North Carolina Orthopaedic Association

2015 Annual Meeting

Upper Extremity
Saturday, October 10

October 9-11, 2015 • Kiawah Island Golf Resort

Kiawah Island, South Carolina

This continuing medical education activity is jointly provided by the NCOA and the Southern Regional Area Health Education Center

Congenital Bilateral Upper Extremity Extrinsic Flexor Contracture

J. Mack Aldridge III, MD
Triangle Orthopaedics
Durham, NC

Kiawah Island

Triangle Orthopaedic Associates, P.A.

Disclosure

- Educational lecturer for Acumed

35 year old female appointments listed as "Trigger Finger"

- Lifetime difficulty extending fingers (on both hands) "unless my wrist is pointed down."
- Father and Grandfather had same condition

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Physical Exam:

- Exam
  - Normally developed female
  - No stigmata of congenital differences
  - Bilateral Extrinsic Tightness of FDS and ? FDP, and mild involvement of FPL
  - No intrinsic tightness, no wrist flexor/pronator tightness
- Recommendation…
  - Continue as you have for 35 years

3 years later…. Same patient

- "I want to try to fix my fingers"
- "I was teased as a child and am scarred"

  (emotional at this point in encounter)
- "It is awkward socially shaking hands"
- "I can't clap at games/concerts, shake hands, braid my daughters' hair, etc…"

- Long discussion had with the patient

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Options??

- Z-lengthening of FDS, FPL, and possibly FDP ??
- Flexor slide ??
- Consented for both, contingent on intra-operative findings

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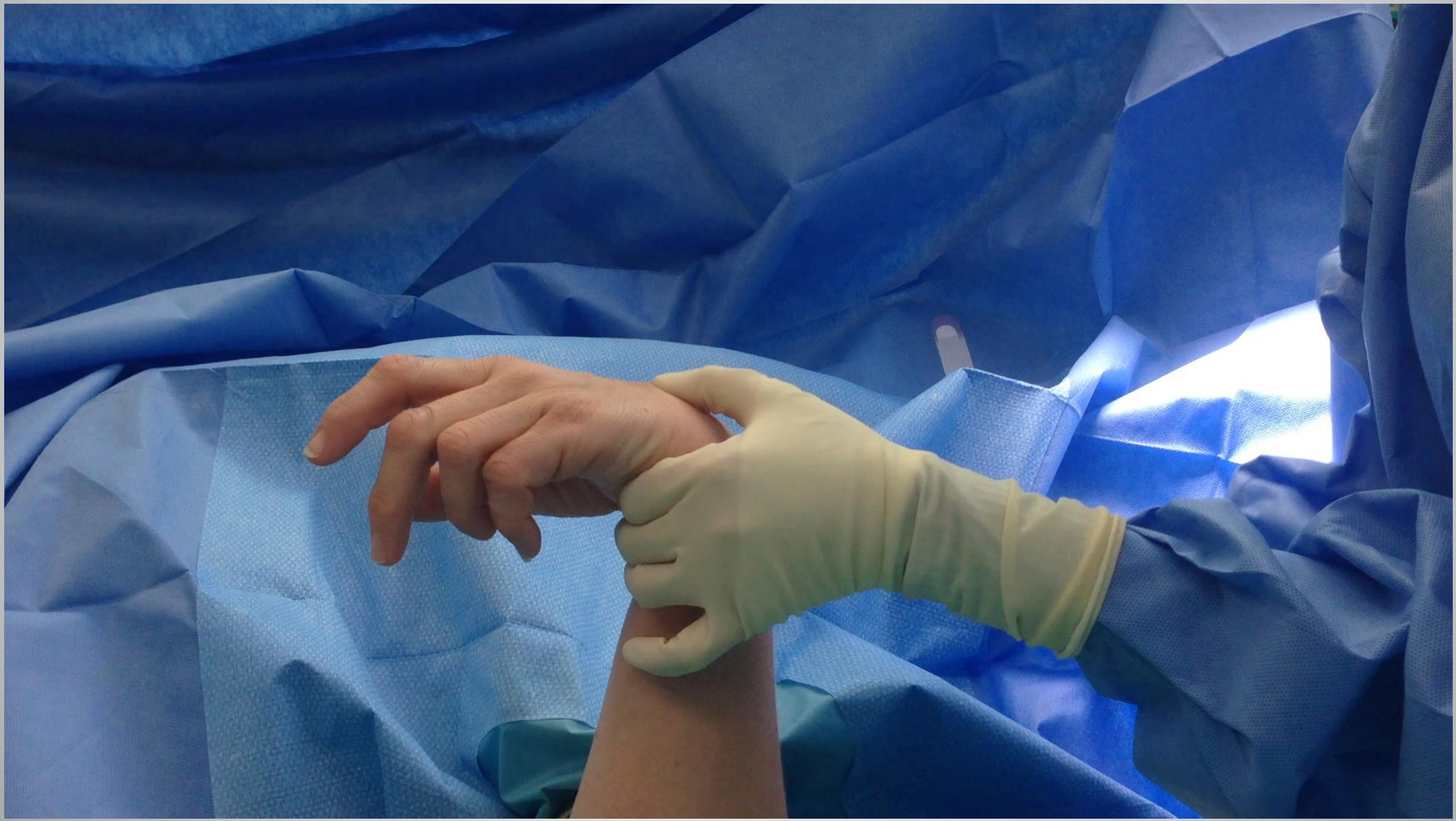
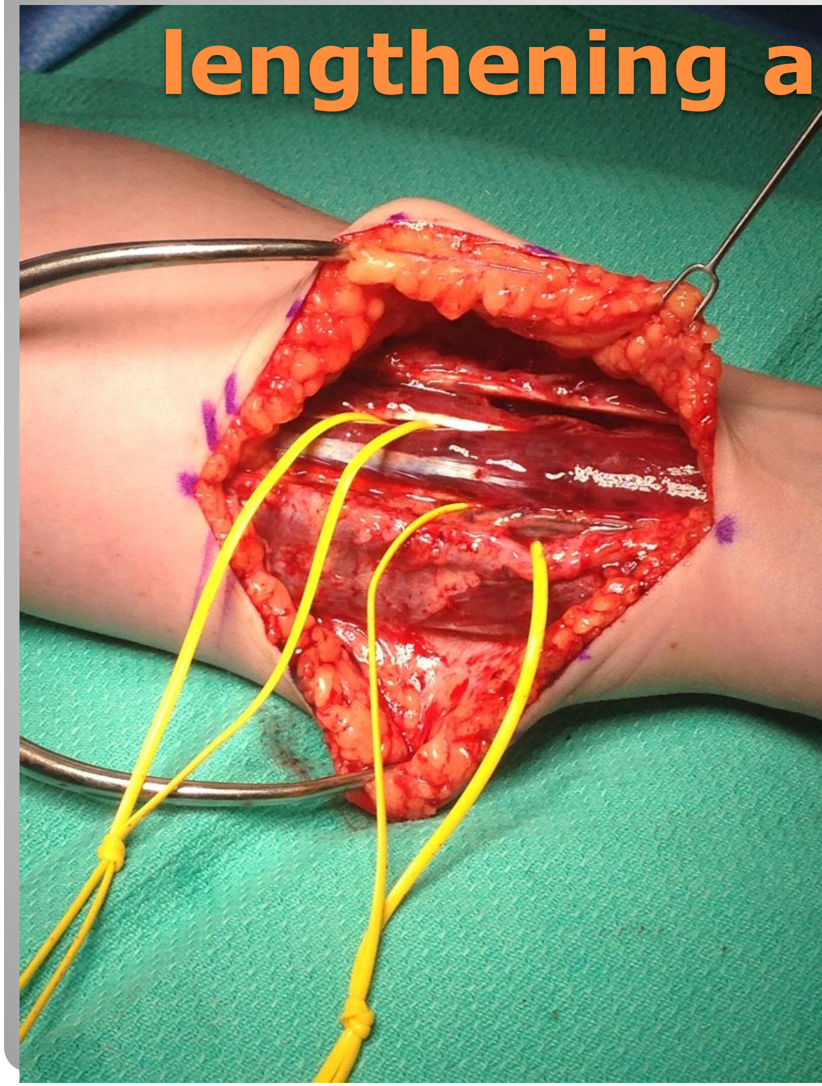
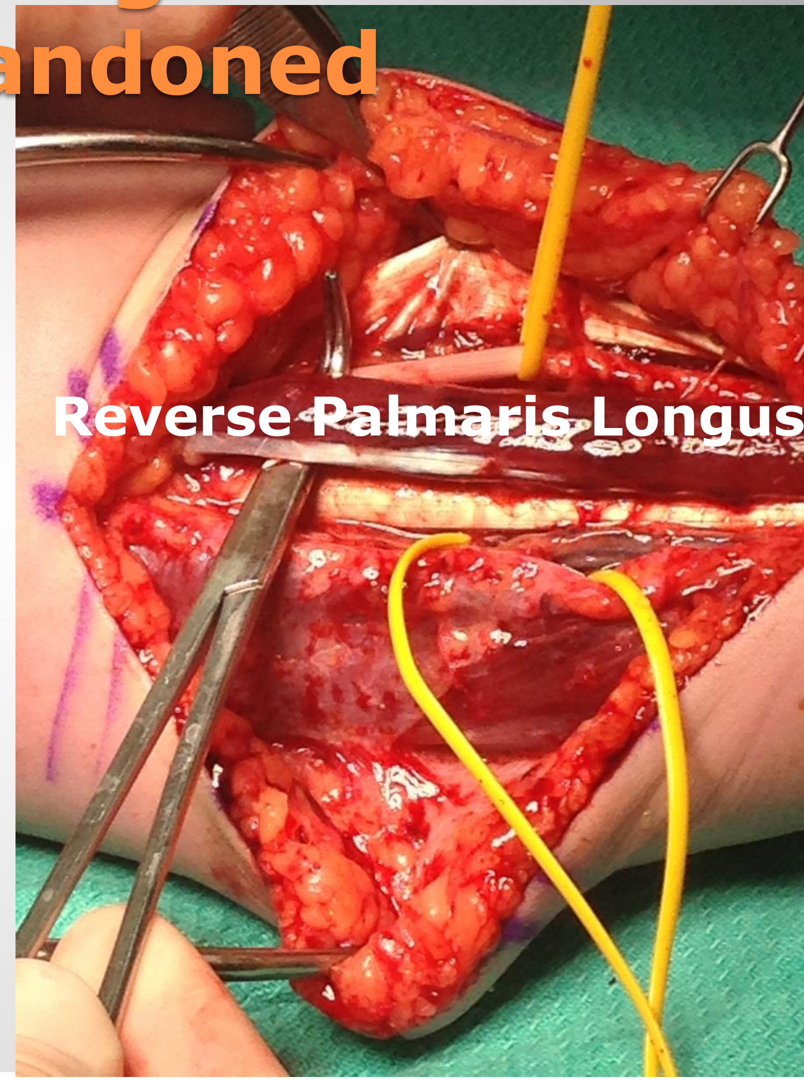
Pre-Op Video

