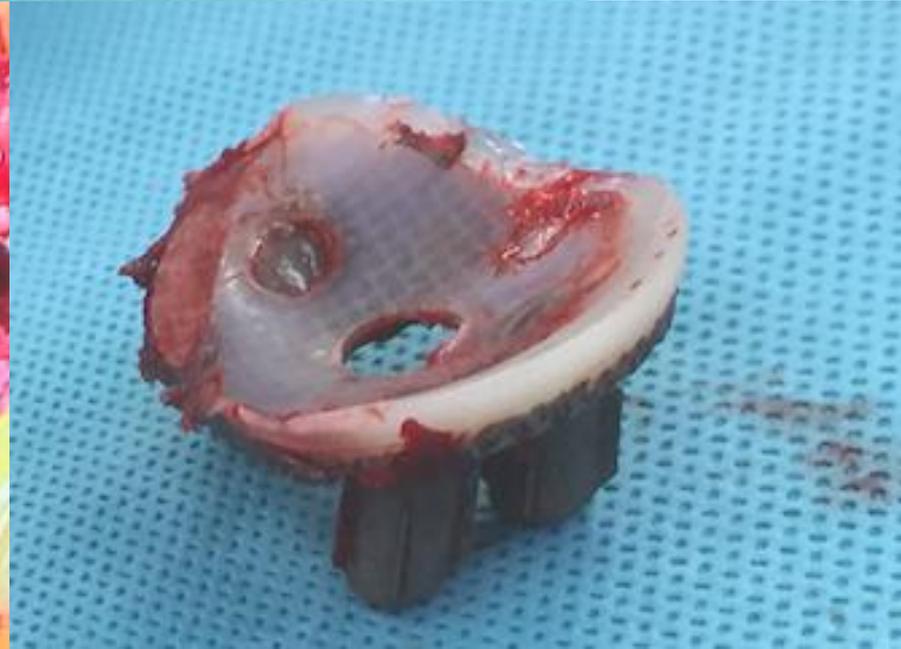
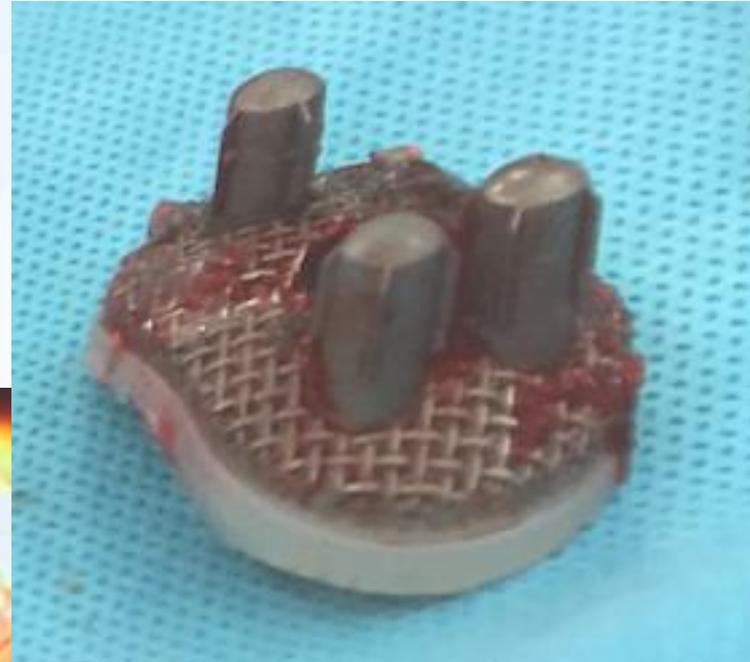


Pseudo-tumor of scar
And metallosis

Suture in subscapularis
Which is stiff and thin

Vessel loops
around axillary
Nerve which has
been dissected to
Quadrilateral space

Severely worn metal-back
Glenoid component





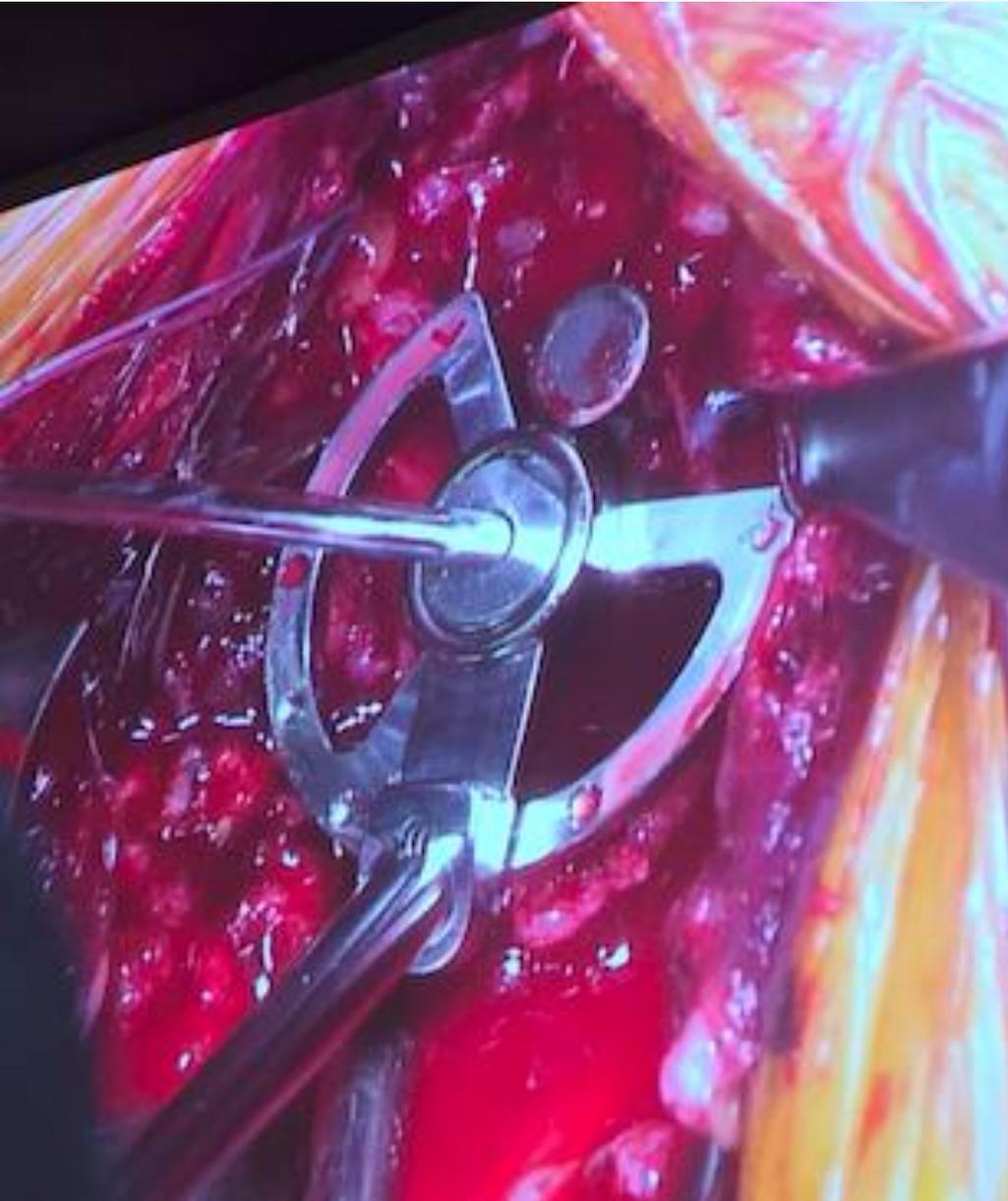
Glenoid retained poly peg

Suture
Through thin
Wall of post.
glenoid



Fakuda
Retractor
On posterior
glenois

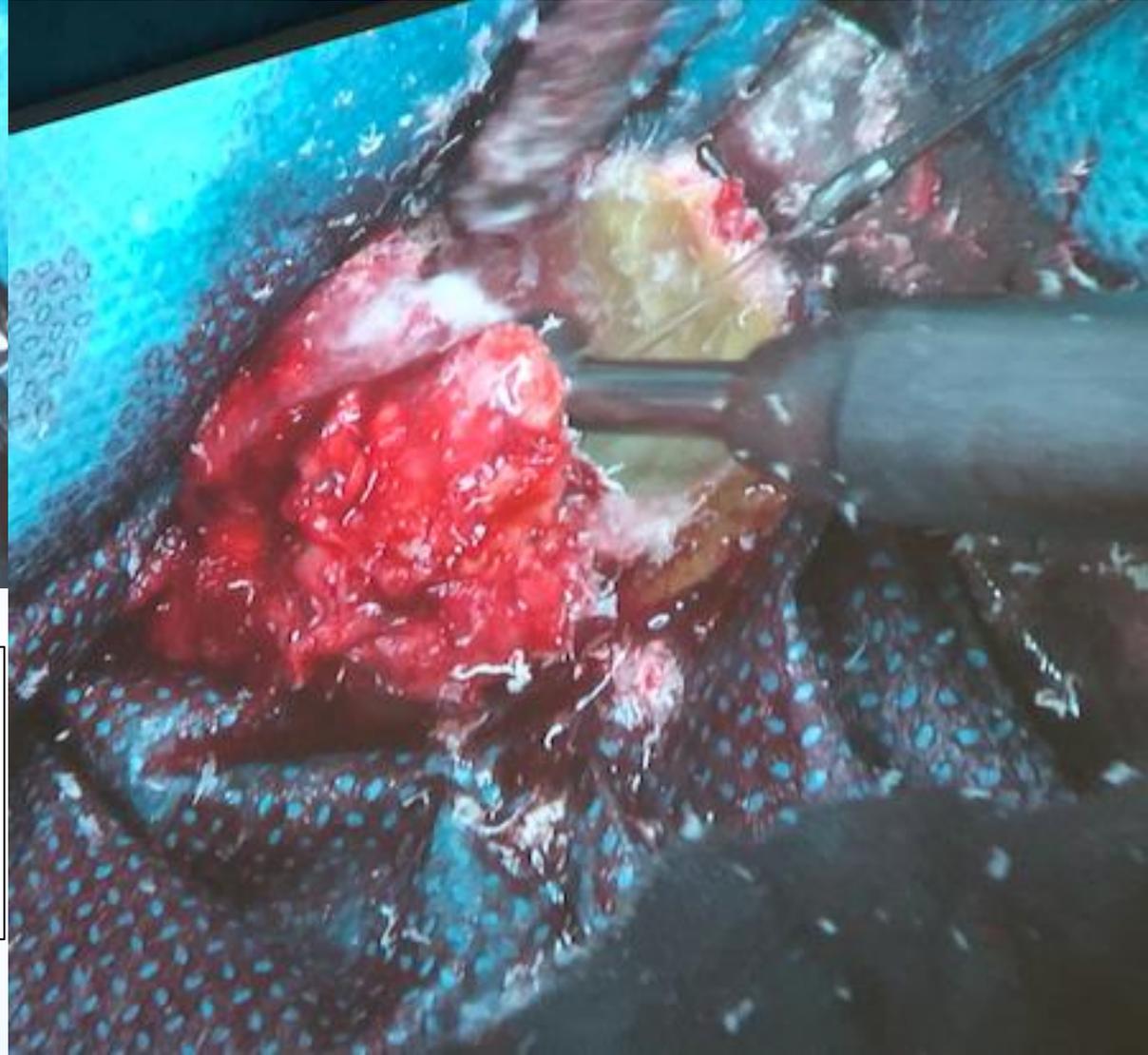
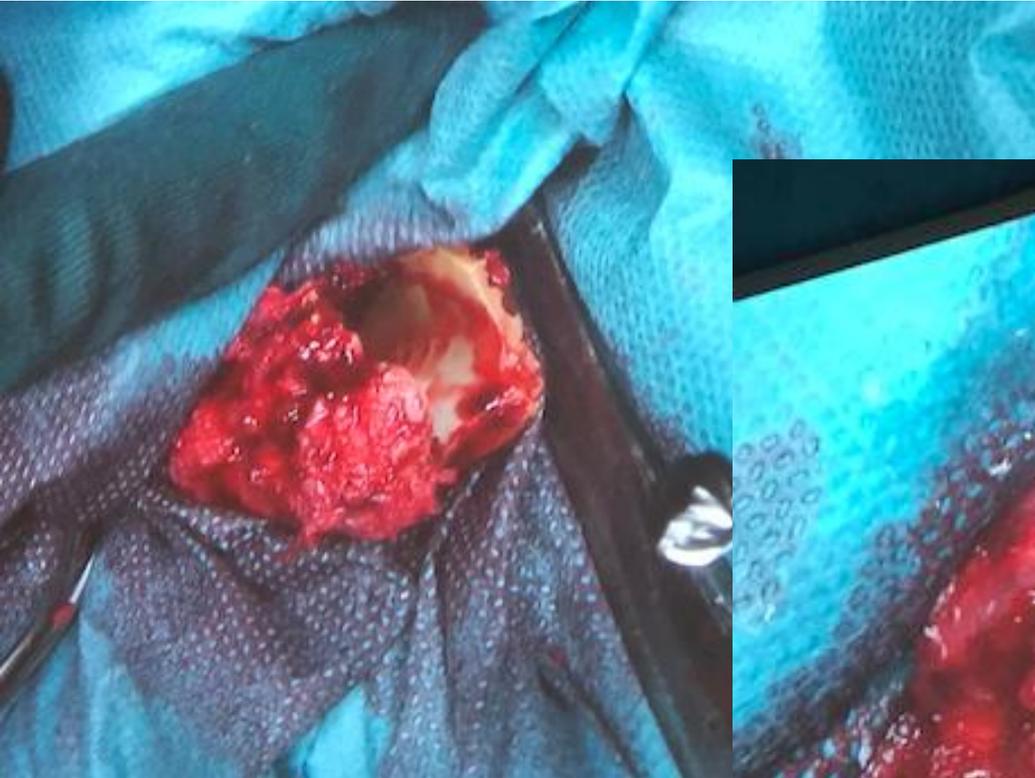
Hohhman
Retractor on
Anterior
glenoid



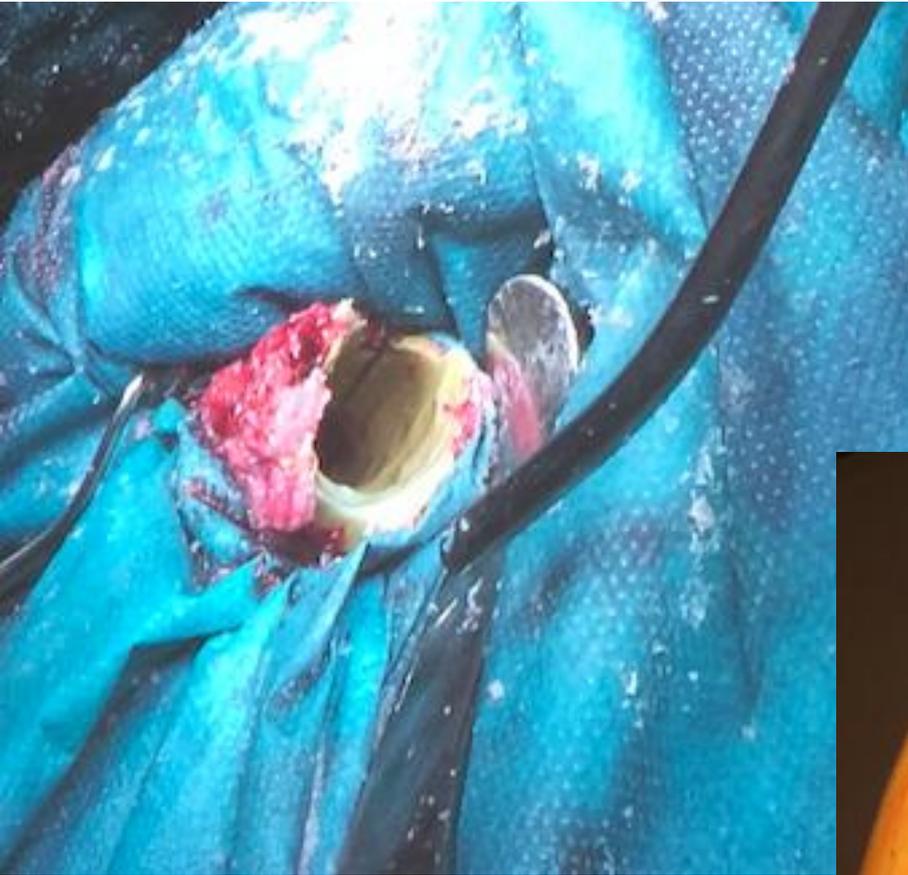
Guide pin placed in glenoid
With guide positioning baseplate
As low as possible...reference for
Superior-inferior inclination is
Difficult here



ICBG: This is tricortical
And is created by drilling
Pin into superior crest &
Reaming with glenoid
Reamer so that this
Rectangular piece fits into
Central defect of glenoid
And post of baseplate goes
Through hole shown here



Cement remaining in canal
Is abraded with a burr in
Order to improve cement
Fixation by cementing into
cement



Prepared shaft with stem
Cemented into cement at a height
Determined by trailing with broach &
Trial head, then adjusted further
through trailing on definitive stem.



OPS
R



PAIN...PAIN...PAIN.
...also motion
Limitation.
Note prior surgery
Note inferior sublux



Case #4:

Is this voluntary
From pectoralis maj.
Or Lat. Dorsi muscle
Contraction?

CASE 2: 62-Y OLD LADY: STATIC INFERIOR SUBLUXATION

L HO

L HO

2 metal anchors

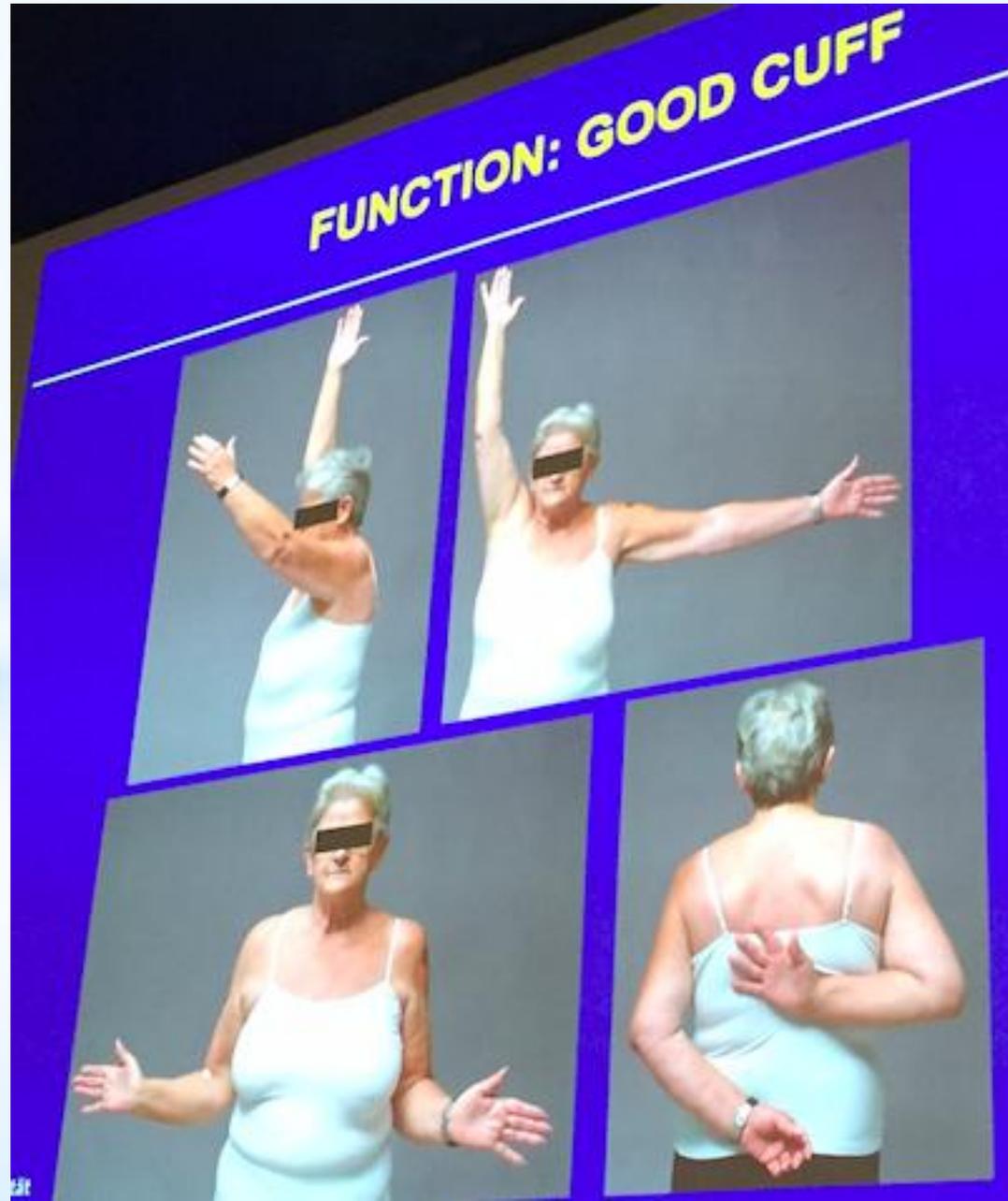
Inferior subluxation

06.06.06

07.08.06

27.05.09







What should I do
For this patient?

Well....



Are you
Asking
Me?





Still pain &
Poor function

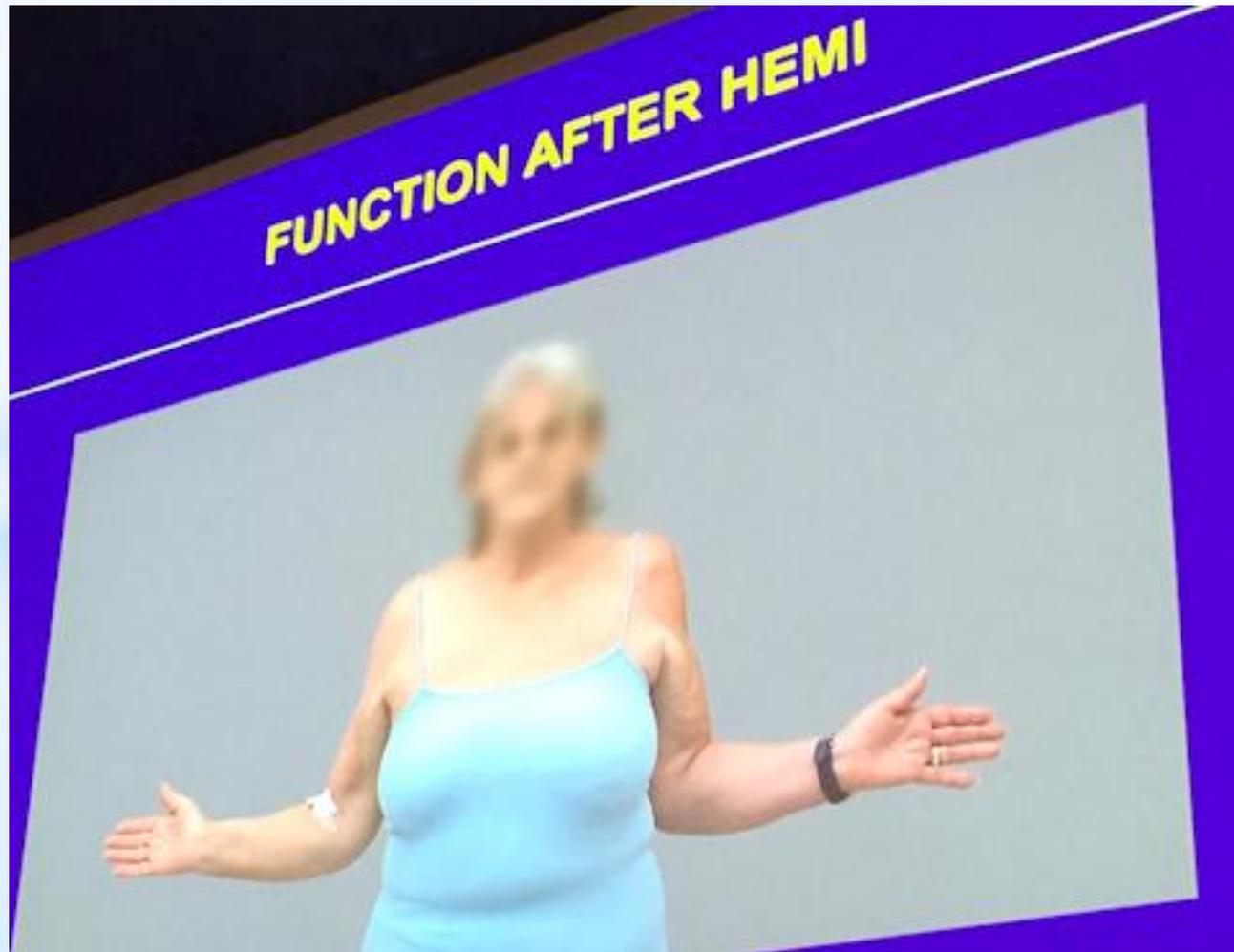




FUNCTION AFTER HEMI



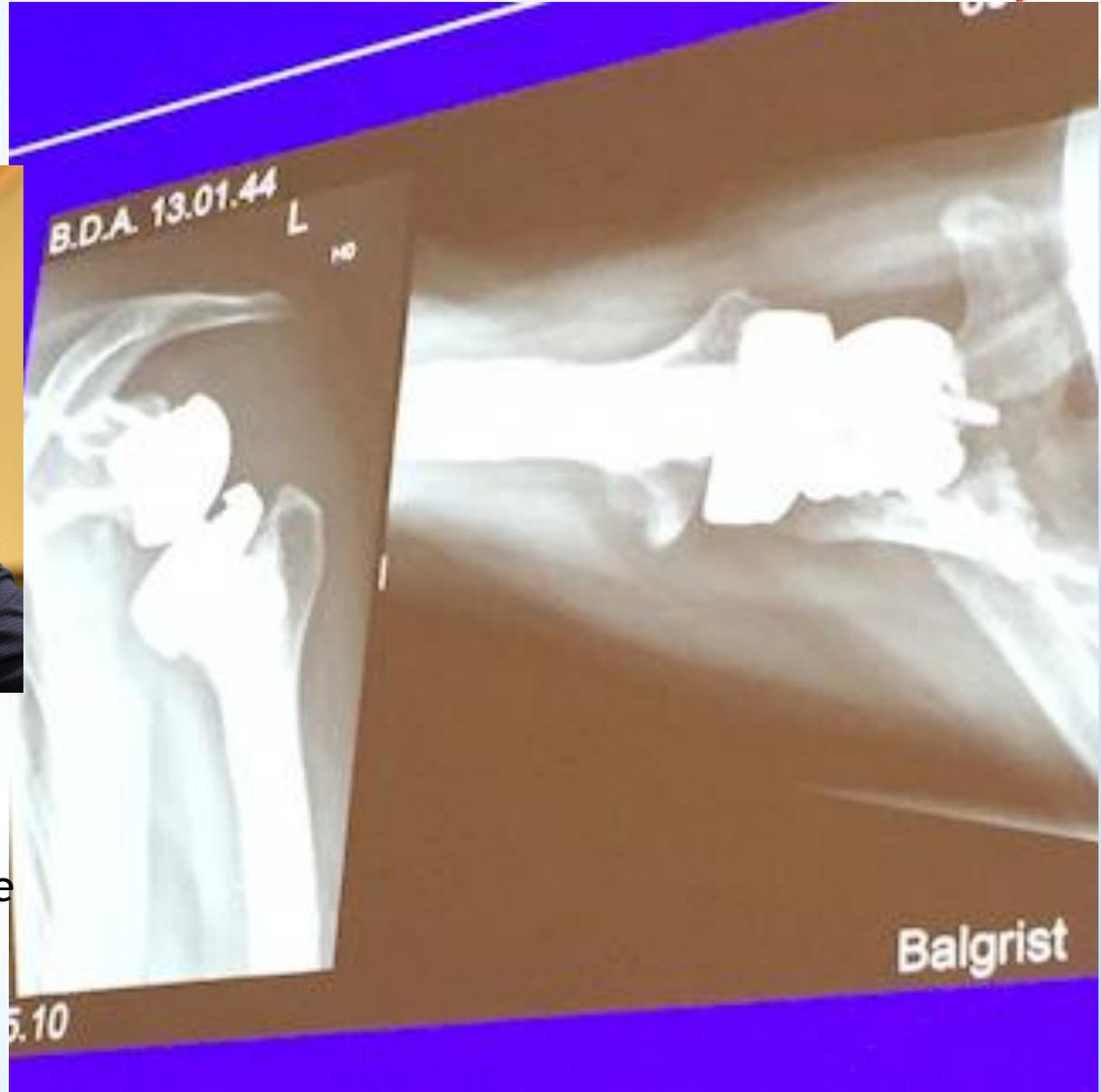








Conversion to reverse...
...still looks subluxated

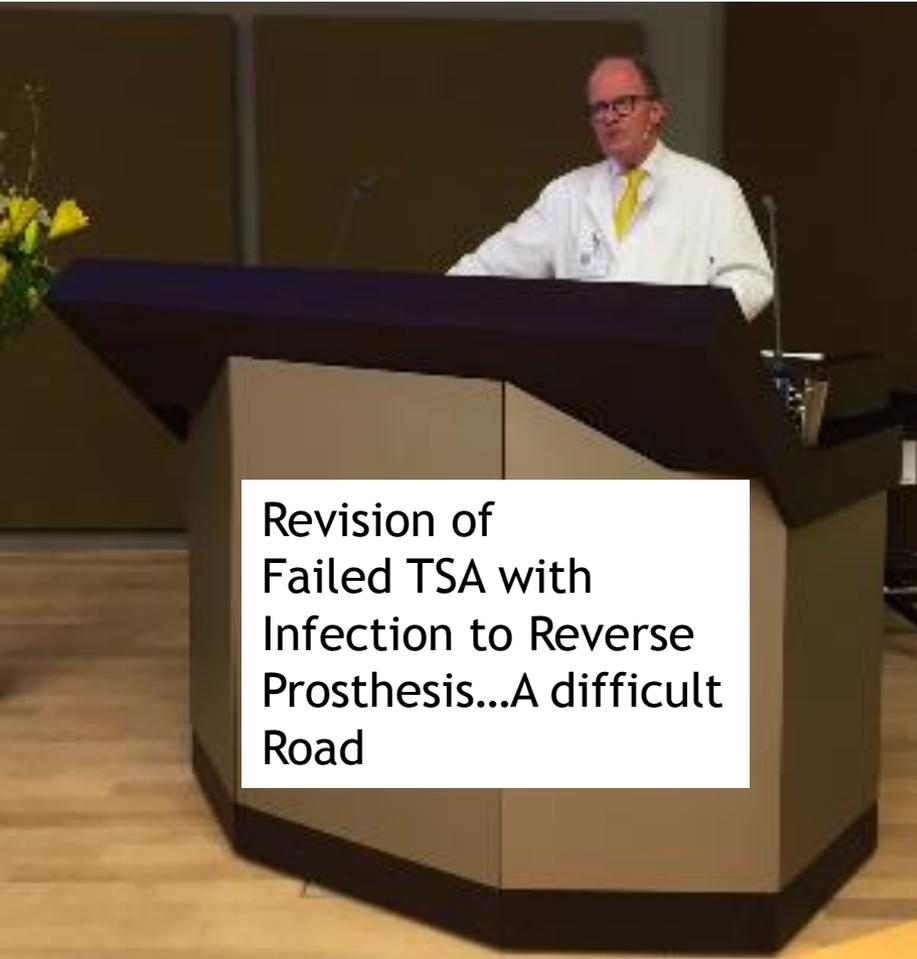


I wonder if Lat. Dorsi is
Over-active...check
Clinically & with EMG...
If yes...lengthen the muscle
To eliminate dynamic
Inferior instability



Let's consider
Infection...
...prevention...
...treatment...





Revision of
Failed TSA with
Infection to Reverse
Prosthesis...A difficult
Road





INFECTION ?

Patient History

- prior operation
- prior hematoma
- persistent pain after previous operation(s)
- elevated CRP and ESR





INFECTION OF TSA

Cut-off levels CRP, ESR (TKR!)



CRP	10 mg/L
ESR	30 mm/1h

(not sensitive)

Ghanem, JBJS 90-A: 1637, 2008
(TKR)

26.02.01



SUSPECTED INFECTION OF TSA

Cut-off levels synovial fluid:



- Cell count
/mm³

1100

Neutrophils

64 %*

- α - Defensin?!**

- IL-6!***

*Ghanem, JBJS 90-A: 1637, 2008 (TKR)

**Frangiamore, JSES 24: 1021, 2015

***Frangiamore, JBJS 97:63, 2015



1st REVISION	
CRP	8
ESR	12
Aspiration	dry!

Intraoperatively:
suspicion of infection
(scar, inelastic tissue, diffuse bleeding)



1st REVISION

Despite CRP 8

ESR 12

Aspiration dry

intraoperatively,
suspicion of infection

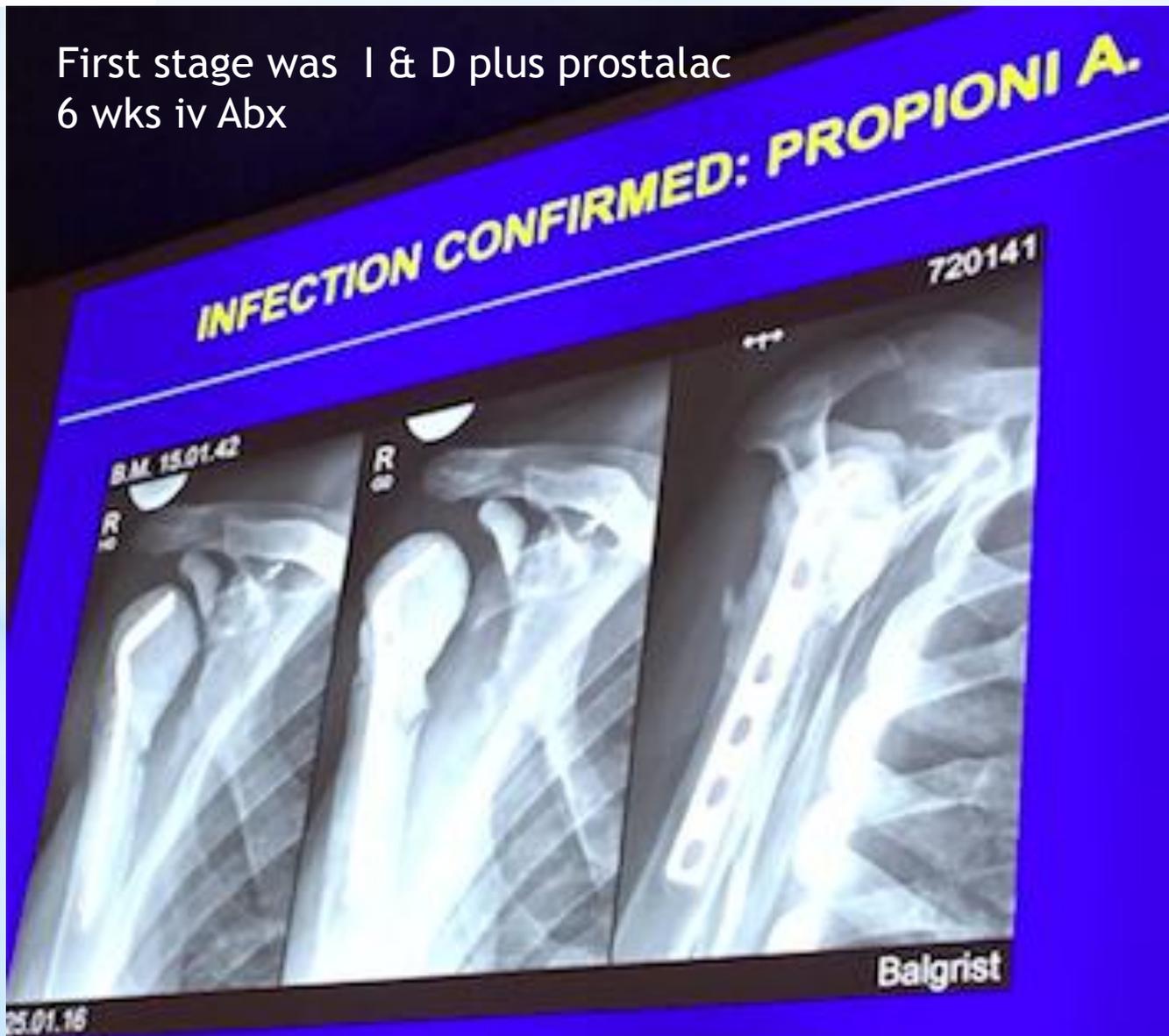
4 / 5 tissue cultures positive
for propioni acnes

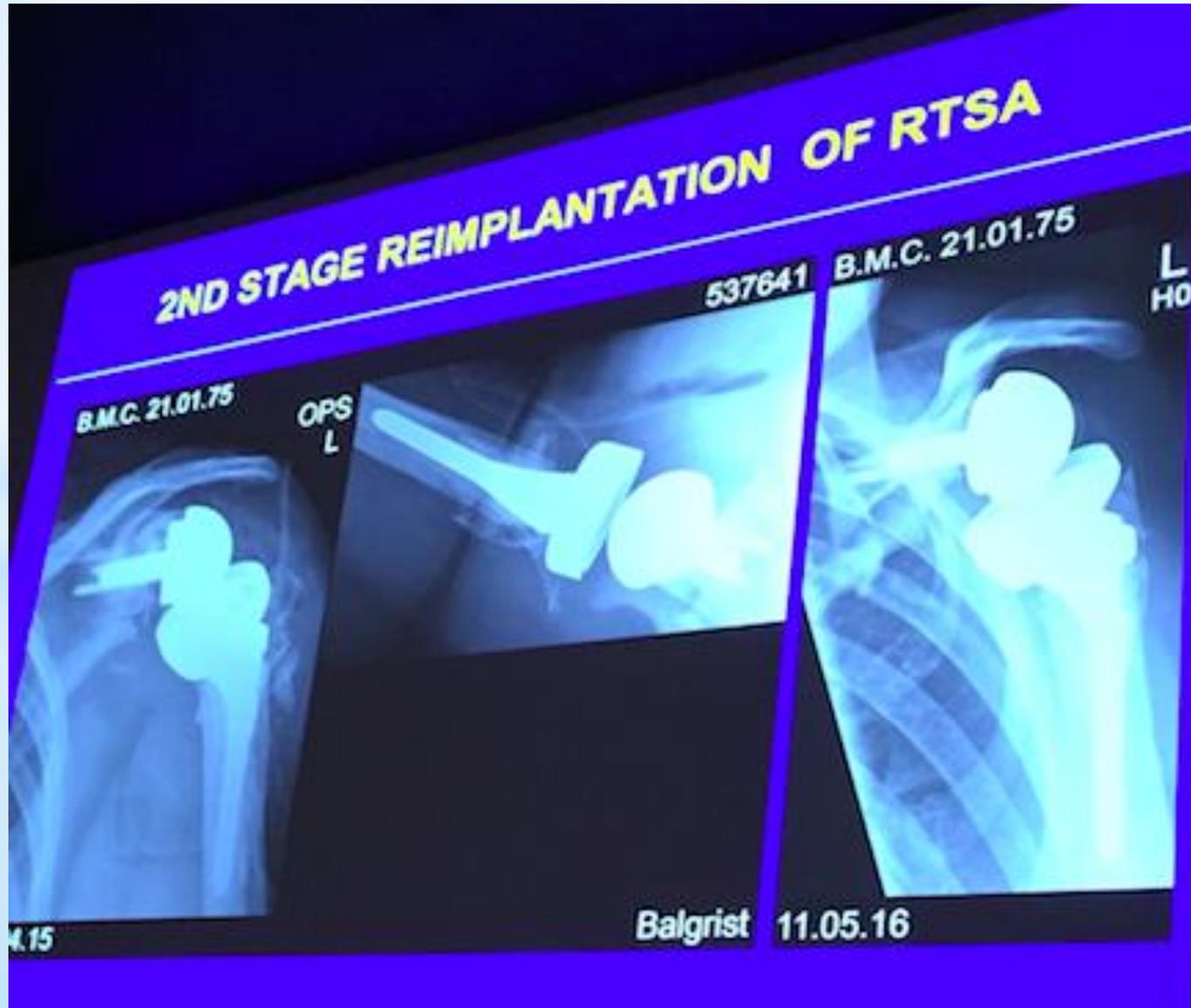


Balgrist



First stage was I & D plus prostalac
6 wks iv Abx







ANTIBIOTIC PROPHYLAXIS

Perioperative, systemic antibiotics?

YES (Ghanem, CORR 461:44, 2007)

If cement with antibiotics?

YES (Gobezie, SECEC Madrid, 2009)

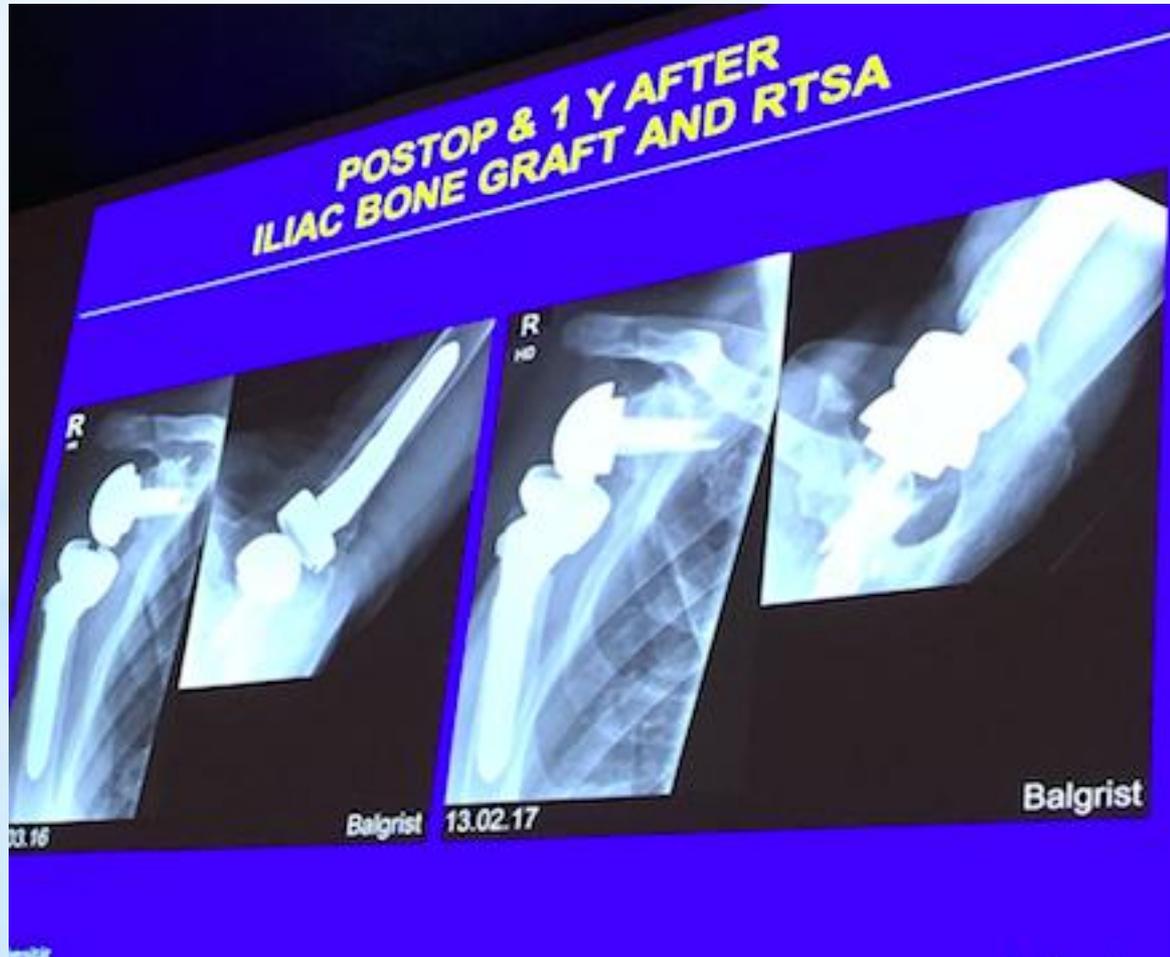
Engesaeter, Acta Scand 2003)

Chiu, JBJS 91-A: 628, 2009),



Vancomycin powder ?

Another case



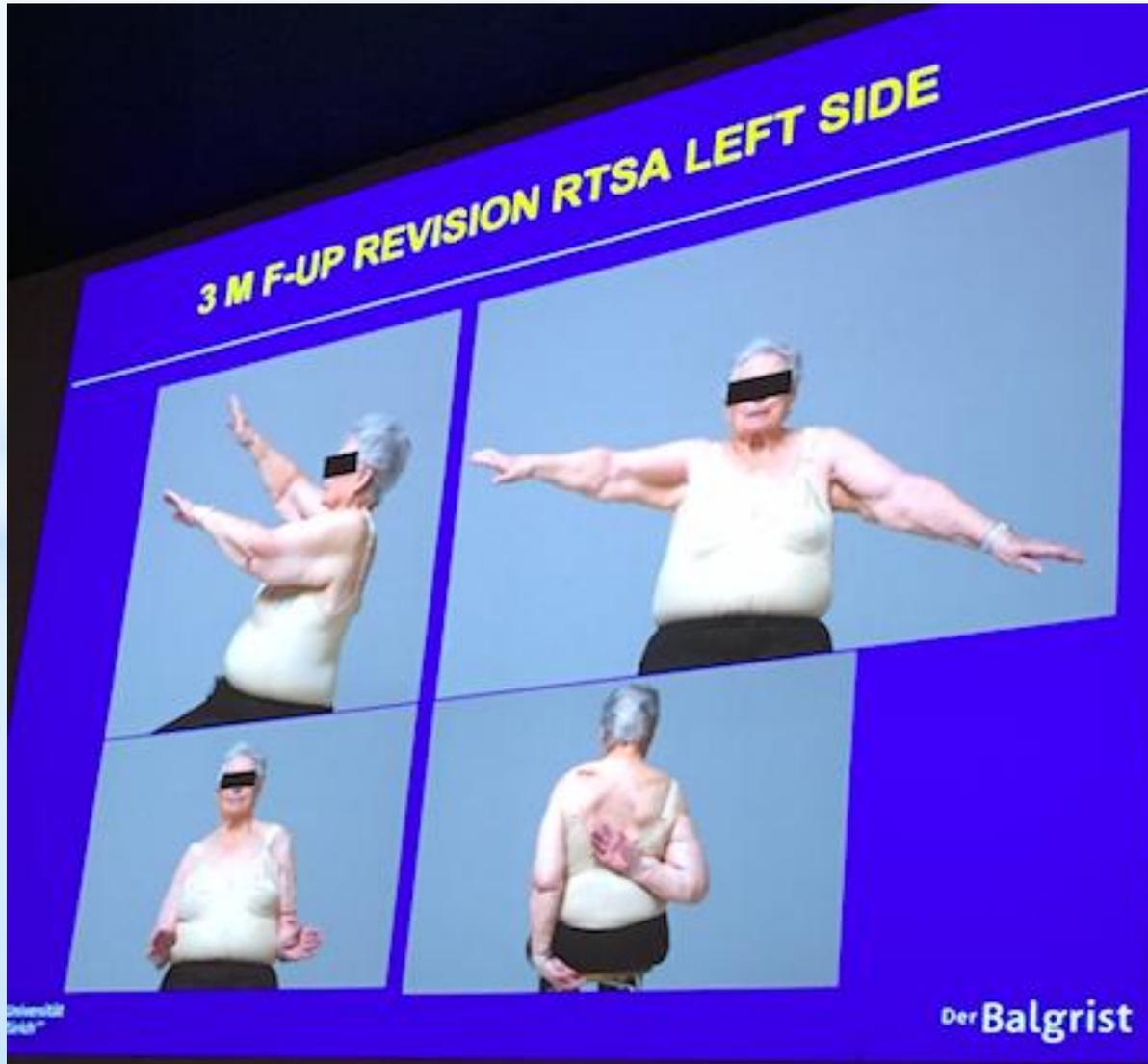


1 y AFTER ILIAC BONE GRAFT AND RTSA

B.M. 15.01.42
R

Der **Balgrist**

Another case





RTSA REVISION

*We always try
to go
back to RTSA
even
if the road is long...*



Can't there be a shortcut? (JPW)



Q: What is your preferred preoperative preparation?

A: Chlorhexidine wash...

Q: What do you do intra-operatively to prevent infection?

A:

1. Chlorhexidine prep & iodine impregnated occlusive drape
2. Let chlorhexidine dry first before applying occlusive drape (Cleveland Clinic had several intraop. fires in CT surgery due to failure to let skin dry first)
3. Chlorhexidine prep. With alcohol is better than without
4. Drape the inferior portion first to ensure complete exclusion of axilla and then do superior portion.
5. Always pass off skin knife and use second knife for deeper incision (P. Acnes lives in Dermis so avoid seeding it deeper into the wound)
6. Enneking study showed: when skin knife was swabbed and cultured it grew P. Acnes 100%. Subcutaneous culture showed 85% P. Acnes. (Matsen recently showed this again in a published study). Irrigation right after skin incision will decrease P. Acnes (C. Gerber, unpublished)



Q: What do you do intra-operatively to prevent infection?

A: (continued)

7. Remove all scar tissue like a benign tumor with revision surgery as this decreases devitalized tissue and risk for nidus for infection.
8. Using bovi may lead to more devitalized tissue than scalpel (C. Gerber, opinion without evidence)
9. Always prevent a hematoma which is associated with higher infection rate (us a drain). We all did not agree on this.
10. Use Transaxamic acid to reduce bleeding (avoid hematoma)
11. Which iv Abx do you use?
 - A. Gerber: Cefuroxime 2 grams; over 80 kg size patient then use 3 grams and repeat after 3 hours; In Switzerland no Vancomycin for routine use due to concern for development for resistance.
 - B. Iannotti: 2 grams (3 grams in larger patients) ancef but he worries about P. Acnes coverage
 - C. Warner: Ancef & Vancomycin routinely



Q. What do you do at the end of surgery to prevent infection?

A.

Iannotti: Vancomycin powder plus drain

Warner: Vancomycin powder plus drain sometimes

Gerber: No vancomycin but always a drain

Q. If you want to rule out infection in a patient who is suspect to have one.
what do you do?

A. Do biopsy and DO NOT hold Abx PRIOR to biopsy as the risk of infection is greater if hold Abx and it does not affect yield of culture (Iannotti & Gerber)
Do biopsy & HOLD Abx until after biopsy (Warner)



INCLINATION OF THE GLENOID

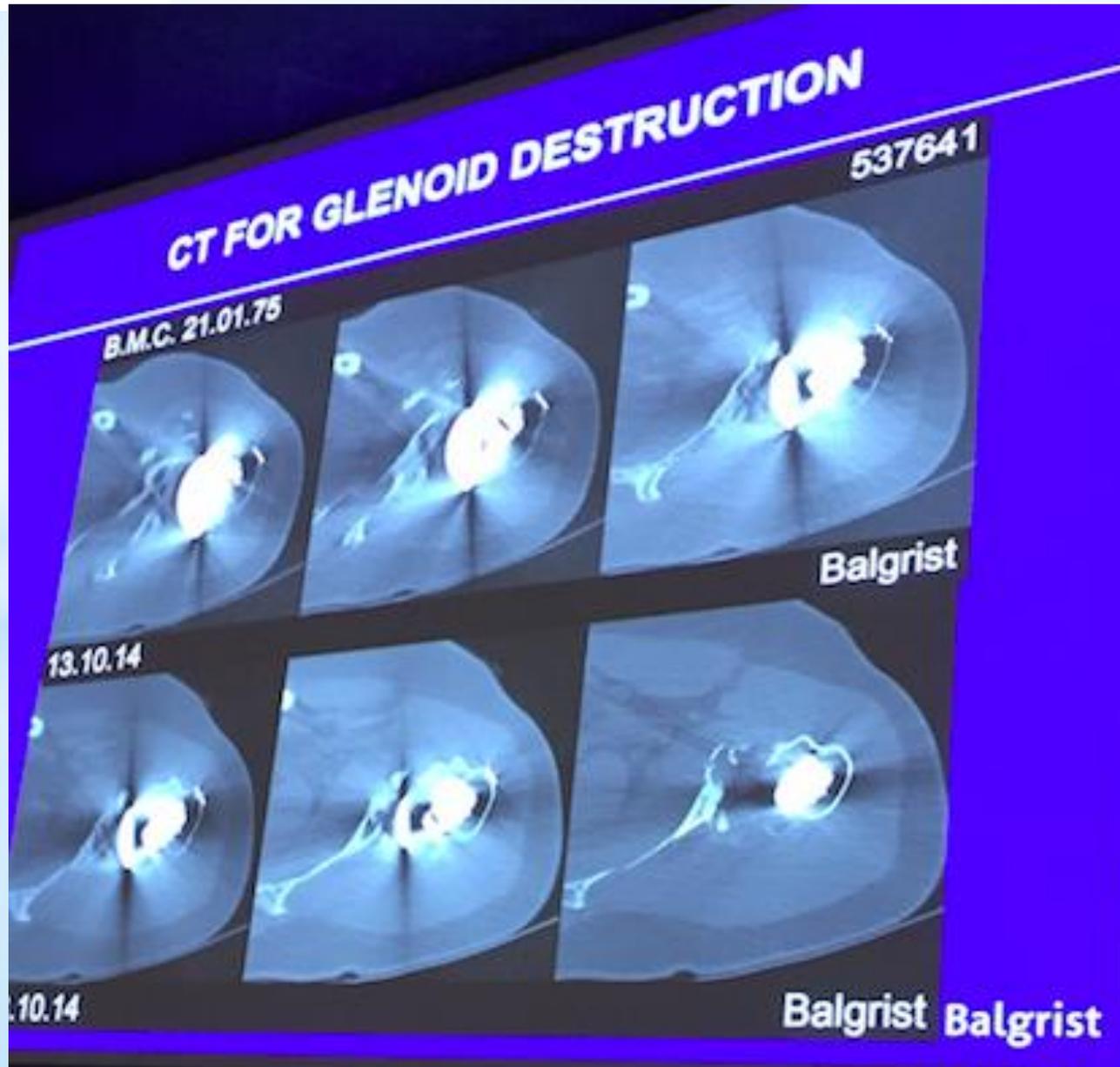


Mean β : 75°

Maurer, JSES 21:1096, 2012
Der Balgrist

Understand this before
You do a Reverse prosthesis..

...do you measure inclination?





**ADDITIONAL VIEWS REDUCING METAL
ARTEFACTS: GLENOID DESTRUCTION**

B.M.C. 21.01.75

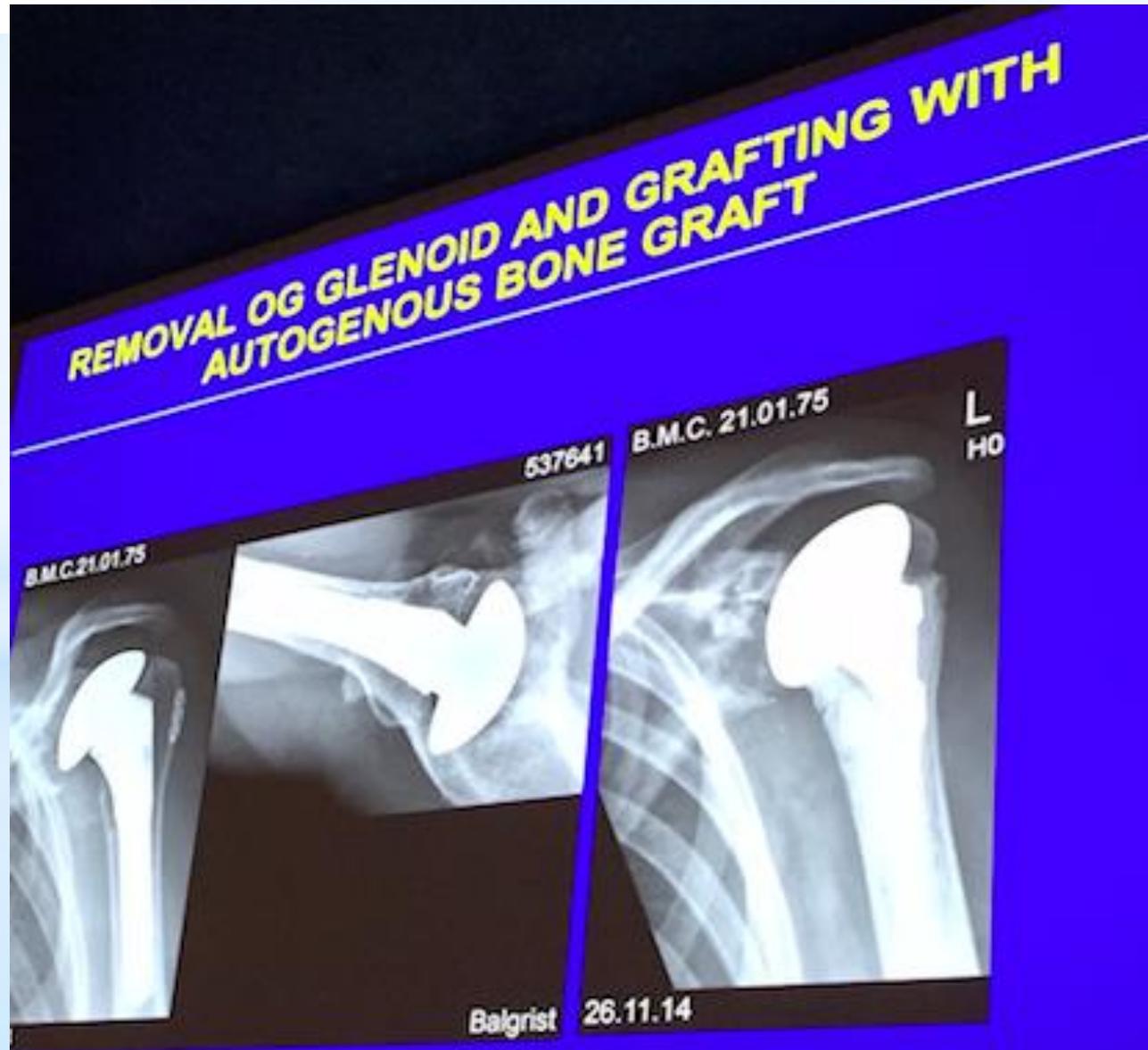


537641



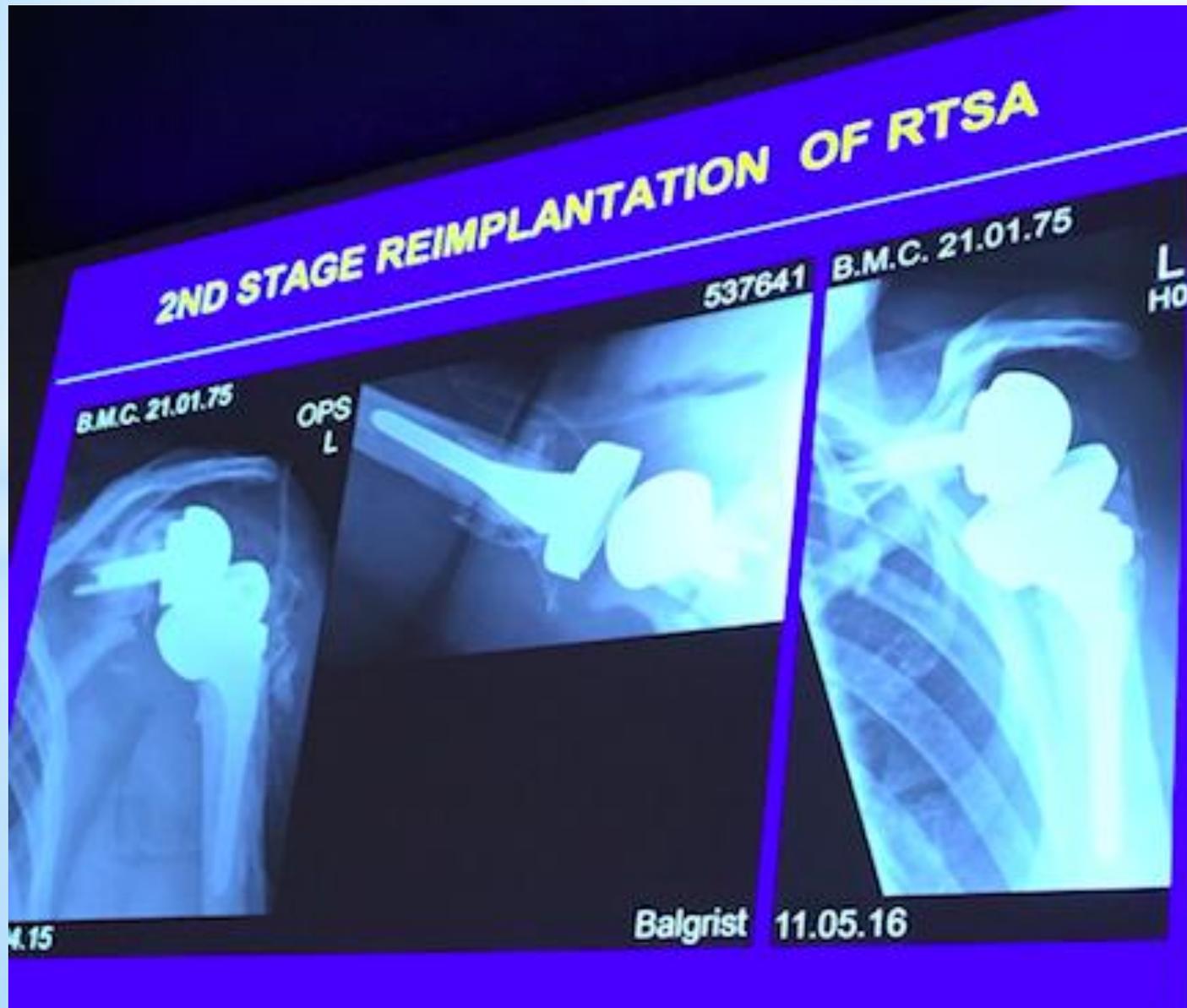
B.M.C. 21.01.75













Pain relieved

Function improved...
...modestly



ROLE OF ARM LENGTHENING

Average arm lengthening 23 ± 12 mm
 insufficient lengthening \rightarrow instability

Lädemann, JSES 18: 588, 2009

Table I AAE according to arm lengthening

Arm lengthening	n (%)	AAE (°)
<0 cm	26 (14.2)	121
0 to 1 cm	30 (16.4)	140
>1 to 2.5 cm	75 (41.0)	144
>2.5 cm	52 (28.4)	147

Lädemann, JSES 21: 336, 2012



Can pain occur due to over-lengthening of the Deltoid?

- a. Gerber says I have not seen this.
- b. Iannotti says I am not sure about this.
- c. Molé says yes based on the French Multi-center study of reverse. The ideal lengthening with reverse is about 2.0-2.5 cm. If over-lengthen the patient may have pain but it usually goes away in 1-2 years

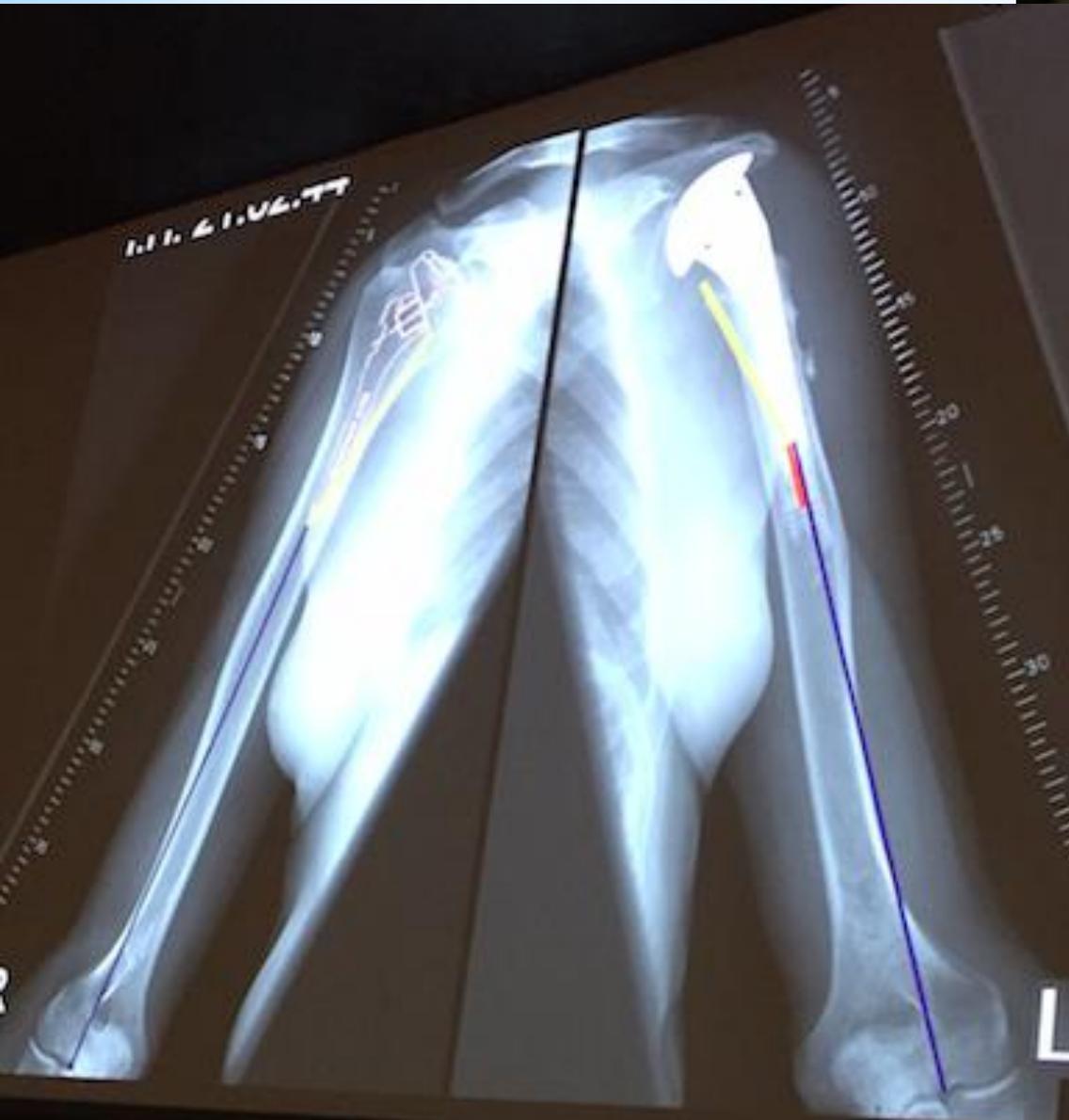




For length determination use long-arm films
With scanogram



Measurement may be to
The tip of the stem from
The condyles





**How do we define a glenoid
component at risk for clinical
failure?**

Joseph P. Iannotti MD, PhD
Maynard Madden Professor and Chairman
Orthopaedic and Rheumatologic Institute
Cleveland Clinic



Conflict of Interest

- **DePuy – Synthes Royalties**
- **Wright - Tornier – Royalties**
- **DJO – Consulting and Royalties**
- **Custom Orthopaedic Solutions – Equity**
- **Lippincott WW – Royalties**
- **None related to this talk**



Our Goals

- **Develop and validate 3D MAR CT scanning to**
- **Define**
 - **implant migration**
 - **Bone implant interface**
- **Correlation of implant failure**
 - **Patient pathology**
 - **Surgical factors and**
 - **Implant factors**



Study Criteria

- 170 patients prospectively enrolled
- Two shoulder surgeons
- Anatomic TSA DePuy Global AP with APG or Step Tech APG
- Intact rotator cuff OA
- 3D CT planning and use of PSI
- MAR 3D CT within 2 months of surgery
- MAR 3D CT 2-3 years after surgery
- Routine x-rays performed at same time of CT



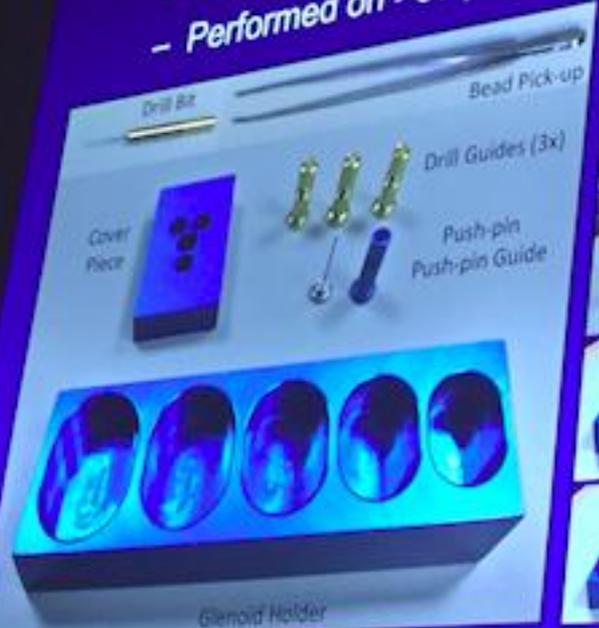
The Question

- *Early results of the first 64 patients completing the protocol*
- *Development and validation of 3D CT imaging*
- *What are the patterns of glenoid component shift and osteolysis around the center peg*



Radiopaque Tantalum Markers

- Intra-operative insertion
 - DePuy Anchor Peg Glenoid and Steptech Glenoid
 - Current standard of care at Cleveland Clinic
 - Performed on >60 patients, ~ 5 minutes additional OR time





Registration Process: Implants

- Glenoid implant registration:



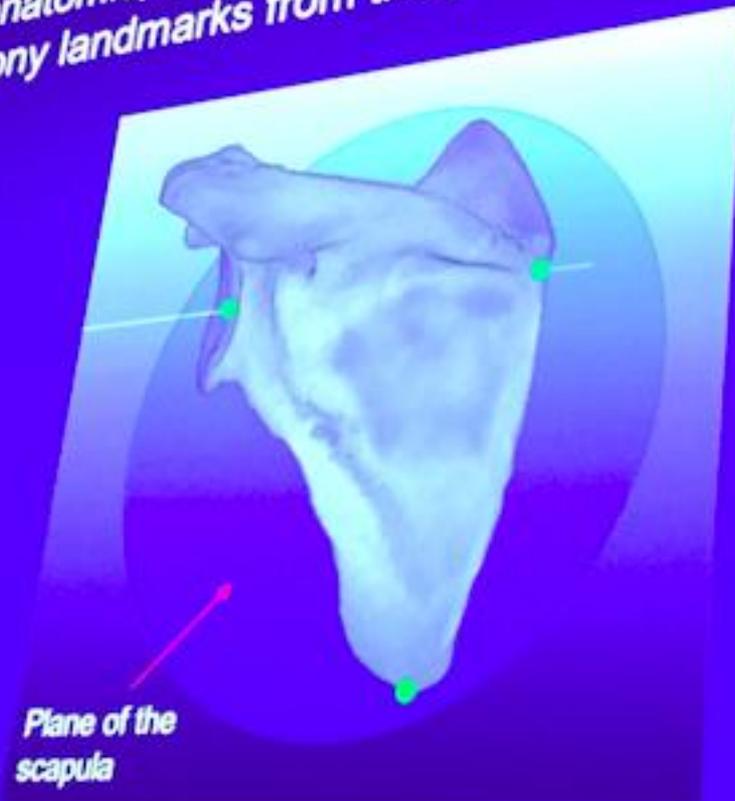
Marker Visualization

Implant Registration



Advanced 3D clinical CT imaging allows defining an anatomic coordinate system

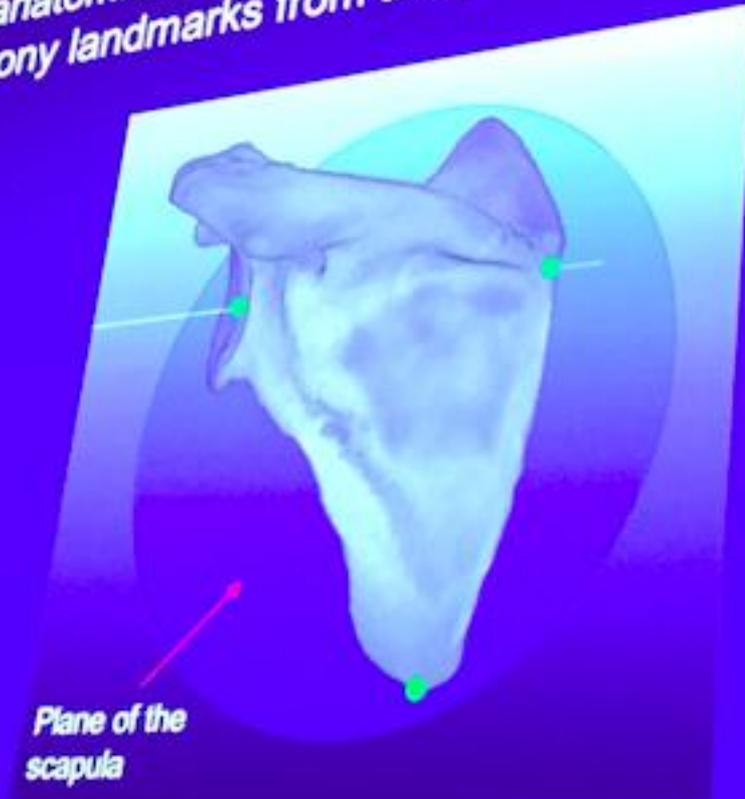
- An anatomic, scapular coordinate system defined based on bony landmarks from the pre-operative CT scan





Advanced 3D clinical CT imaging allows defining an anatomic coordinate system

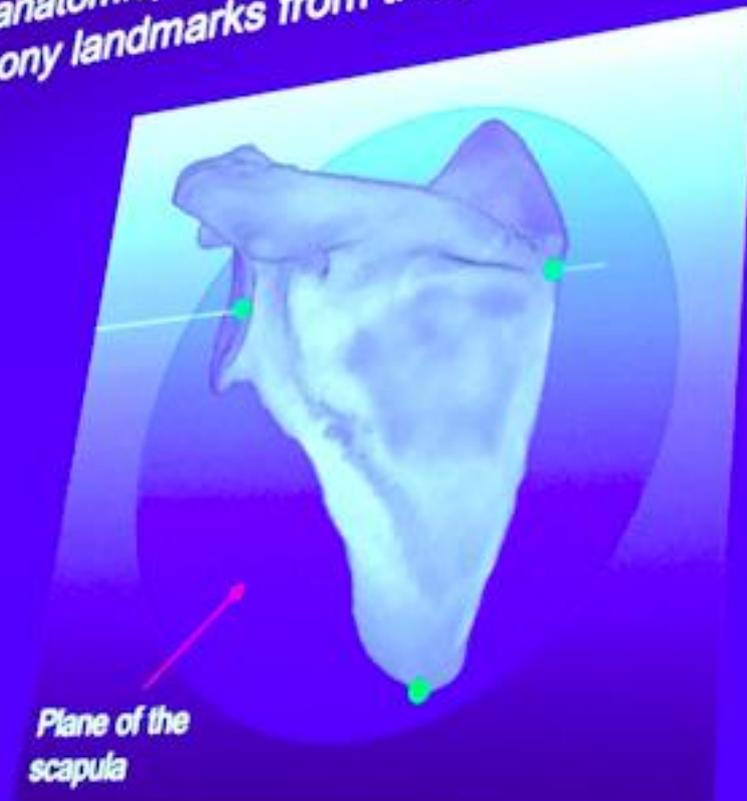
- An anatomic, scapular coordinate system defined based on bony landmarks from the pre-operative CT scan





Advanced 3D clinical CT imaging allows defining an anatomic coordinate system

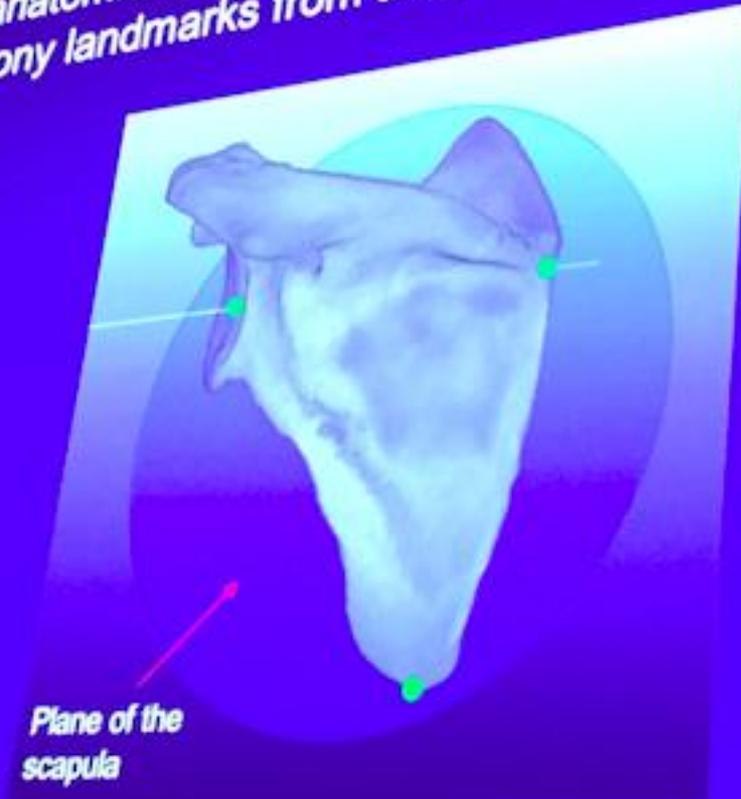
- An anatomic, scapular coordinate system defined based on bony landmarks from the pre-operative CT scan





Advanced 3D clinical CT imaging allows defining an anatomic coordinate system

- An anatomic, scapular coordinate system defined based on bony landmarks from the pre-operative CT scan





Advanced 3D clinical CT imaging allows super-imposition of multiple 3-D CT volumes

- Multiple 3D CT volumes (immediate post-operative and follow-up) with respect to a pre-operative scapula bone



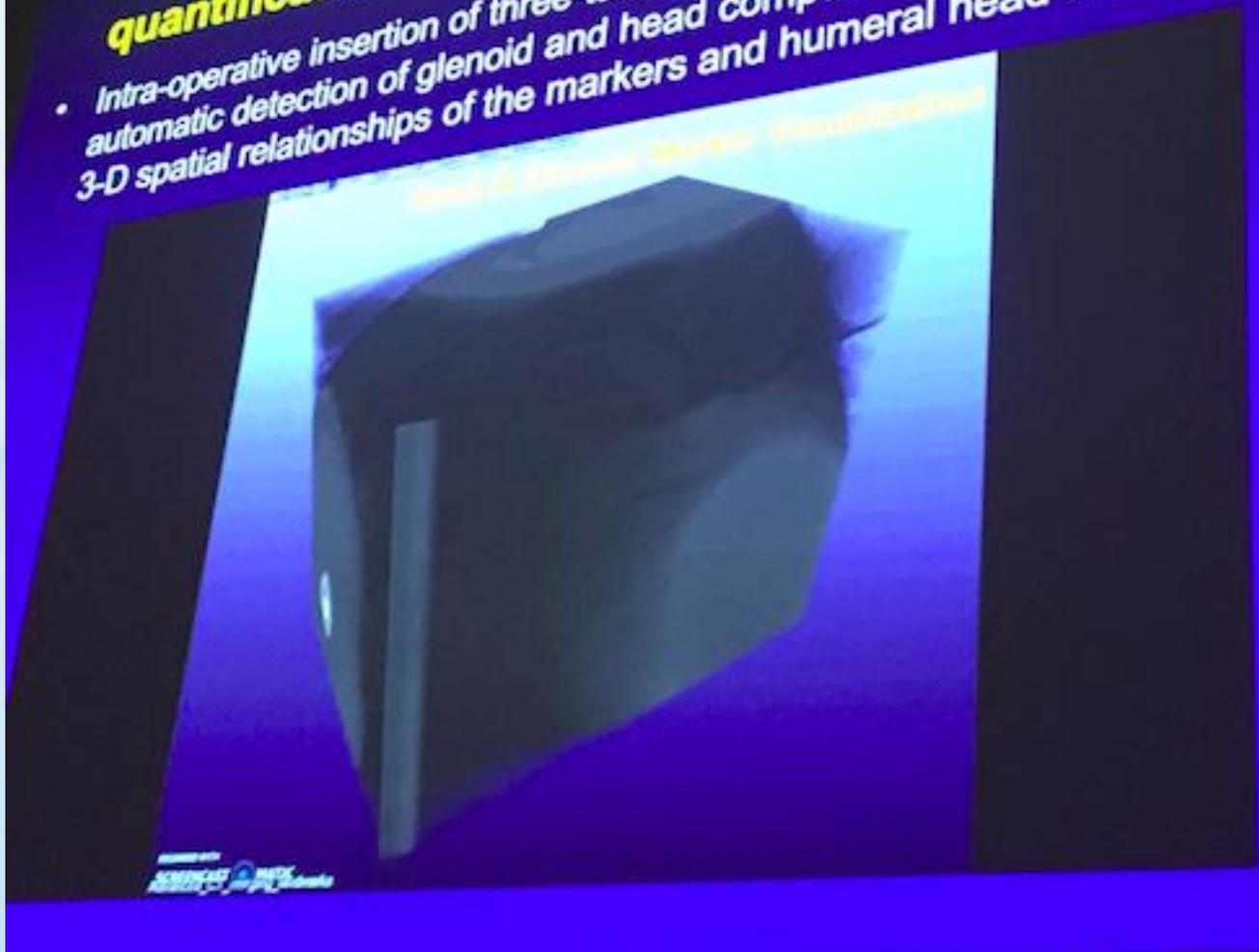
Superimposition of post-op & follow-up to pre-op scapular bone





Advanced 3D clinical CT imaging allows quantification of glenoid component migration

- Intra-operative insertion of three-tantalum bead markers allows automatic detection of glenoid and head component position based on 3-D spatial relationships of the markers and humeral head size





Advanced 3D clinical CT imaging allows quantification of glenoid component migration

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Advanced 3D clinical CT imaging allows quantification of glenoid component migration

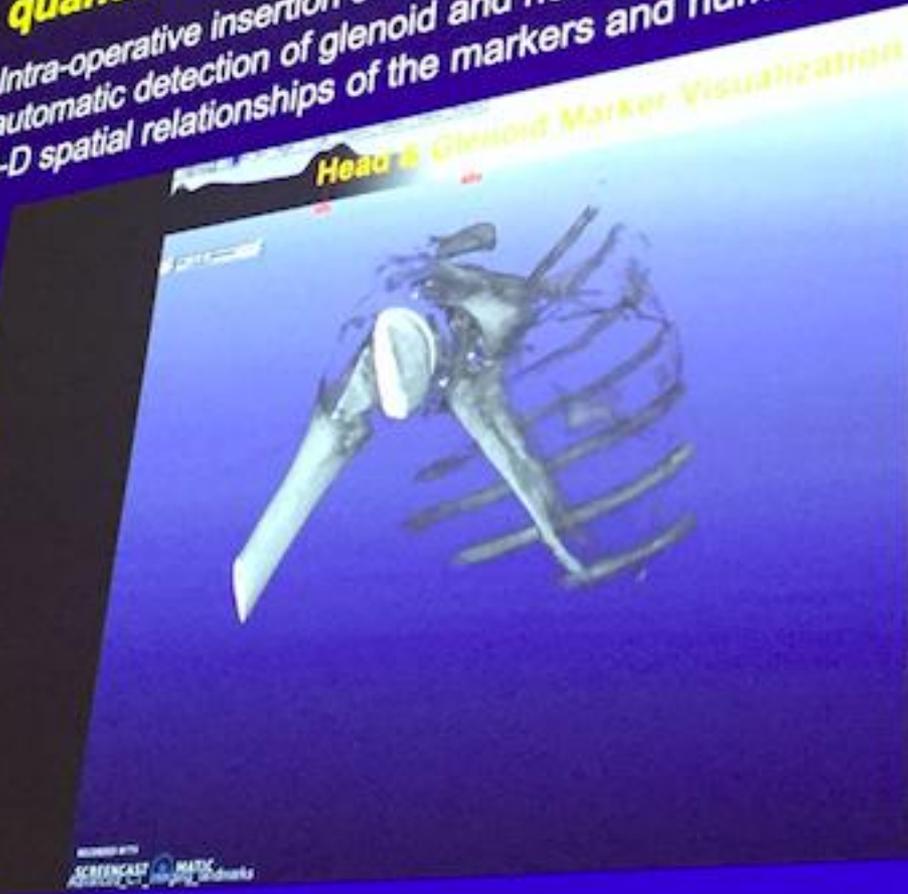
- Intra-operative insertion of three-tantalum bead markers allows automatic detection of glenoid and head component position based on 3-D spatial relationships of the markers and humeral head size





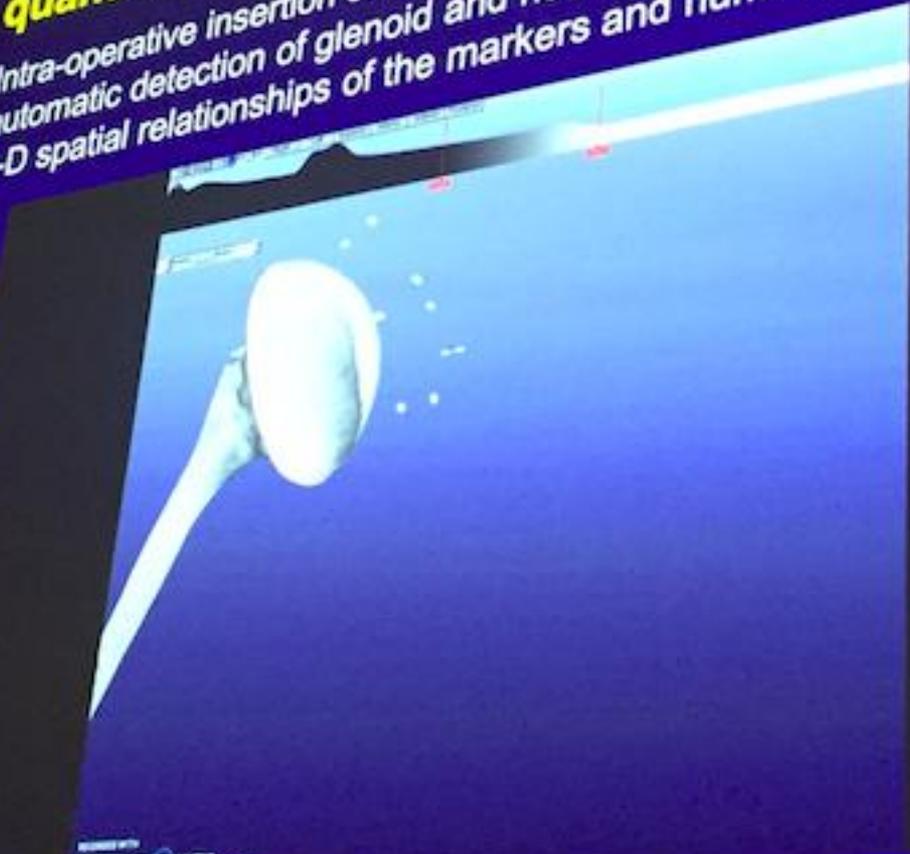
Advanced 3D clinical CT imaging allows quantification of glenoid component migration

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Advanced 3D clinical CT imaging allows quantification of glenoid component migration