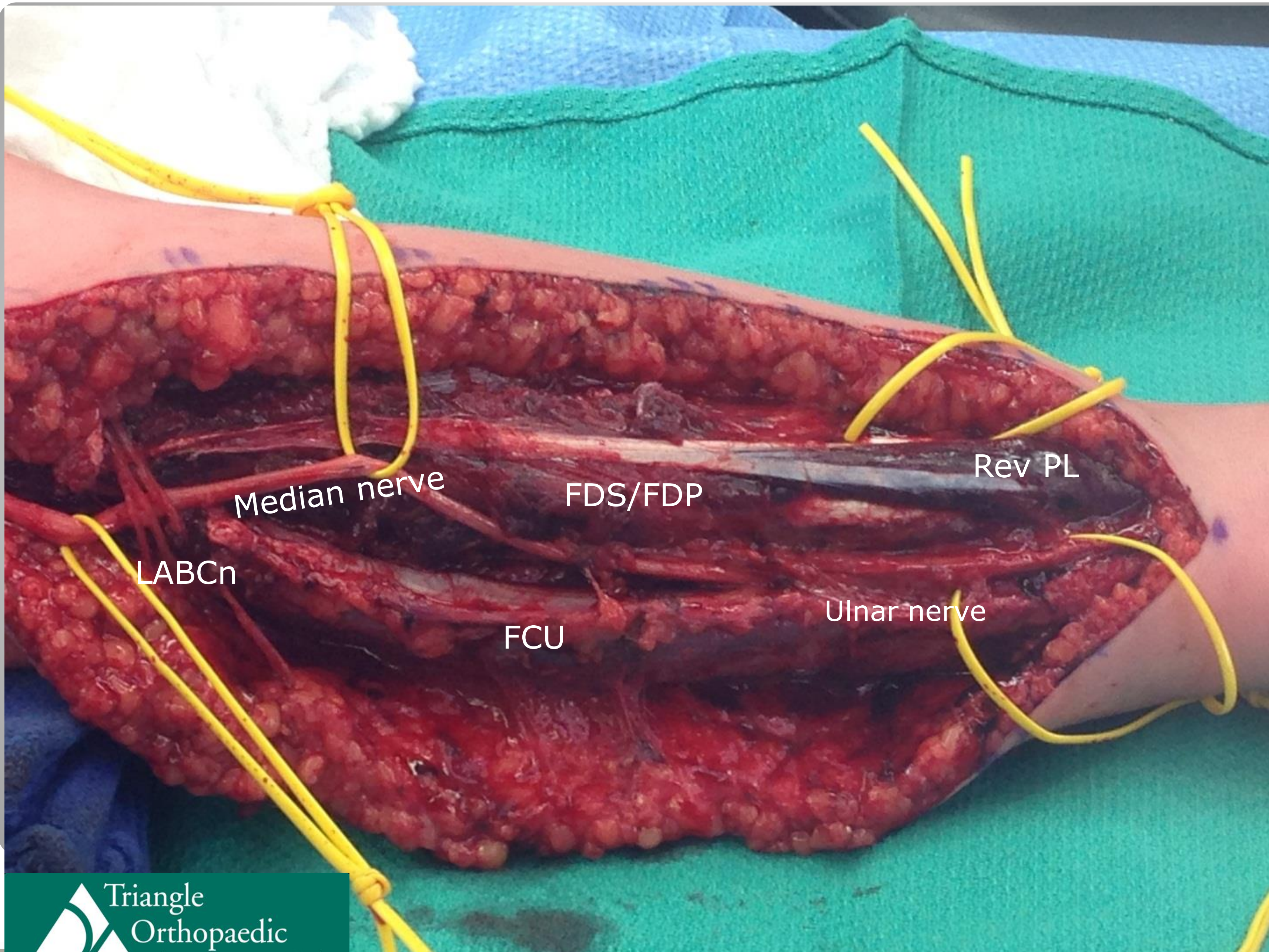


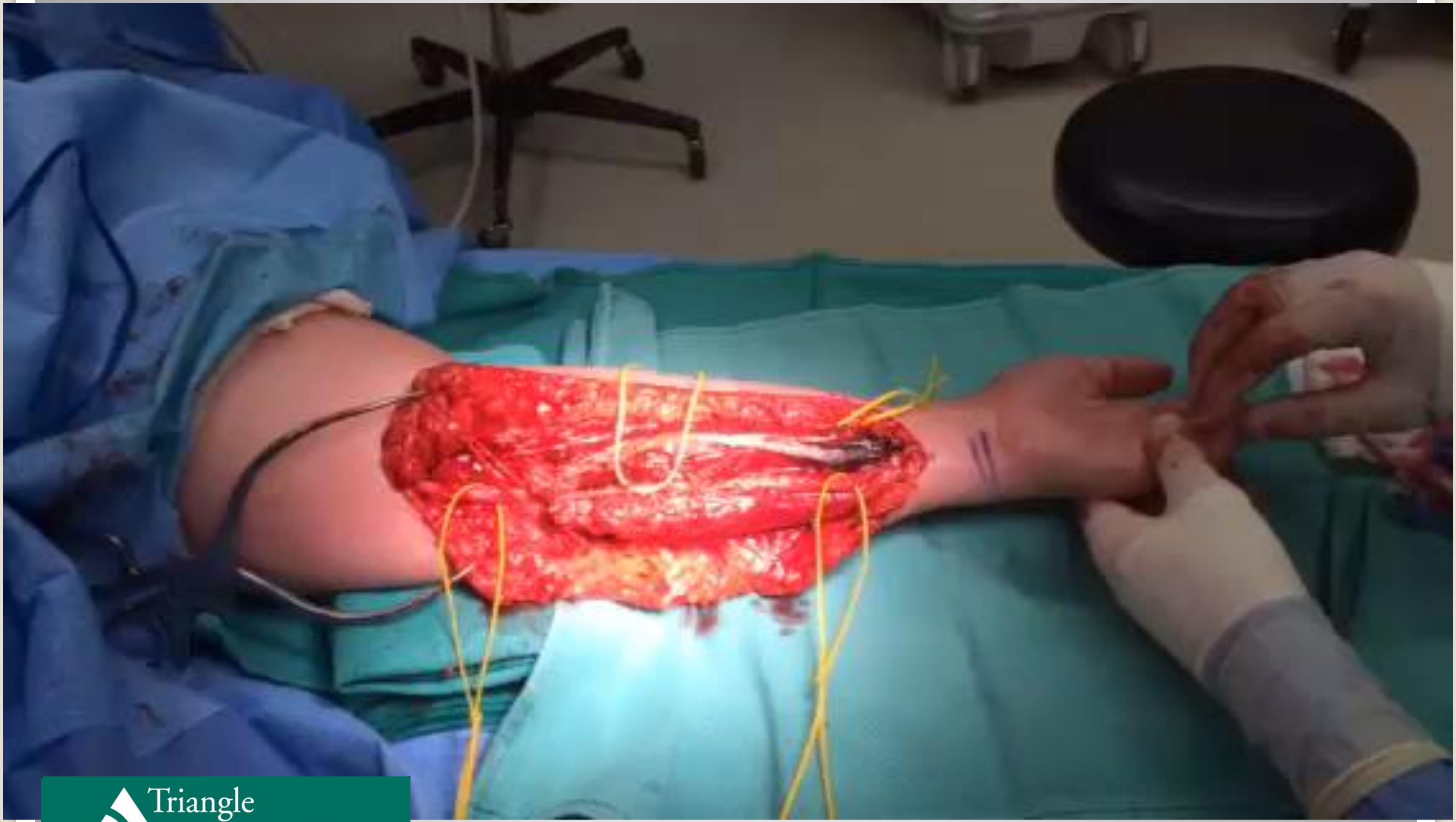
Both FDP & FDS tight…Z-lengthening abandoned





Ulnar & Median nerves isolated


Median nerve
FDS/FDP
Rev PL
LABCn
FCU
Ulnar nerve



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st-Op (NVI)

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OT dorsal ext block splint for 6 weeks- Active Extension no active flexion, but digital PROM allowed

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Knuckle Pads Non-op side

Knuckle Pads Operative Side

6 months later- Dominant Side

1 Year Left / 6 months Right

Hereditary Congenital Shortening of FDP/FDS & FDP – paucity of literature

- **Congenital Shortening of the Flexor Digitorum Profundus Muscle,** J Hand Surg, 2007 32(2), pp. 168–171; Takehiko Takagi, Shinichiro Takayama, Hiroyasu Ikegami, Toshiyasu Nakamura

- **Congenital Flexion Deformity of the Long, Ring, and Little Fingers With an Aberrant Origin of the Flexor DigitorumProfundus: Case Report,** *J Hand Surg 2008;33A:1358 – 1361.* Ge Xiong, MD, PhD, Yankun Sun, MD, Shuhuan Wang, MD

- Trismus pseudocamptodactyly syndrome.
  - Inability to open mouth fully, IP contractures with wrist extended

- Congenital Volkmann's ischemic contracture

Thank you

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Massive rotator cuff repairs using interposition porcine acellular dermal matrix xenograft

32nd Annual Southern Orthopaedic Association Annual Meeting

Kiawah Island, SC

October 10, 2015

Duke Orthopaedic Surgery

Julie A Neumann, MD
Kathleen D Reay, MD
Milt H Zgonis, MD
Stephanie W Mayer, MD
Blake R Boggess, DO
Alison P Toth, MD

Disclosures/Source of Funding

- Julie A Neumann, MD
  - None
- Kathleen D Reay, MD
  - None
- Milt H Zgonis, MD
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- Stephanie W Mayer, MD
  - None
- Blake R Boggess, DO
  - Educational grants to teach ultrasound courses: GE®; SonoSite, Inc.; Bioventus LLC; Arthrex, Inc.
- Alison P Toth, MD
  - Research support, Education Consultant, Speaker's bureau: Tornier, Inc.

Background

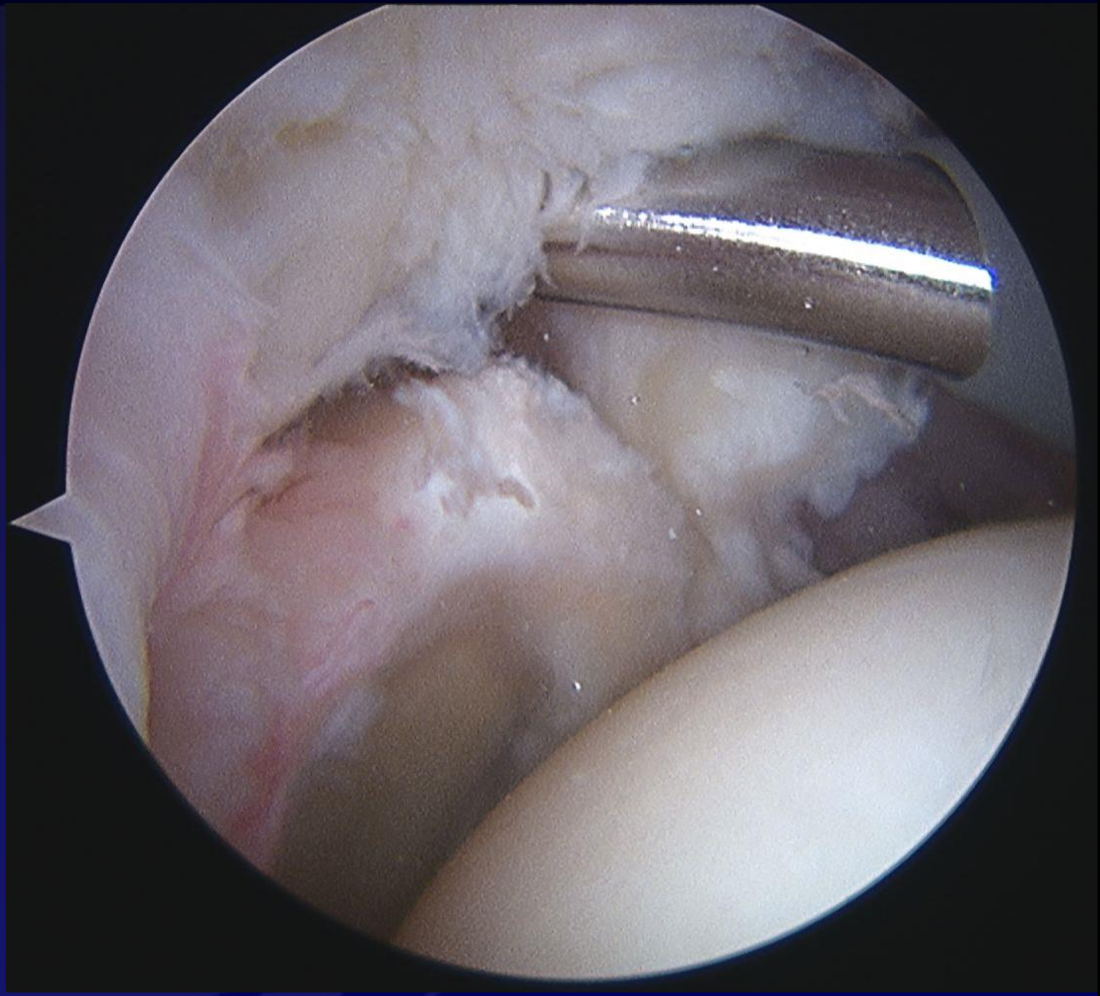
- Massive rotator cuff tears (RCT): debilitating shoulder pain & decreased range of motion[1]