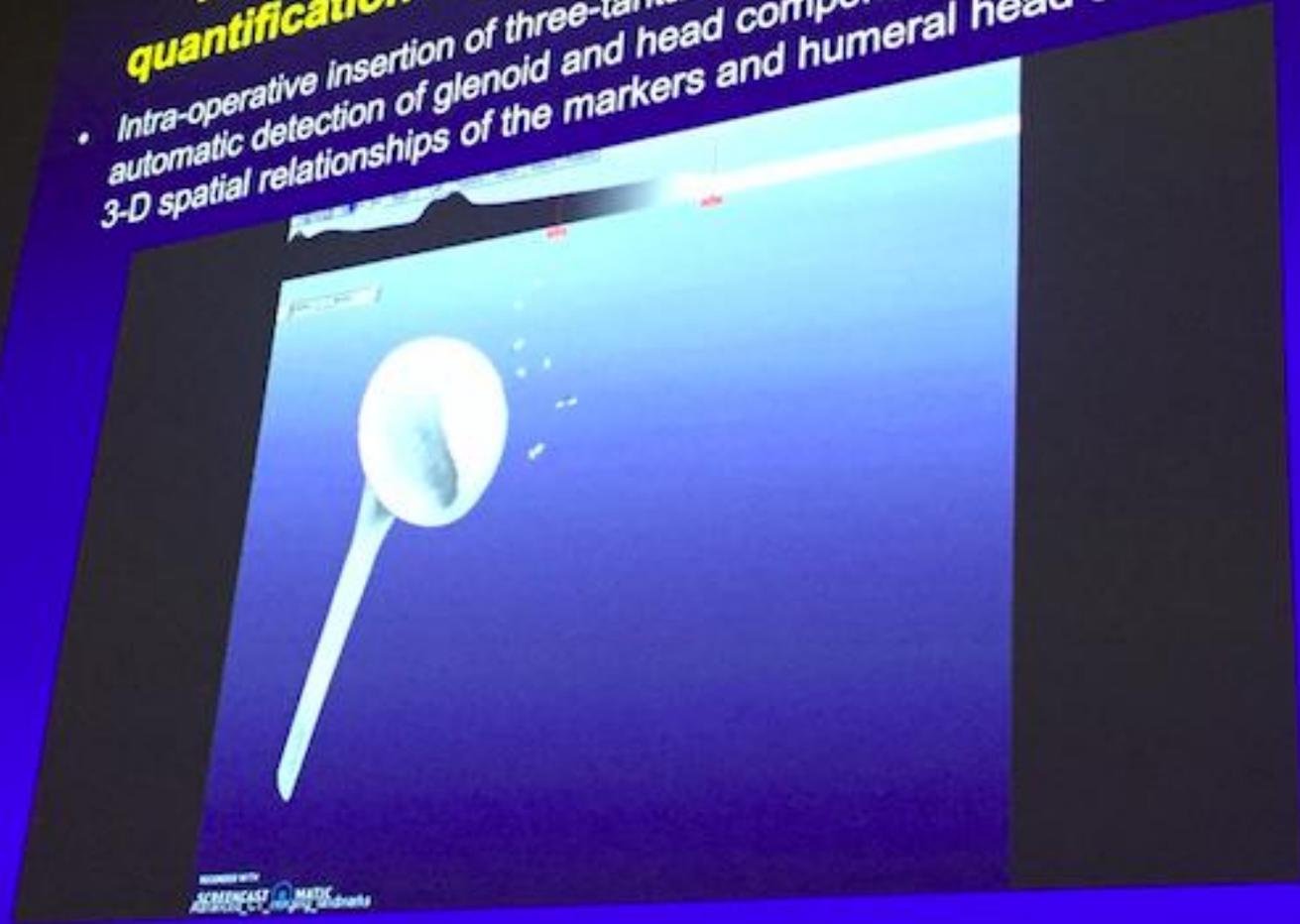
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Advanced 3D clinical CT imaging allows quantification of glenoid component migration

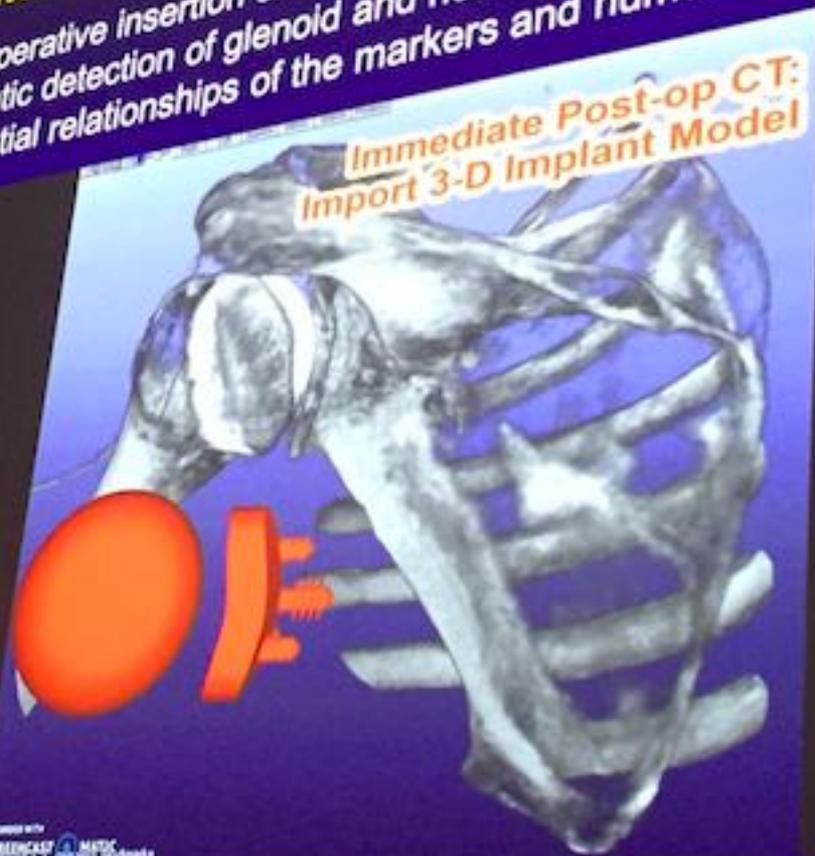
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Advanced 3D clinical CT imaging allows quantification of glenoid component migration

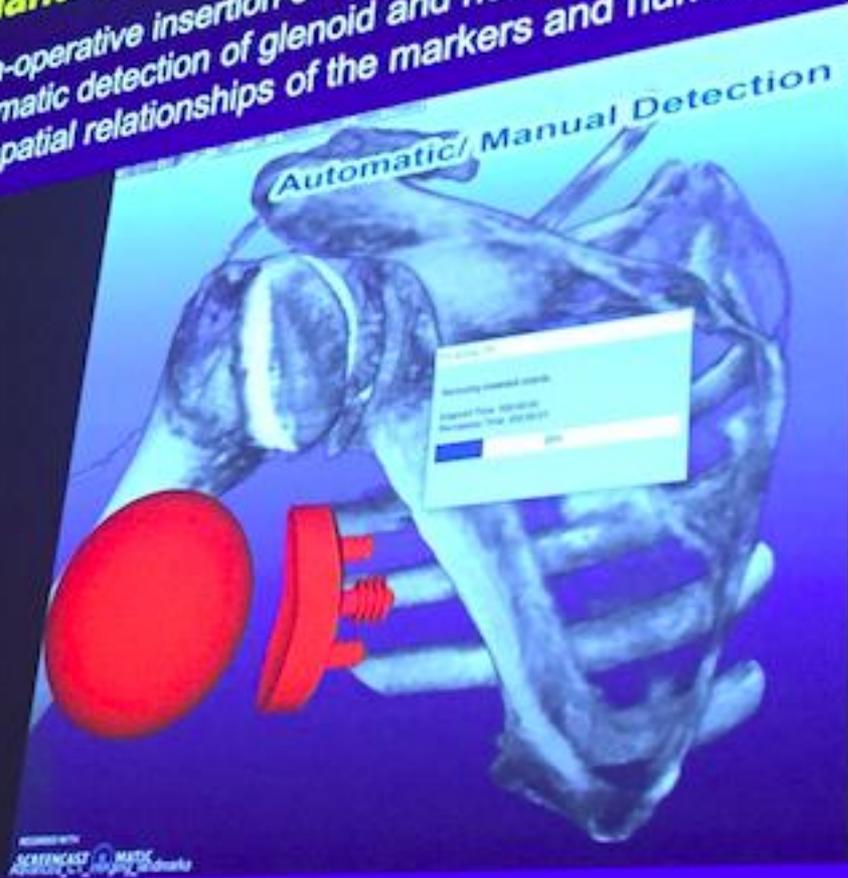
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Advanced 3D clinical CT imaging allows quantification of glenoid component migration

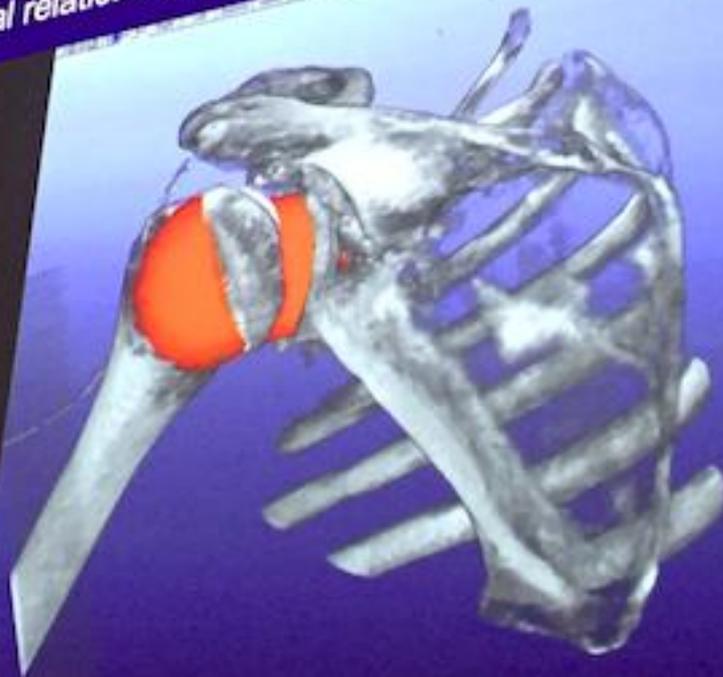
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Advanced 3D clinical CT imaging allows quantification of glenoid component migration

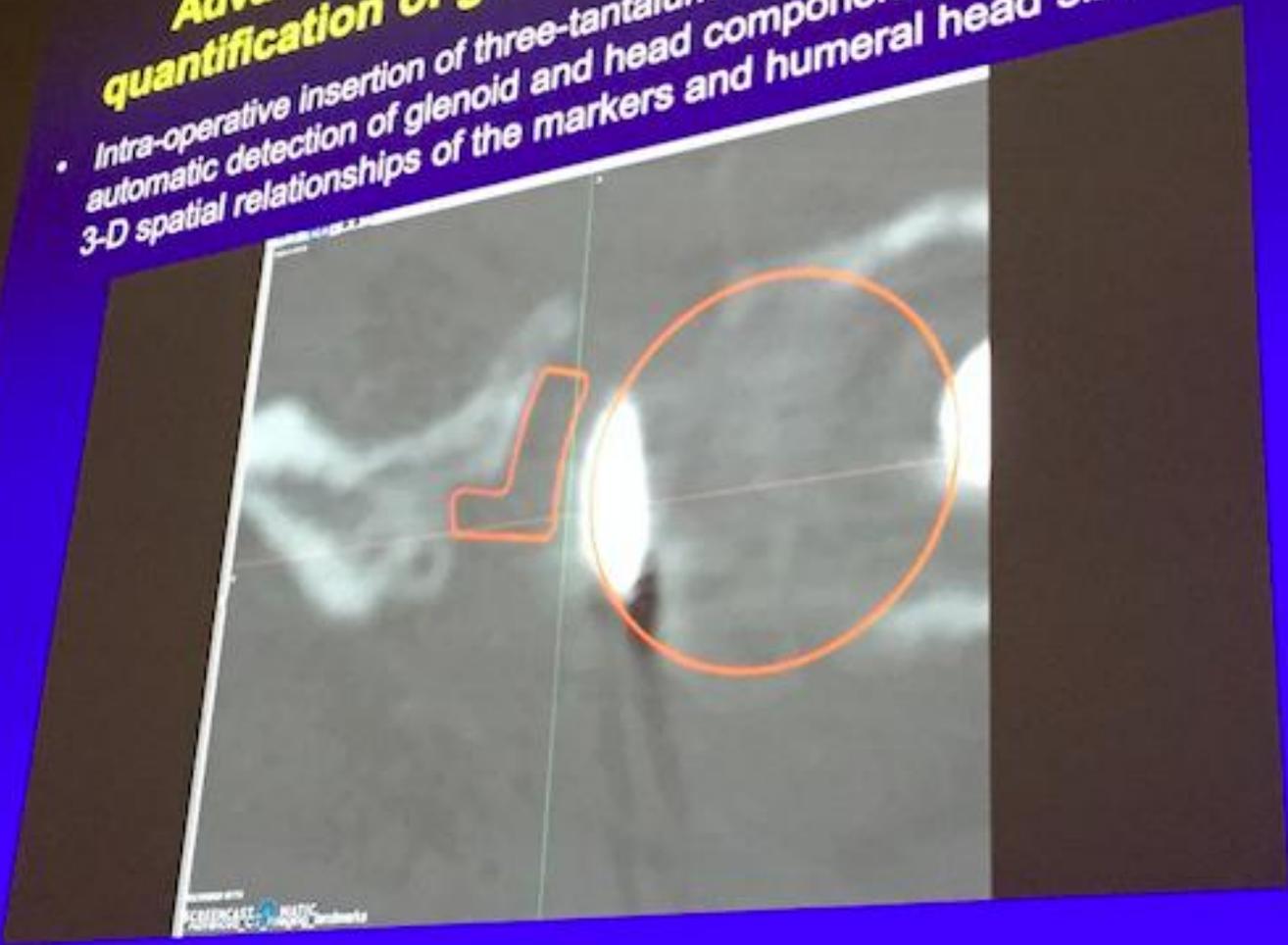
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Advanced 3D clinical CT imaging allows quantification of glenoid component migration

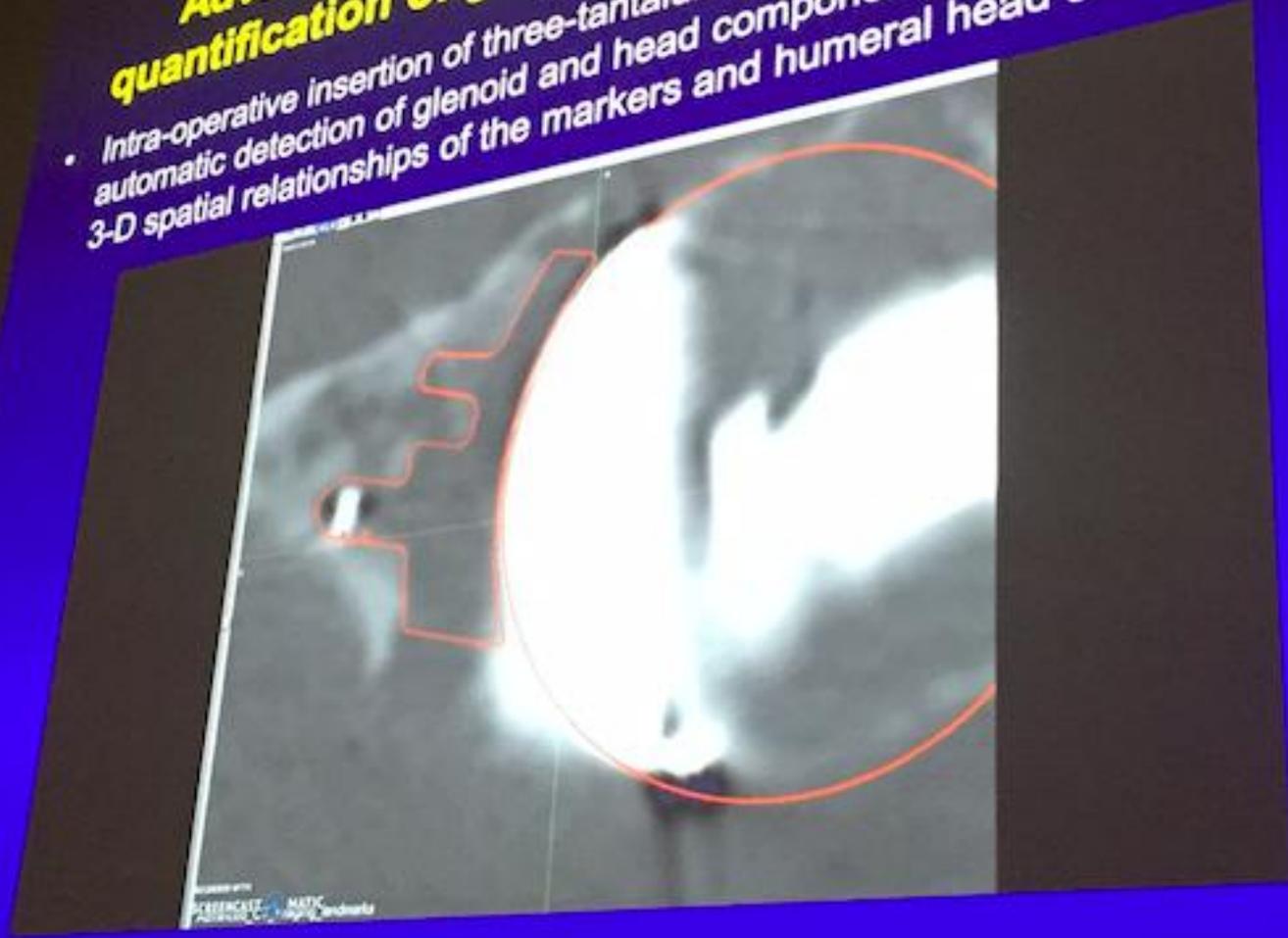
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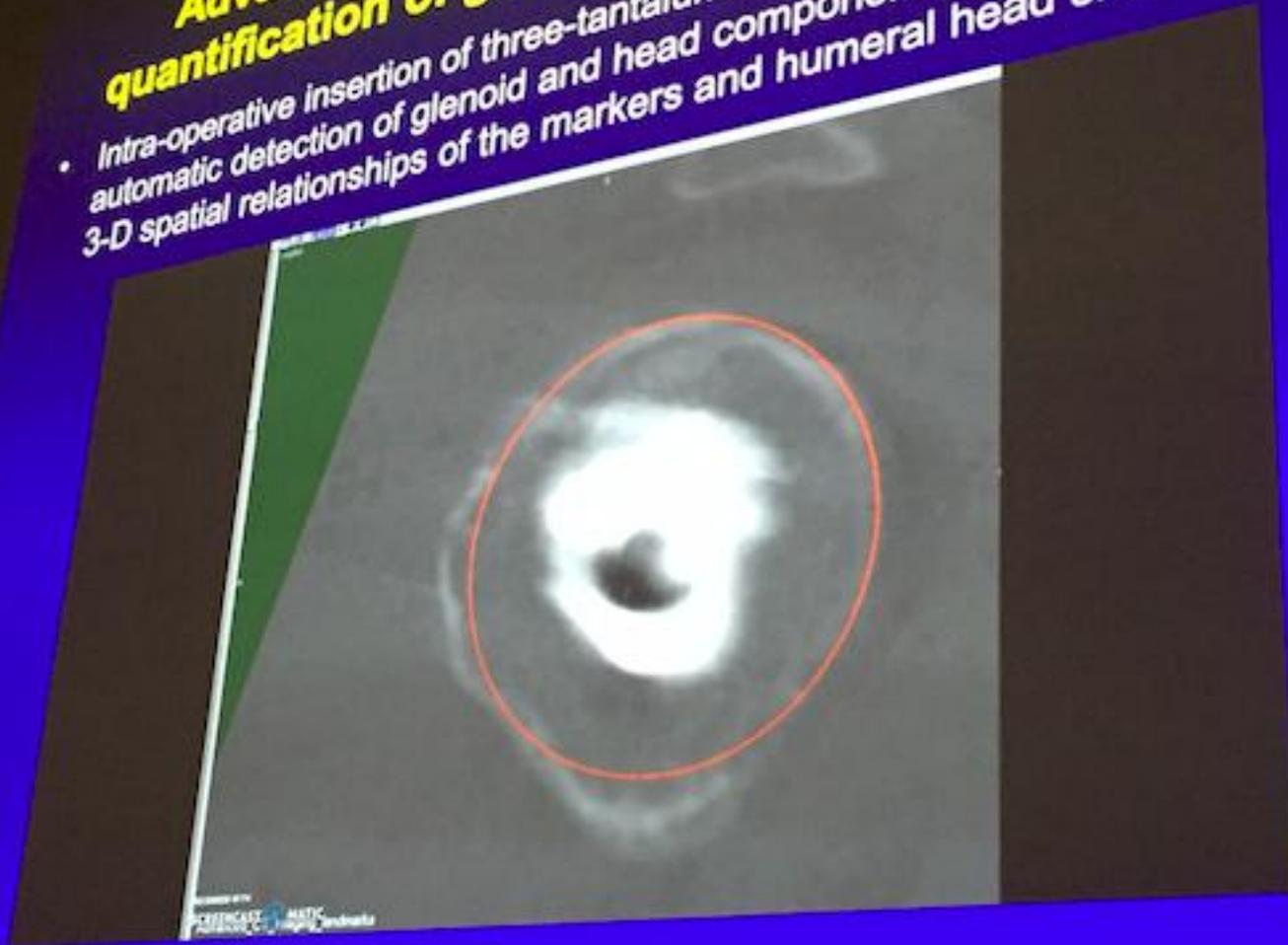
Advanced 3D clinical CT imaging allows quantification of glenoid component migration

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Advanced 3D clinical CT imaging allows quantification of glenoid component migration

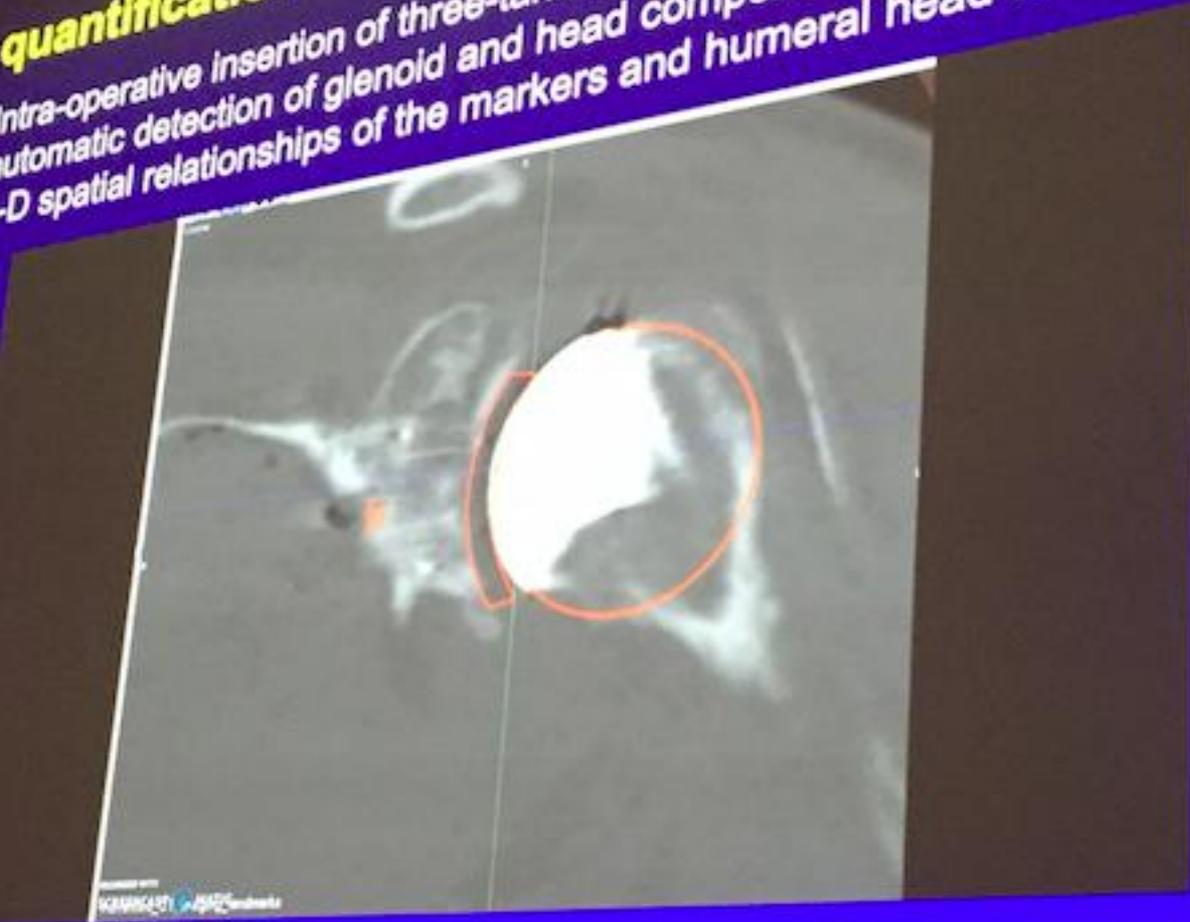
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Advanced 3D clinical CT imaging allows quantification of glenoid component migration

- Intra-operative insertion of three-tantalum bead markers allows automatic detection of glenoid and head component position based on 3-D spatial relationships of the markers and humeral head size



Case Example: What you are missing on x-rays

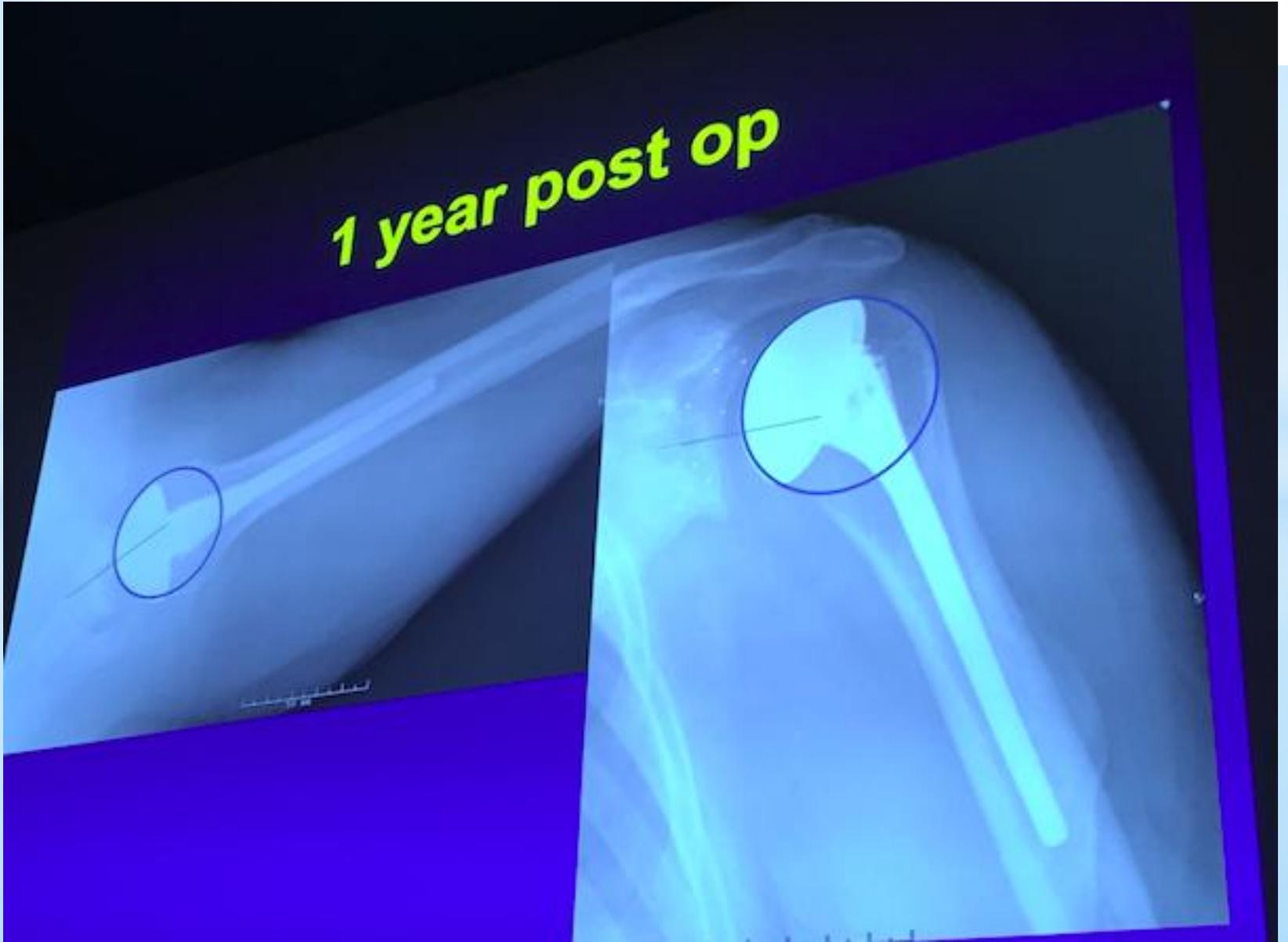


1 month post op





1 year post op





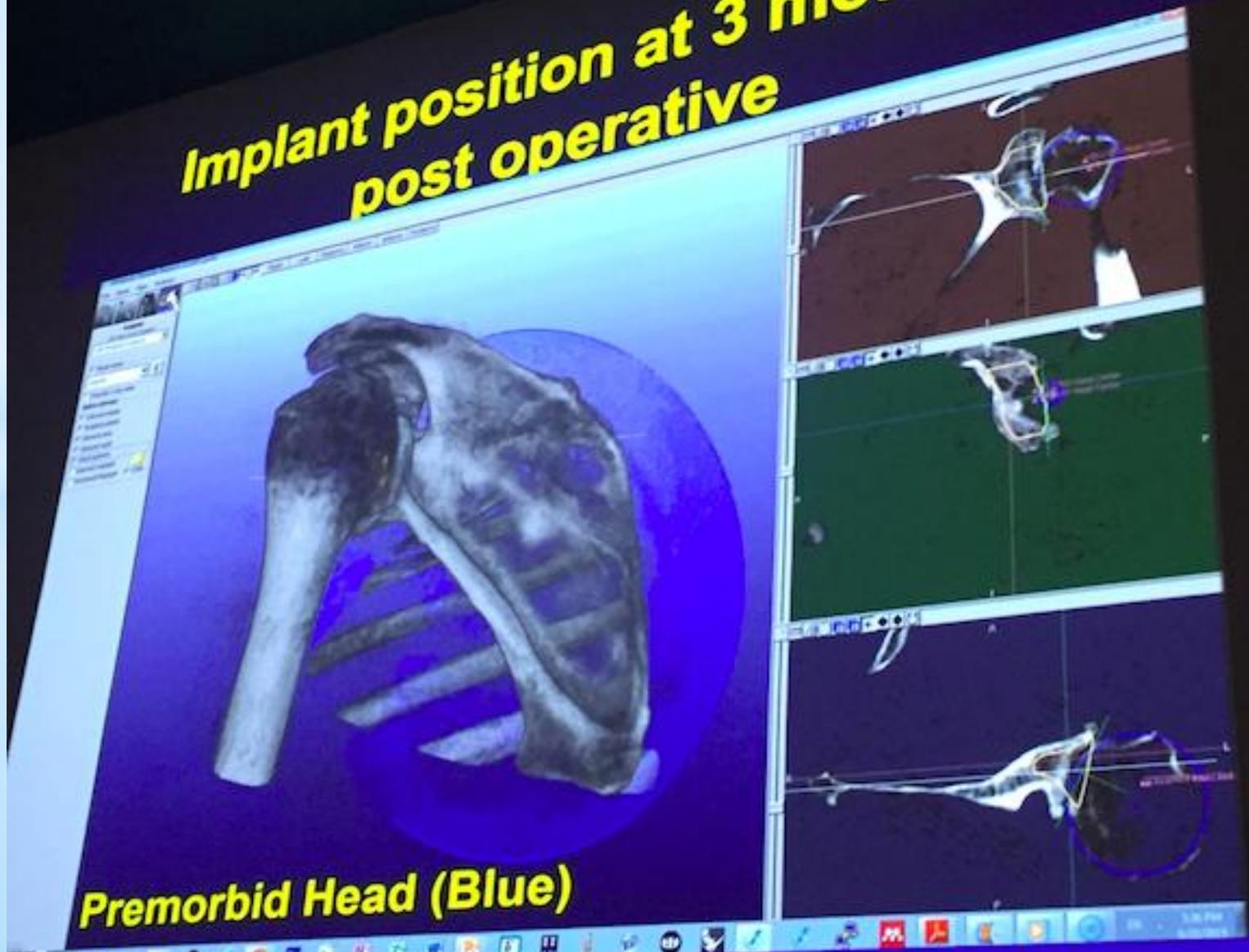
2 year post op



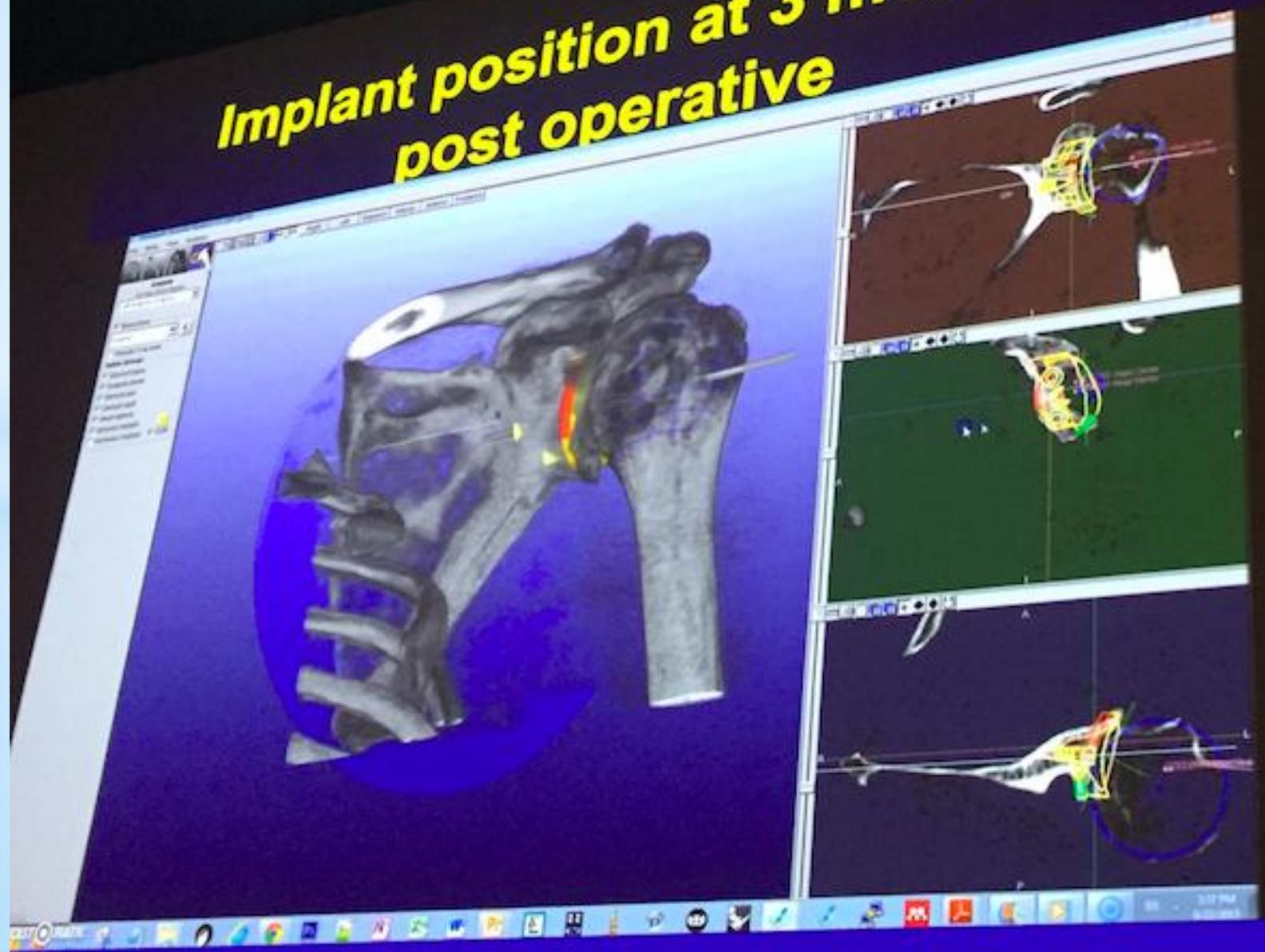
- Shoulder score = 100/100 points

Implant position at 3 months post operative

Premorbid Head (Blue)

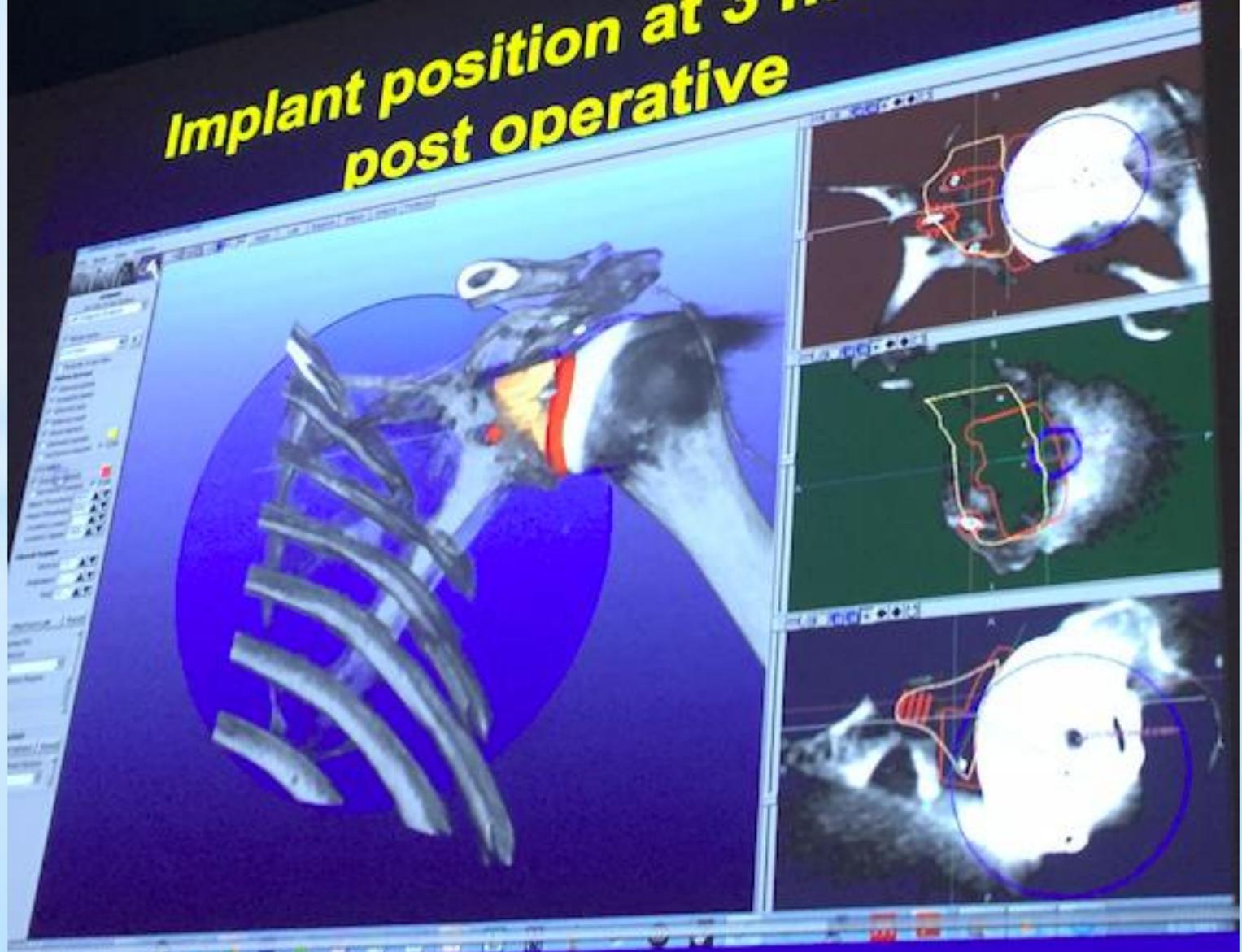


Implant position at 3 months post operative

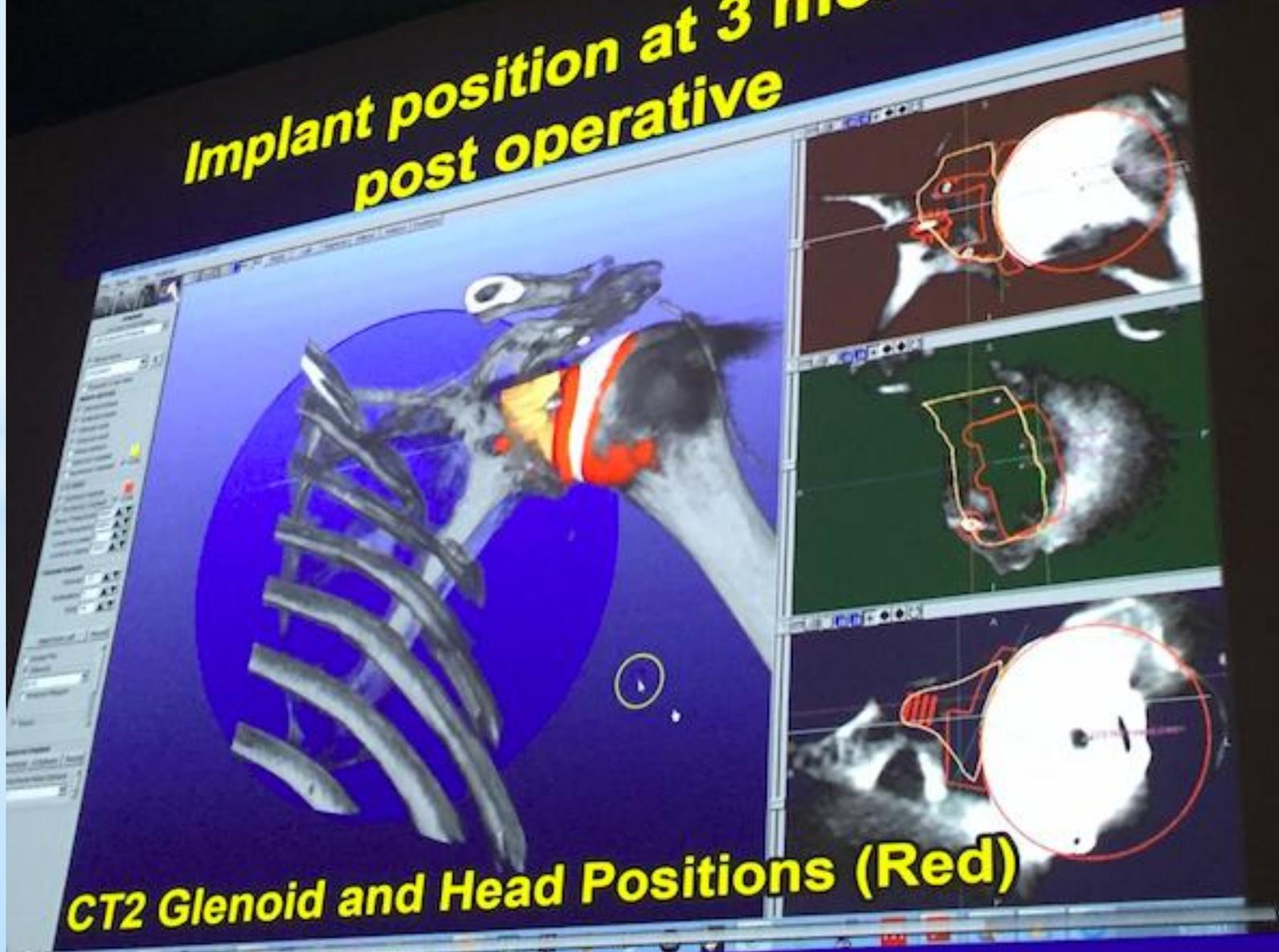




Implant position at 3 months post operative



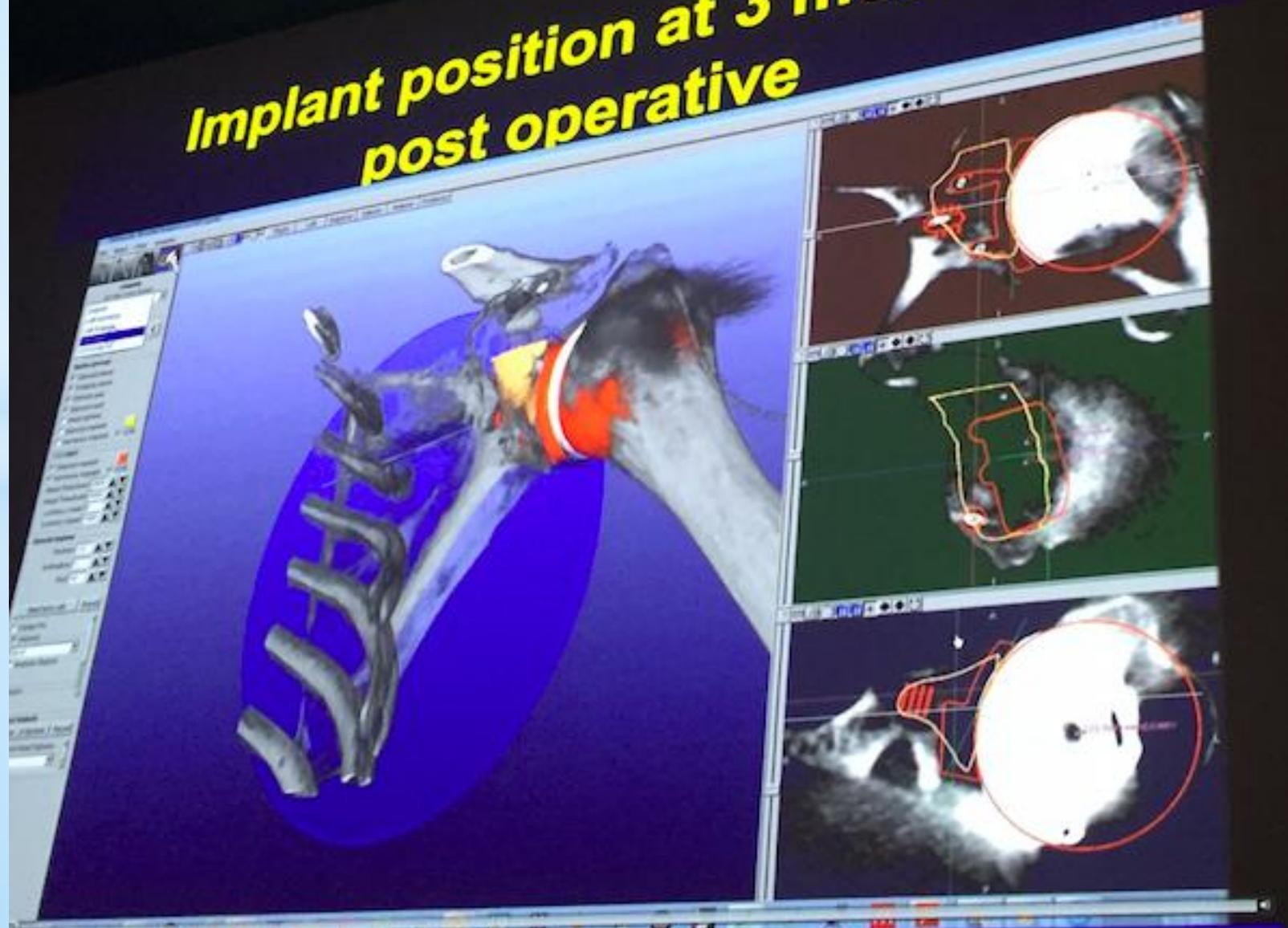
Implant position at 3 months post operative