Source: Dr. Toth's personal files

- Difficult problem to treat[1,3]
- Failure rates of primary RCR 20-90%[1,4]
- Healing ability RCT inversely size tear & retraction[1]

Background

Cuff retracted to glenoid



Source: Dr. Toth's personal files

- Massive RCT:
  - Nonoperative
  - Debridement
  - Partial open or arthroscopic RCR
  - Muscle transfers
  - Arthroplasty
  - Extracellular matrix augmentation
  - Tissue interposition[1]
- No clear front runner
- Porcine acellular dermal matrix xenograft (Conexa™, Tornier, Inc; Bloomington, Minnesota) not FDA-approved as interposition grafts

Purpose

- Short-term safety & efficacy of repairing massive tears with interposition porcine acellular dermal matrix xenograft

Source: Dr. Toth's personal files

- Second and largest case series of repair of massive RCTs with porcine xenograft in which patients are followed clinically and via imaging

- Hypothesis: Interposition of porcine acellular dermal matrix xenograft in massive RCT will improve:
  - Subjective outcomes, pain, function, ROM, strength

Methods

- Prospective, observational
- PI performed all surgeries
- RCR
  - Mini-open approach
  - Interposition porcine acellular dermal matrix xenograft
  - Jan 2009 to March 2011
- 37 patients
  - 5 revisions

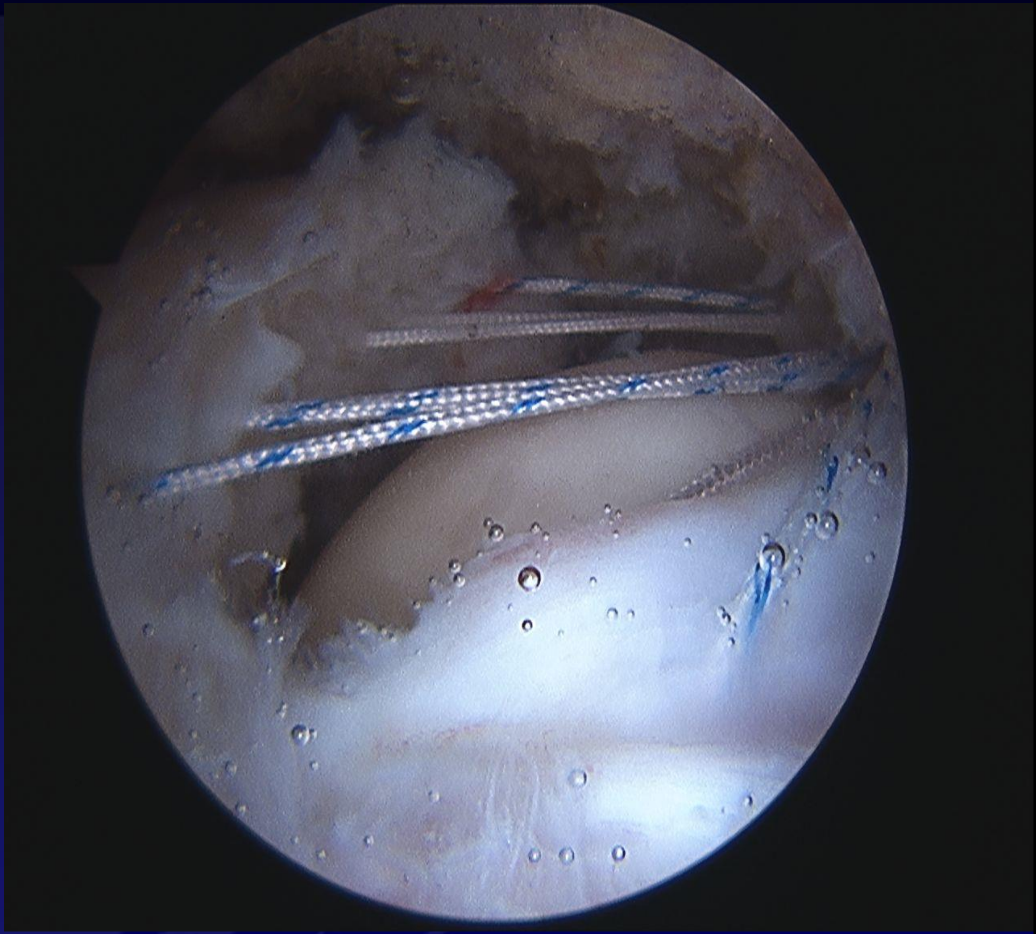
Arthroscopically place medial sutures

Source: Dr. Toth's personal files

- Mean age 66 years (range, 51 to 80)
- Mean follow-up 33 months (range, 23 to 48)

Indications

Assess mobility

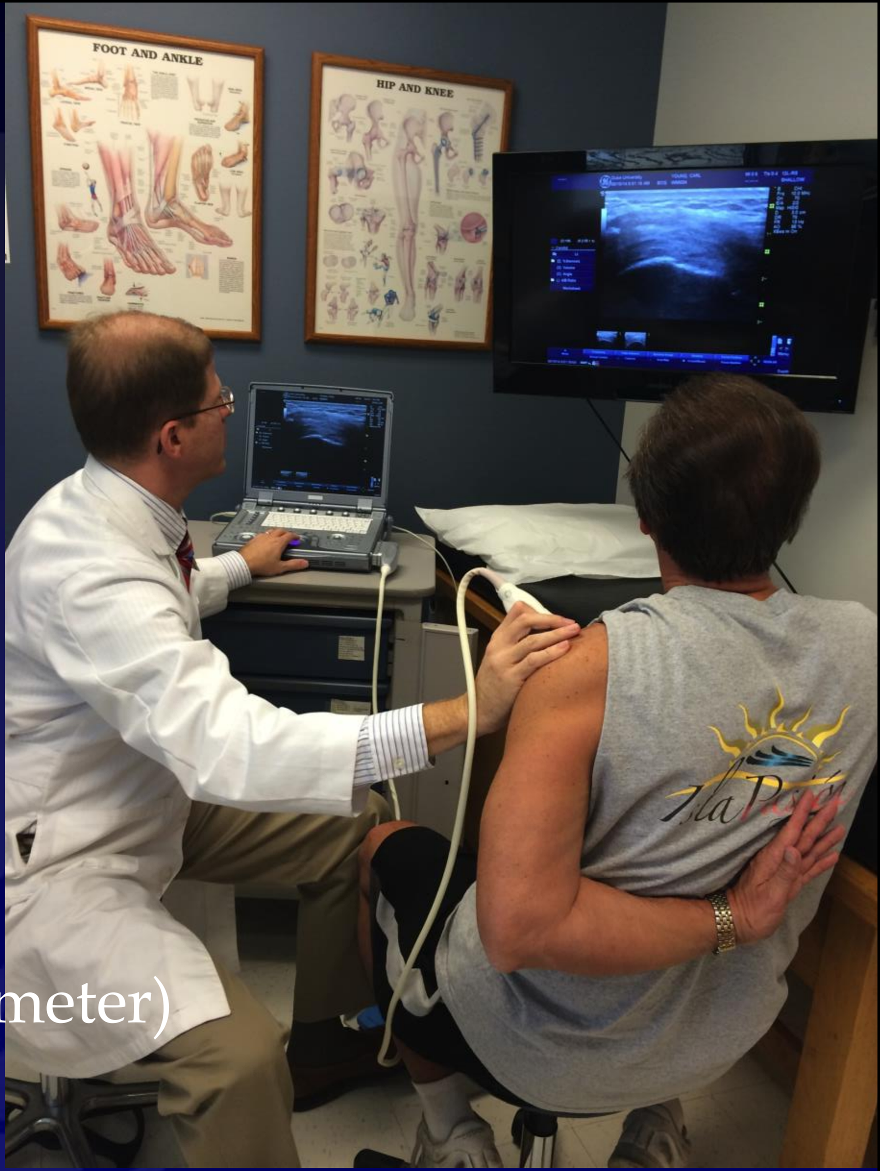


Source: Dr. Toth's personal files

- Full-thickness RCT, >5cm preoperative MRI
- Failed non-operative management X 6 mo
  - NSAIDs and PT
- Inability to restore cuff to anatomic footprint
- No limitation to postoperative PT

Methods

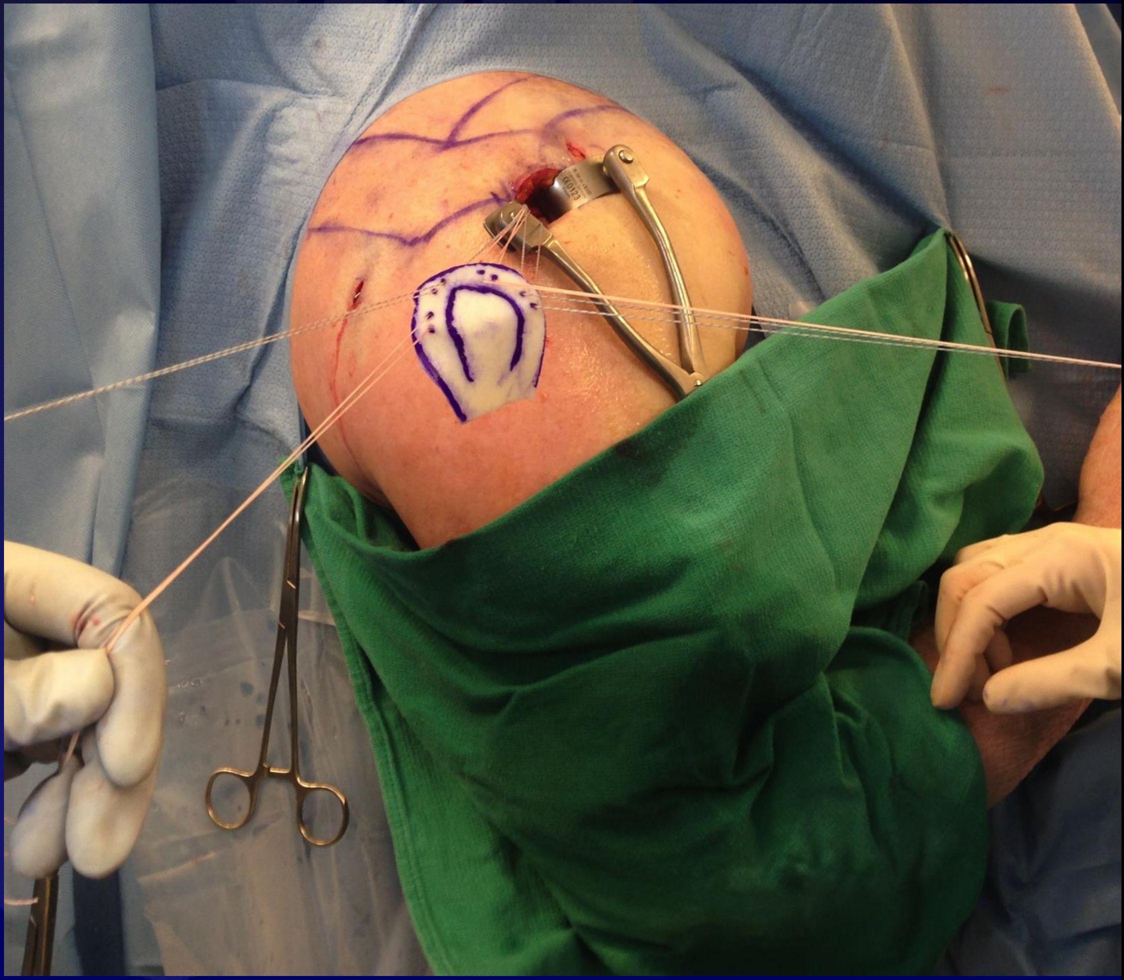
- Subjective:
  - Visual Analog Score (VAS) (0 to 10, 0 = no pain)
  - Modified American Shoulder and Elbow Score (MASES)
  - Short-Form 12 (SF-12)
- Objective:
  - Active ROM FF, ER, IR (goniometer)
  - Strength SS and IS:
    - Manually (10 pt scale)
    - IsoSource Control Dynamometer (Medical Devices Solutions AG, Oberburg, Switzerland)
  - Ultrasound: integrity of the repair