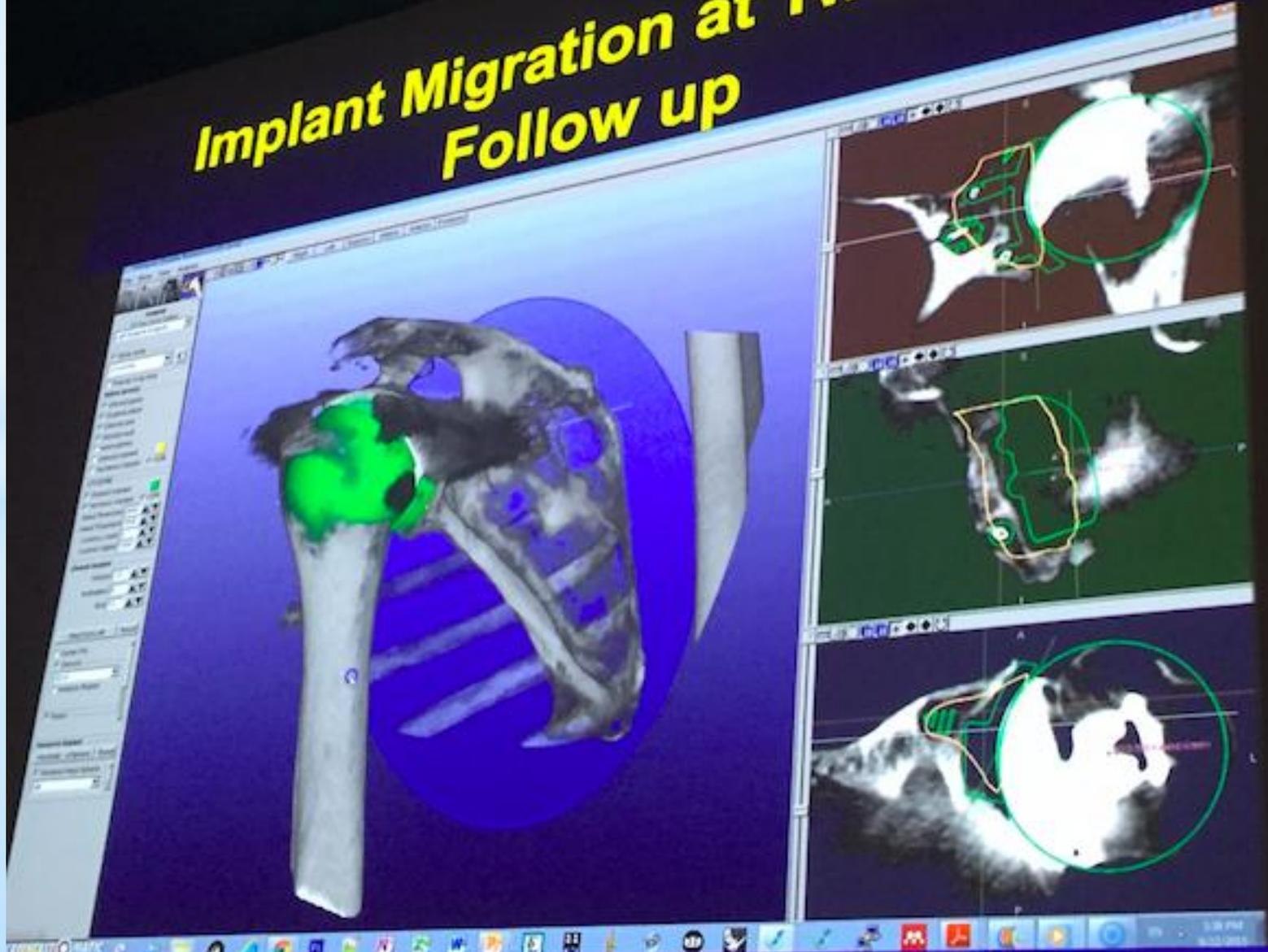
CT2 Glenoid and Head Positions (Red)



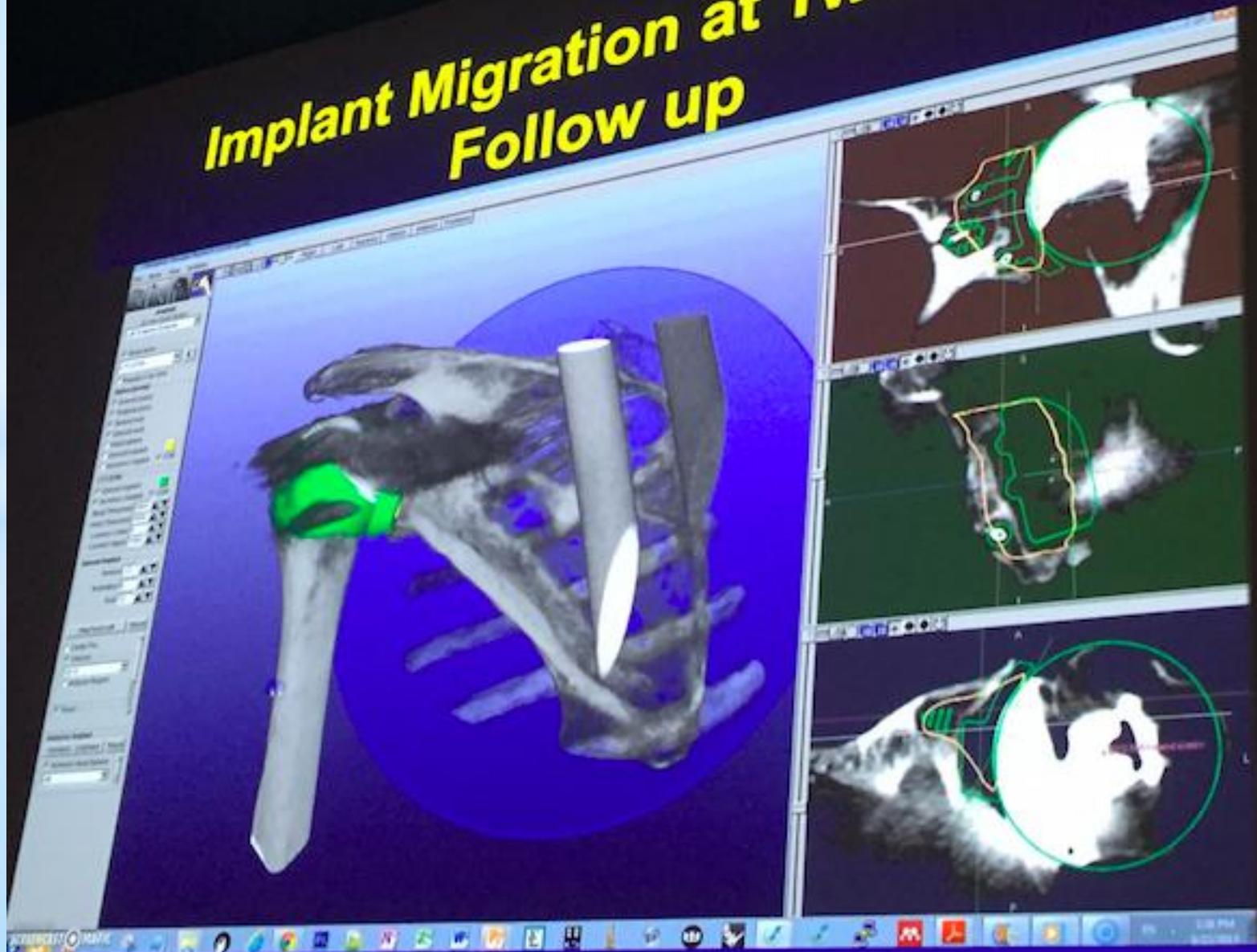
Implant position at 3 months post operative



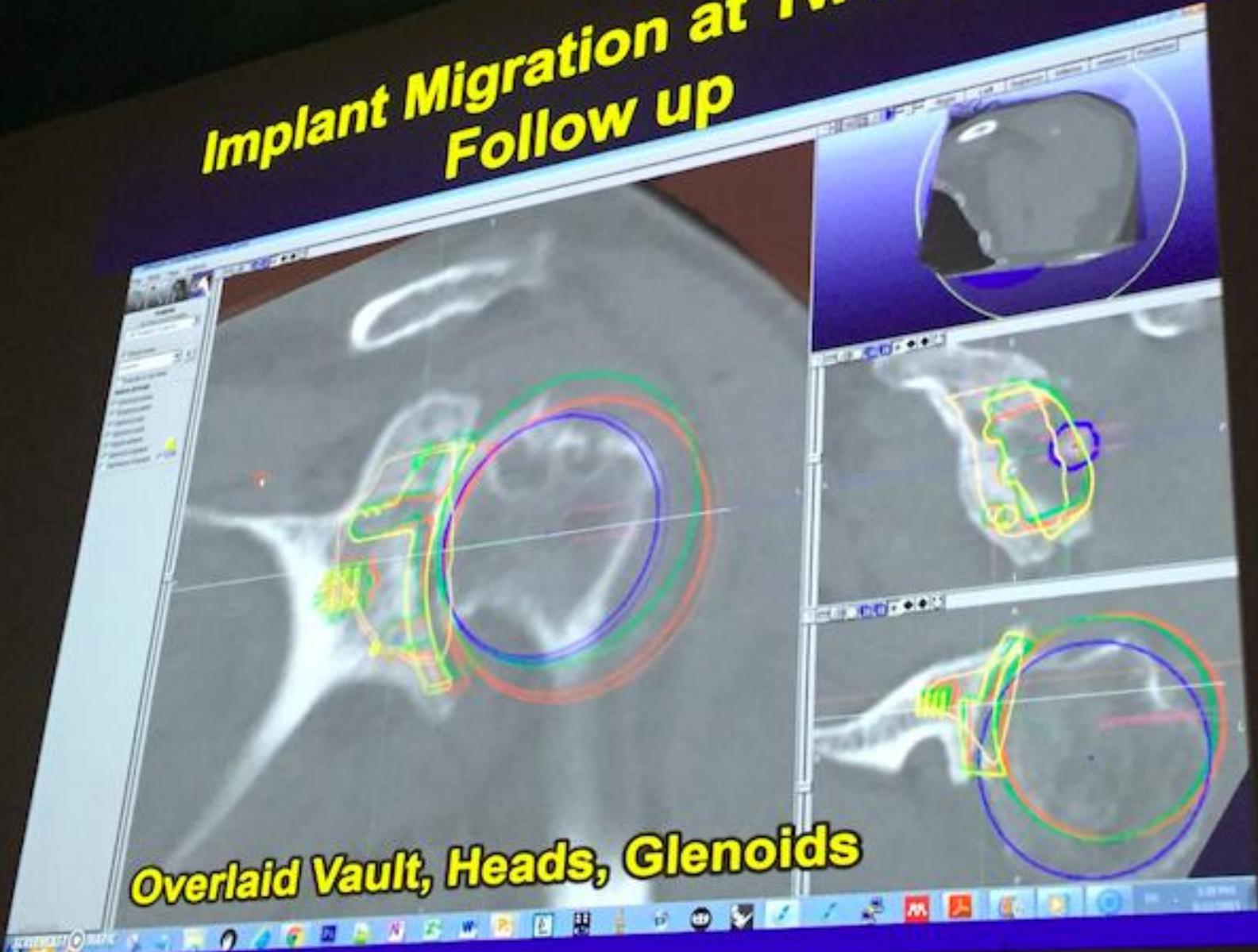
Implant Migration at Two Year Follow up



Implant Migration at Two Year Follow up



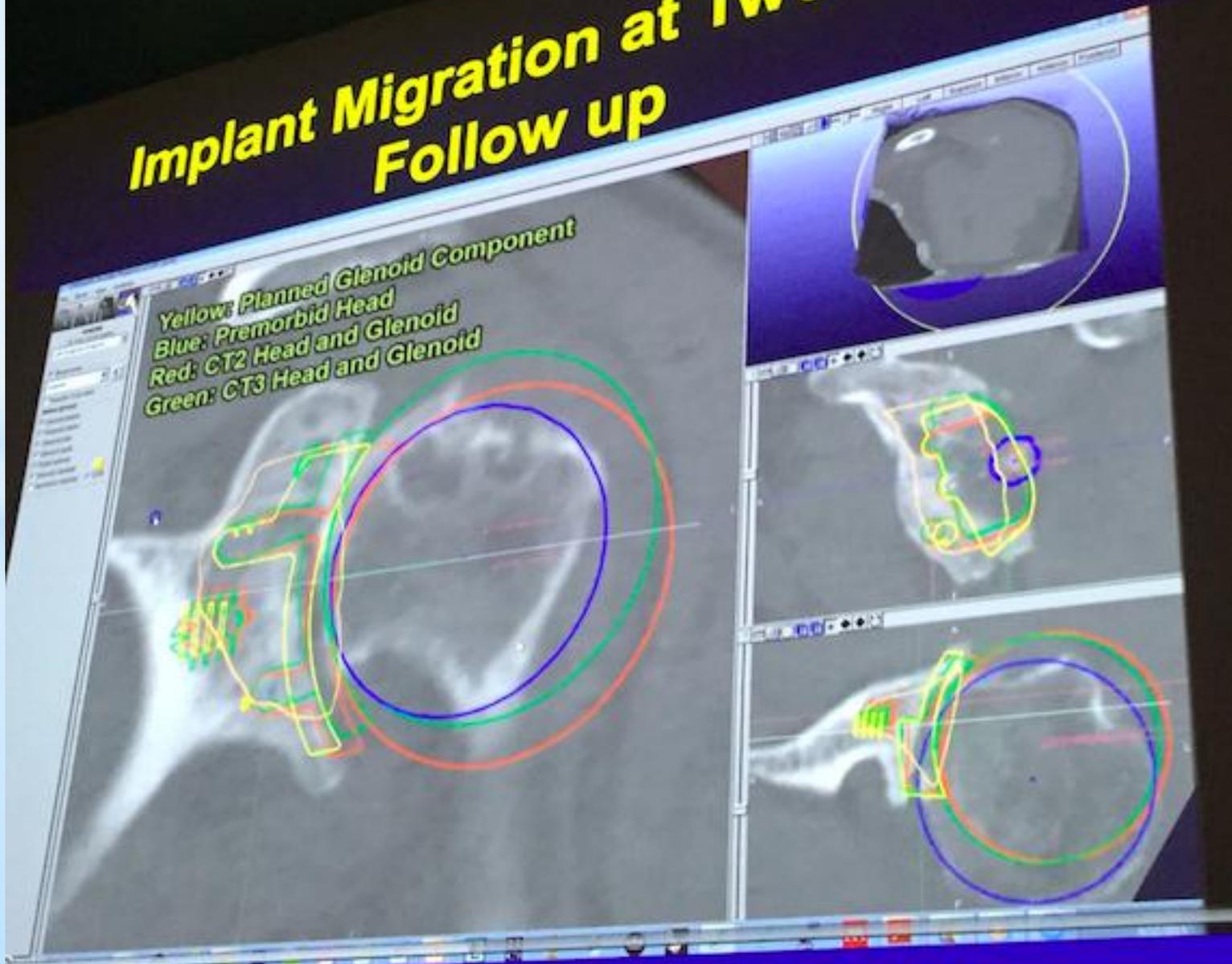
Implant Migration at Two Year Follow up



Overlaid Vault, Heads, Glenoids

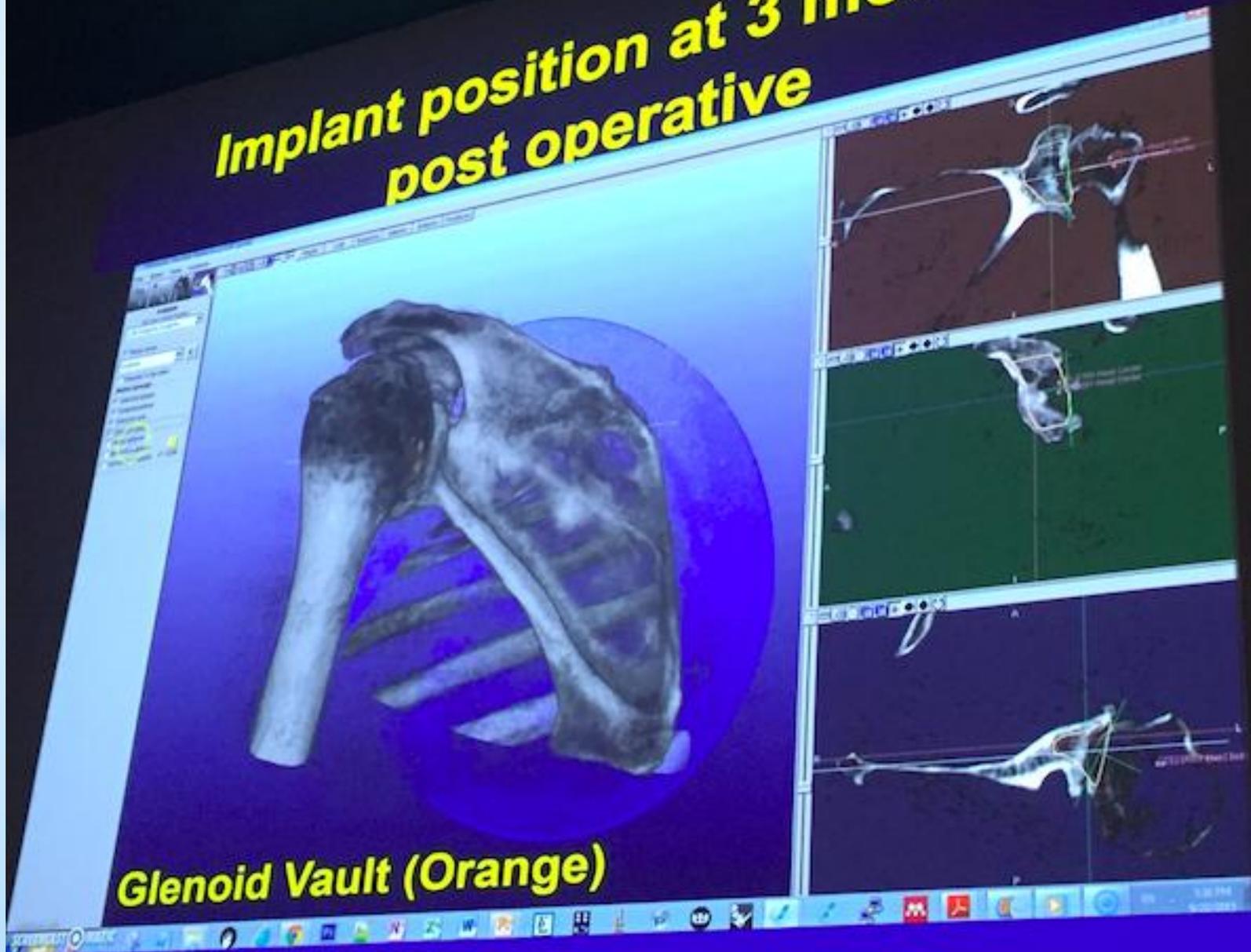


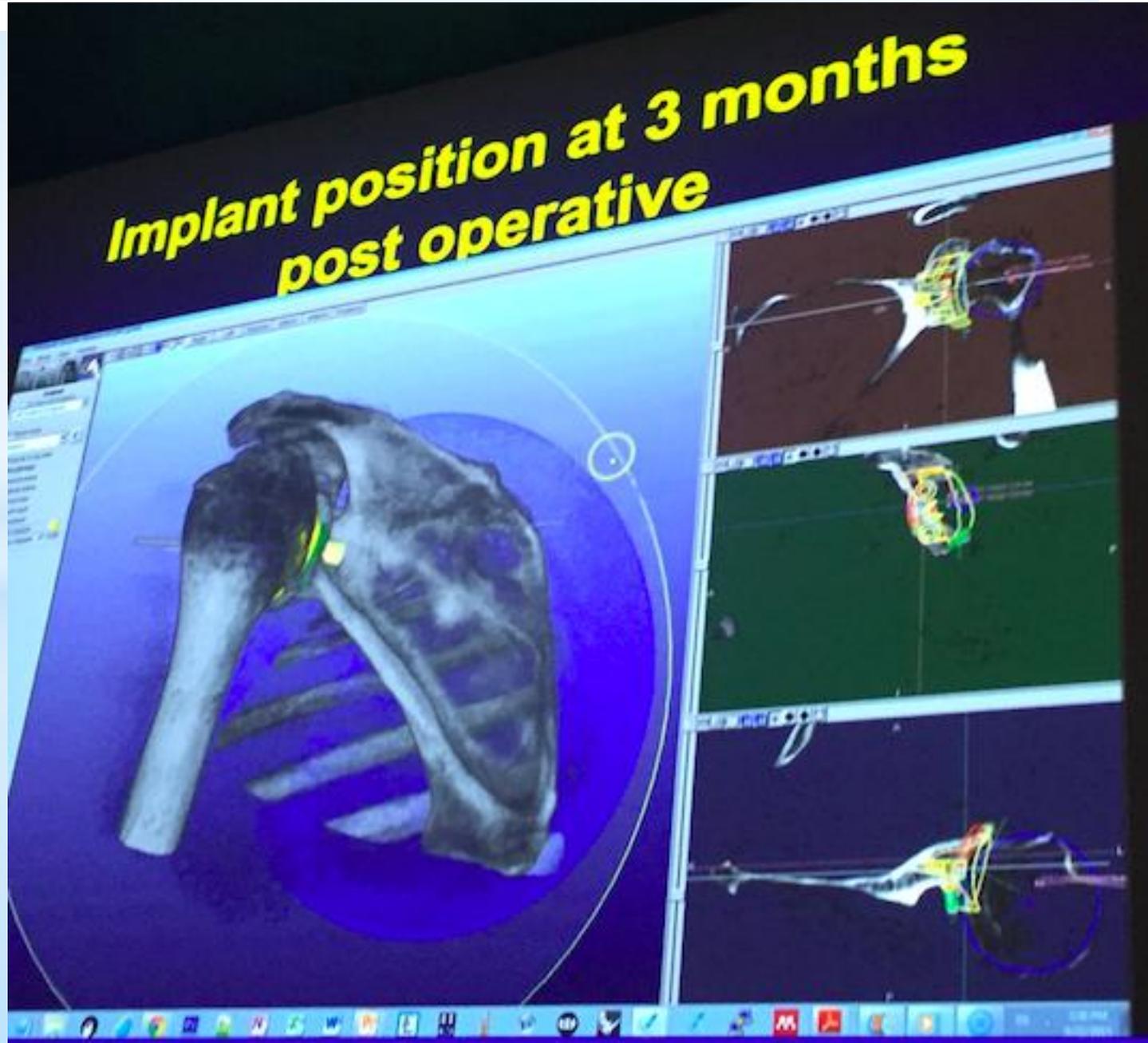
Implant Migration at Two Year Follow up



Implant position at 3 months post operative

Glenoid Vault (Orange)

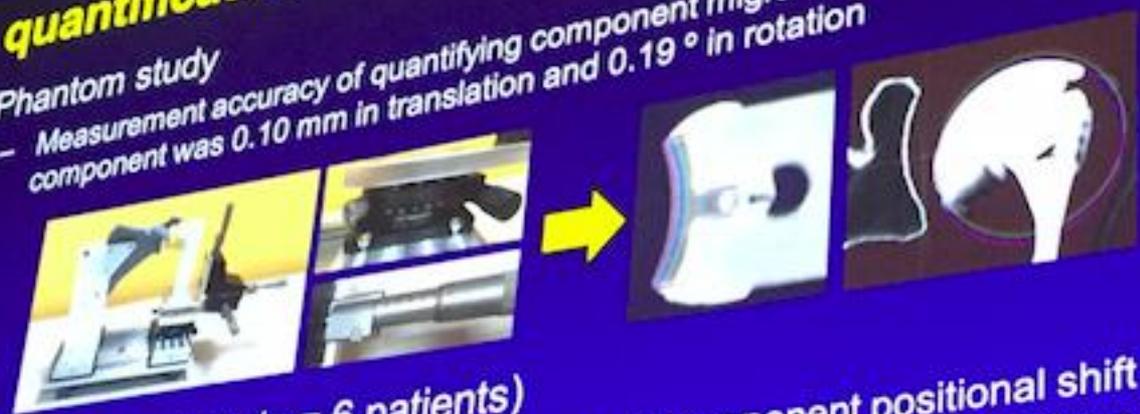






Advanced 3D clinical CT imaging allows quantification of glenoid component migration

- Phantom study
 - Measurement accuracy of quantifying component migration of glenoid and head component was 0.10 mm in translation and 0.19° in rotation



In vivo patient study (n = 6 patients)

- In vivo measurement errors in measuring glenoid component positional shift using advanced CT imaging analysis were 0.3mm, 0.4mm, 0.2mm for translations and 0.4°, 0.5°, 0.6° for rotations, compared to radiostereometric analysis (RSA) method



Before Post-image Processing



After Post-image Processing



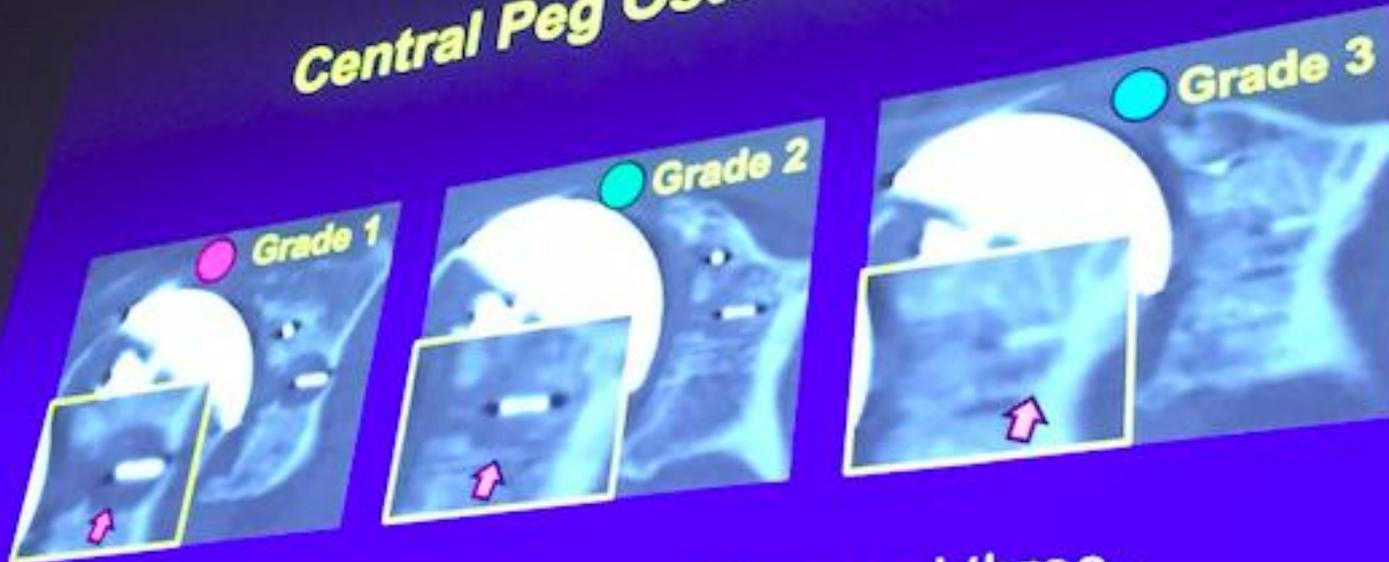
A Preliminary Study of Advanced 3D CT Imaging Analysis in a Cohort of Patients

- A total of 64 patients who underwent an anatomic total shoulder arthroplasty between 2013 and 2015
 - Gender
 - Male: 44
 - Female: 20
 - Age
 - 64 ± 8 years old
- Advanced 3-D CT imaging analysis was performed using sequential clinical CT scans @ pre-, post-op, & min 2yr
 - Implant migration was analyzed for rotations in superior/inferior and anterior/posterior directions
 - Central peg osteolysis grade (1, 2, and 3) was assessed using the minimum 2 year follow up CT scan

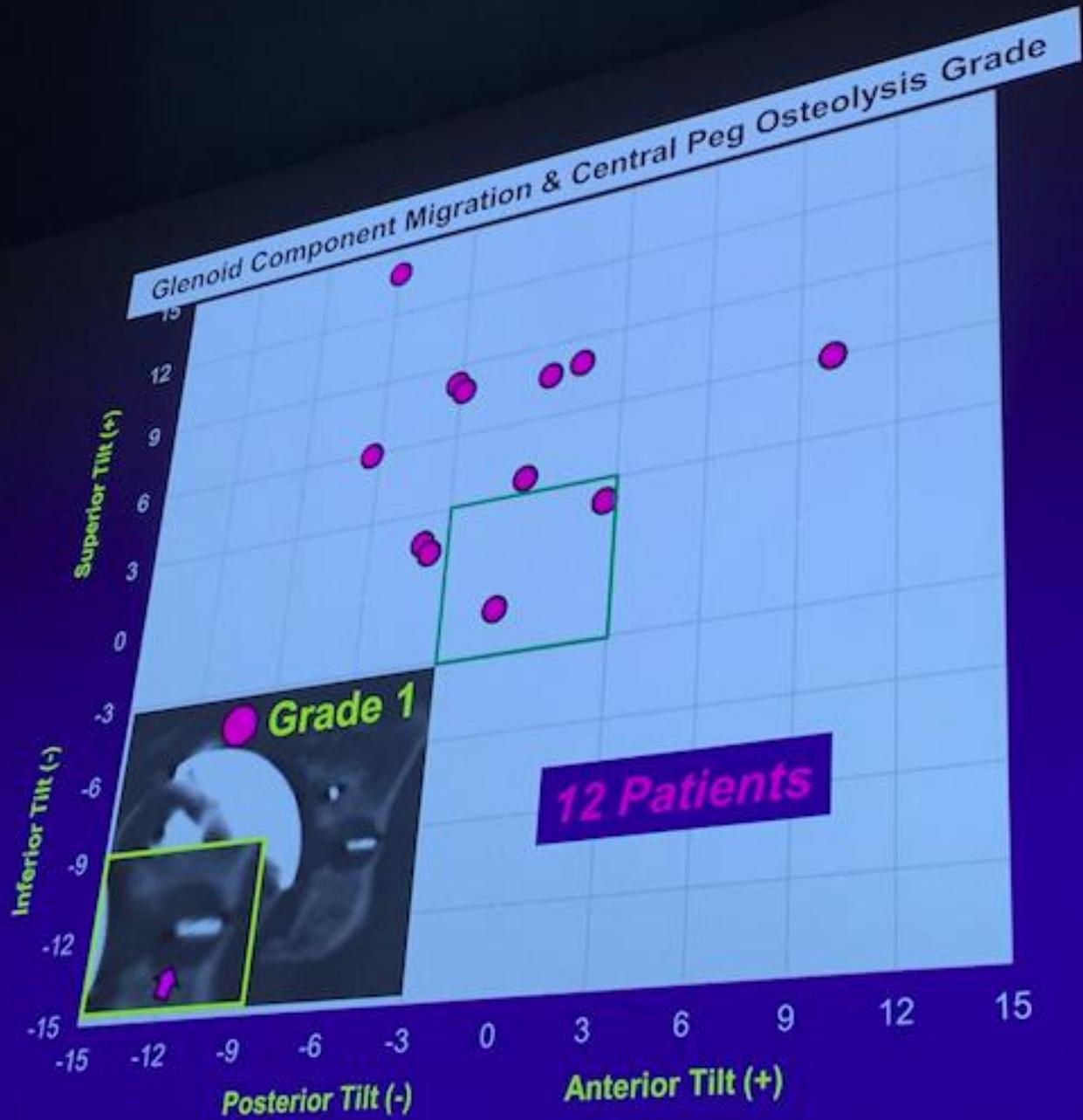


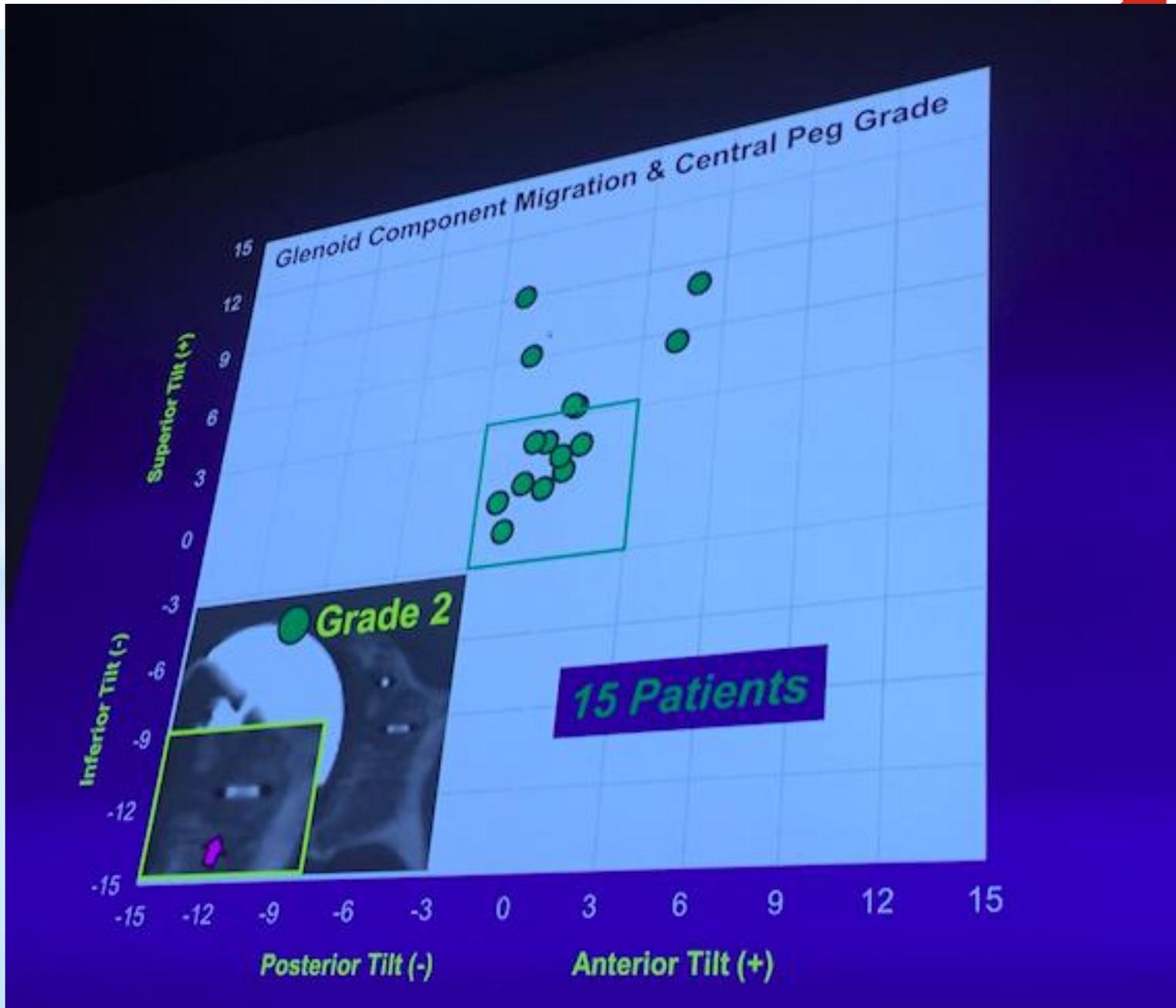


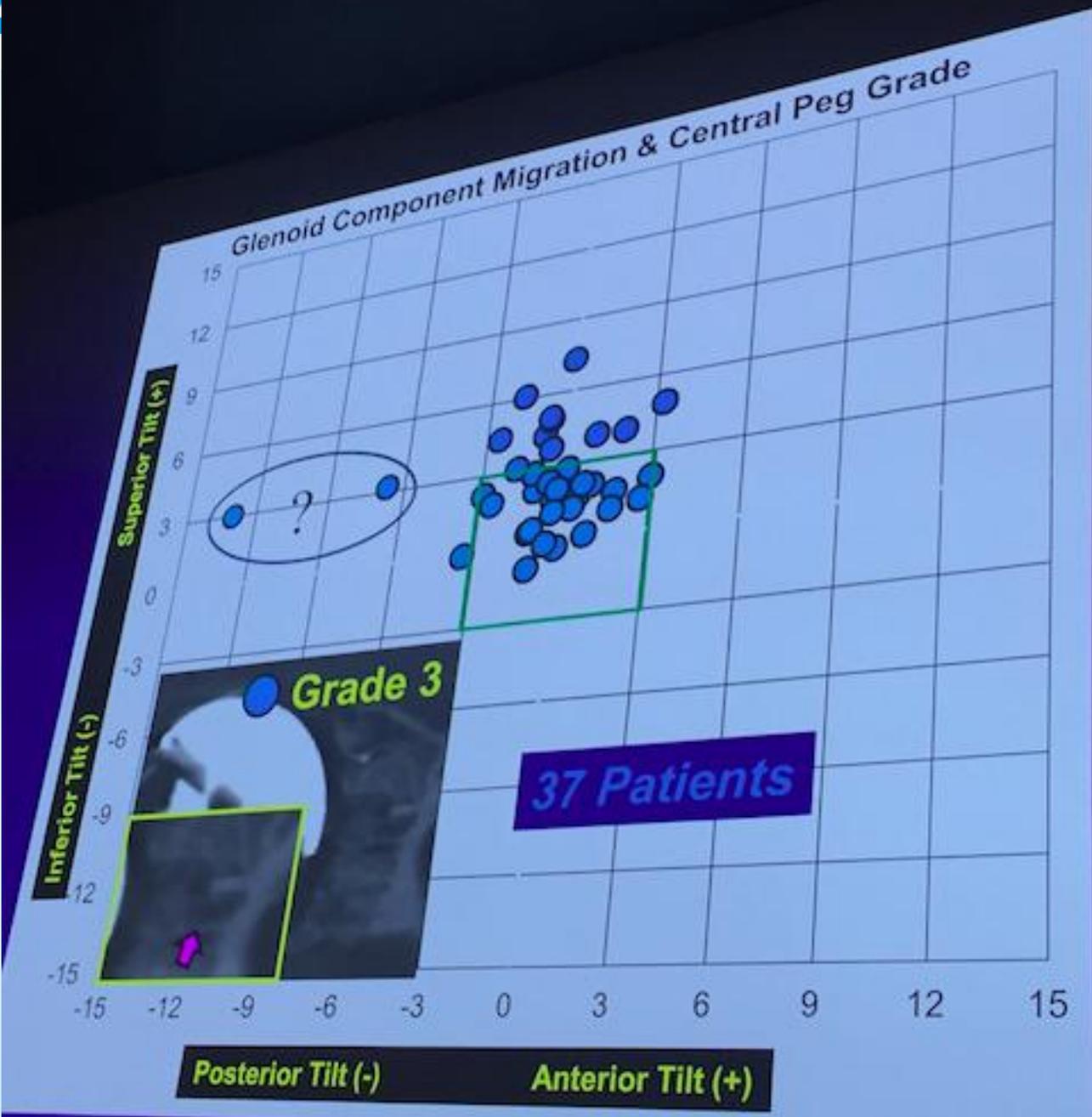
Central Peg Osteolysis Grade



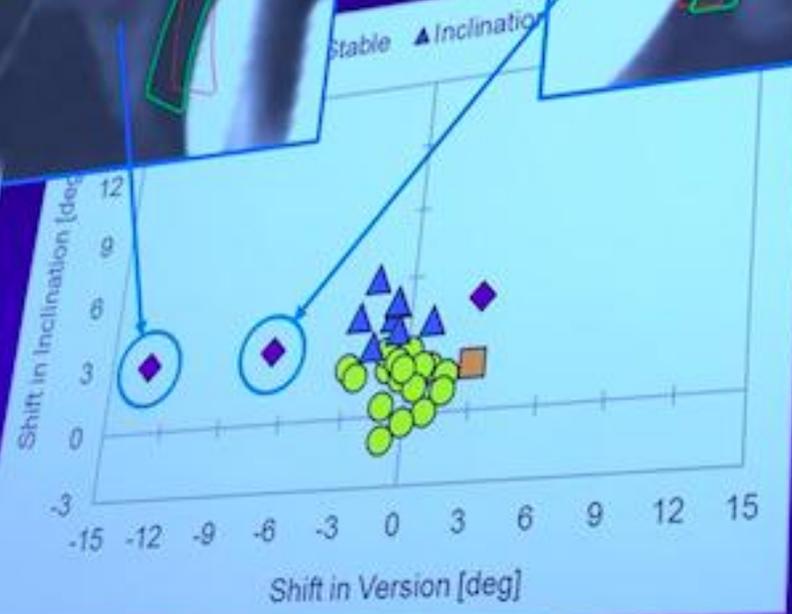
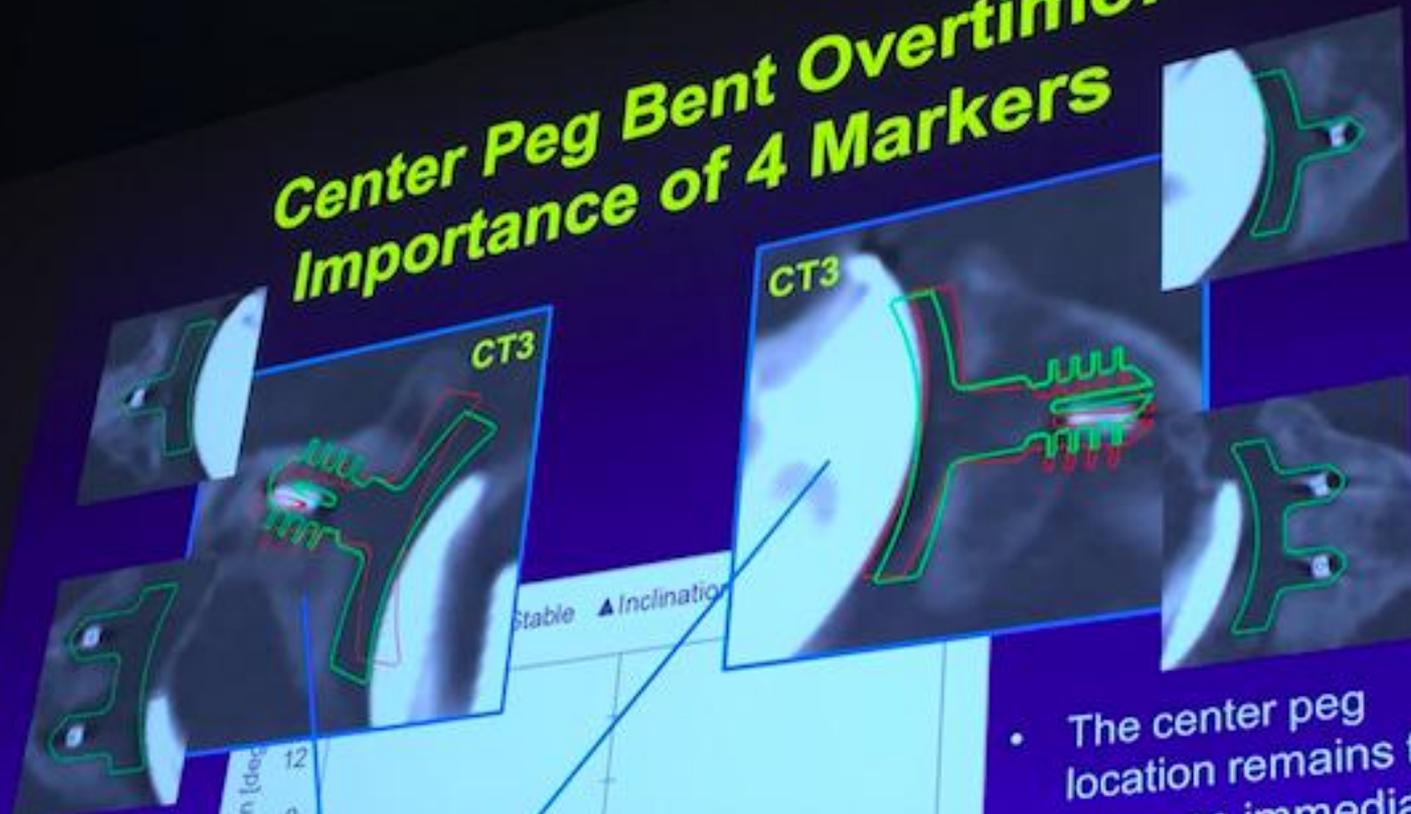
Central peg osteolysis grade was assessed three-dimensionally through anterior-posterior and superior-inferior view





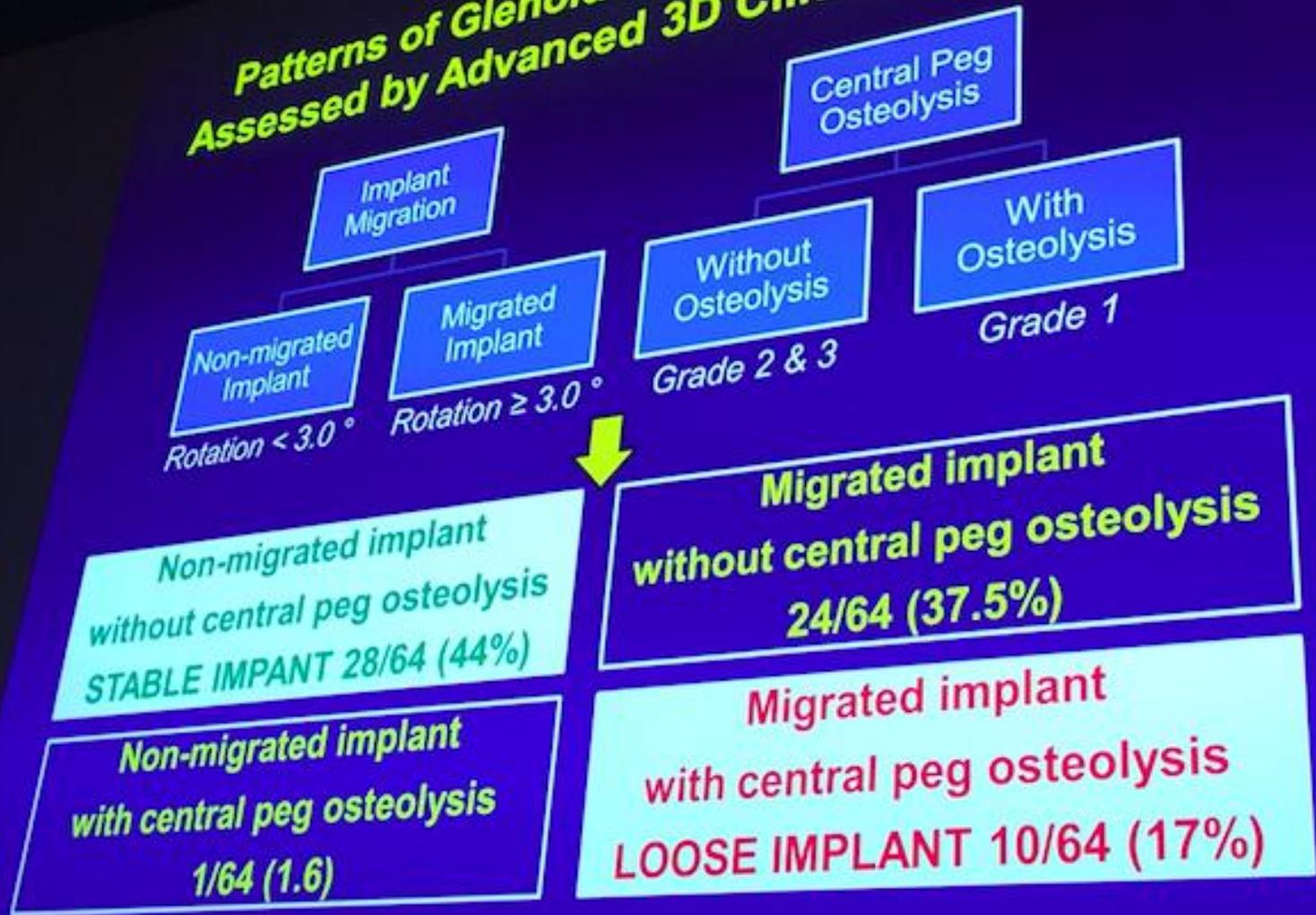


Center Peg Bent Overtime: Importance of 4 Markers



- The center peg location remains the same as immediate post-op (CT2: red)
- Other three-peg beads of follow-up (CT3: green) indicate implant shift in version

Patterns of Glenoid Component Loosening Assessed by Advanced 3D Clinical CT Imaging





Summary of Advanced 3D CT Imaging Analysis in a Cohort of Patients

- Patterns of implant migration more than 3°
 - Superior tilt (27 pts) was the major direction of the implant migration, followed by posterior (8 pts) and anterior tilt (5pts)
 - No inferior tilt was found
- Patterns of central peg osteolysis
 - Grade 1 found in 12/64 patients (19%)
 - Grade 2 found in 15/64 patients
 - Grade 3 found in 37/64 patients
- Relations between implant migration and osteolysis
 - 11/12 patients with central peg osteolysis grade 1 had shown implant migration more than 3°
 - 24/64 Implants with migration (34%) more than 3° was not always associated with central peg osteolysis



Conclusions

- We have developed a 3D CT based imaging method that has a detection accuracy for glenoid implant shift, validated in vivo patients, to be < 1 degree of translational or < 1 degree of rotational movement when compared to RSA measurements.*



Conclusions

- In a series of 64 patients using this CT based method, at two years follow up, we demonstrated that 34/64 (53%) patients have at least 3 degrees of shift
- In patients with shift there are patients with and without radiolucency around the pegs. 70% with shift have no radiolucency
- Shift \neq Loosening



Conclusions

- At this time we have not defined the progression of these imaging findings over time. At this length of follow these finding are not correlated with a significant decrease in PRO or revision surgery.
- It is our current working hypothesis that those implants with greater than 3 degrees of shift AND radiolucency are at risk for progression and earlier clinical failure defined by a decrease in PRO and the need for revision surgery.



Conclusions

- *Our study demonstrates the novel finding of glenoid implant shift without radiolucency which we currently interpret to be a stable implant. The fate of these implants are not know but we anticipate that progression of implant shift may not be as likely or will result in earlier clinical failure.*



Conclusions

- *When assessing shift of a glenoid implant it is important to assess the implant bone interface to assess if the shift is associated with resorption of bone around the implant as an additional feature of an implant at risk for clinically relevant loosening.*



Future Studies

- Additional 110 patients due for 2 year 3D CT scans by June 2018.
- Correlation with:
 - Pre op Walch type and humeral head subluxation
 - Correction of retroversion and inclination, joint line medialization
 - Back side contact and
 - Humeral head position
 - Trabecular bone patterns and bone quality
- Correlation with x-rays findings
- Longer term follow up 5-10 years



**3D preoperative planning and patient
specific instrumentation improve glenoid
component positioning**

**Joseph Iannotti; Kyle Walker; Eric Rodriguez; Tom
Patterson; Bong Jae; Eric Ricchetti**

Cleveland Clinic Department of Orthopaedic Surgery





Conflict of Interest

- **DePuy – Synthes Royalty**
- **DJO Royalties and consultation**
- **Wright - Tornier- Royalties**
- **Lippincott Williams and Wilkins:
Royalties**
- **Custom Orthopaedic Solutions: Equity**
- **COS relevant to this presentation**



The Problem:

We are dealing with widely variable

- **Patient Pathology: 3D deformity making surgical orientation difficult**
 - Ability to translate a pre operative plan in the OR
- **Skill of the surgeon**
- **How do we get a reproducible and accurate method of preparing the glenoid bone to place the glenoid component in the desired position?**



Our Questions

- *Will 3D CT based imaging and PSI improve the precision of glenoid component placement?*
- *Is one type of PSI more accurate than another?*

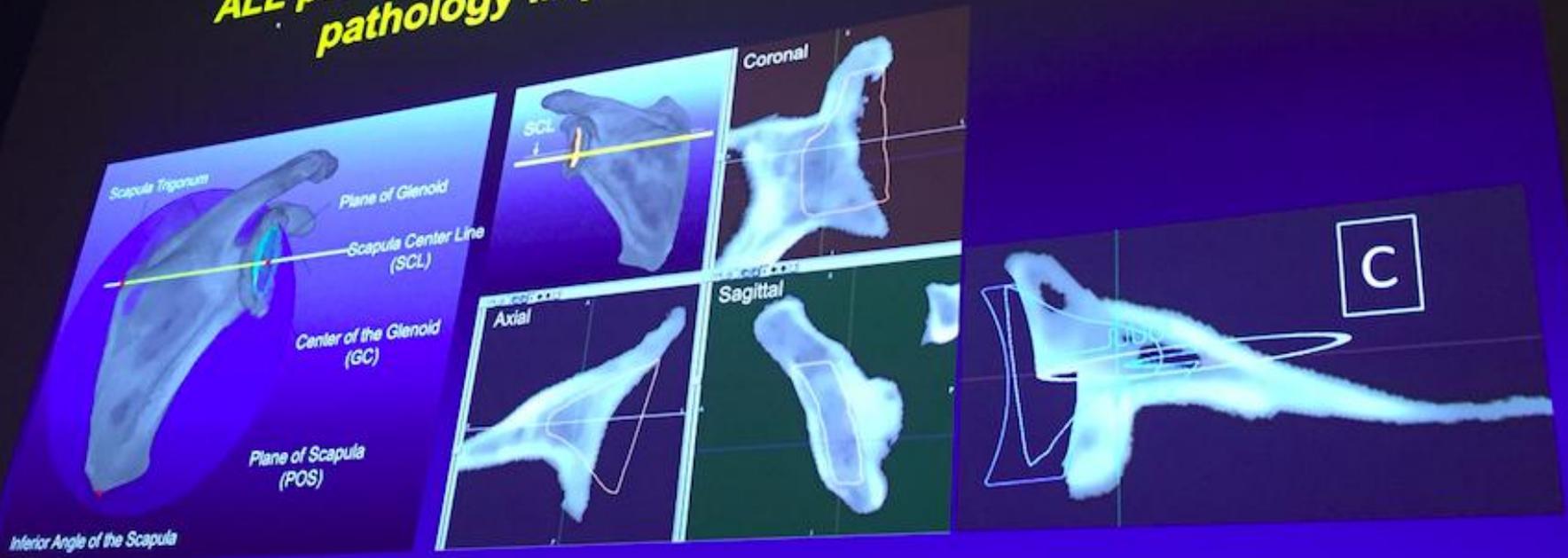


Study Design

- **Single Center, 157 patients with primary OA randomized into five groups of PSI**
- **Anatomic TSA in Primary OA Same surgical procedure and same implant**
- **2 very experienced shoulder surgeons**
- **Post op 3D MAR CT all patients registration of the scapula with pre op 3D plan**



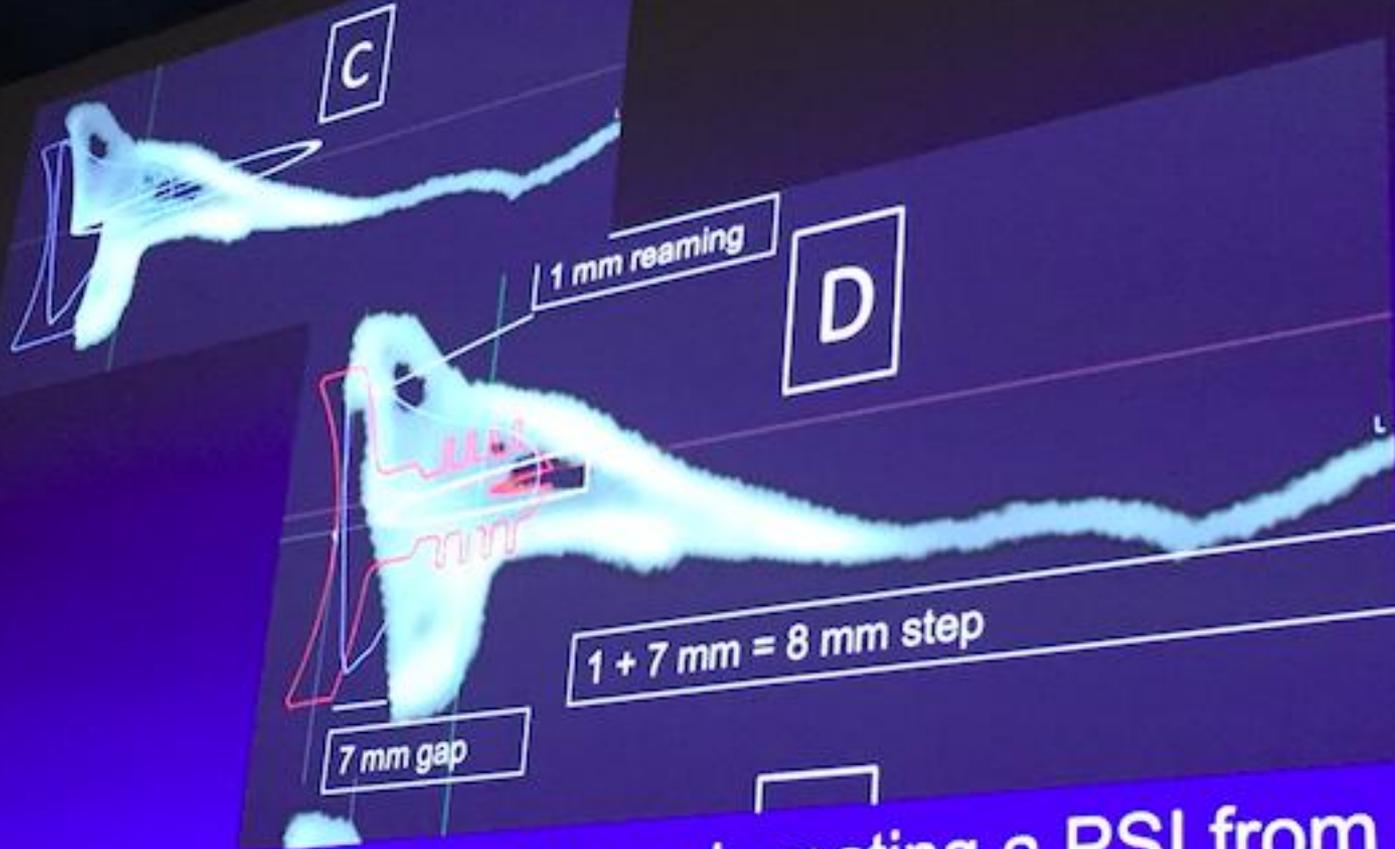
ALL patient recieved 3D CT imaging to define the pathology implant type and position





Five Groups of Instrumentation **All with 3D planning and Implant Templating**

- **3D planning and Standard Instrumentation 62 patients**
(two groups)
- **Single use PSI: 37 patients**
- **Reusable PSI: 58 patients**
 - **Software to a 3D printed surrogate model**
 - **Software to a adjustable and reusable surrogate jig**



Pre-operative planning and creating a PSI from a standard instrumentation system

1. Use of standard instrumentation
"PSI" = the software and the patient
specific use of a standard instrument





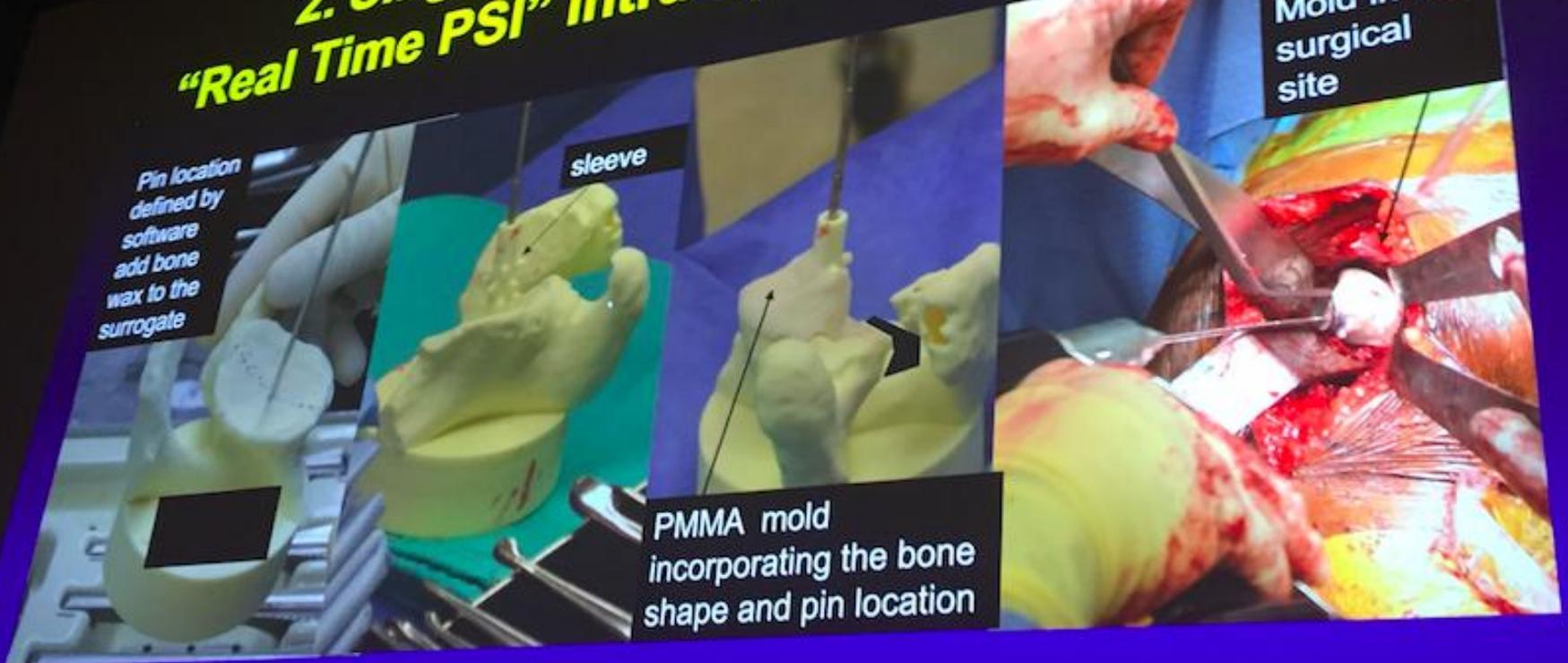
2. Single Use PSI Time of Surgery "Real Time PSI" Intra-operatively fabricated

Pin location defined by software
add bone wax to the surrogate

sleeve

PMMA mold incorporating the bone shape and pin location

PMMA Mold in the surgical site



IRI Plus 3D printed SmartBone



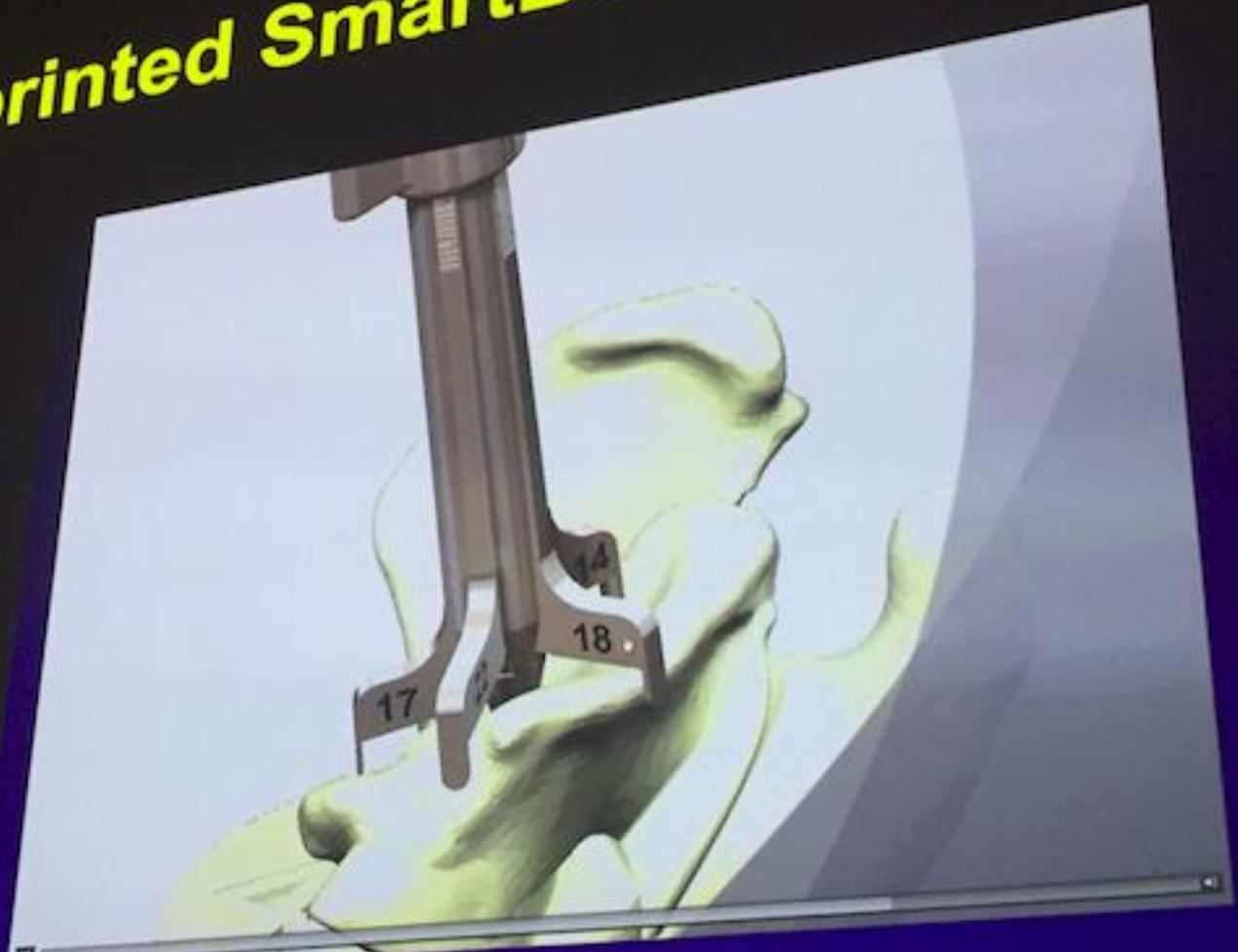


IRI Plus 3D printed SmartBone



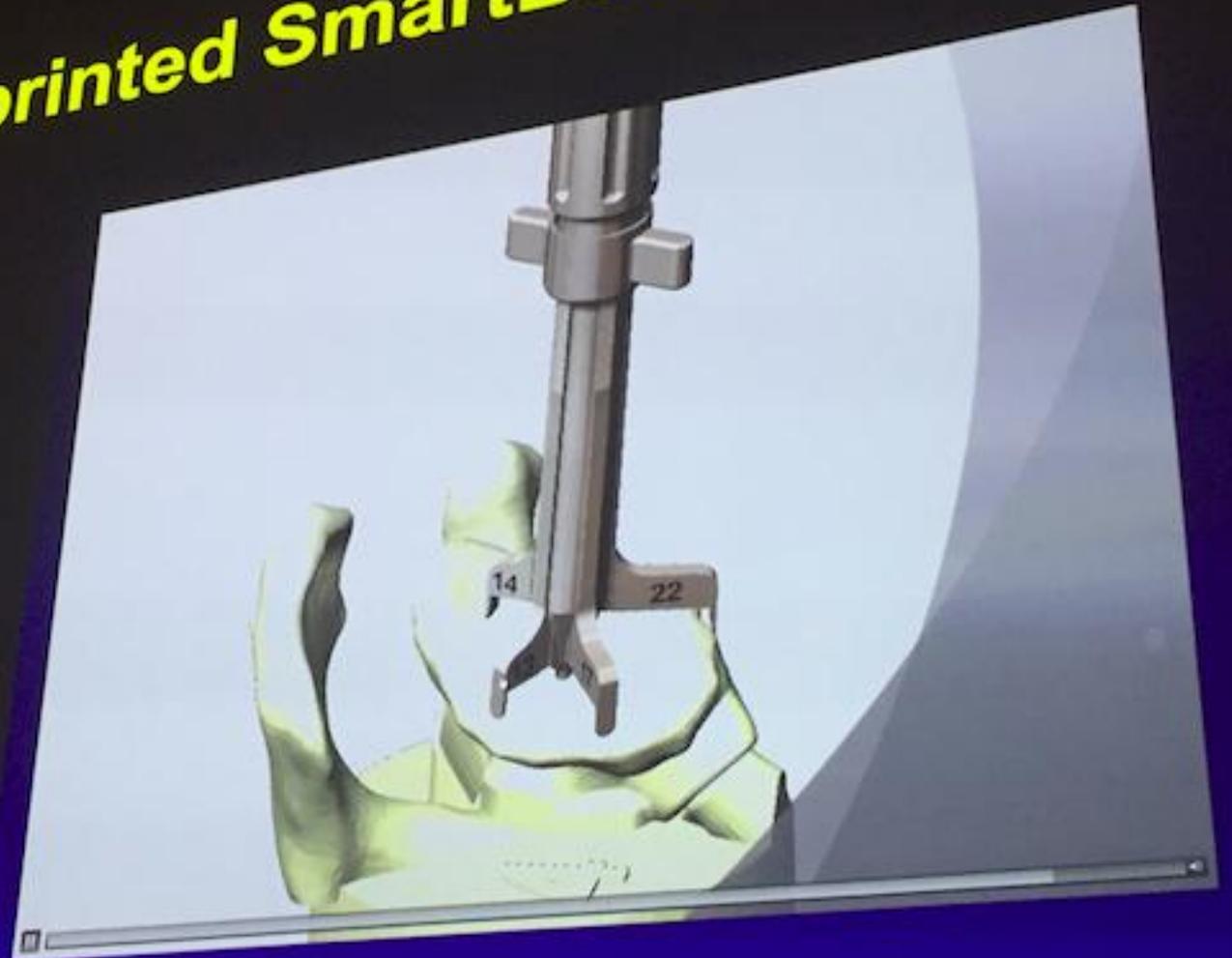


IRI Plus 3D printed SmartBone

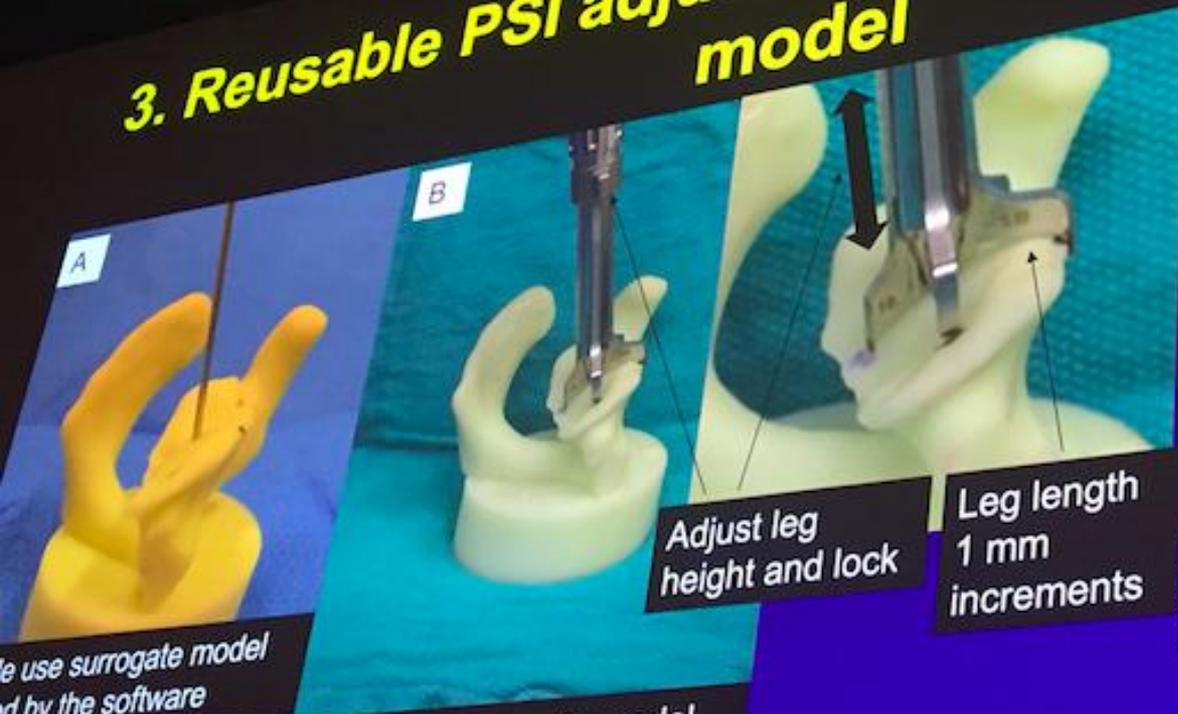




IRI Plus 3D printed SmartBone



3. Reusable PSI adjusted by use of a surrogate model

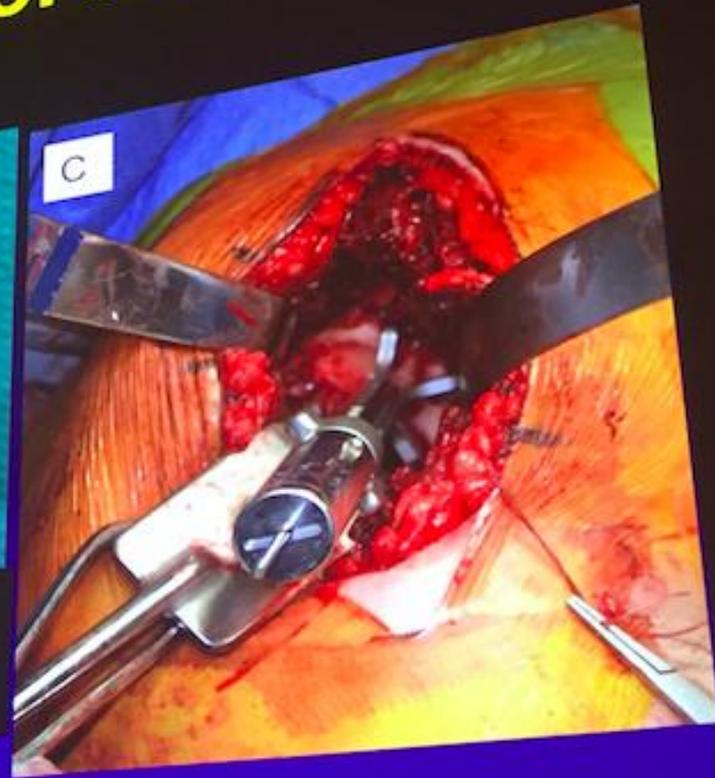


Use surrogate model
defined by the software

Single use surrogate model
adjusting leg length and leg
height

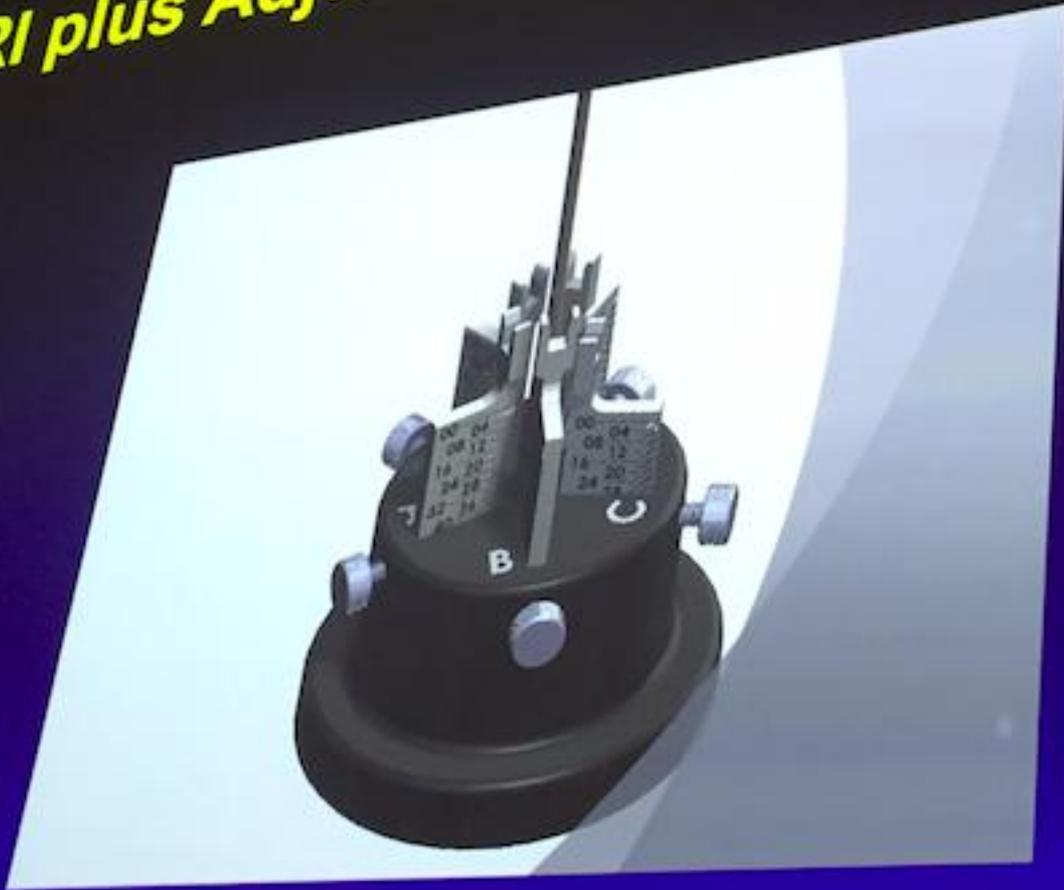
Adjust leg
height and lock

Leg length
1 mm
increments



C

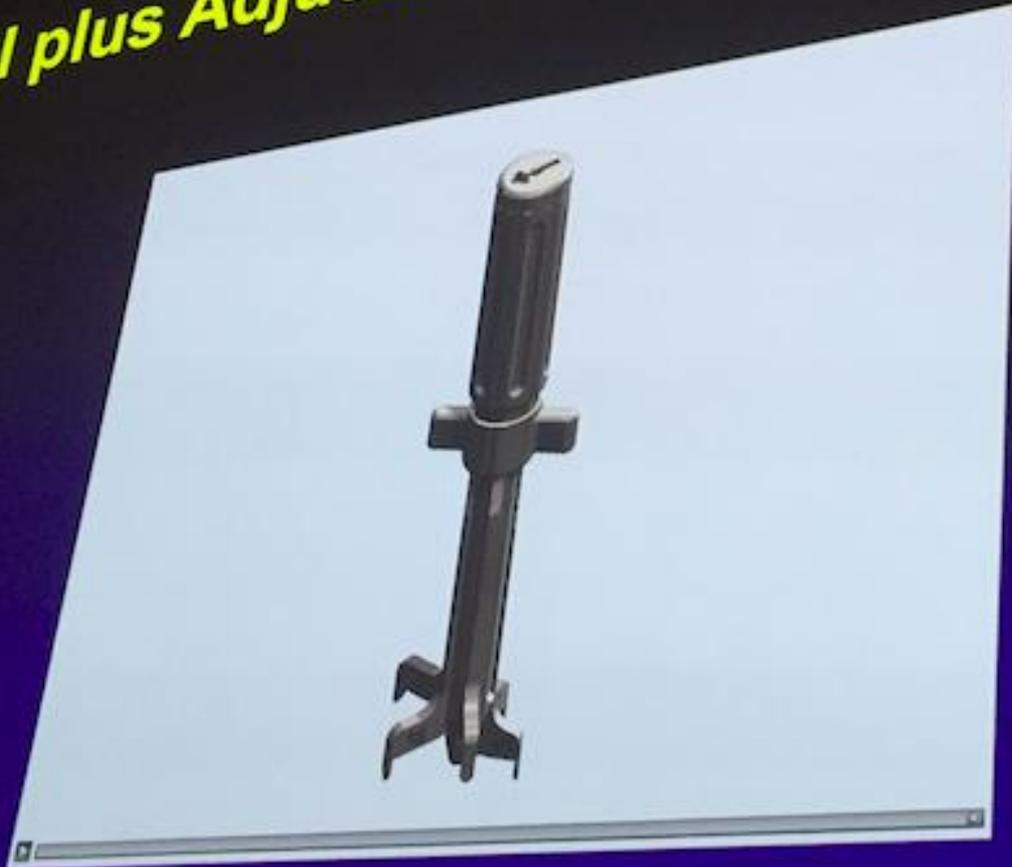
IRI plus Adjustable Base Reusable PSI



IRI plus Adjustable Base Reusable PSI

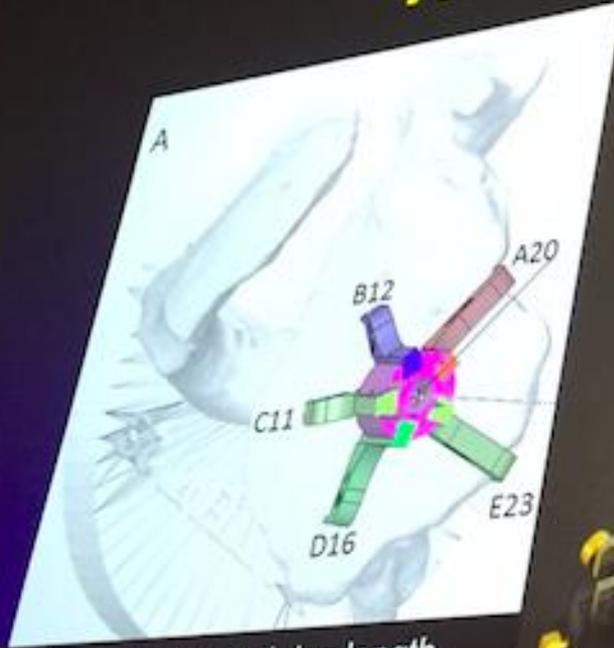


IRI plus Adjustable Base Reusable PSI





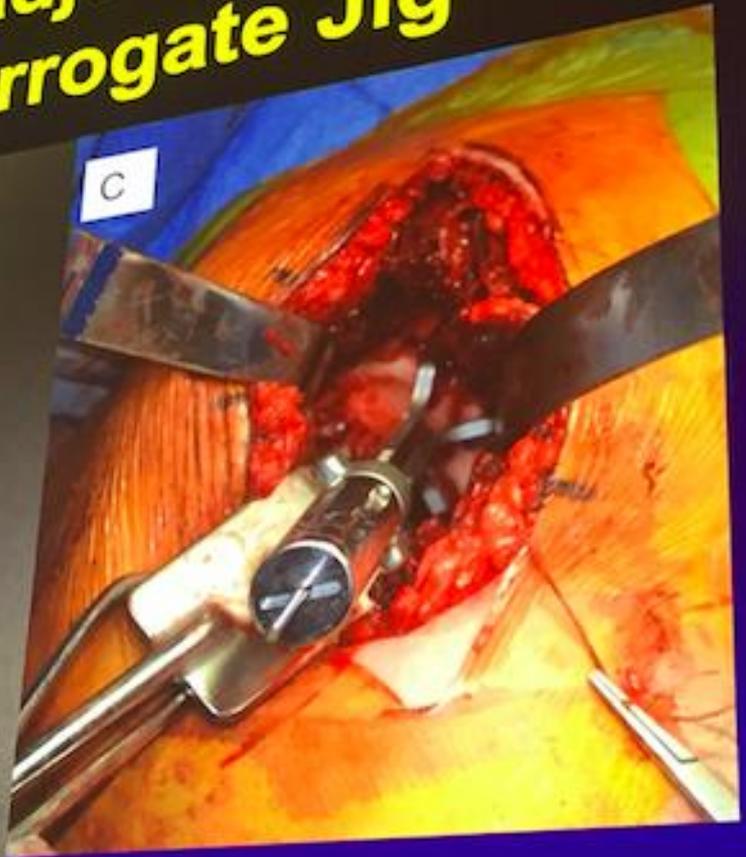
4. Reusable PSI adjusted using a Reusable Surrogate Jig