Source: Dr. Boggess's personal files

Results

- No major postoperative complications
  - Infection
  - Tissue rejection
  - Hardware migration/fractu re



Source: Dr. Toth's personal files

Table 2: Average Pain, Functional Outcome, Active Range of Motion and Strength Pre-operatively and Post-operatively at an Average of 33-Months Follow-up

	Pre-operative (Standard Deviation)	Final Follow-up (Standard Deviation)	P Value[a]
Pain (VAS)	4.53 (2.22)	1.06 (1.81)	<0.001
SF-12	47.49 (6.27)	48.50 (6.81)	0.544
Active forward flexion	133.2° (42.3)	157.9° (25.4)	0.003
Active external rotation at 0° abduction	51.56° (21.68)	64.25° (17.1)	0.001
Active internal rotation at 90° of abduction	49.81° (19.72)	73.96° (9.83)	<0.001
Supraspinatus strength[b]	7.3	8.9	<0.001
Infraspinatus strength[b]	7.4	9.4	<0.001

[a]Within subjects differences were tested using paired t-tests. Significance (2-tailed) was set at 0.05.

[b]Based on muscle strength conversion scale adapted from Table 1 of Kendall et al (Kendall)

Table 2: Average Pain, Functional Outcome, Active Range of Motion and Strength Pre-operatively and Post-operatively at an Average of 33-Months Follow-up

	Pre-operative (Standard Deviation)	Final Follow-up (Standard Deviation)		P Value[a]
Pain (VAS)	4.53 (2.22)	1.06 (1.81)	-3.47	<0.001
SF-12	47.49 (6.27)	48.50 (6.81)		0.544
Active forward flexion	133.2° (42.3)	157.9° (25.4)	+24.7	0.003
Active external rotation at 0° abduction	51.56° (21.68)	64.25° (17.1)	+12.69	0.001
Active internal rotation at 90° of abduction	49.81° (19.72)	73.96° (9.83)	+24.15	<0.001
Supraspinatus strength[b]	7.3	8.9	+1.6	<0.001
Infraspinatus strength[b]	7.4	9.4	+2.0	<0.001

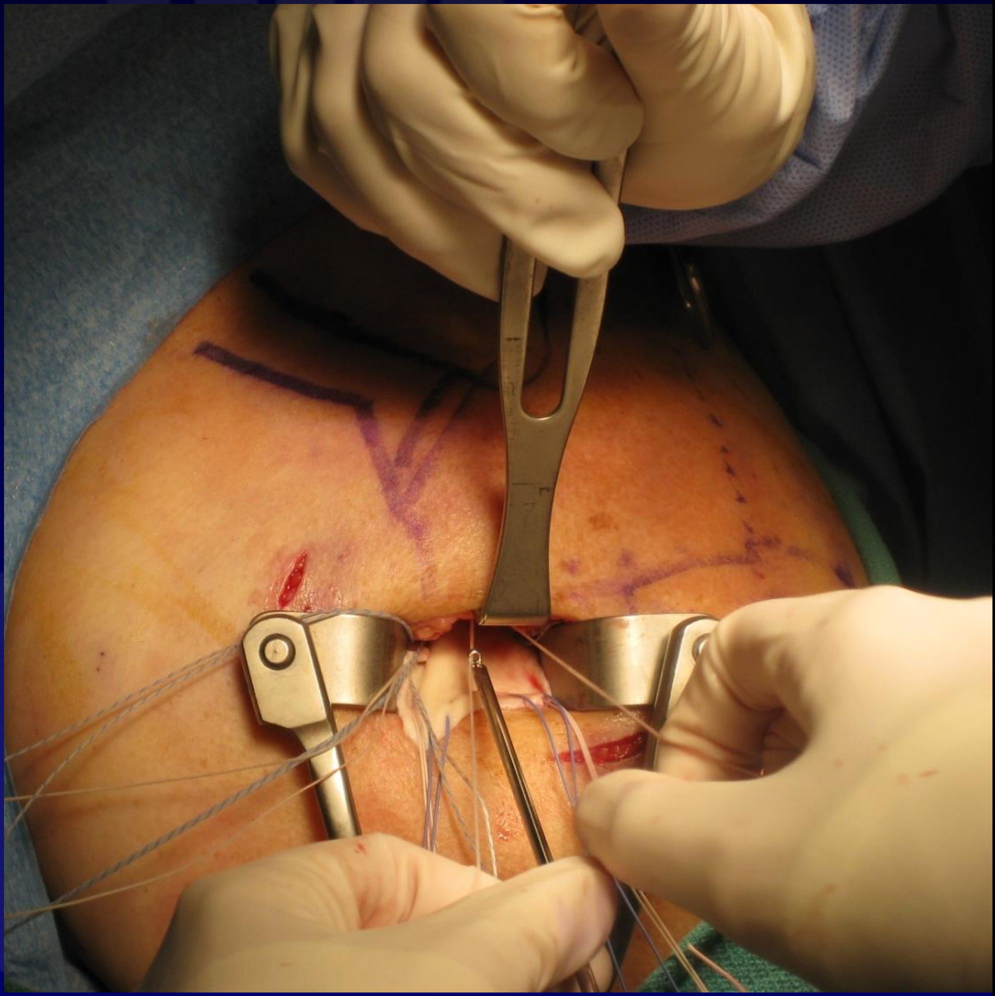
[a]Within subjects differences were tested using paired t-tests. Significance (2-tailed) was set at 0.05.

[b]Based on muscle strength conversion scale adapted from Table 1 of Kendall et al (Kendall)

Dynamometer Results

- Quantitative post-op strength
- Supraspinatus strength
  - Measured in forward flexion
  - Mean 88.1N non-op
  - Mean 68.6N operative
  - $P < 0.01$
- Infraspinatus strength
  - Measured in external rotation
  - Mean 59.3N non-op
  - Mean 50.6N operative
  - $P = 0.03$

Medial sutures tied

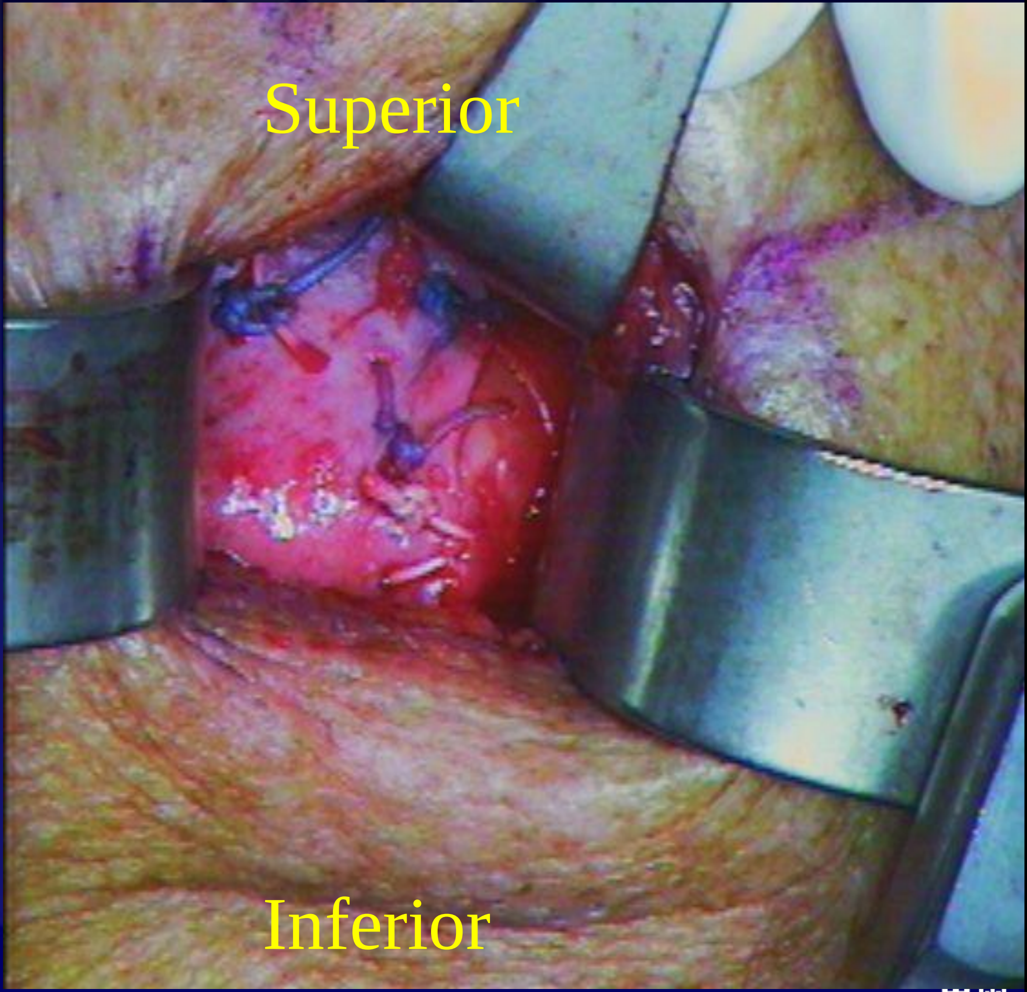


Source: Dr. Toth's personal files

MASES/SF-12 Results

- Average post-operative MASES was 89.23 +/-13.91
- Post-op SF-12 was 48.5
- Only 14 patients had pre-operative SF-12 scores (mean 47.5)
  - Difference in pre-operative and post-operative scores: not statistically significant