Software defines both leg length and leg height A-E

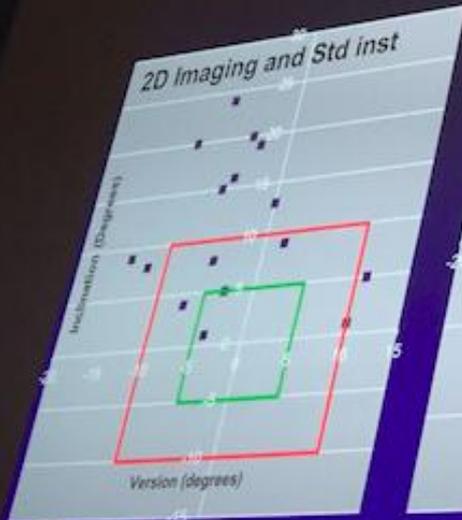


Adjustable base= glenoid
Adjusting the leg height

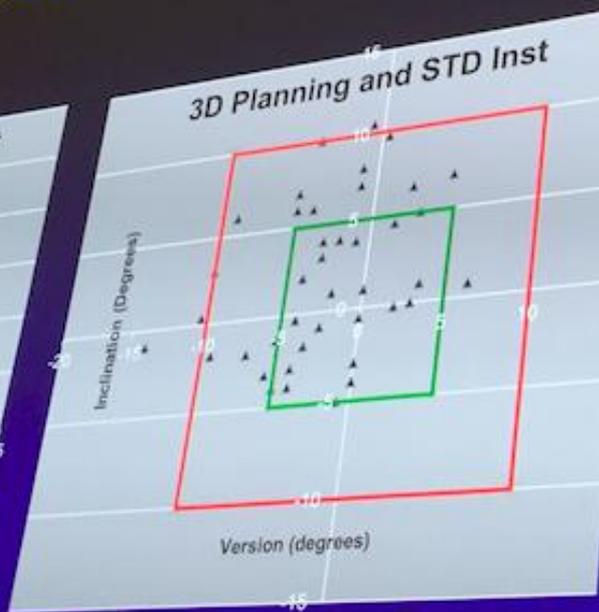




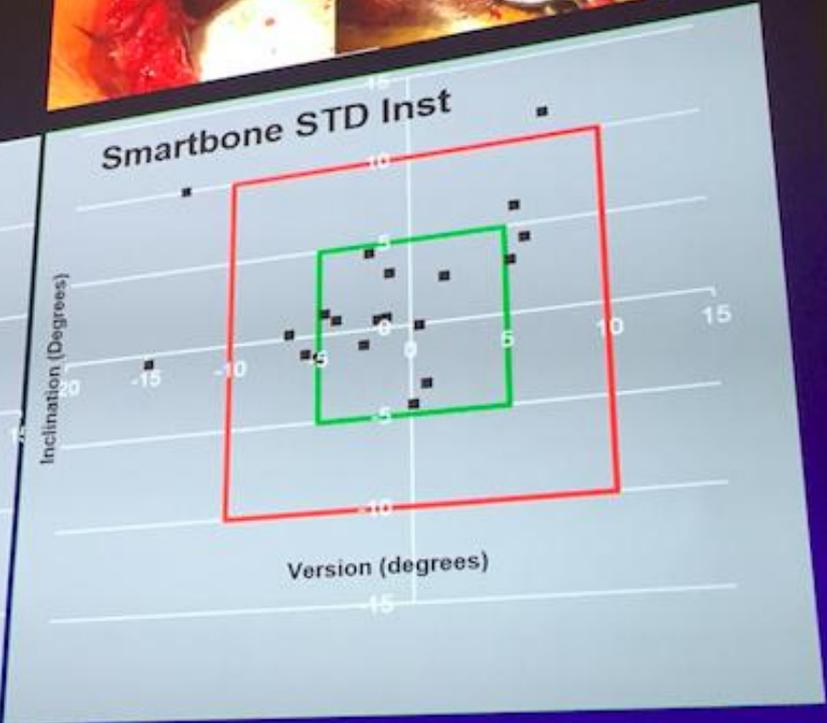
2D vs 3D Imaging with STD Instrumentation N= 62



10/17 outliers

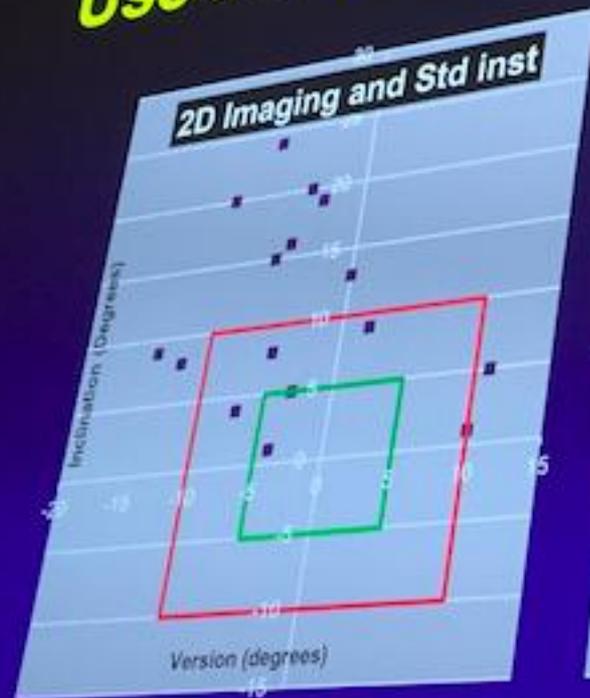


2/42 outliers

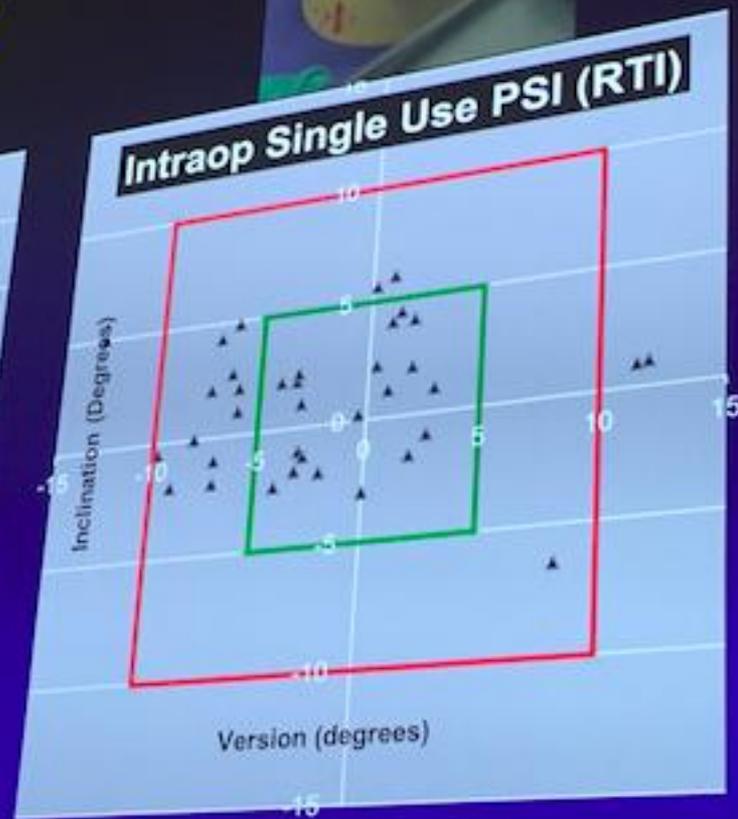


3/20 outliers

3D Imaging and Single Use PSI N = 37



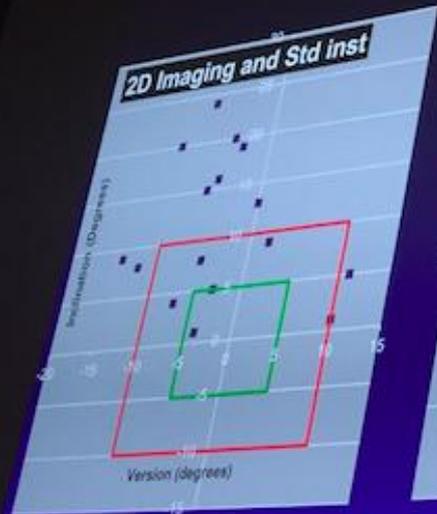
10/17 outliers



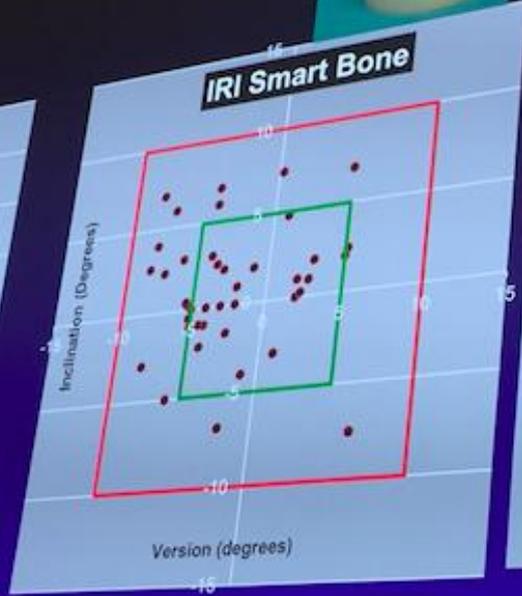
2/37 outliers



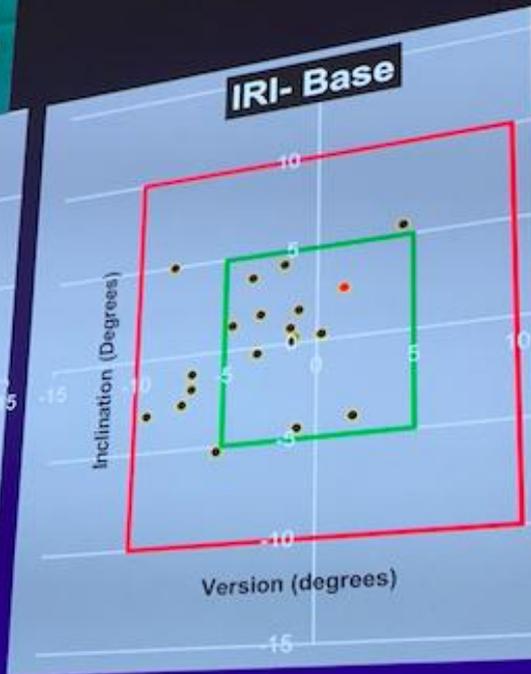
Reusable PSI N= 58



10/17 outliers



0/38 outliers



0/20 outliers





The Challenges for Market Acceptance

- **Cost of the technology**
- **Time to deliver the application**
- **Defining its clinical value**



Conclusions

- **3D planning and templating with any type of patient specific instrumentation shows an improvement in the precision**
- **Compared to 2D imaging without templating and use of standard instrumentation**

Efficiencies of the Technology: Cost, Time and Ease of Use

- Cost to deliver:

-  < \$200
-  \$ 200 - 800
-  > 800

- Time to deliver:

-  < 2 days
-  1-2 weeks
-  > 2 weeks

- Ease of Use: Expertise required

-  Low Trainee
-  Medium Fellowship trained attending
-  Experienced Shoulder Surgeon



Cost, Time and Use Considerations

- **Use of standard instrumentation: Thoughtful use of the 3D plan**
 - Cost: ●
 - Time to delivery: ●
 - Ease of use expertise required: ●
- **Single use patient specific instrumentation: 3D printing**
 - Pre surgical
 - Cost: ●
 - Time to delivery: ●
 - Ease of use, expertise required ●
- **Intraoperative Real Time Instrumentation**
 - Cost: ●
 - Time to delivery: ●
 - Ease of use, expertise required: ●



Cost and Time and Use Considerations

- Reusable patient specific instrumentation: **Customized**
from
- Software to a 3D printed surrogate model and IRI

- Cost: ●

- Time to delivery ●

- Ease of use expertise required ●

- Software to a adjustable and reusable surrogate jig

- Cost: ●

- Time to delivery: ●

- Ease of use expertise required: ●





Conclusions

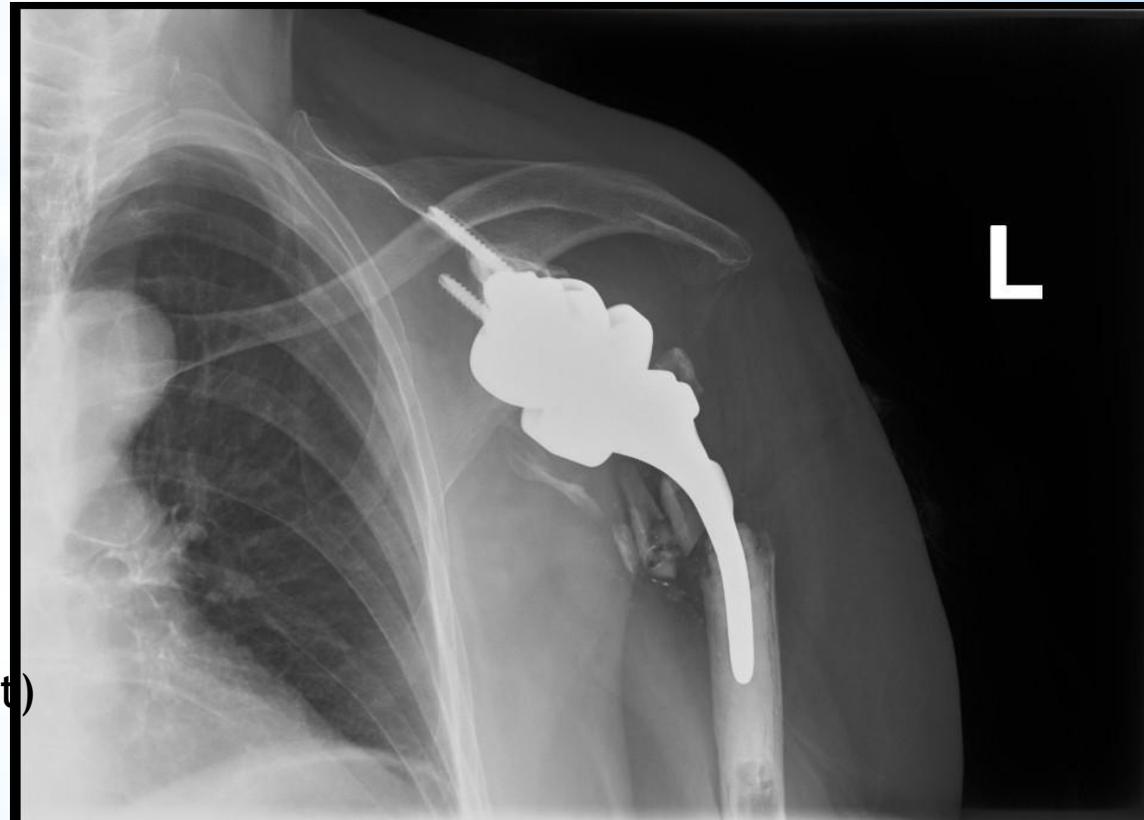
- 3D planning and templating with any type of patient specific instrumentation shows an improvement in the precision
- Compared to 2D imaging without templating and use of standard instrumentation
- **The cost and time to delivery of the each type of technology needs to be considered when using one type of technology over another**

Stem Failure/Revision

Jon JP Warner, MD
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Boston Shoulder Institute
Founder, Codman Shoulder Society



Kyong Min, MD (Shoulder Fellow)



Henry Fox, MS (Research assistant)
Michelle Change (Research assistant)

DISCLOSURES

“Never let you COI or your COE stand in the Way of your patient’s best interest”

- JP Warner & EA Codman

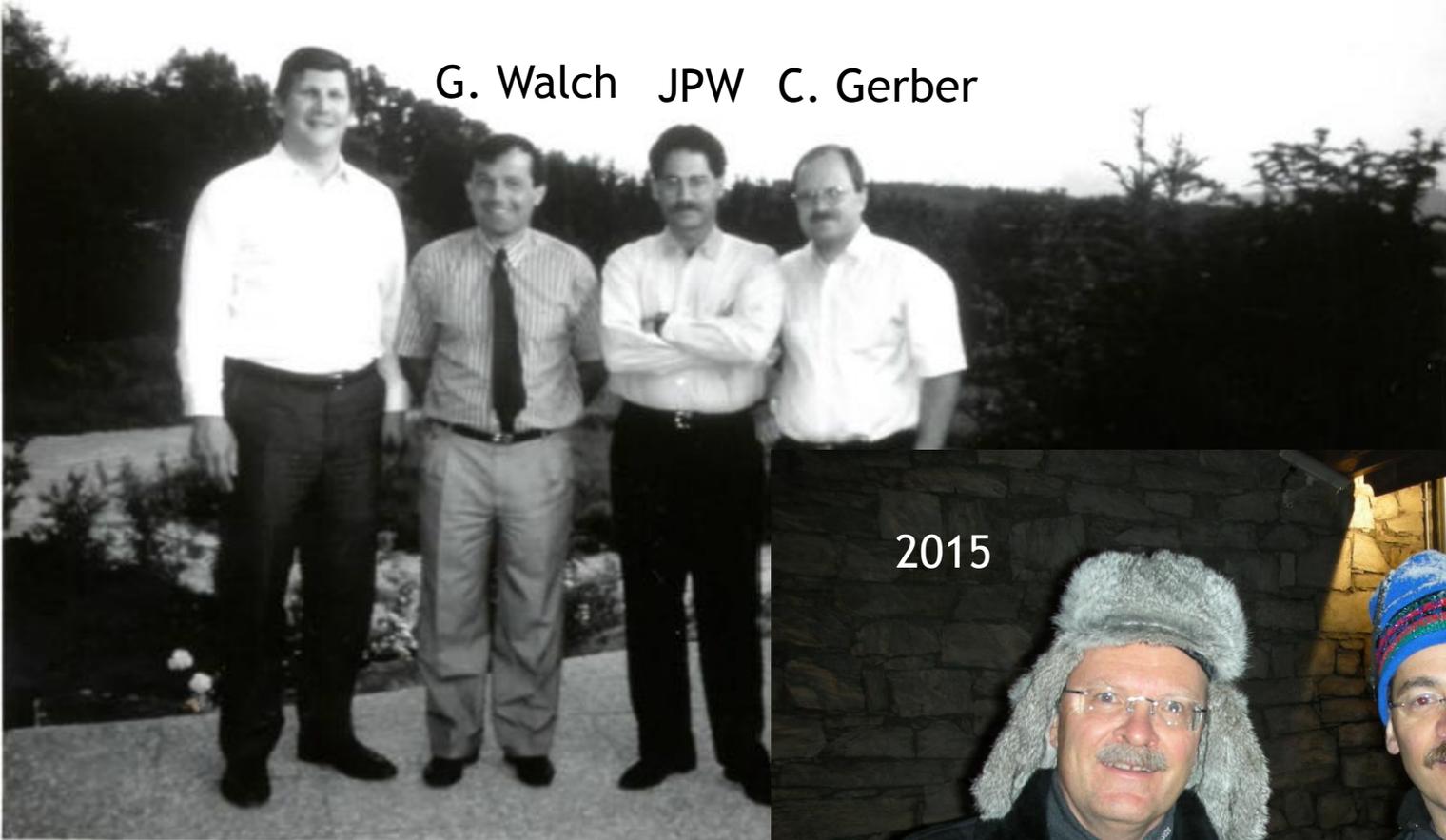
- Royalty: Wright Medical: Shoulder Implant & RC Implant
- Consulting: Wright Medical
- Stock: Vumedi, Orthospace, IMASCAP



1993

E. Flatow

G. Walch JPW C. Gerber



2015





1996



COMPLEX AND REVISION
PROBLEMS IN

Shoulder Surgery

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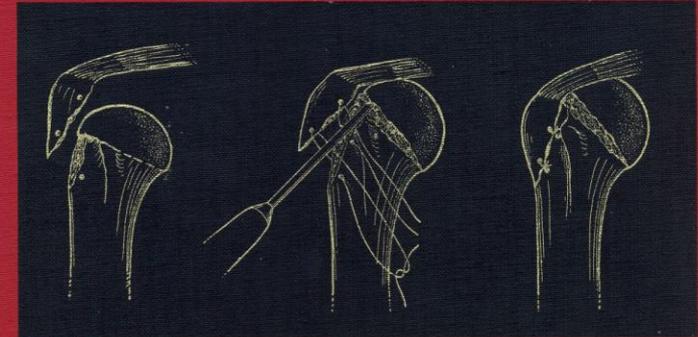
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 **Lippincott - Raven**
F U T U R E S I T Y
Philadelphia • New York

Complex and Revision Problems in

Shoulder Surgery



EDITORS

Jon J. P. Warner
Joseph P. Iannotti
Christian Gerber

Lippincott-Raven

of improving patient care was made possible by these visionary supporters.
to acknowledge each hour of active caring since our opening on December 4, 2015.

11542

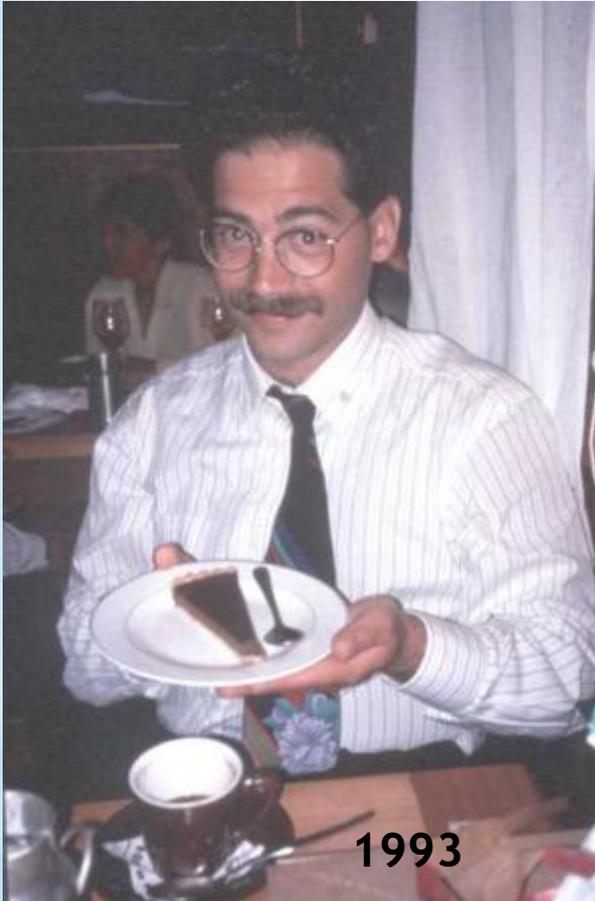
← “The clock is ticking”

Henry C.M. Bodmer Novartis Foundation Schindler Holding Ernst Thomke
Stiftung Lotteriefonds Karol Sch ResOrt Stiftung Schwabacher Verein Balgrist
Borer Chemie AG Karl Storz Skope Med International
Liechtenstein Wag & Johanna Stiftung Robert Zingg



Stem Failure & Revision

Repas misérable



1993

Jon JP Warner, MD
Boston Shoulder Institute
Codman Shoulder Society

Descellement huméral

*Humeral Stem
Loosening*

...avec infection

...sans infection

Malpositionnement de la tige humérale

Stem Malposition

...avec infection

...sans infection

RETENTION DE LA TIGE

Stem retention

Sans tige

Stemless

*Problèmes
glénoïdiens*

Problem with glenoid

*Problèmes de
Parties molles*

Soft tissue problem

Personnes âgées

elderly

Ostéopénie

Poor bone

Comorbidité

Medical comorbidity

Circles of Hell in Dante's Inferno

S
T
E
M

R
E
V
I
S
I
O
N

1st Circle: Limbo

The unbaptized and virtuous pagans including Virgil, Homer, Horace, Ovid, Socrates, Plato, and Saladin

2nd Circle: Lust

Souls are blown about in a violent storm, without hope of rest. Francesca da Rimini and her lover Paolo are here.

3rd Circle: Gluttony

The gluttons are forced to lie in vile, freezing slush, guarded by Cerberus. Ciaccio of Florence is here.

4th Circle: Avarice & Prodigality

The Miserly and spendthrift push great heavy weights together, crashing them time and time again. Plutus guards them.

5th Circle: Wrath & Sullenness

The wrathful fight each other on the surface of the Styx while the sullen gurgles beneath it. Filippo Argenti is here.

6th Circle: Heresy

Heretics are trapped in flaming tombs. Florentines Farinata degli Uberti and Cavalcante de' Cavalcanti are here.

7th Circle: Violence

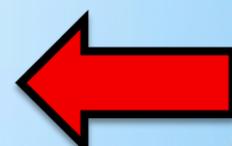
The violent against people and property, the suicides, the blasphemers, the sodomites and the usurers.

8th Circle: Fraud

Panderers and seducers, flatterers, sorcerers and false prophets, liars, thieves, and Ulysses and Diomedes.

9th Circle: Treachery

Betrayers of special relationships are frozen in a lake of ice. Satan, Judas, Brutus, and Cassius are here.



A Black Swan (event)



Loose stem

Infection

STEM LOOSENING

Radiographic Changes Around Humeral Components in Shoulder Arthroplasty

Patric Raiss, MD, T. Bradley Edwards, MD, Allen Deutsch, MD, Anup Shah, MD, Thomas Bruckner, PhD, Markus Loew, MD, PhD, Pascal Boileau, MD, and Gilles Walch, MD

JBJS 2014

Investigation performed at the Centre Orthopédique Santy, Lyon, France

5 centers, mean f/u 8.2 yrs (4-18 yrs)

Aequalis humeral stem

395 shoulders: 1 cemented stem loose; no uncemented stem appeared loose

The incidence of radiographic aseptic loosening of the humeral component in reverse total shoulder arthroplasty



JSES 2015

Gregory Gilot, MD^a, Andres M. Alvarez-Pinzon, MD, PhD^{a,*}, Thomas W. Wright, MD^b, Pierre-Henri Flurin, MD^c, Michael Krill, MD^a, Howard D. Routman, DO^d, Joseph D. Zuckerman, MD^e

177 cemented/115 press-fit (38 mo F/U)

Overall rate of loosening = 0.74%

No press-fit stem was loose

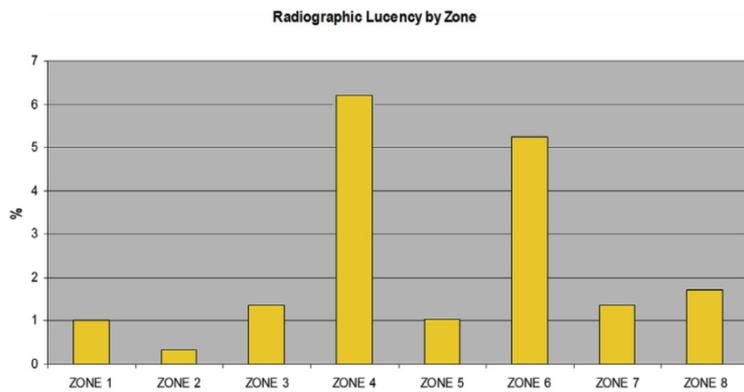


Figure 2 Radiographic lucency evaluated by humeral stem zone.⁵

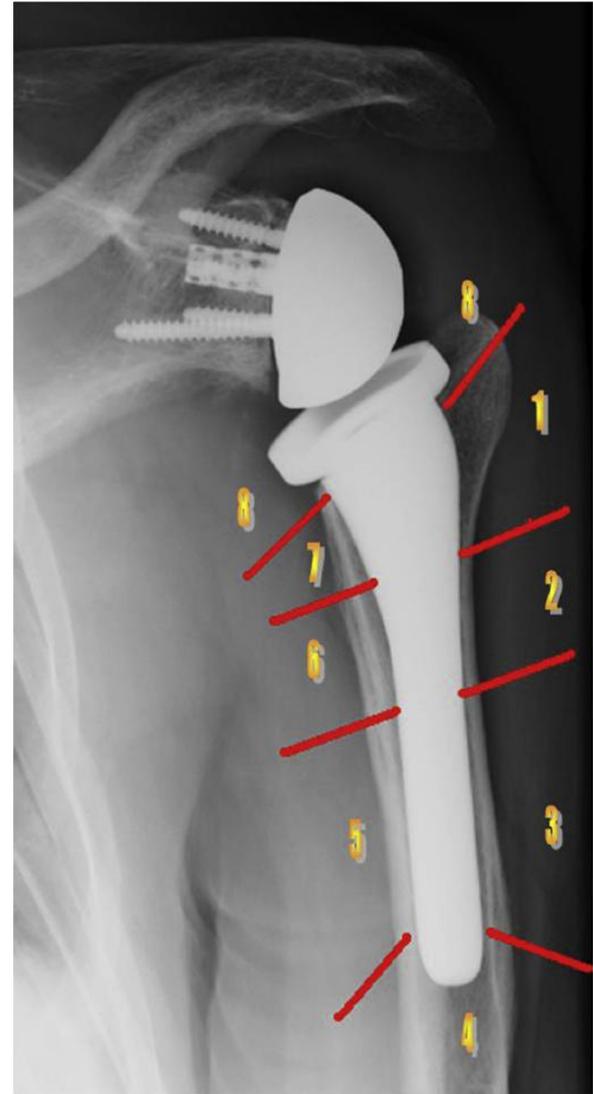


Figure 1 Humeral stem divided into thirds. Bone adjacent to the stem is divided into 8 zones. Zones 1, 2, and 3 represent the lateral aspect of the stem at the proximal, middle, and distal thirds, respectively. Zone 4 is the area around the distal stem tip, respectively. Zones 5, 6, 7, and 8 denote the medial portion of the stem from the distal, middle, and proximal thirds, and base, respectively.

- Systemic review of 41 studies to compare functional outcome and complications of cemented vs uncemented stems in RSA. **1455 cemented, 329 uncemented shoulders.**
- limitation is the wide, varied swath of data they're surveying

Table VII. Complications: reported incidence and relative risk.

Complication	Cemented		Uncemented		p-value	RR*	
	Cases	%	Cases	%		Cemented	Uncemented
Humeral stem migration	3/1162	0.3	10/214	4.9	< 0.001		18.1 (CI 5.0 to 65.2)
Radiolucent lines	87/1162	7.5	38/214	17.8	< 0.001		2.4 (CI 1.7 to 3.4)
Acromion/scapular fracture	31/1455	2.2	0/329	0	0.004	14.3 (CI 0.9 to 232.8)	
Nerve injury	25/1455	1.7	1/329	0.3	0.07	5.7 (CI 0.7 to 41.5)	
Thromboembolism	8/1455	0.5	0/329	0	0.36	3.9 (CI 0.2 to 66.6)	
Infection	29/1455	2.0	2/329	0.6	0.1	3.3 (CI 0.8 to 13.7)	
Intra-operative glenoid fracture	6/1455	0.4	0/329	0	0.59	2.9 (CI 0.2 to 52.2)	
Intra-operative humeral fracture	8/1455	0.5	4/329	1.2	0.25		2.2 (CI 0.7 to 7.3)
Instability	48/1455	3.3	7/329	2.1	0.29	1.6 (CI 0.7 to 3.4)	
Late peri-prosthetic humeral fracture	14/1455	0.9	2/329	0.6	0.75	1.6 (0.4 to 6.9)	
Scapular notching	279/1176	19	68/329	21	0.64	1.1 (CI 0.8 to 1.4)	
Stem loosening	5/1455	0.3	1/329	0.3	0.9	1.1 (CI 0.1 to 9.6)	
Glenoid loosening	10/1455	0.6	2/329	0.6	0.9	1.1 (CI 0.2 to 5.1)	
Overall complication rate	561/1455	39	138/329	42	0.4	1.06 (CI 0.9 to 1.2)	

* Relative risk ratio (RR) with 95% confidence intervals (CI). RR of > 2 were considered clinically relevant

Uncemented: significantly higher incidence of early stem migration and non-progressive radiolucent lines. No difference in risk of stem loosening or revision between groups. Functional outcome and ROM equivalent.

Clinical and radiographic results of cementless reverse total shoulder arthroplasty: a comparative study with 2 to 5 years of follow-up



JSES 2014

J. Michael Wiater, MD^{a,*}, James E. Moravek Jr, MD^a, Matthew D. Budge, MD^a,
Denise M. Koueiter, MS^b, David Marcantonio, MD^c, Brett P. Wiater, MD^a

- Prospective database of pts undergoing RSA retrospectively reviewed.
- 37 patients with cemented, and 64 with cementless.
- Minimum follow-up 2 years

Table I Cohort demographics

	Cemented (n = 37)	Uncemented (n = 64)
Age, years (range)	71.95 (55-83)	72.47 (48-92)
Gender		
Male	15 (40.5%)	20 (31.3%)
Female	22 (59.5%)	44 (68.8%)
Follow-up, months (range)	37.0 (24-77)	32.4 (24-63)
Diagnosis		
Cuff tear arthropathy	27 (73%)	34 (53%)
Irreparable rotator cuff tear	10 (27%)	29 (47%)
Implant		
DePuy	10 (27%)	0
Tomier	27 (73%)	0
Zimmer	0	64 (100%)

- No significant difference between improvements in functional scores, forward elevation, IR between groups.

- No evidence of loosening or “at risk” humeral components in either group.
- No significant difference in incidence of humeral component radiolucent lines or scapular notching.

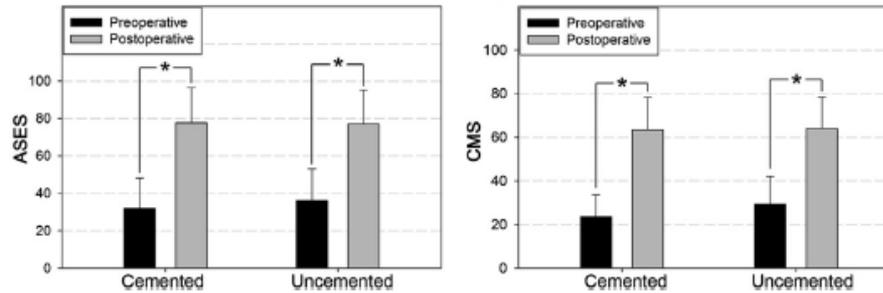


Figure 2 The American Shoulder and Elbow Surgeons score (ASES, *left*) and Constant-Murley score (CMS, *right*) both improved significantly in the cemented and cementless cohorts.

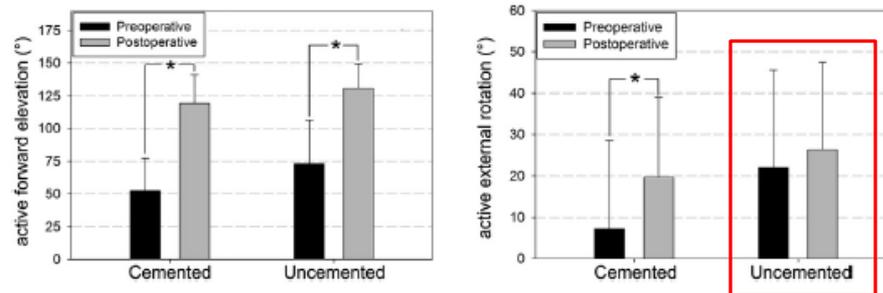


Figure 3 The active forward elevation (*left*) improved significantly in the cemented and cementless cohorts. The active external rotation (*right*) improved significantly in the cemented cohort but not in the cementless cohort.

- Their conclusion: cementless provides similar outcomes to those of cemented (except ER). Cementless also has advantages in operative technique, ease of revision, biologic fixation, and no cement-related complications

Humeral prosthetic failure of reversed total shoulder arthroplasty: A report of three cases

Lieven De Wilde, MD,^a and Gilles Walch, MD,^b Ghent, Belgium, and Lyon, France

Fracture
Loss proximal humerus
Infection
Unscrewing of stem

Case 1:

- 60 YO M traumatic comminuted fracture of the proximal humerus
- Hemiarthroplasty, tuberosity resorption. Frank humeral loosening and osseous disappearance of proximal humerus.
- Resection arthroplasty and antibiotics, revised to RSA
- 4 months later, unscrewing of lengthener. Rescrewed and good outcome achieved.
- (FF 100, ER 40, pain-free, Constant 33).



Figure 1 Case 1: Unscrewing of humeral lengthener.

Case 2:

- Proximal humerus resection for plasmacytoma, excised proximal humerus reimplanted with irradiation and TSA
- 4 years later post-operative loosening and pain with forward flexion
- Humeral component completely loose surrounded by synovitis. Humeral component had to be changed and cemented
- 6 month post-revision: constant score back to that of pre-implant breakage

- Tumor resection
- Allograft non-union
- radiation

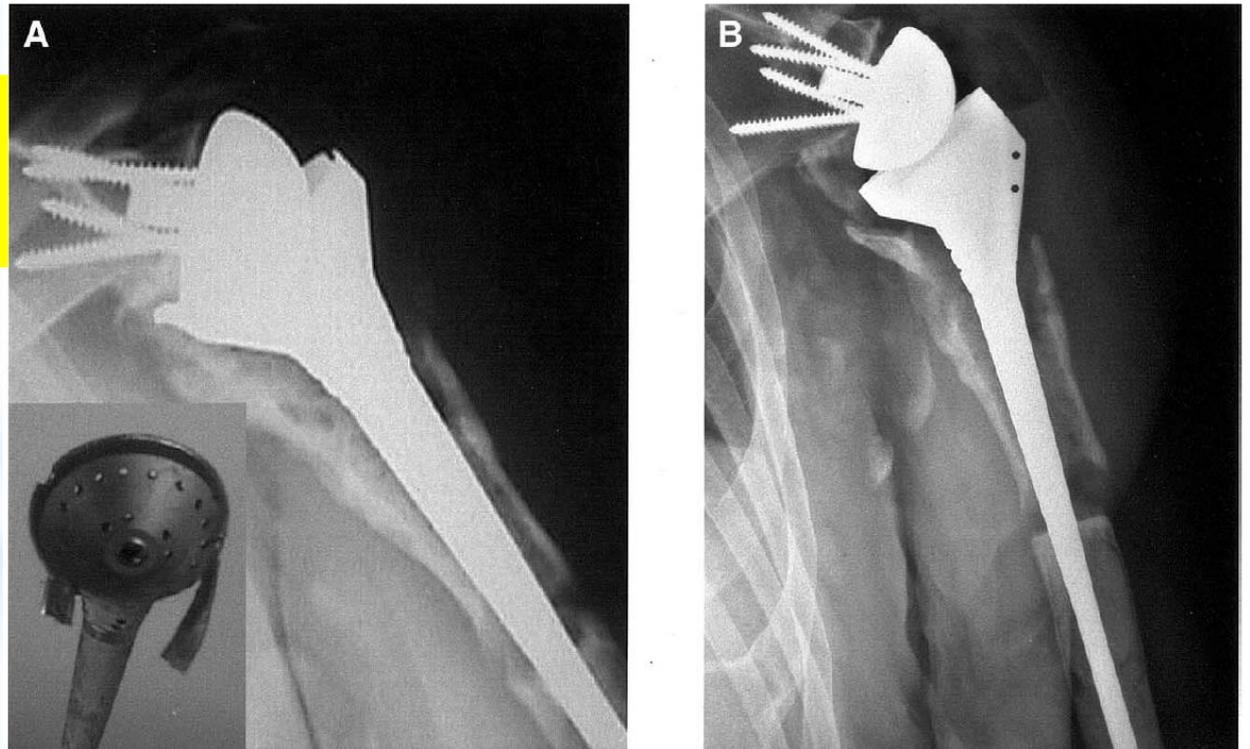


Figure 2 Case 2. **A**, Epiphyseal prosthetic failure. **B**, Radiograph at 6 months after surgery showing resorption of bone grafts.

Case 3:

-33 year-old female, traumatic proximal humerus fracture, treated w hemiarthroplasty
- Loosening and loss of greater tuberosity: painful, poor function

- At 35 year-old: treatment with reverse TSA.

- 3 years post-op: Constant from 9 to 61
- 4 years post-op: pain, loss of power due to prosthetic loosening
- Revision with ICBG

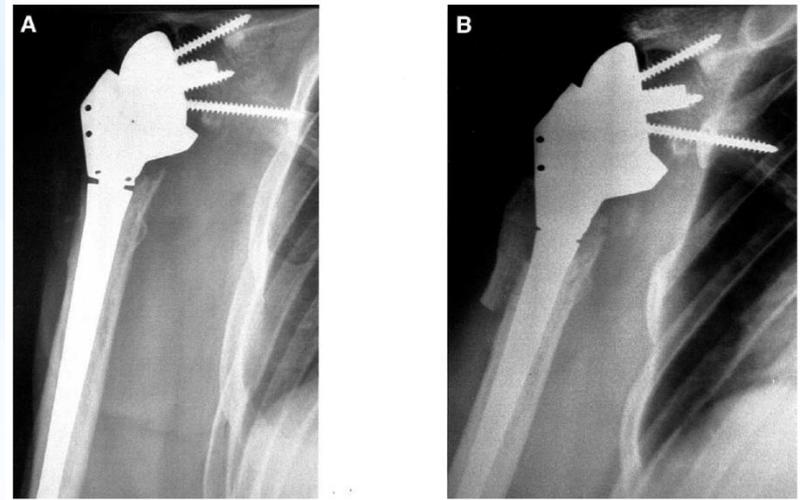


Figure 3 Case 3. **A**, Unscrewing of humeral diaphysis. **B**, Radiograph at 6 months after surgery showing partial resorption and partial incorporation of bone graft.

INSIGHTS:

- Arm movement that can lead to unscrewing with RSA (Poor design)
- Proximal bone loss

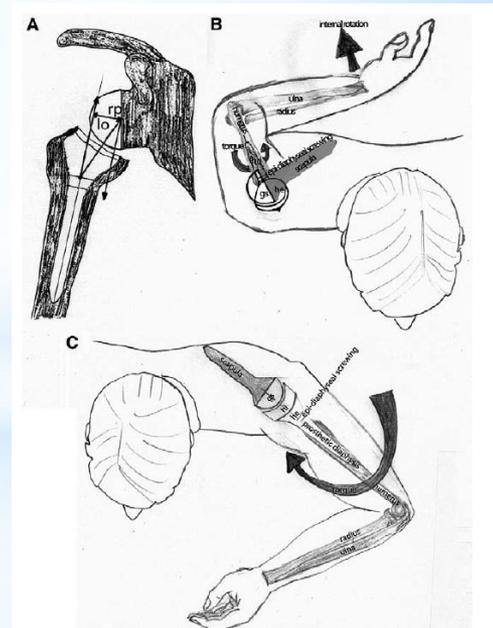
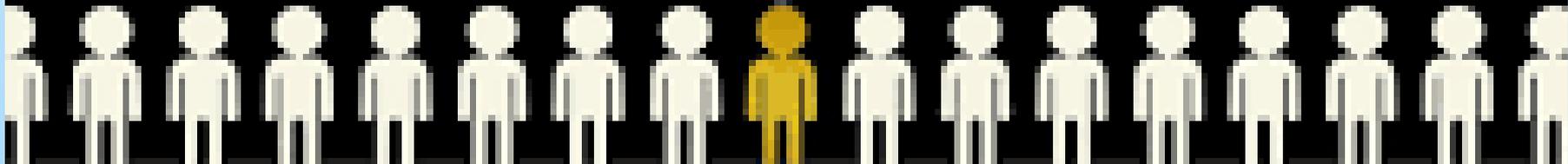


Figure 4 **A**, Prosthetic failure mechanism resulting from lateral humeral offset. **B**, Prosthetic unscrewing mechanism of left shoulder. **C**, Prosthetic unscrewing mechanism of right shoulder. *rp*, Rotation point; *hl*, prosthetic humeral lengthener; *hd*, humeral prosthetic diaphysis; *he*, humeral prosthetic epiphysis; *gs*, glenosphere; *lo*, lateral offset to break prosthetic epiphysis or to unscrew prosthesis.

Stem

Malpositioning

**WHY
INCREDIBLY
UNLIKELY
THINGS
KEEP
HAPPENING**



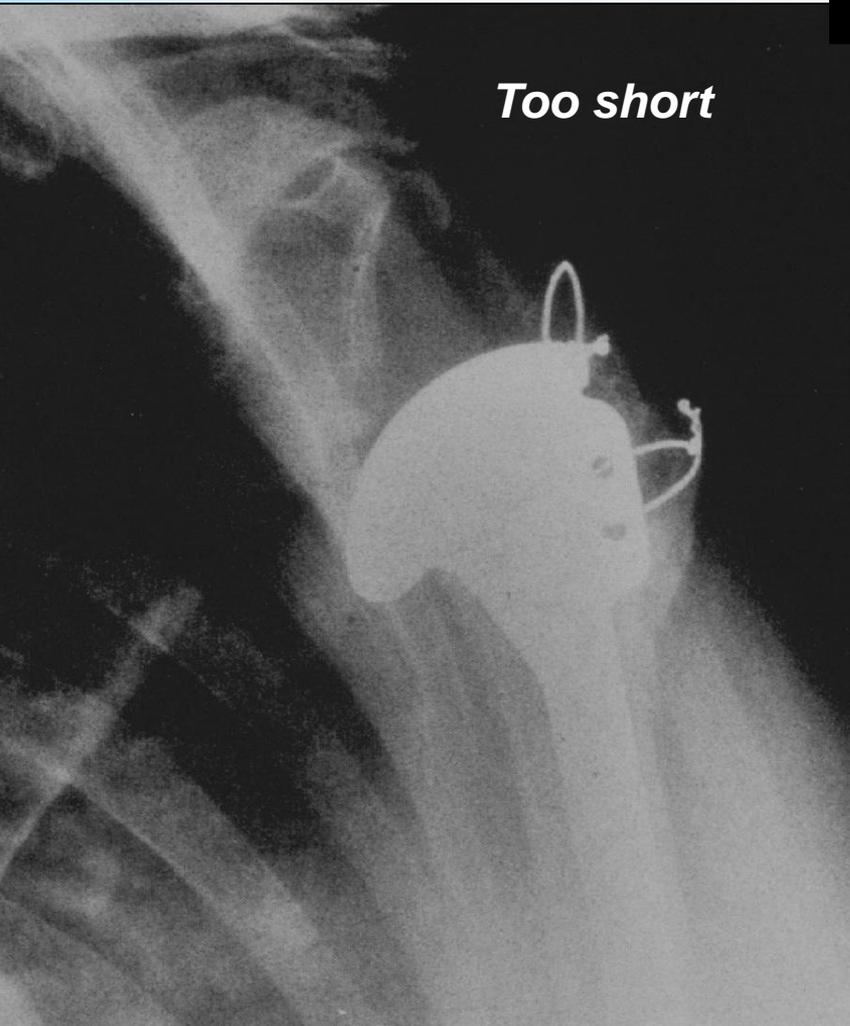
Poor Choices

+

Inexperience

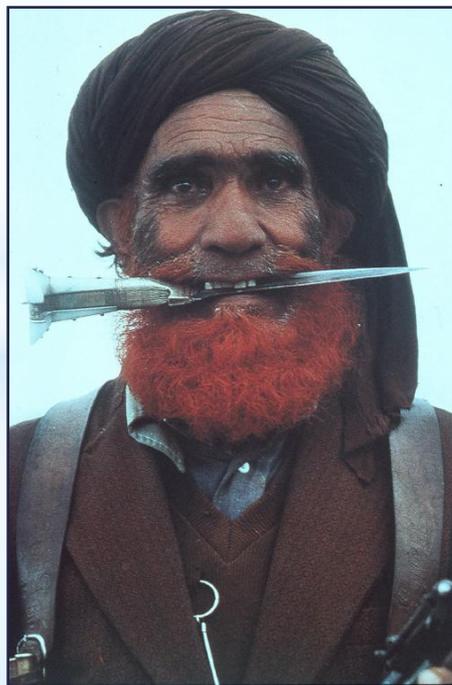
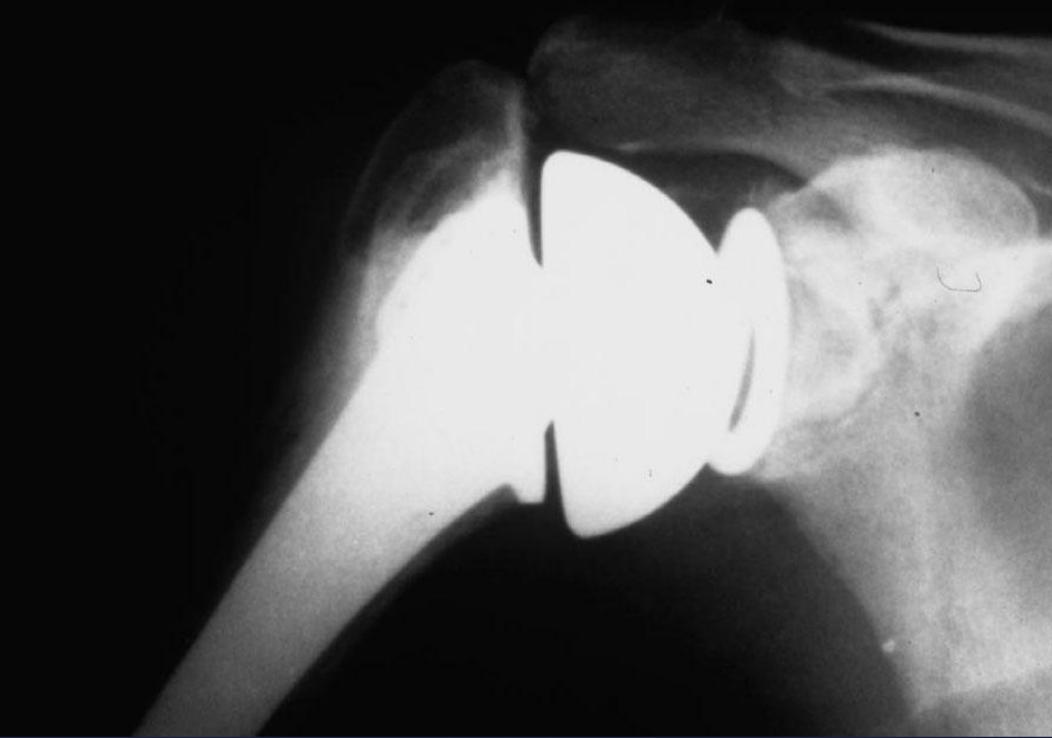
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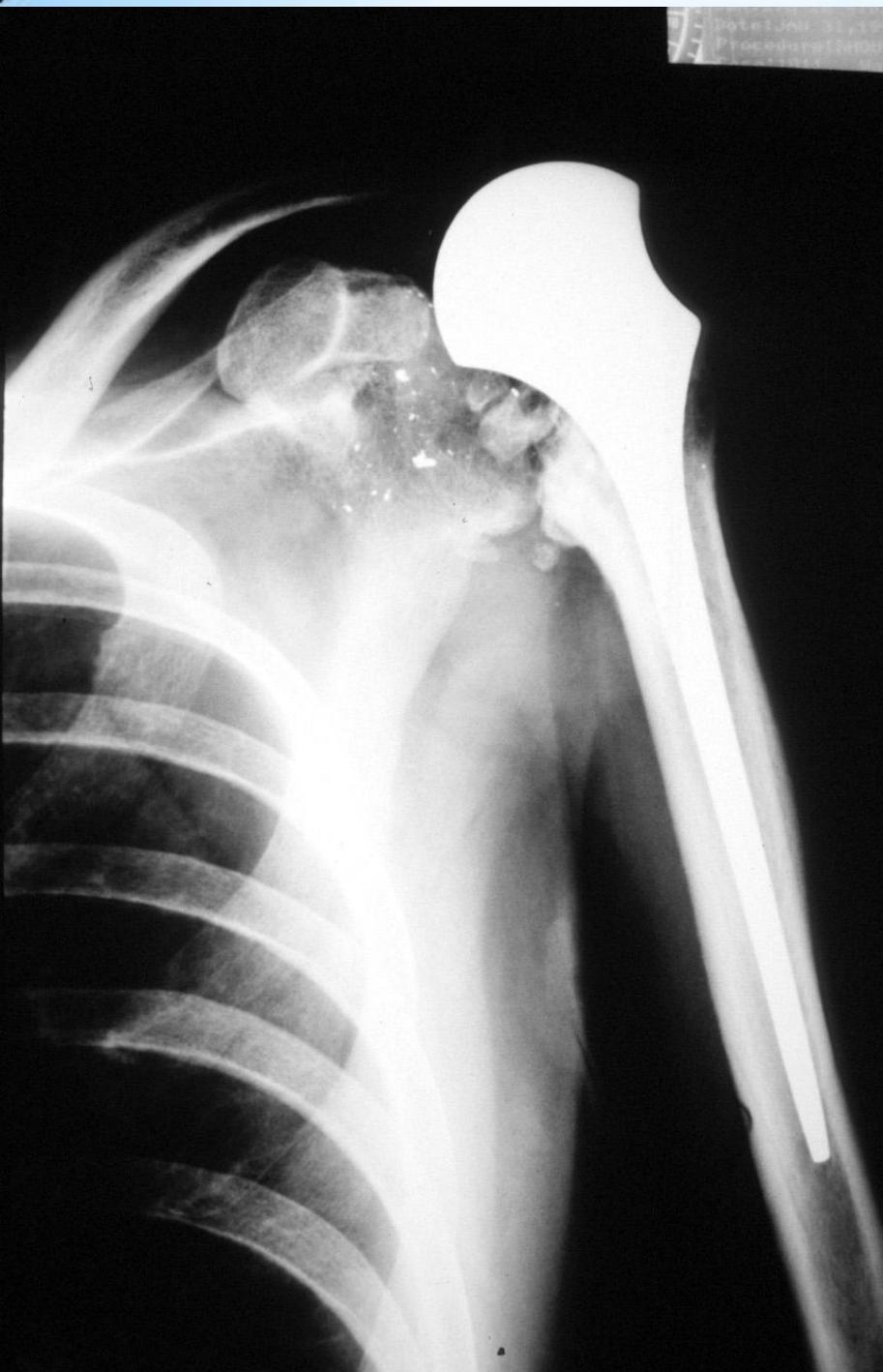
Too short



Too tall







How to Revise a stem



Humeral windows in revision shoulder arthroplasty

John W. Sperling, MD, and Robert H. Cofield, MD, Rochester, MN

JSES 2005

- 20 patients had humeral window in order to remove cement & extract prosthesis
- 4 Intraoperative Fractures!
- No cases of malunion or loosening after 4 years

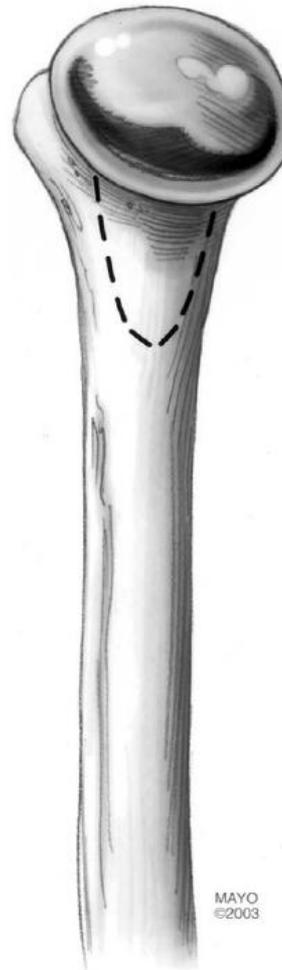


Figure 3 Medial window.

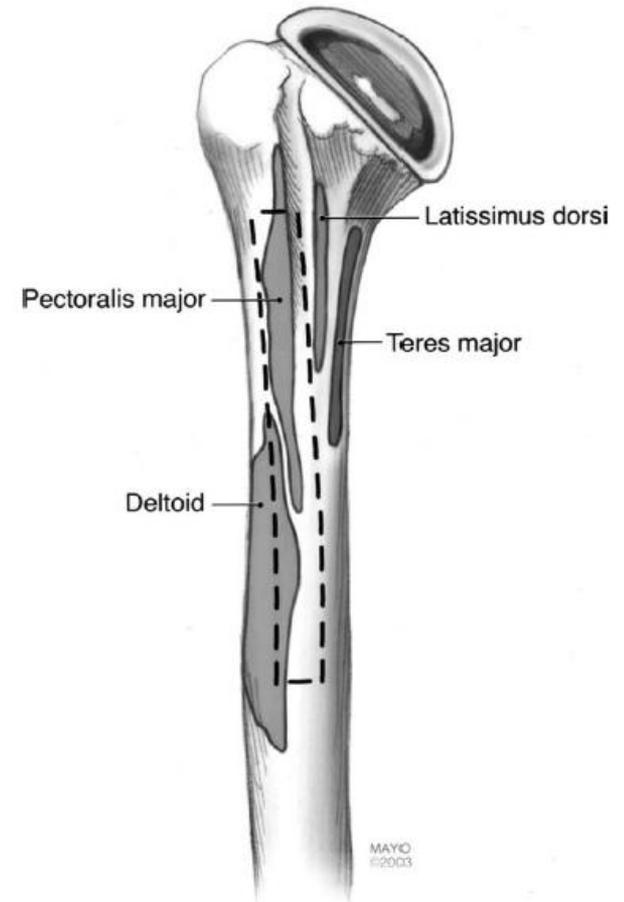


Figure 1 Anterior window.

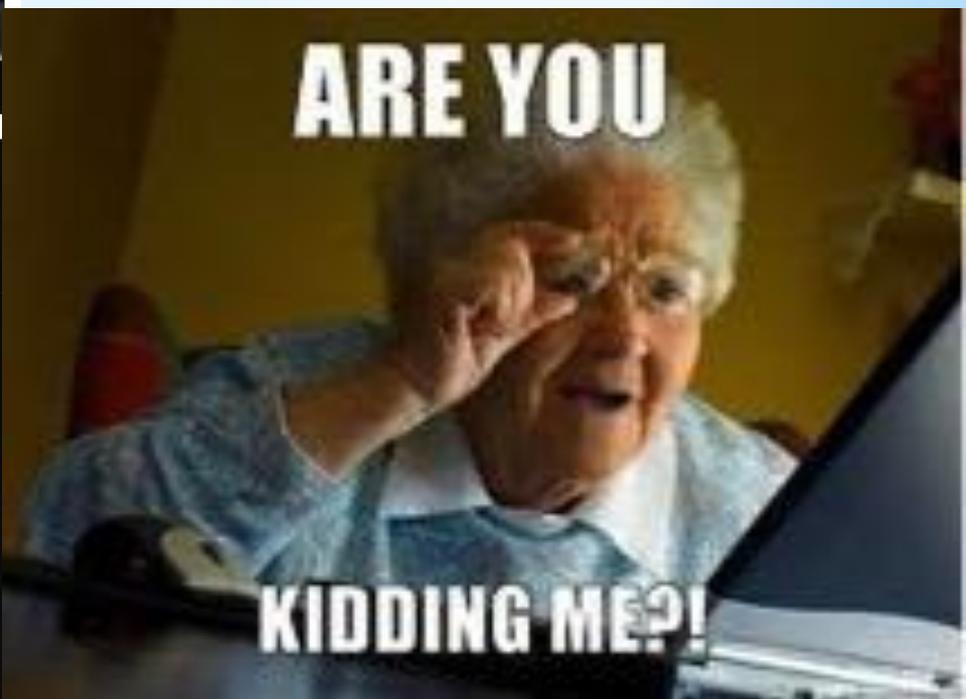
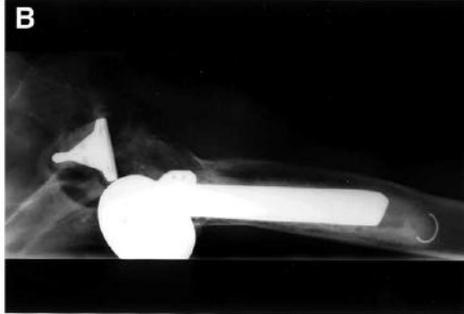


Figure 2 **A** and **B**, Preoperative radiographs of a 69-year-old man with a posteriorly dislocated total shoulder arthroplasty. **C**, Radiograph taken 1 month postoperatively demonstrates a long-stem prosthesis with gaps present at the osteotomy site for the anterior window. The cortical window was repaired with suture and bone-grafted. **D** and **E**, Radiographs taken 5 years postoperatively demonstrate healing of the cortical window.

The vertical humeral osteotomy for stem removal in revision shoulder arthroplasty: results and technique

Geoffrey S. Van Thiel, MD*, James P. Halloran, MD, Stacy Twigg, PA-C, JSES 2011
Anthony A. Romeo, MD, Gregory P. Nicholson, MD

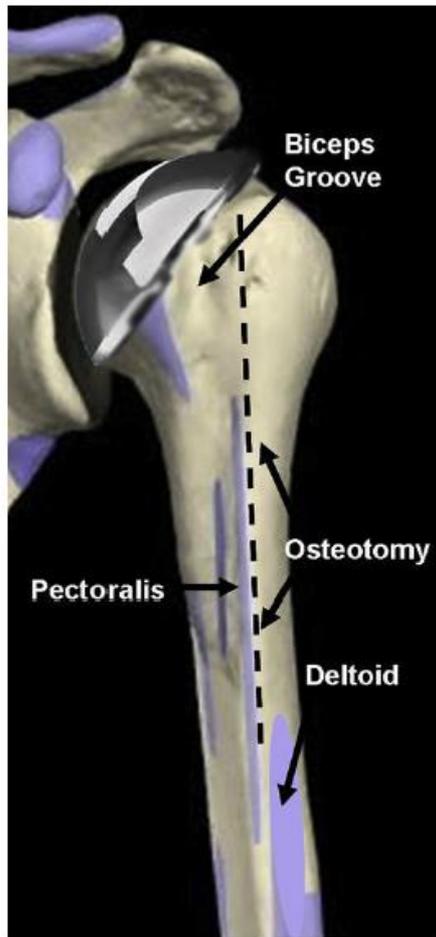


Figure 2 The osteotomy is located lateral to the biceps groove, between the pectoralis and deltoid insertions.

- 23 Patients all revisions cemented
- No Intraop/postop fractures
- F/U 41 months = no loosening
- No Need for extraction devices



Figure 6 The vertical osteotomy has been stabilized with cerclage wires.

Conversion of Stemmed Hemi- or Total to Reverse Total Shoulder Arthroplasty: Advantages of a Modular Stem Design



Karl Wieser MD, Paul Borbas MD, Eugene T. Ek MBBS, PhD,
Dominik C. Meyer MD, Christian Gerber MD, FRCS

CORR 2015

-2005-11: 48 hemis and 8 TSAs converted to reverse TSA
- 43 with stem exchange, 13 without stem exchange

- Complete follow up (min 1 yr) available on 32 with stem exchange and 13 without stem exchange

- Intraoperative complications:

- 30% with stem removal
- 8% w/o stem exchange

- Reinterventions after revision:

- 14% with stem removal
- 8% w/o stem exchange

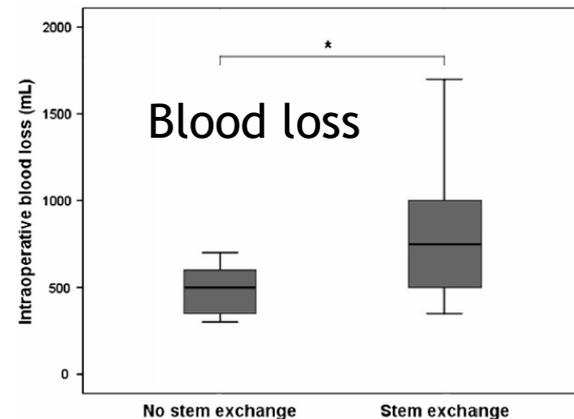


Fig. 3 The mean blood loss was reduced ($p = 0.001$) in patients without stem exchange (mean, 485 mL; range, 300–700 mL; SD, 151 mL) compared with the group with stem exchange (mean, 831 mL; range, 350–2000 mL; SD, 400 mL).

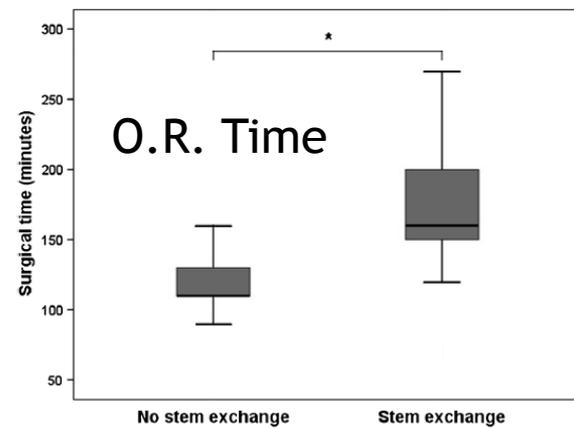


Fig. 4 The surgical time could be decreased to 118 minutes (range, 90–160 minutes; SD, 21 minutes) when the stem could be left in place, which spared, on average, 58 minutes surgical time ($p < 0.0001$) compared with cases in which the stem had to be exchanged (mean, 176 minutes; range, 120–300 minutes; SD, 42 minutes).

Fig. 2A–D A 55-year-old woman presented with severe pseudoparalysis of her left arm 7 months after a hemiarthroplasty as a result of a four-part humeral head fracture. Her (A) AP and (B) axial radiographs show a well-fixed humeral stem with anterosuperior instability resulting from rotator cuff insufficiency. Two years after conversion to a reverse total shoulder arthroplasty, the patient had a pain-free overhead function with good component positioning without any signs of loosening observed on the (C) AP and (D) axial radiographs.



Conversion to Reverse Shoulder Arthroplasty: Humeral Stem Retention Versus Revision

Orthopaedics 2015



MATTHEW F. DILISIO, MD; LINDSAY R. MILLER, MPH; ELANA J. SIEGEL, BA; LAURENCE D. HIGGINS, MD

- 26 Failed Arthroplasties converted to Reverse
- Stem retention: Shorter O.R. Time, less blood loss, shorter hospital stay (Trend, NS)
- Minimal clinical difference in outcome between groups
- Complications = Humeral shaft/greater tub Fx
 - Stem Retention = 0%
 - Stem Removal = 21%





My Experience/Learning Curve

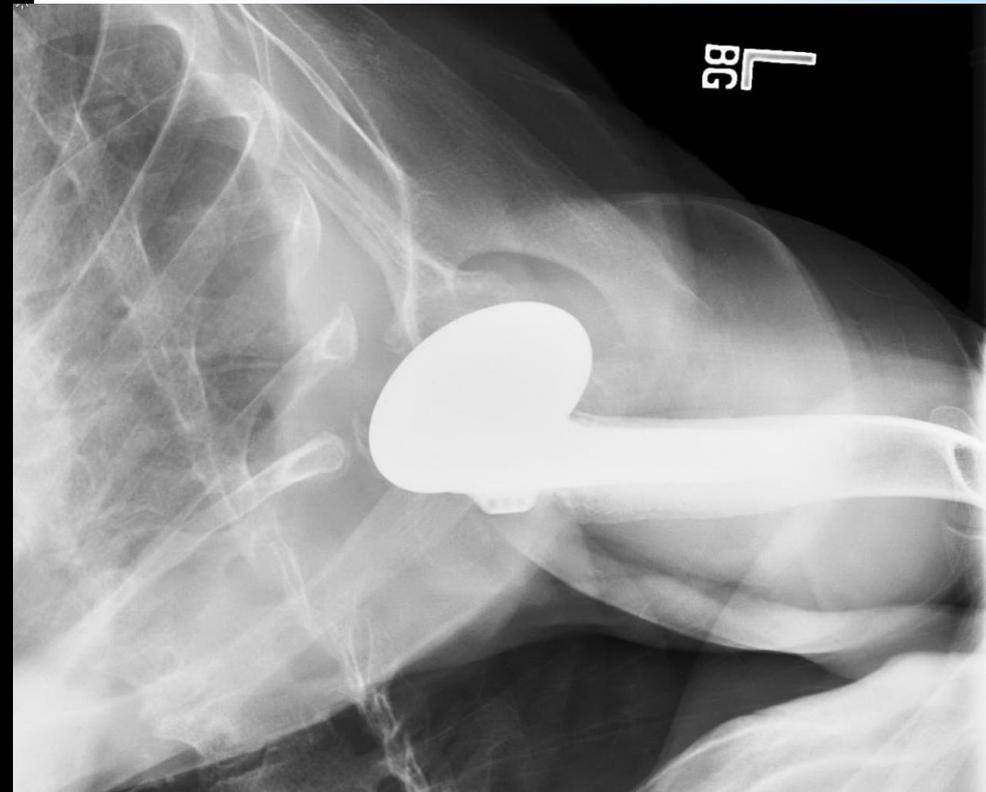


71 YO Woman:

1/6/2009: presented to clinic w chronic pain and poor function, RC insufficiency



PMH: mylodysplasia, HTN, CAD, s/p MI, chronic hyponatremia, RA, osteopenia, Hx right THR, Left knee fusion,





Right: 2 mo post-op,
doing well.

4 mo post-op:

- 80% SSV
- AFF = 100°
- Can place hand on top of head
- Minimal pain



9/22/2009: 3 mo post-op, 0-7/10 pain. ERS, CRP and white count normal, aspiration negative



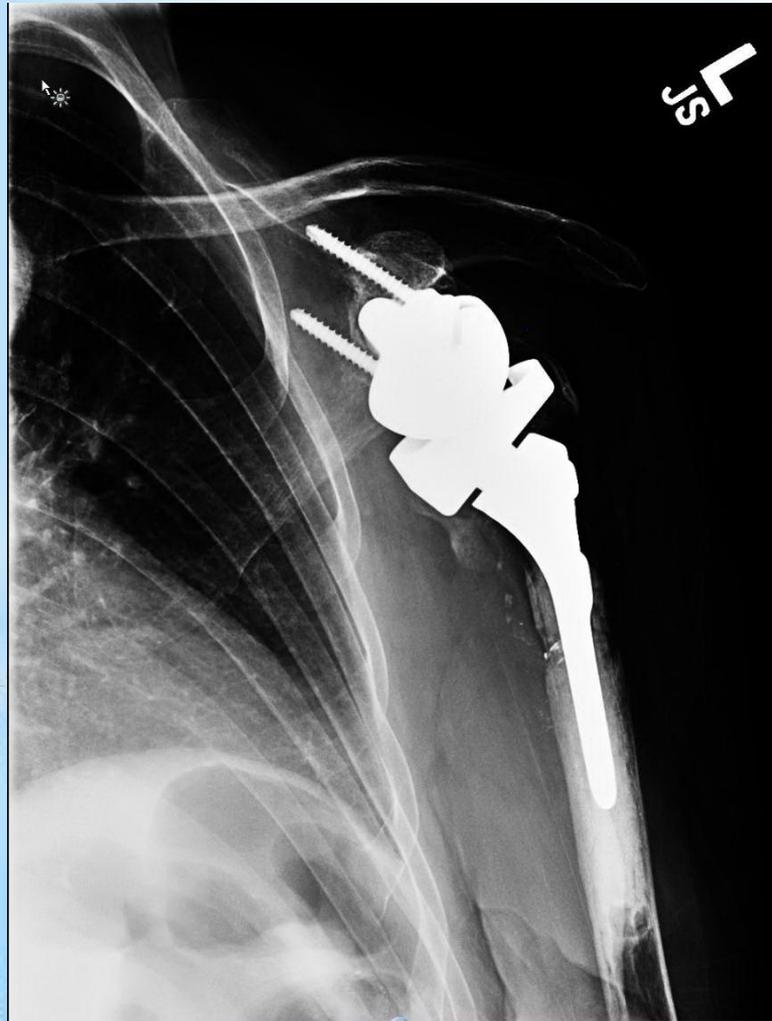
Marked ER Lag signs
AFF= 70°



Revision with only Latissimus
Transfer (all cultures negative)

3 mo after lat transfer= very happy, no pain, able to put hand on head

→ (5/10) 8 mo post-lat transfer: patient very happy

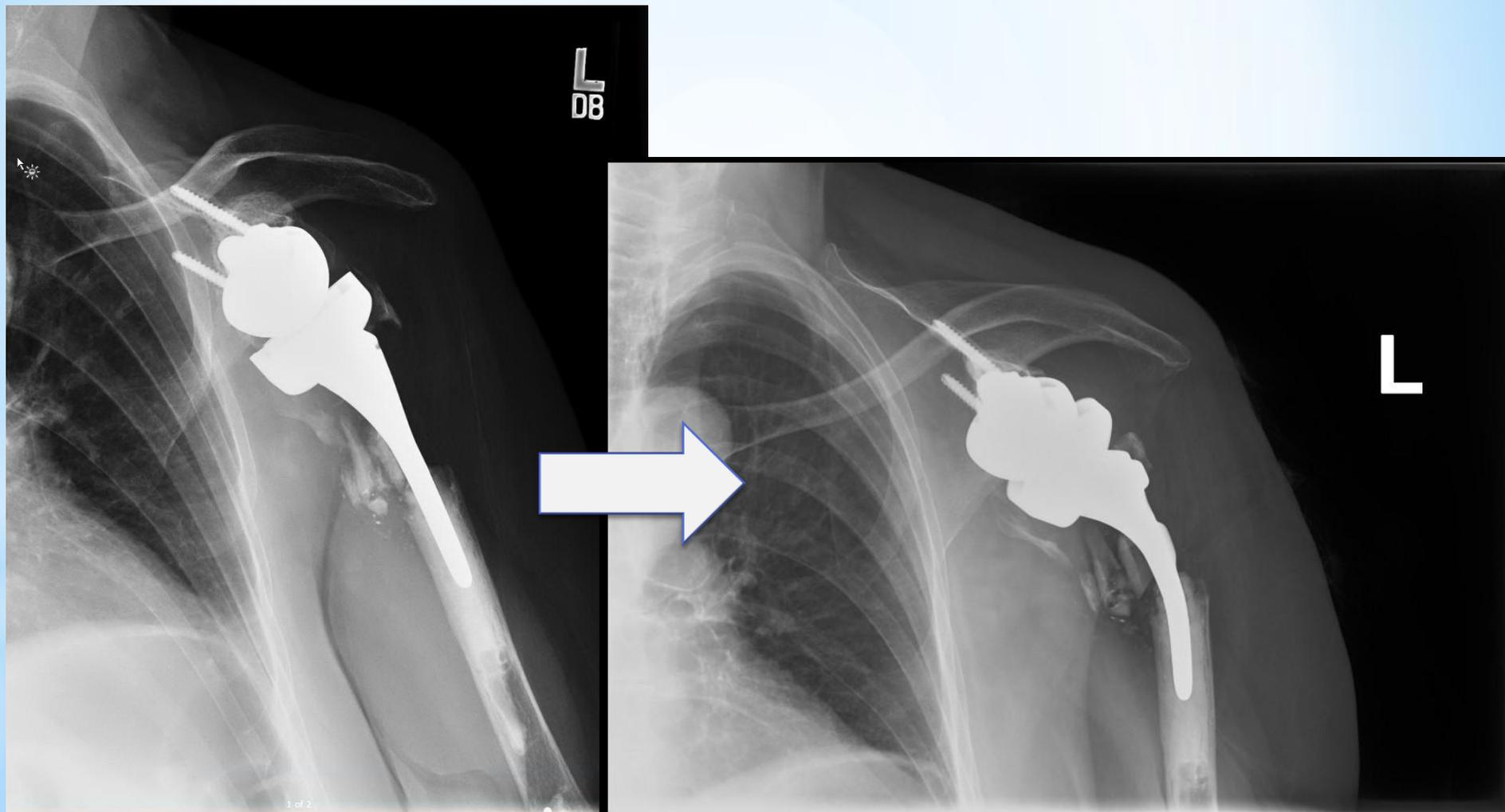


ALL SMILES

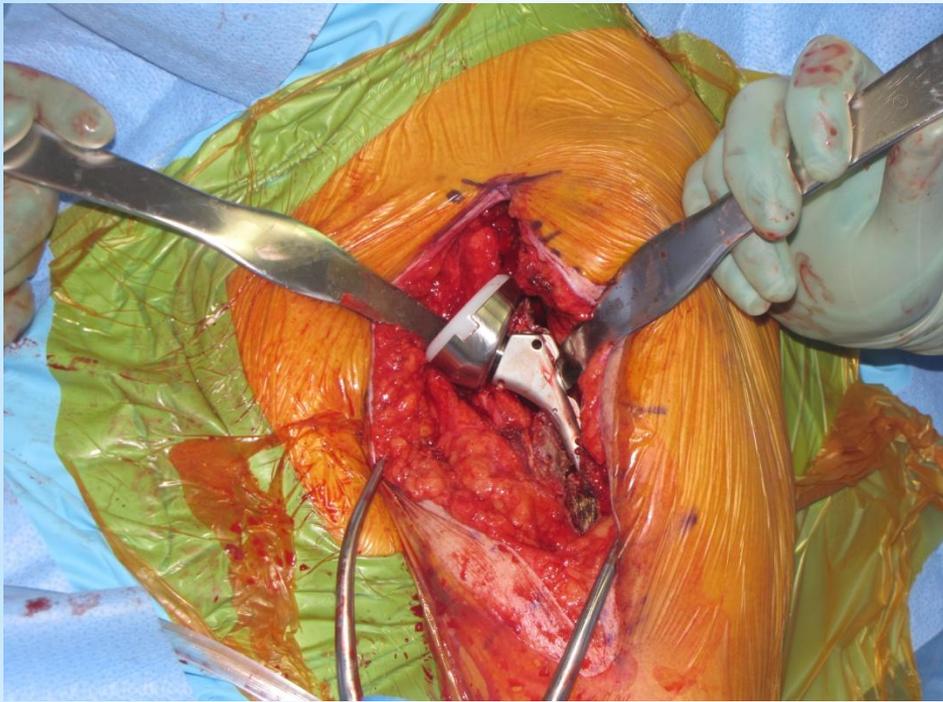


8/4/2013: Ground level fall 53 months after her revision arthroplasty

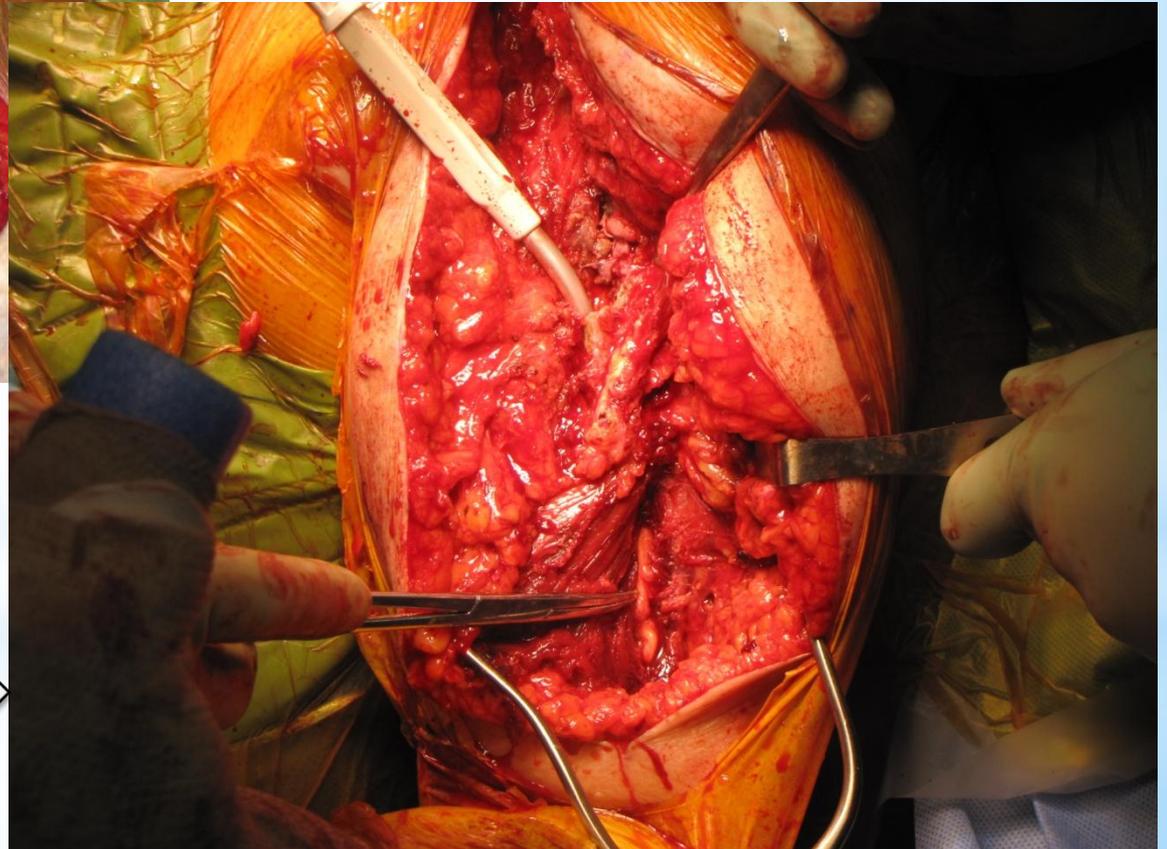
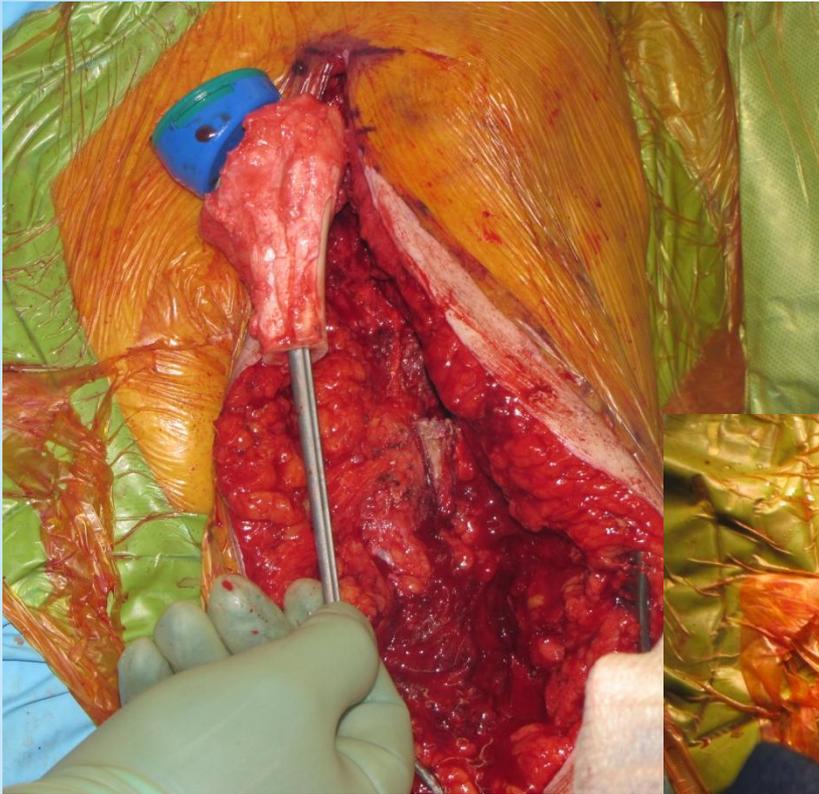
...Then she fell again...



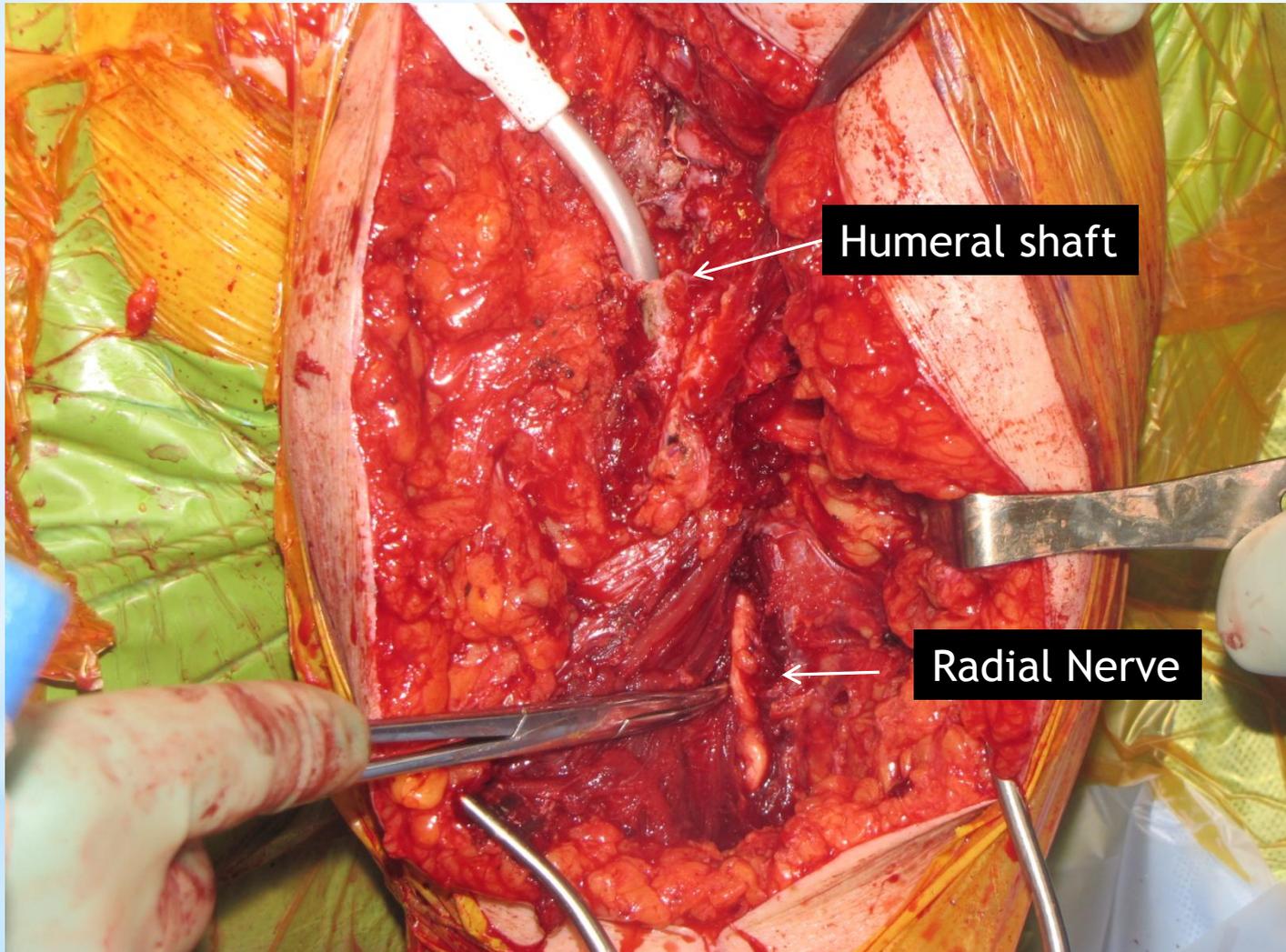
9/2013: Complex L reconstruction w/ radial nerve exploration and protection
(JPW and Dr. Jesse Jupiter)



Proximal Humeral Allograft Reconstruction



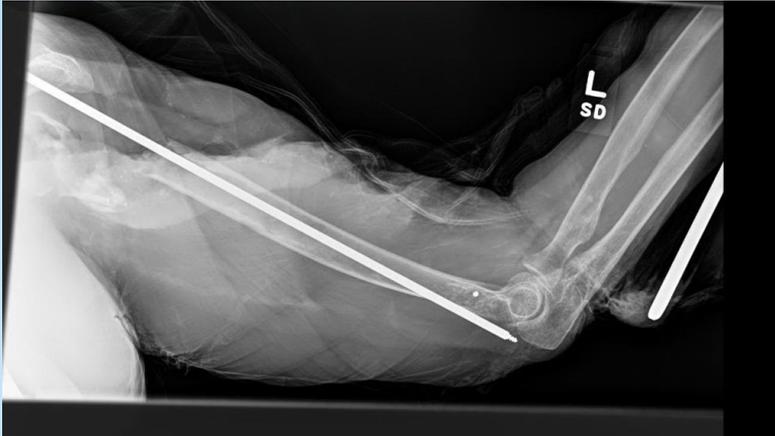
**Radial Nerve
Exploration**



Humeral shaft

Radial Nerve

9/2013, intra-op



Fall, 6/2014 (9 mo post-op)

AP 1/14 (4 mo post-op)



6/2014: Treated in long arm cast.
Persistent pain

11/14 (1 yr post-op, 5 mo after fall). Painful and uncomfortable, like “something is moving”



“I may have fallen?!”