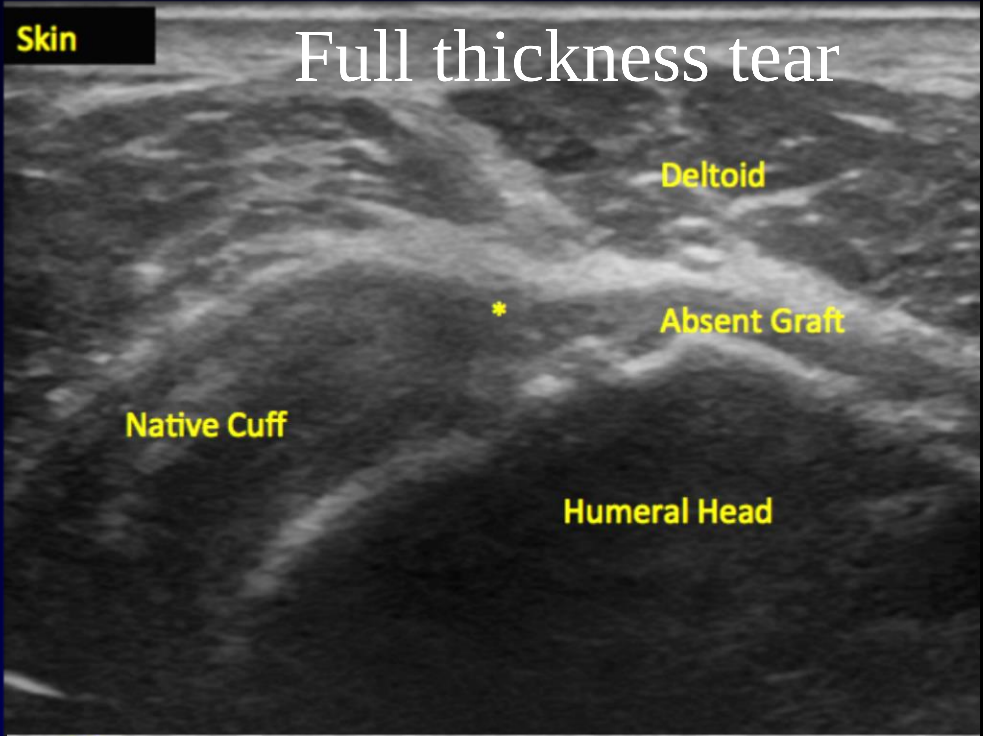
Conexa™ graft implanted



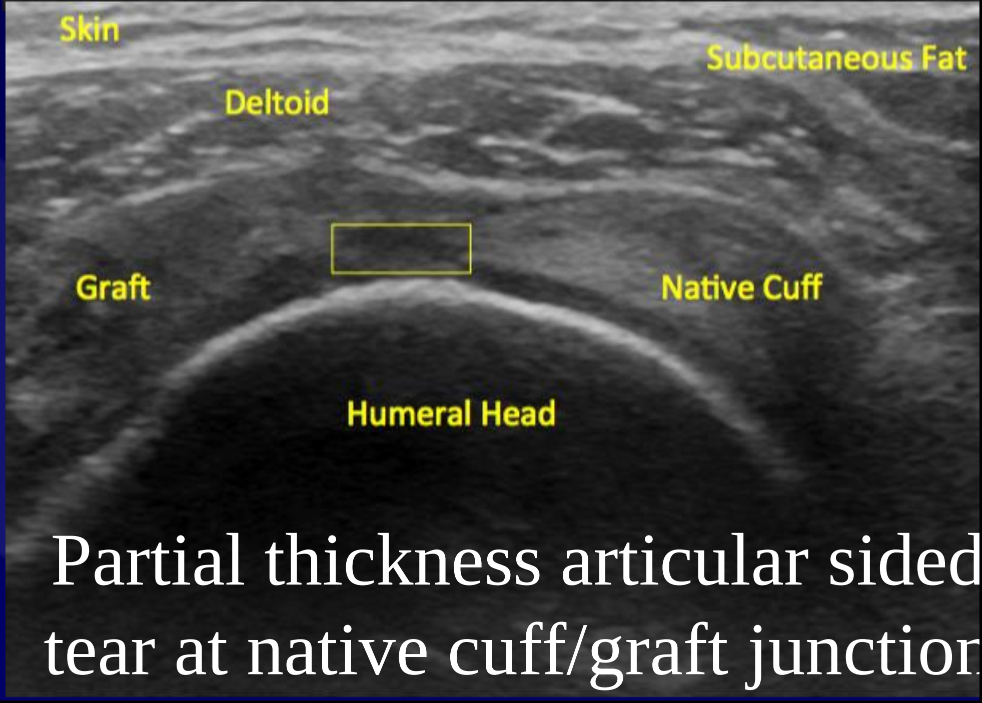
Source: Dr. Toth's personal files

Ultrasound Results

- 89.1% (33/37) fully intact
- 8.1% (3/37) partial tears
  - 1/3 : revision RCR
- 2.7% (1/37) not intact
  - Revision RCR
  - Early post-op weight lifting
  - Tx conservative



Full thickness tear



Partial thickness articular sided tear at native cuff/graft junction

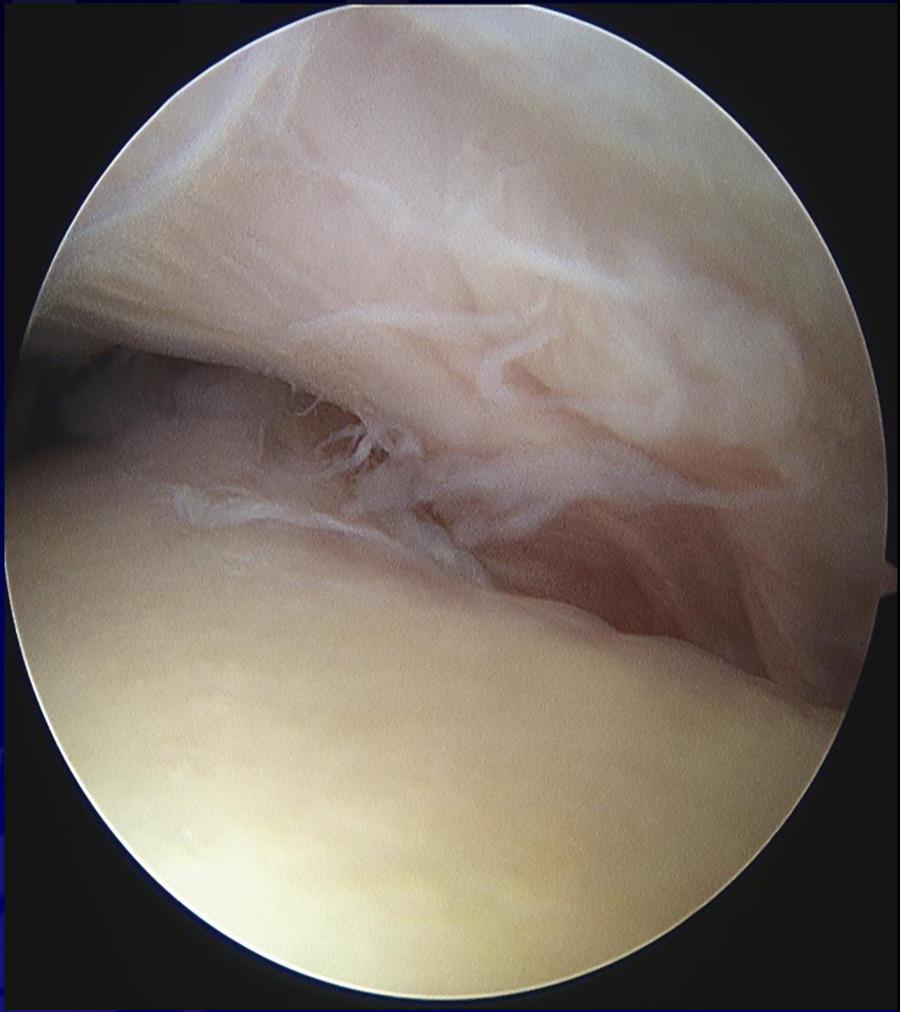
Table 2. Characteristics of patients who had partial thickness RCT based on ultrasonographic examination.

	Patient #1	Patient #2	Patient #3
Revision RCR	No	Yes	No
Preoperative VAS → postoperative VAS	6 → 0	2 →2	8 →3
Postoperative M-ASES	96.2	75.9	73.5
Manual preoperative SS strength → manual postoperative SS strength	5→9	8→9	8→9
Manual preoperative IS strength → manual postoperative IS strength	5→9	8→9	10→9
Active ROM in forward flexion, external rotation, and internal rotation from preoperatively to postoperatively	Improved	Improved	Improved

RCR: Rotator Cuff Repair
VAS: Visual Analog Scale
SS: supraspinatus
IS: Infraspinatus

Generally, manual SS and IS strength as well as active ROM improved.

Graft/"cuff" inserting into footprint at the articular margin



Source: Dr. Toth's personal files

Limitations

- Nonrandomized design
- Limited # of patients
- Associated procedures
- Dynamometer only used post-op
- Observation bias
  - Primary surgeon measured post-operative ROM and manual muscle strength
  - Ultrasonographer not blinded to physical exam findings and clinical status of patients during exam

Conclusions

- After RCR with interposition xenograft, significant improvement in pain, range of motion, and manual muscle strength
  - Subjectively good function by MASES and SF-12

- Repair was completely intact in 89% on U/S, vast improvement vs. primary repairs of massive RCT

- Interposition porcine acellular xenograft holds great promise in treatment of massive RCTs

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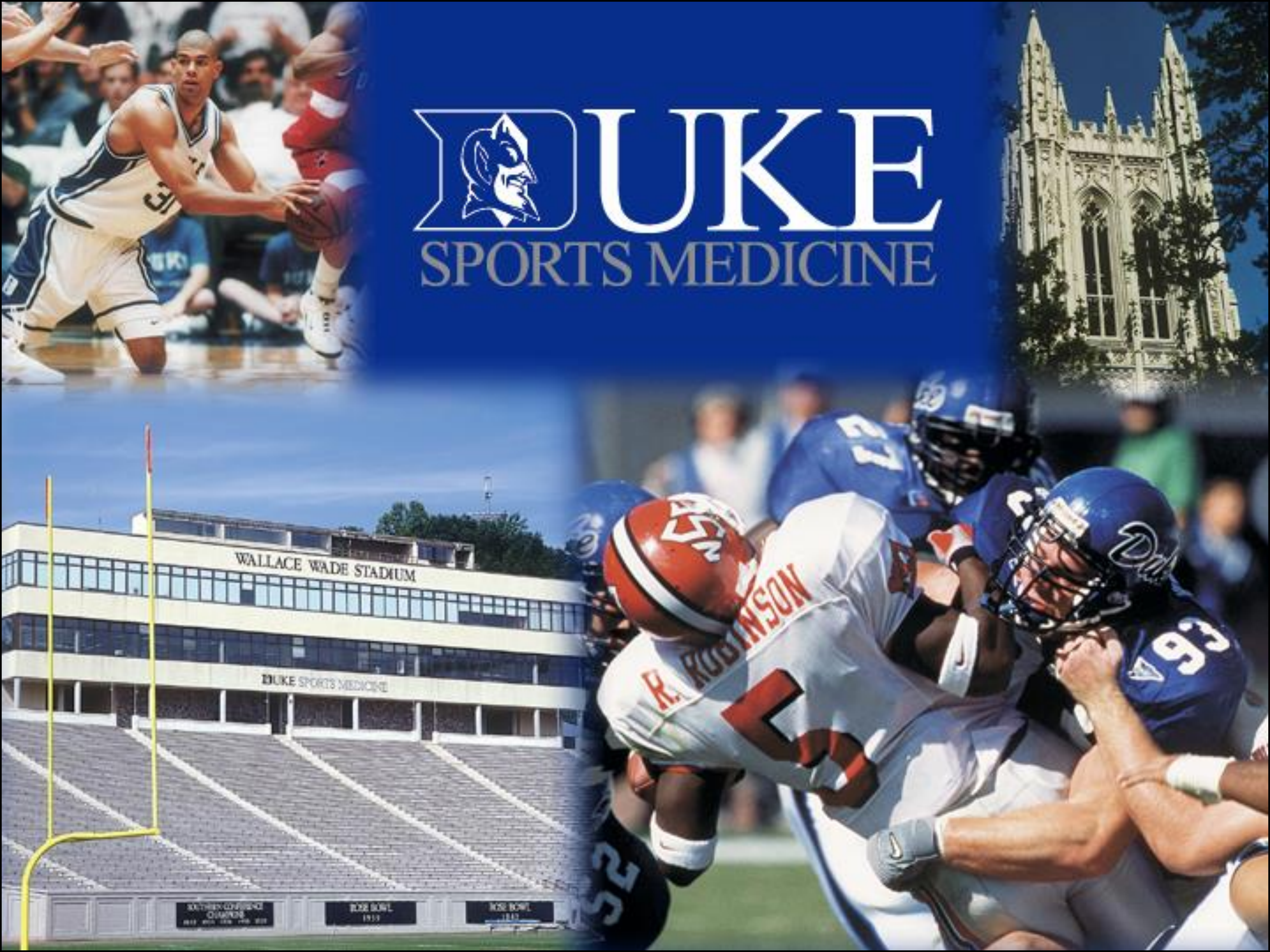
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93