12/2014: Felt an “acute change”, deformity above elbow with increasing pain, second fracture at distal end of prosthesis.



1/2015: Suspected infection. Resection arthroplasty, radial nerve neurolysis, placement of antibiotic spacer by NC and JPW

8/2015: Discussion of free fibular flap to reconstruct humerus (vs. amputation)
- unstable shoulder, large humeral defect after infected nonunion. Team decided not to undergo either



1/27/16



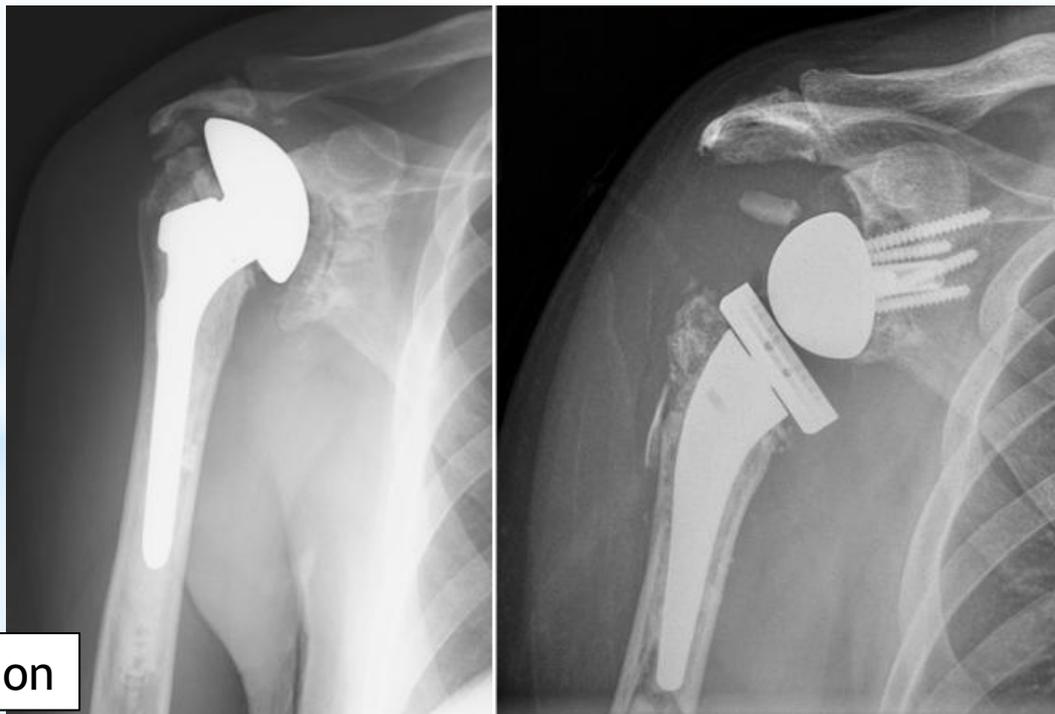
2/16: I&D, osteotomy, removal of cement spacers
Continued monitoring by ID and Dr. Chen

A Happier Case

53 yo Orthopedic Surgeon:

- Age 38: Capsulorrhaphy Arthropathy with B-2 Glenoid

1. (2000) Capsular release + subscapularis reconstruction
2. (2002) TSA + posterior capsular shift
3. (2007) Traumatic RCR Arthroscopically repaired
4. (2015) Lifting patient = Pain; Biopsy no infection; failed glenoid



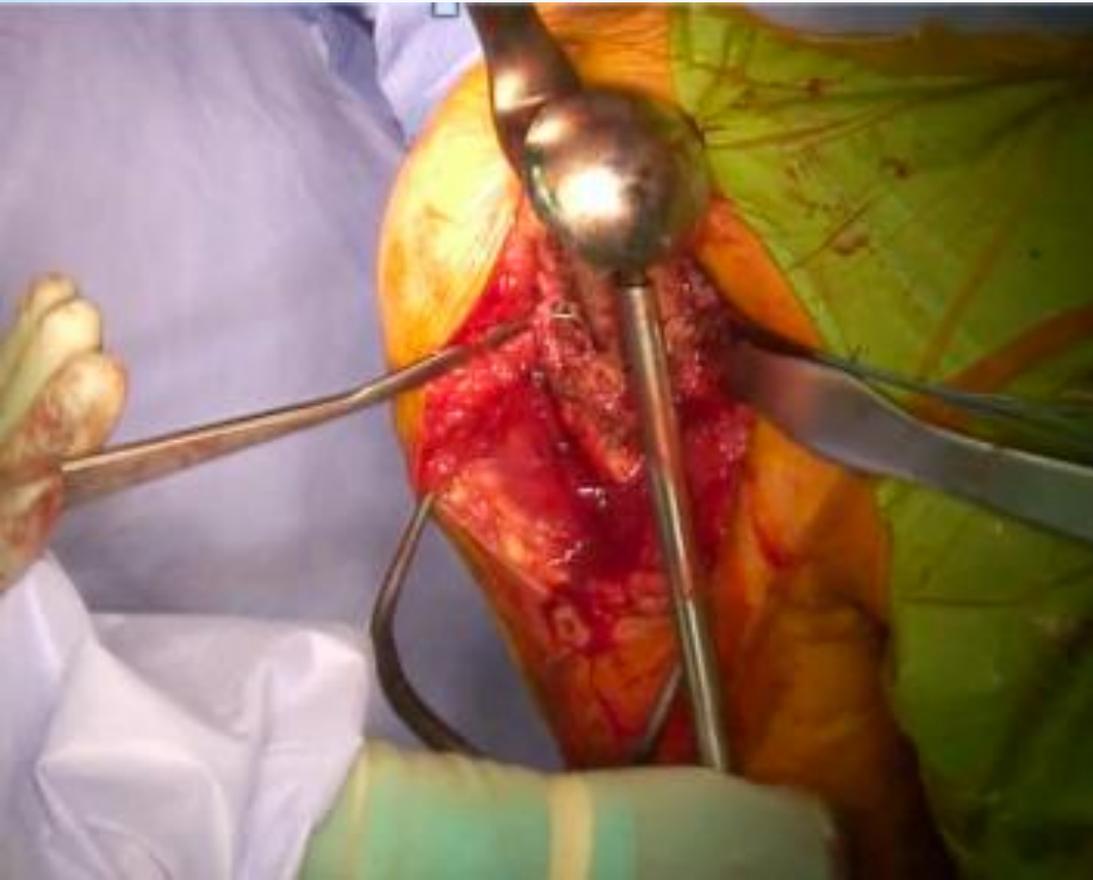
2 Years after Revision

2017 (2 years postop): Pain = 1-2; SSV = 85%; Working as an Orthopedic Surgeon
Specialty is Sports Medicine & Shoulder

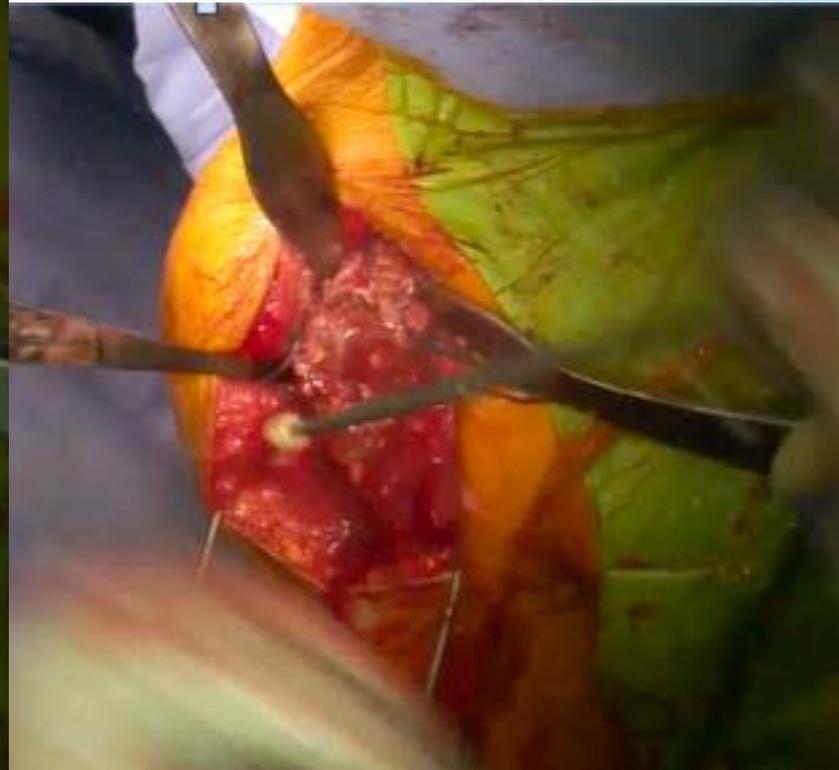


How did I get there?

Short, smooth stem easily extracted



Ultradrive to remove enough
Cement to allow for cementing
Into cement mantle



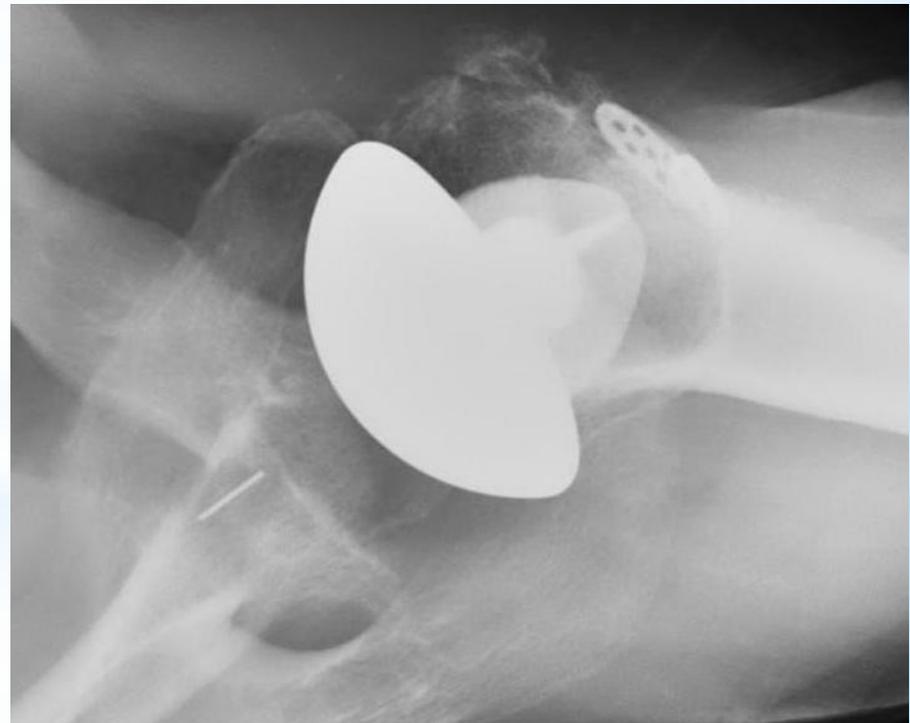
KEEP
CALM
AND
NO
PROBLEM



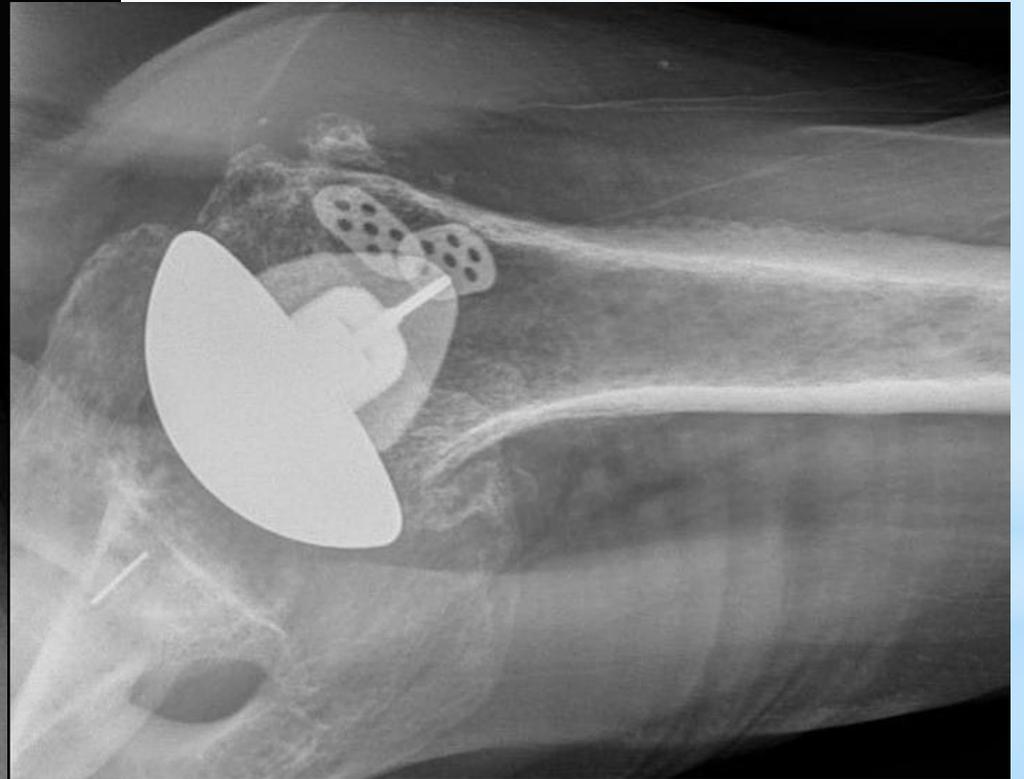
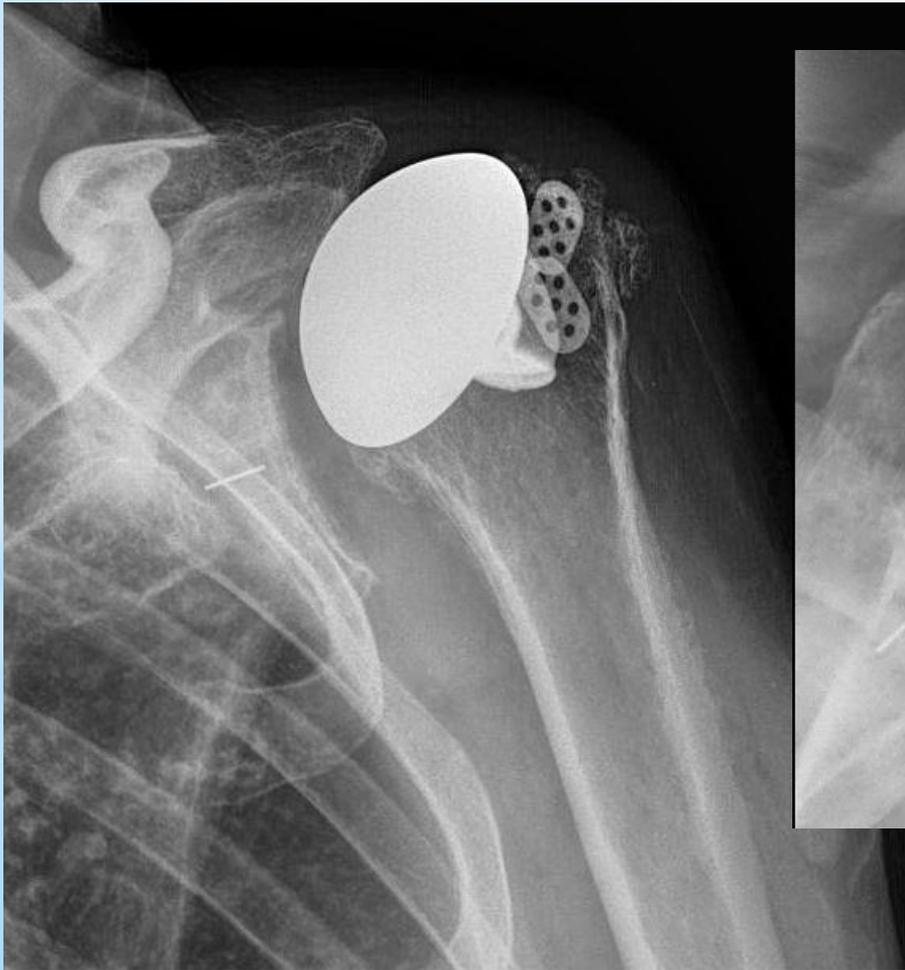
© 2008 King & Country Ltd. www.kingandcountry.com

84 YO M: Stemless TSA: 2 months postop SSV = 90%

7 months later he returns from Florida with weakness & Pain....thinks he may have fell...has been "very active"



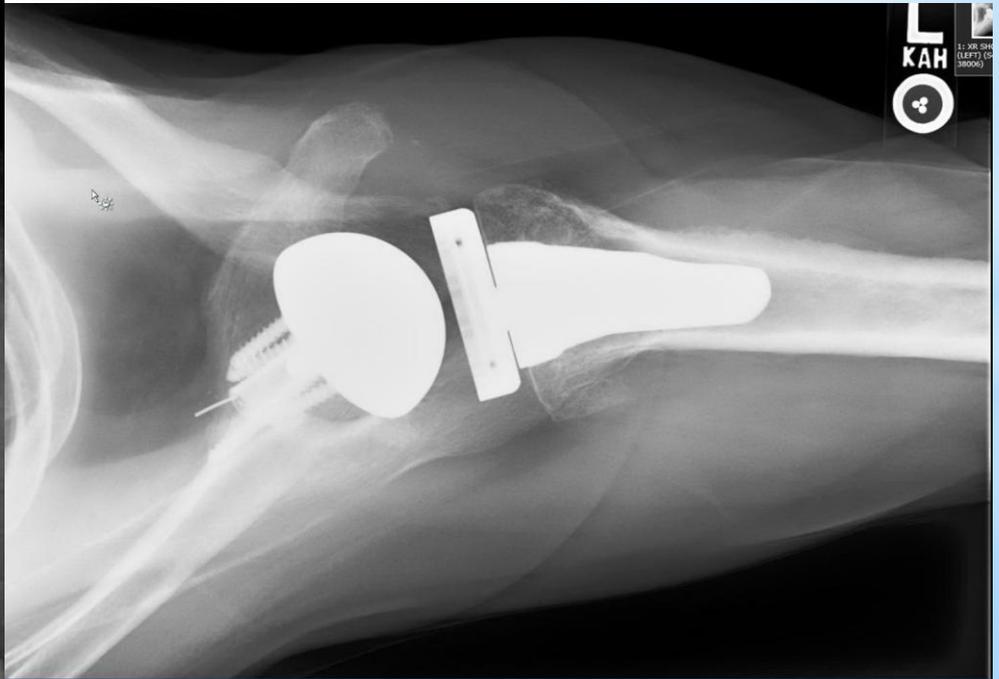
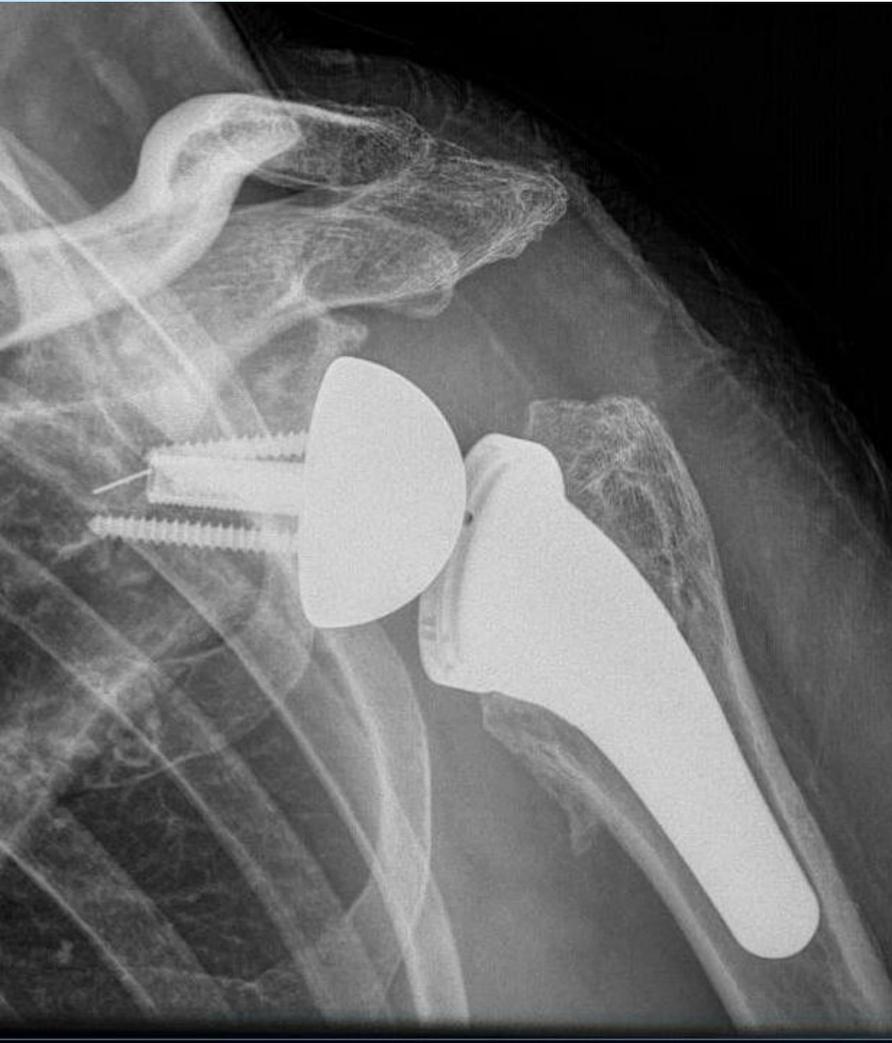
Rotator Cuff Tear



9/16, 3 mo post-op:

Pt very happy, no pain, SSV 80%. FF 140, easily put hand on head.

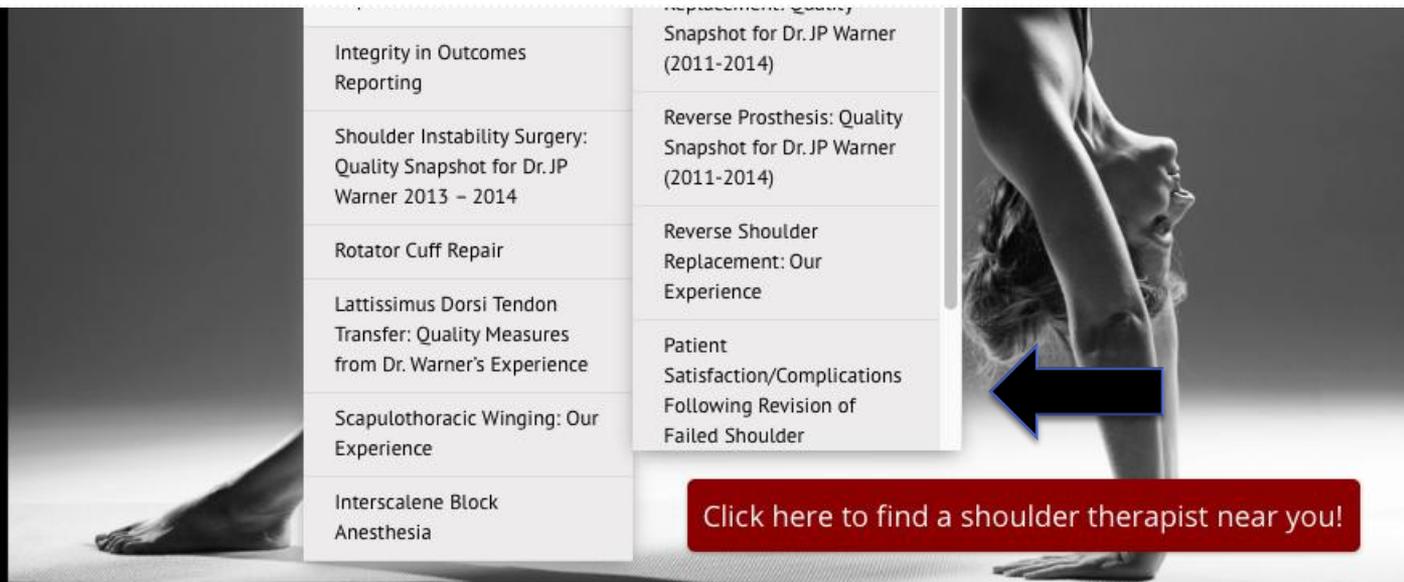
Continued strengthening and headed back to Florida for the winter.





Patient Satisfaction and Complications Following Revision of Failed Shoulder Replacement

Jon J.P. Warner, MD, Maggie Coats-Thomas, BS, & Megan Marshall, BA – November 2015



Integrity in Outcomes Reporting

Shoulder Instability Surgery: Quality Snapshot for Dr. JP Warner 2013 – 2014

Rotator Cuff Repair

Lattissimus Dorsi Tendon Transfer: Quality Measures from Dr. Warner's Experience

Scapulothoracic Winging: Our Experience

Interscalene Block Anesthesia

Replacement Quality Snapshot for Dr. JP Warner (2011-2014)

Reverse Prosthesis: Quality Snapshot for Dr. JP Warner (2011-2014)

Reverse Shoulder Replacement: Our Experience

Patient Satisfaction/Complications Following Revision of Failed Shoulder

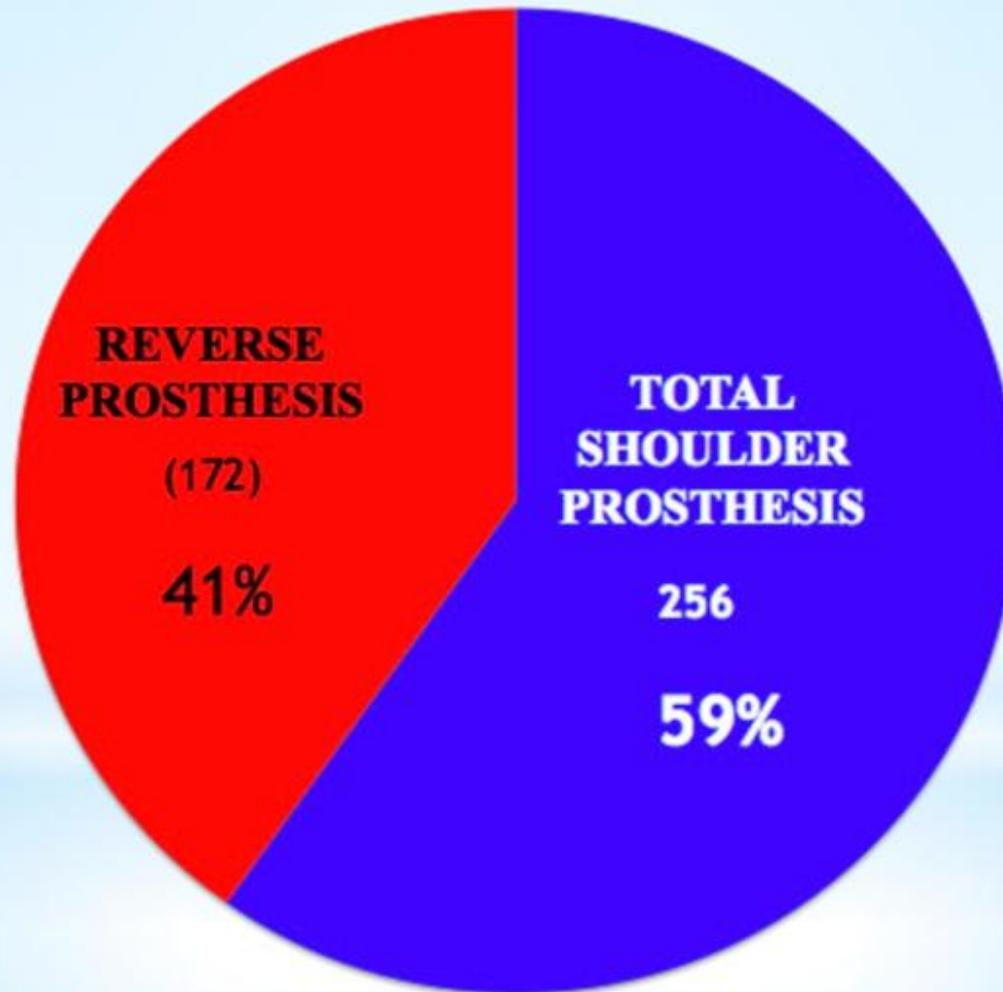
Click here to find a shoulder therapist near you!

Welcome to the Boston Shoulder Institute

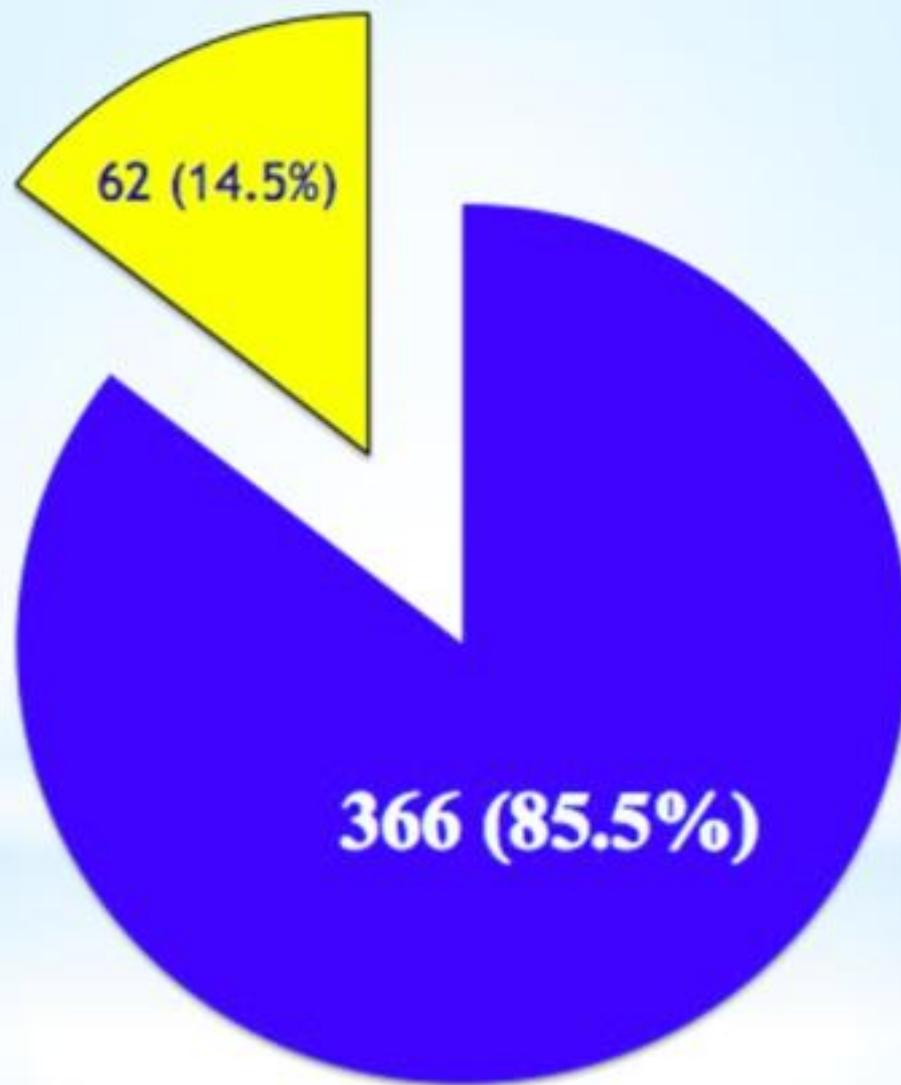
The Boston Shoulder Institute is based at the Massachusetts General Hospital and the Brigham and Women's Hospital. We specialize in management of all problems affecting the shoulder and have a particular emphasis on management of failed treatments, arthroscopic reconstruction, joint replacement for arthritis, and more. Read our [mission statement](#), [meet the doctors](#), or [contact us](#) to learn more.

Dr. Jon J.P. Warner's Experience

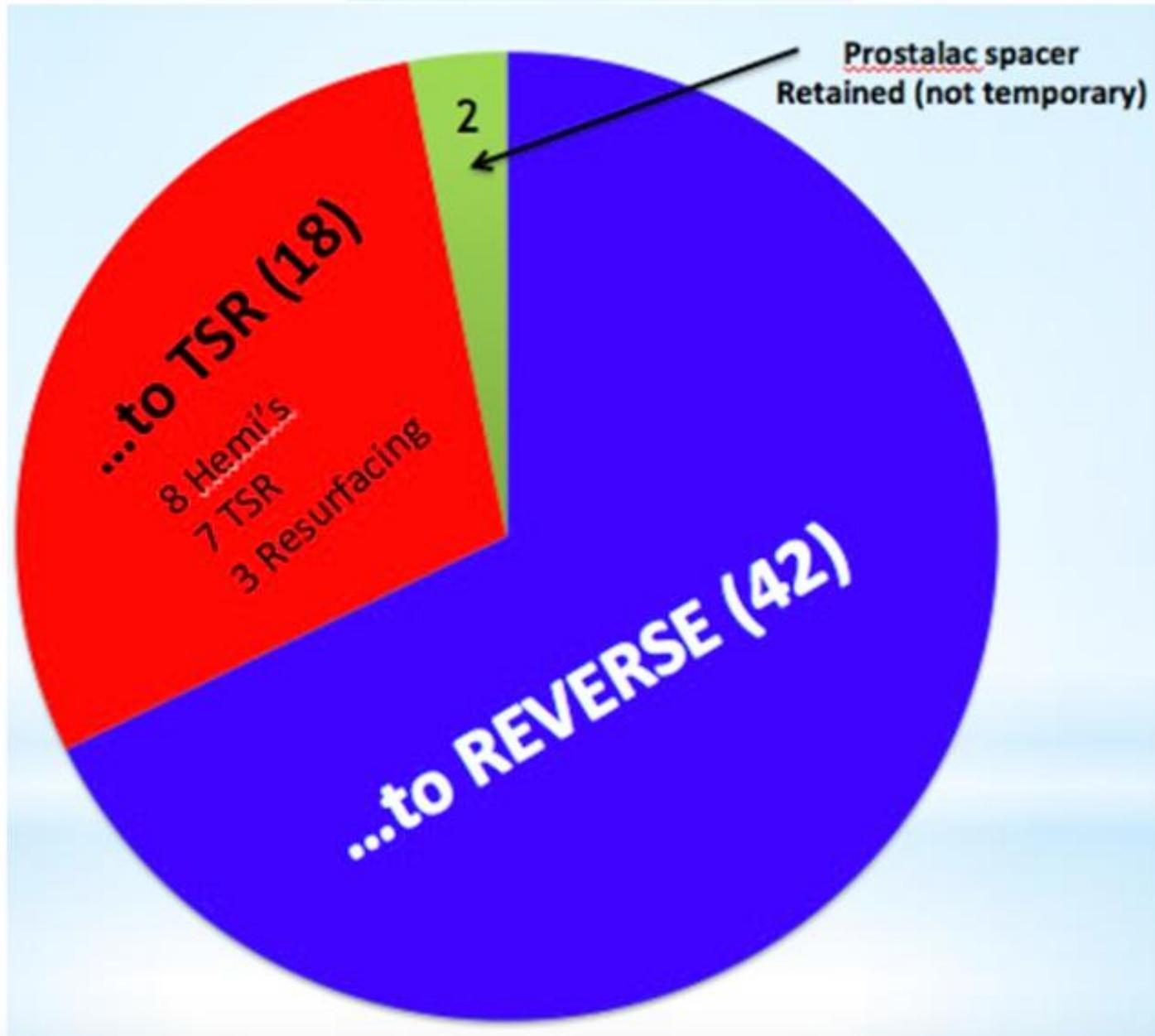
4-YEAR (2011-2014) ARTHROPLASTY EXPERIENCE JPW): 428 Cases



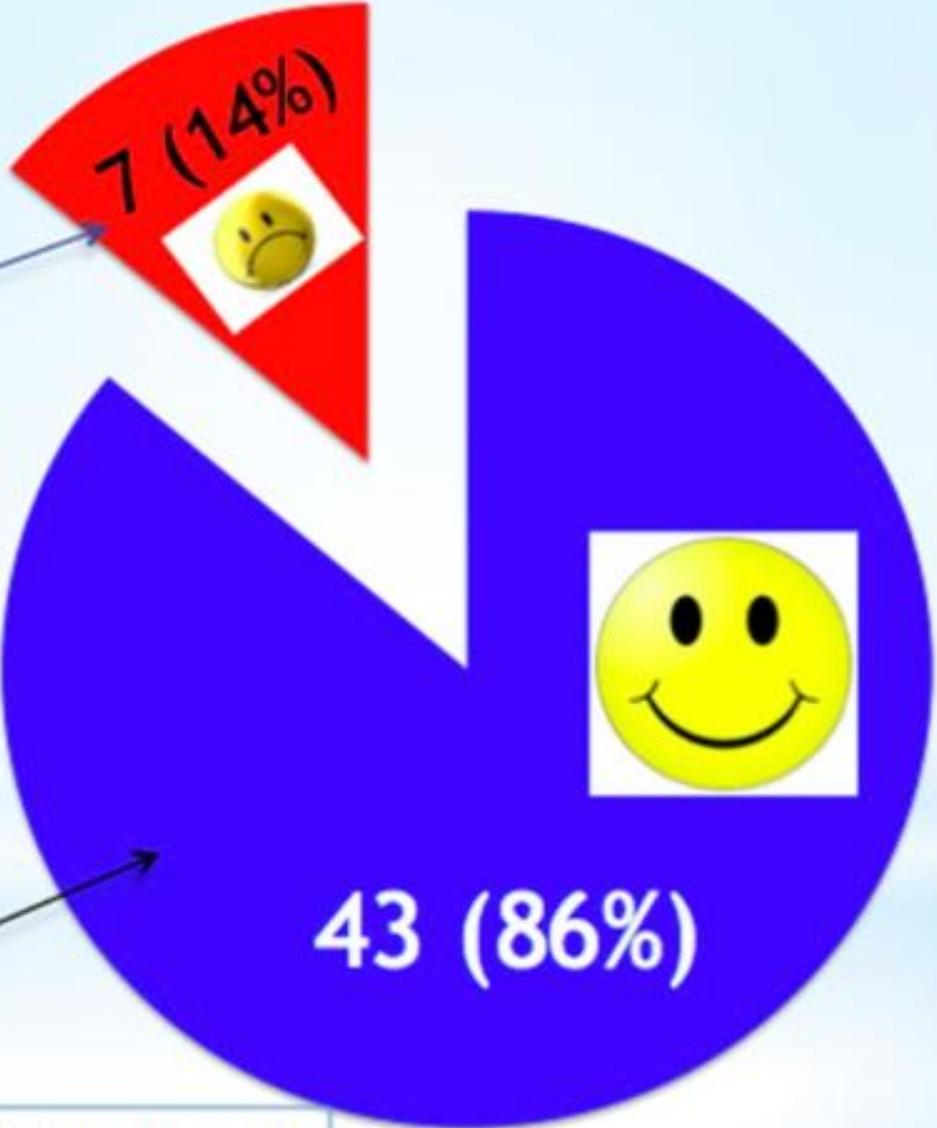
REVISION SHOULDER ARTHROPLASTY (2011-2014)



Revision to.....



PATIENT SATISFACTION (50)



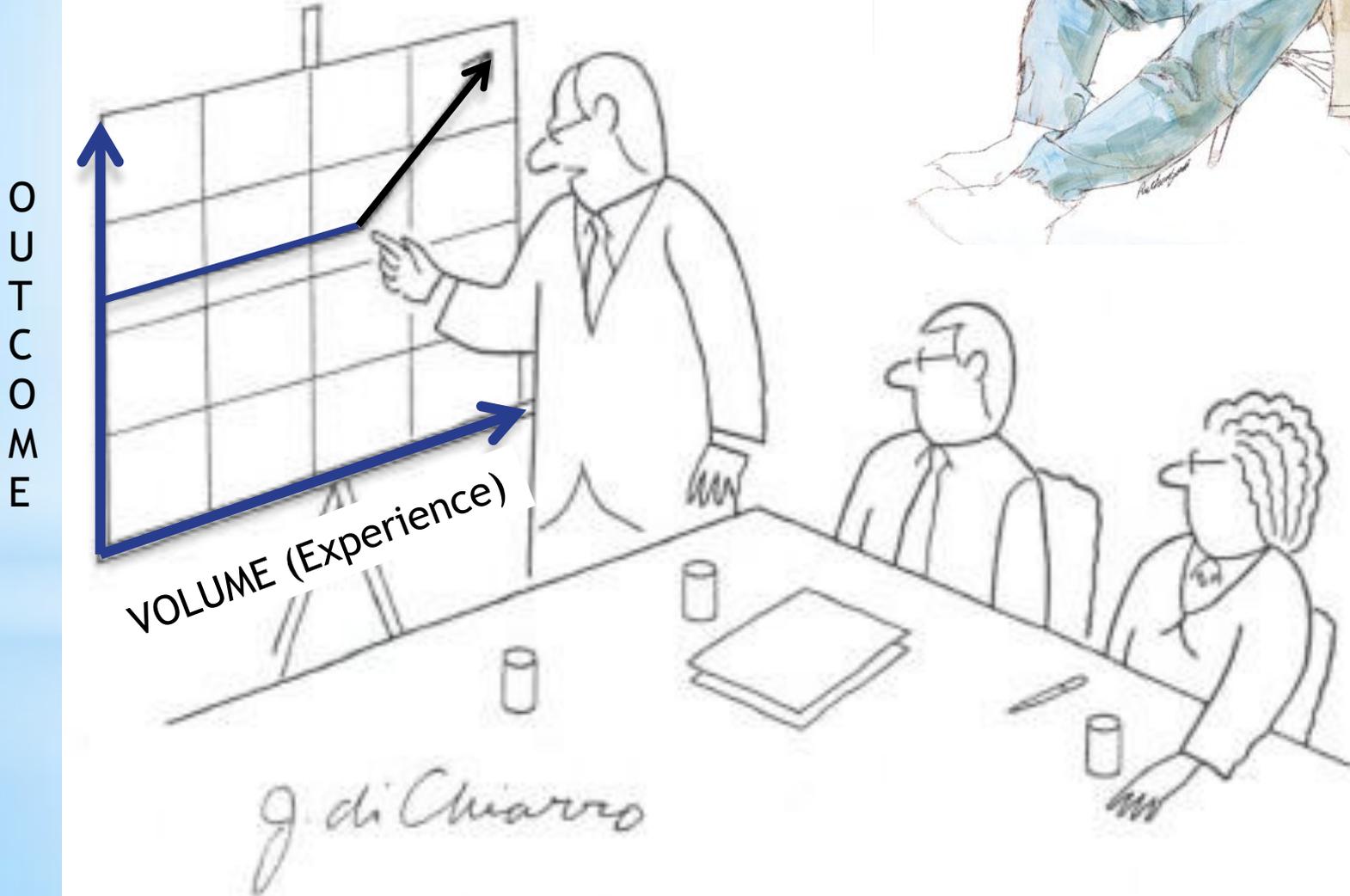
Unhappy/Feel worse

Happy with outcome/would do it again

Good results comes from Bad results,
...which comes from experience



Value curve





Münzplatz

BOHN

blumen fitze

blume