OUTCOMES VALIDATION OF THE ASES, DASH, EQ5D, AND VR6D IN A POPULATION OF ORTHOPEDICS PATIENTS WITH UPPER EXTREMITY MORBIDITY

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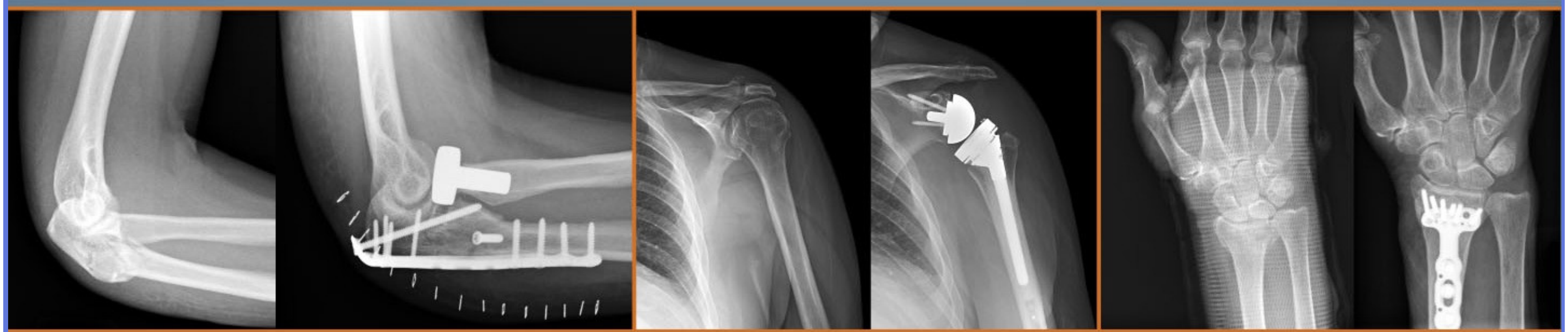
Introduction

- Providers will soon be reimbursed based on quality performance.
- Growing consensus that patient reported outcome measures (PROMs) will be mandated.
- Adequate information regarding measurement properties for PROMs is needed to select the best PROMs to use in any given patient population.

Purpose

To evaluate which patient reported outcome measures (PROMs) perform best in patients with upper extremity morbidity.



Methods

- New patients presenting with upper extremity complaints were asked to complete questionnaires at initial visit and 6 months later
- Region Specific PROMs
  - American Shoulder and Elbow Surgeon (ASES)
  - Disabilities of the Arm, Shoulder, and Hand (DASH)
- General Health Related Quality of Life PROMs
  - EuroQol-5D (EQ-5D)
  - Veterans Rand – 12 (VR-6D)

Methods

299 patients completed all PROMS before their initial clinic visit and 6 months later

Region	PROM	No. Patients	Conservative Tx	Operative Tx	No Tx
Hand/Wrist	DASH, VR-6D, EQ-5D	111	33	18	60
Elbow	ASES, DASH, VR-6D, EQ-5D	65	28	8	29
Shoulder	ASES, DASH, VR-6D, EQ-5D	123	40	22	61
TOTAL		299	101	48	150

Methods: Psychometric Properties

- Ceiling effect and floor effect were analyzed to determine if the PROM differentiates patients at the highest and lowest scores.
- Pearson Interclass Correlation (ICC) to determine if PROM is valid, e.g does it measure what it is supposed to measure.

Methods: Psychometric Properties

- Cronbach's alpha (CA) to determine if the PROM is consistent or reliable from pre to post.
- Effect size to determine ie PROM will detect a clinically meaningful change from pre to post

Results

- Mean initial scores
  - ASES: 53.1/100
  - DASH: 26.9/100 (reverse scored)
  - EQ5D: 0.79/1
  - VR6D: 0.70/1
- Mean 6 month scores
  - ASES: 64.6/100
  - DASH: 20.0/100 (reverse scored)
  - EQ5D: 0.81/1
  - VR6D: 0.72/1

Significant differences in the initial and six-month scores were found for all instruments.

Results - Combined

- Ceiling effects with DASH and EQ5D
- Validity: Compared to ASES, DASH (ICC -0.6467, -0.4945) does not meet threshold criterion of 0.7
- Internal consistency/Reliability: DASH is superior (CA 0.6777) to ASES (CA 0.6406).
- Responsiveness: ASES is superior (ES 0.6740) to DASH (ES -0.4056)
- VR-6D is superior to EQ-5D in all aspects

Results - by Body Part

Differences in validity based on region and timepoint

	Initial		6 Months	
Region	EQ-5D and VR-6D	ASES and DASH	EQ-5D and VR-6D	ASES and DASH
Hand/Wrist	0.7206	-	0.6912	-
Elbow	0.7422	0.0371	0.5964	0.3343
Shoulder	0.6351	-0.8287	0.7885	-0.8142
All	0.7007	-0.6467	0.7227	-0.4945

Results - by Body Part

The DASH and VR-6D are the most reliable, or consistent, from initial to 6 months. DASH is least reliable for shoulder patients

Region	ASES	DASH	EQ-5D	VR-6D
Hand/Wrist	--	0.8134	0.6479	0.8506
Elbow	0.6243	0.7823	0.7512	0.7735
Shoulder	0.6114	0.6777	0.596	0.7033
All	0.6406	0.7576	0.6613	0.7825

Results - by Body Part

Only the ASES for shoulder patients was responsive to change from initial to 6 months

Region	ASES	DASH	EQ-5D	VR-6D
Hand/Wrist	---	-0.2466	0.132	0.0993
Elbow	-0.464	-0.6093	0.0428	0.1548
Shoulder	0.8973	-0.5189	0.3588	0.3165
All	0.674	-0.4056	0.1917	0.1857

Conclusion

- The VR-6D is the best choice for a general HRQOL measure for upper extremity patients.
- Tradeoff between validity, reliability and responsiveness properties between the DASH and ASES region specific measures.
- It may be necessary to use both ASES and DASH instruments to completely measure the PRO of all upper extremity patients.

Thank you

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Current Trends in Carpal Tunnel Release:

Effects of Hand Fellowship Training on Endoscopic and Open Carpal Tunnel Release utilizing the ABOS Certification Examination Database

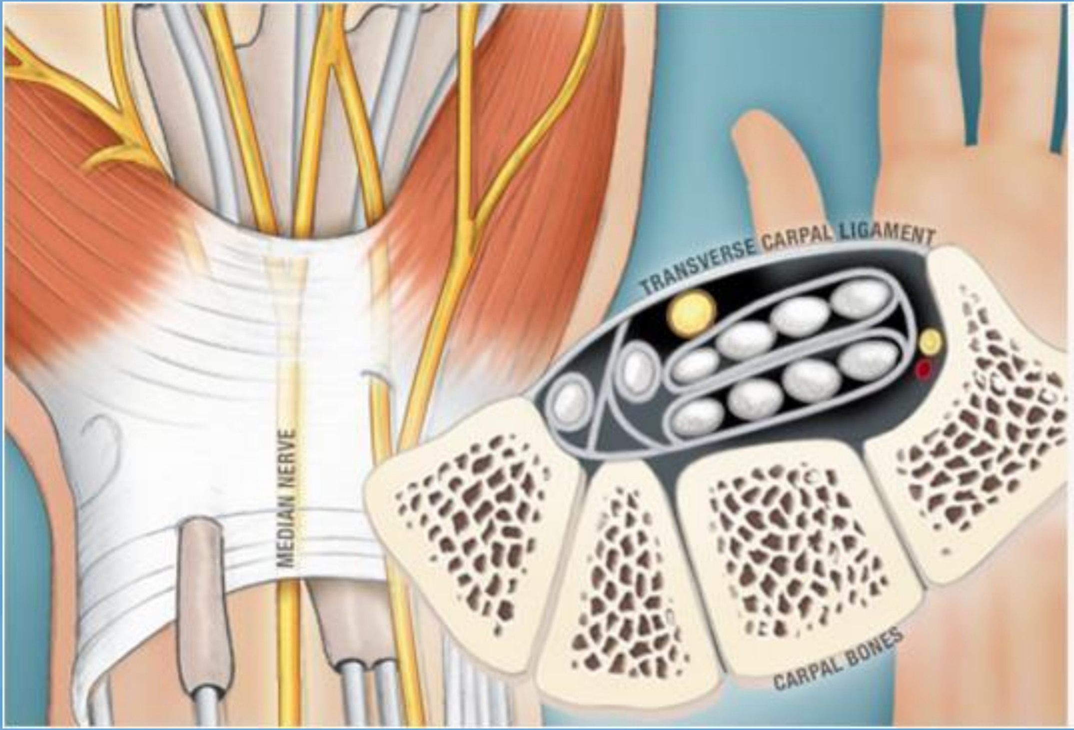
Brandon S. Smetana, MD
UNC Department of Orthopaedics
NCSSH/NCOA Meeting
October 9th/10th 2016
Kiwah Island, SC

Disclosures

- No relevant conflicts to disclose

Introduction

- Carpal tunnel syndrome
  - Most commonly reported and treated compression neuropathy within the United States (1,2,3)



http://www.webmd.com/pain-management/carpal-tunnel/ss/slideshow-carpal-overview

Introduction

- Recent trends in the treatment of compressive neuropathies favor minimally invasive or endoscopic techniques (4)

http://www.handbiolab.com/products/other-ideas/

Introduction

- Current rates of utilization of the open or endoscopic technique?
  - Current practicing orthopaedic surgeons in the United States?
  - Trained hand specialists versus non-hand fellowship trained orthopaedists?

Introduction

- Use of American Board of Orthopaedic Surgery (ABOS) Part II Database:
  - trends amongst orthopaedic surgeons
  - more prevalent in current literature (5,6,7,8).

- Accurate assessment of:
  - Current standards of practice
  - Evaluation of trends in management
    - Inference of core surgical skills (outcomes, complications)
    - Determining areas of need for further research

Purpose

- Utilize ABOS Part II database to investigate Carpal Tunnel Surgery:
  - Current rates (open/endoscopic)
  - Recent trends (regional/national)
  - Complications
  - Influence of type of fellowship training
    - hand vs. non-hand

Methods

- Query of ABOS database from 2003-2013 for:
  - Patients with CTS (ICD-9: 354.0)
  - Carpal tunnel release (CTR) either:
    - **Open** (CPT: 64721)
    - **Endoscopic** (CPT: 29848)
- Exclusion: cases with multiple CPT codes

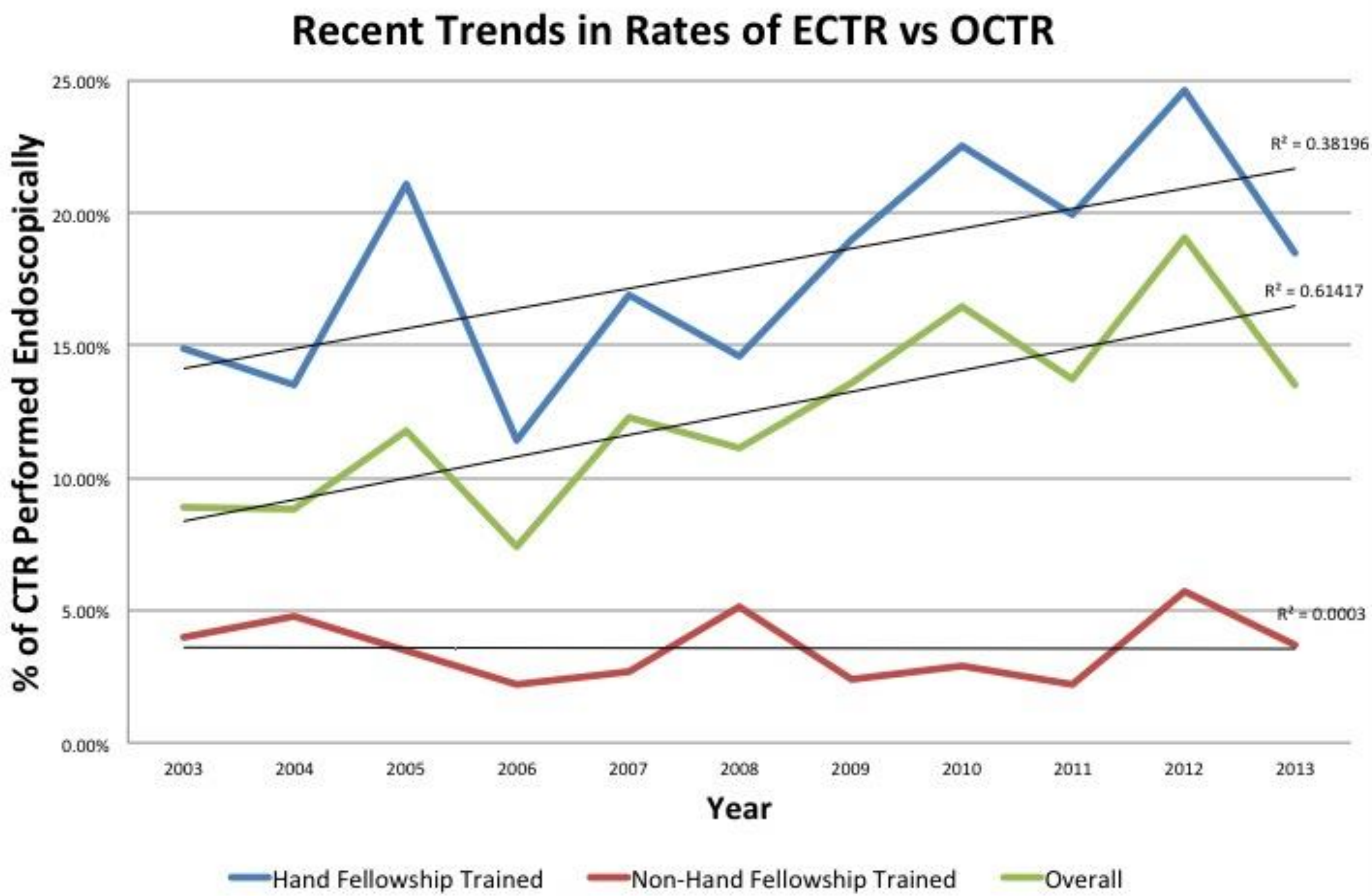
Methods

- Data gathered:
  - Geographic location
  - Fellowship
  - Surgical Complications

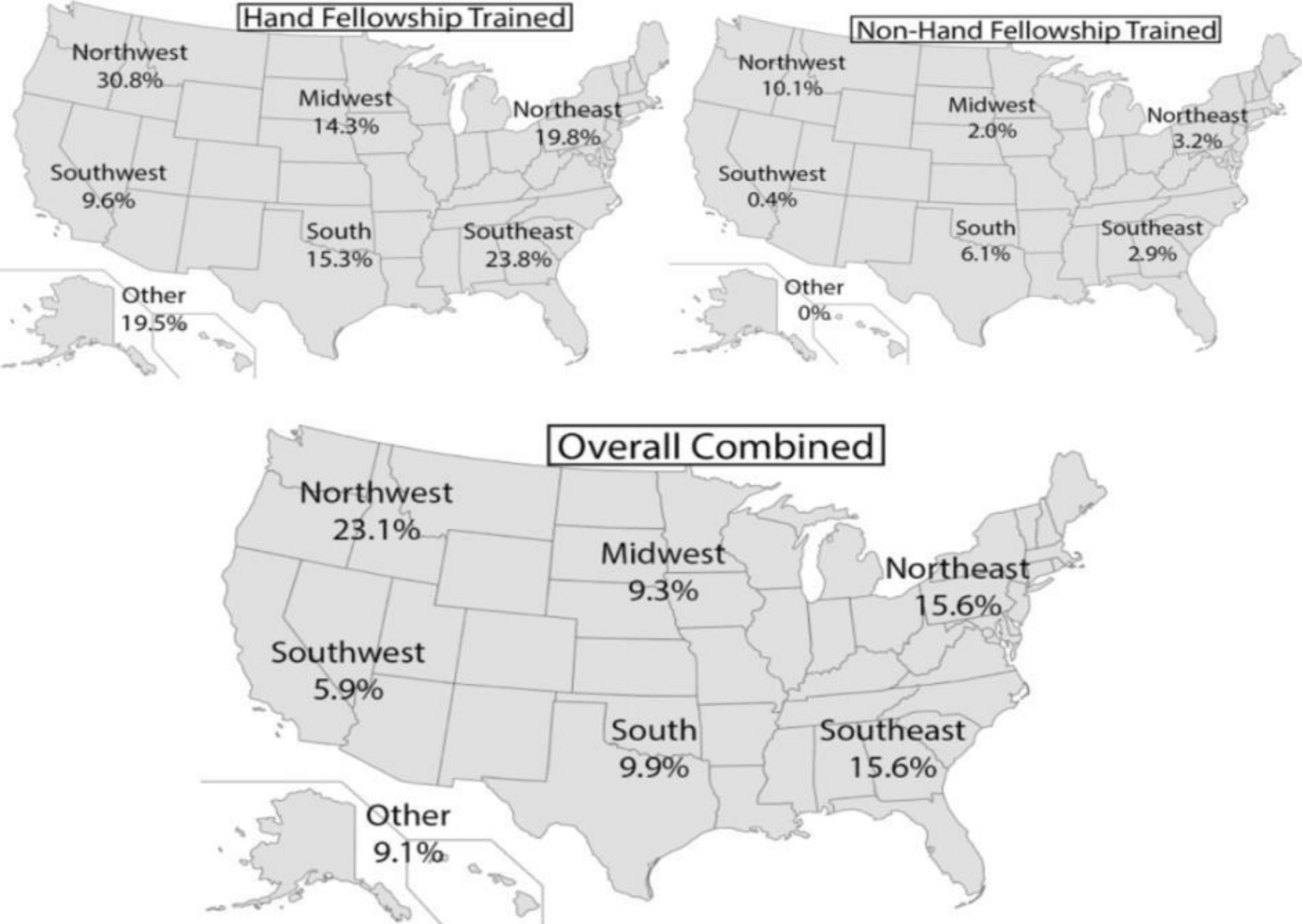
- Divided into two cohorts:
  - Hand fellowship trained
  - Non-hand fellowship trained (all others)

- Analysis with Chi-square tests of independence and for trend.

Results



Recent Trends in Rates of ECTR vs OCTR
25.00%
20.00%
15.00%
10.00%
5.00%
0.00%
% of CTR Performed Endoscopically
R² = 0.38196
R² = 0.61417
R² = 0.0003
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
Year
Hand Fellowship Trained
Non-Hand Fellowship Trained
Overall


Hand Fellowship Trained
Northwest
30.8%
Midwest
14.3%
Northeast
19.8%
Southwest
9.6%
South
15.3%
Southeast
23.8%
Other
19.5%
Non-Hand Fellowship Trained
Northwest
10.1%
Midwest
2.0%
Northeast
3.2%
Southwest
0.4%
South
6.1%
Southeast
2.9%
Other
0%
Overall Combined
Northwest
23.1%
Midwest
9.3%
Northeast
15.6%
Southwest
5.9%
South
9.9%
Southeast
15.6%
Other
9.1%

Results

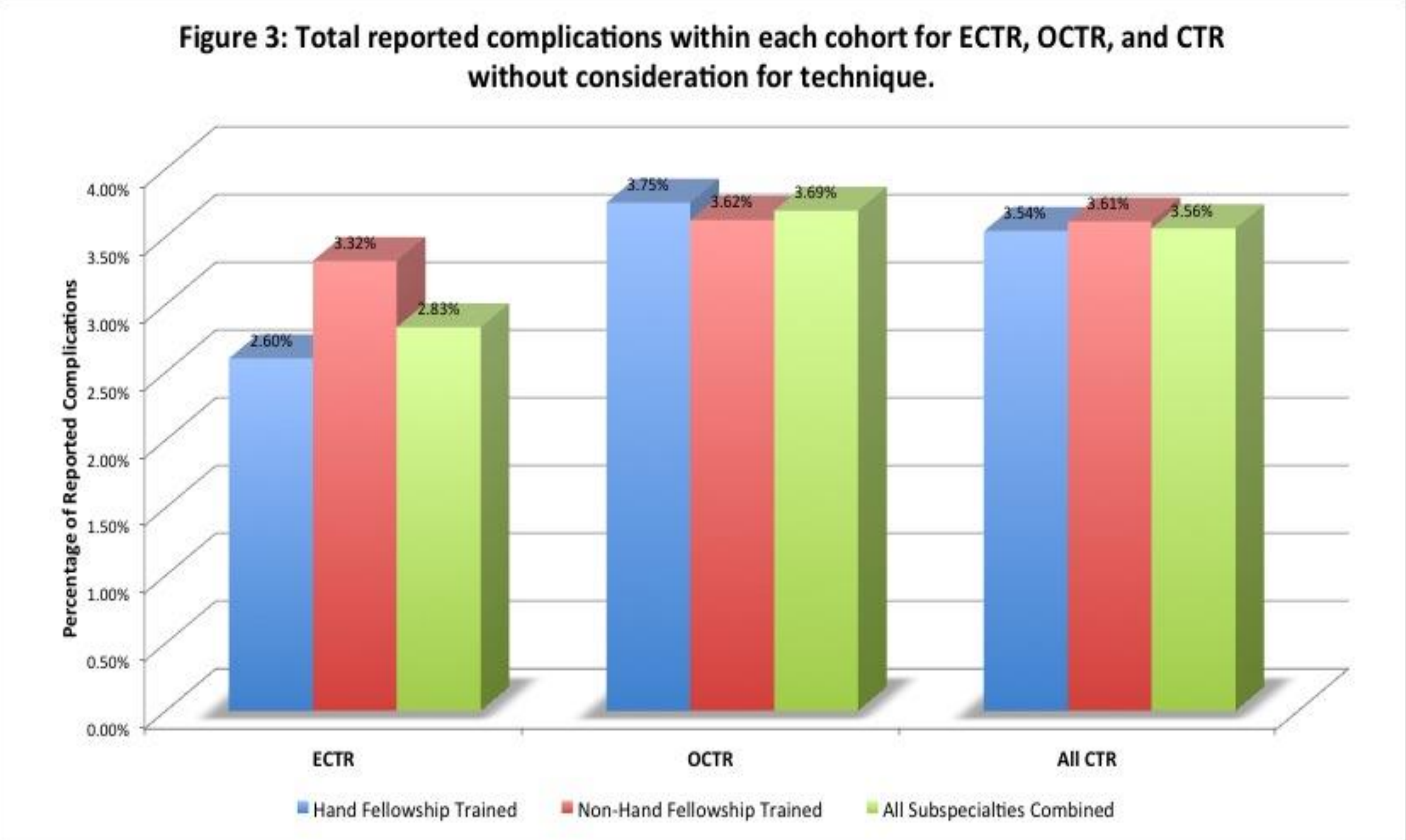


Figure 3: Total reported complications within each cohort for ECTR, OCTR, and CTR without consideration for technique.
Percentage of Reported Complications
0.00%
0.50%
1.00%
1.50%
2.00%
2.50%
3.00%
3.50%
4.00%
2.60%
3.32%
2.83%
3.75%
3.62%
3.69%
3.54%
3.61%
3.56%
ECTR
OCTR
All CTR
Hand Fellowship Trained
Non-Hand Fellowship Trained
All Subspecialties Combined

Results

- No difference in complications between two cohorts (fellowship training)
  - Overall, ECTR, OCTR

- Specific complications:
  - OCTR: higher wound complications
  - ECTR: higher nerve palsy
  - Postoperative pain equivalent (ECTR vs OCTR)

Discussion

Prior Data:

- Leinberry et al. 2012 (9):
  - Repeated a survey of the American Society for the Surgery of the Hand (ASSH)
  - 36% utilized ECTR a majority of the time
  - 48% response rate
  - Complications were not reported.

- Munns et al. 2015 (10):
  - Similar online survey of ASSH members
  - 30% response rate
  - 26% use of the ECTR

Discussion

Our results:

- Much lower utilization rate of 12.4% ECTR (18% for hand fellowship)
- Strong trend towards ECTR over 11 year period (hand-fellowship cohort)
- Regional analysis:
  - NW performed the largest proportion ECTR (23.1%)
  - SW performed the fewest (5.9%)

Discussion

Endoscopic vs. Open?

Controversy still exists

- ECTR:
  - may avoid early postoperative morbidity of decreased grip and pinch strength; earlier return to work.(11,12,13)
- Multiple studies ECTR vs. OCTR:
  - equivalent complication rates (11,12,13)
  - ~ 5% complication rate (1)
- Learning curve associated with ECTR (2)
- High rate complications seen by ASSH members (14)
  - ? concern over non-hand fellowship trained physicians performing ECTR

Discussion

Endoscopic vs. Open?

- Hypothesized a higher rate of complications than previously reported for two reasons:
  - candidate surgeons for Part II ABOS would be more likely to report complications
  - case collection falls during the first few years and during the learning curve

- We found similar complication rates compared to previously reported data:
  - 3.6% overall (2.8% ECTR, 3.7% OCTR)

Discussion

Endoscopic vs. Open?

- We expected to discover a higher rate of complications among non-hand fellowship cohort

- Operative technique (open versus endoscopic) & Fellowship training (hand fellowship versus non-hand fellowship trained)

  → no significant impact on overall complication rates

Limitations

- Observational cohort study:
  - Inherently biased, relying on surgeon reported rates and complications.
- ABOS dataset:
  - No descriptive requirements of reporting complications (rely on the surgeon judgement for reporting)
    - "Surgeon Unspecified" (exact rates unclear)
    - "Conversion to open technique" not listed complication
  - Data only from surgeons early in their career
    - Does <u>not</u> represent the true rates and trends within the US
- 13 cases were coded as both OCTR and ECTR - excluded

Conclusions

- Increasing rate of ECTR over 11 years
  - 12.4% of all CTR cases were done endoscopically.
- Hand fellowship trained orthopaedists - performed 4.5 times (18% versus 4%) the number of ECTR than non-hand fellowship trained surgeons
- Complication rates remain low in the first few years of practice
- No difference in complication rates between these groups

Thanks

AMERICAN BOARD OF ORTHOPAEDIC SURGERY, INC
ABOS
FOUNDED MCMXXXIV

Shep Hurwitz, M.D.

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UNC THE NORTH CAROLINA TRANSLATIONAL & CLINICAL SCIENCES INSTITUTE

Xin Zhou, PhD

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Questions?

Wake Forest®
School of Medicine

A Critical Review of the Long-Toss in Baseball Throwing

Austin V. Stone MD, PhD | Sandeep Mannava MD, PhD

Michael T. Freehill, MD

Disclosures

No potential conflicts of interest related to this study. This study was funded by the Department of Orthopaedic Surgery

Michael T. Freehill, MD

- Research support: Smith & Nephew
- Consultant: Smith & Nephew

Sandeep Mannava, MD, PhD

- Patent issued: Rotator cuff tensioning device

Austin V. Stone, MD, PhD

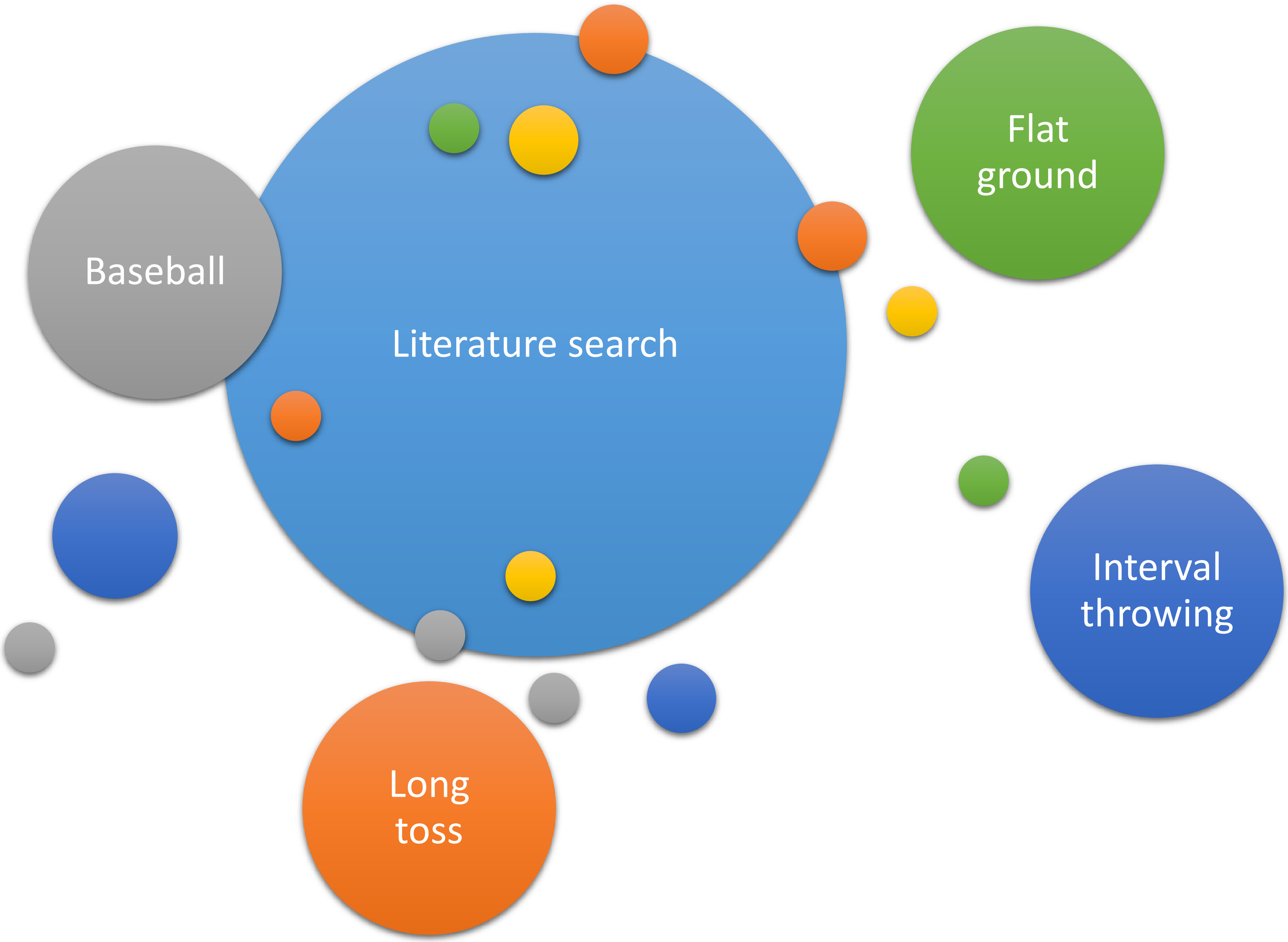
- Research Support: Smith & Nephew

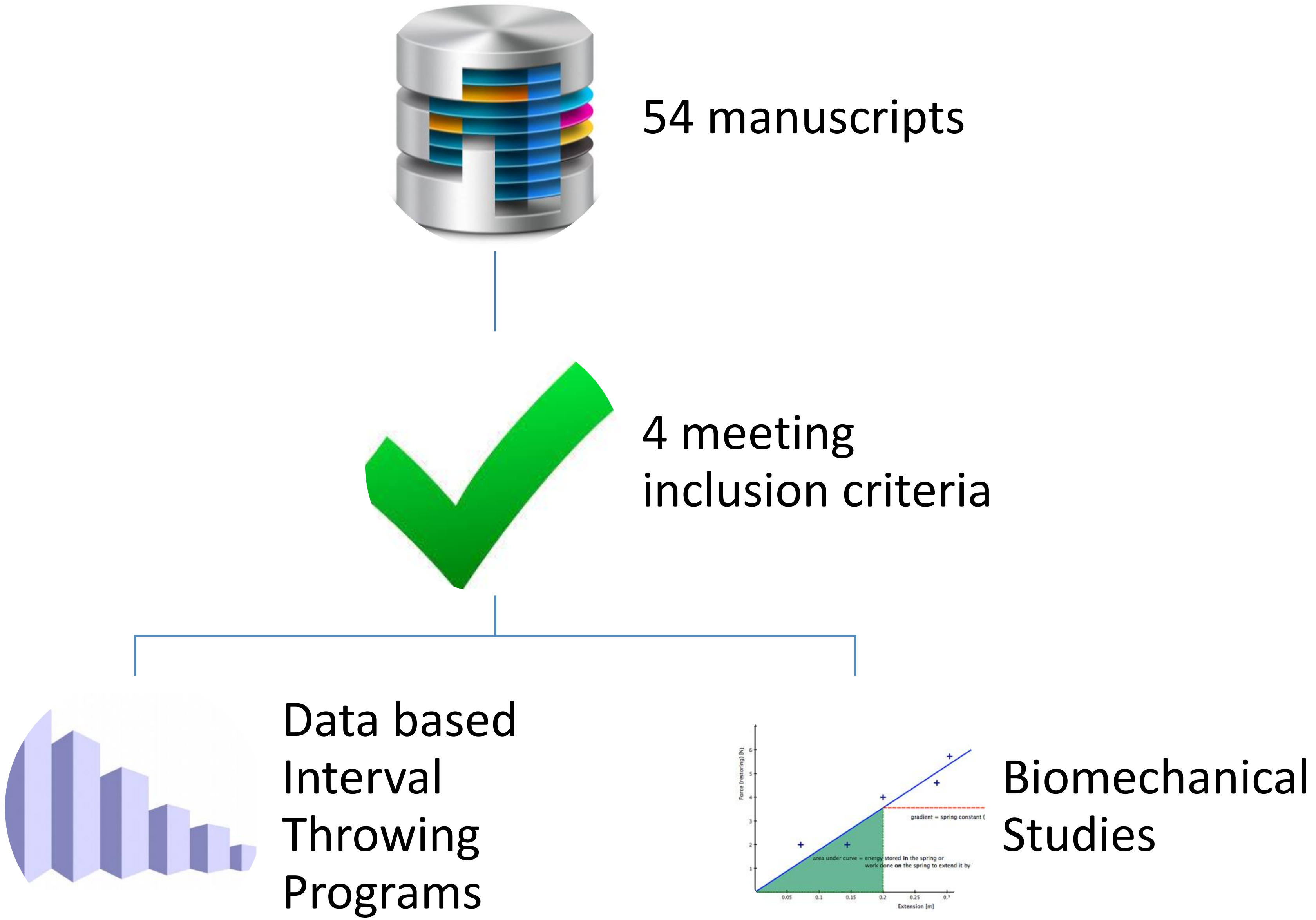
Define the problem

What is long-toss?

When do we use long-toss?

How is long-toss used?


Baseball
Literature search
Flat ground
Interval throwing
Long toss


54 manuscripts
4 meeting inclusion criteria
Data based Interval Throwing Programs
Biomechanical Studies

Return to Throwing

- Short toss throws, 50% effort
- Progressive long-toss from level ground for arm strength and endurance

Return to Pitching

- Pitching from ground level
- 50%-75% effort, fastballs

Intensified Pitching

- Pitching while standing on mound
- 50-75% maximum effort
- Progressive effort to 100% with off-speed pitches

Simulated Game

- 10 Minutes warm-up of 50–80 pitches with gradually increasing velocity
- 5–8 Innings for starters
- 3–5 innings for relievers
- 2–3 innings for closers
- 15–20 Pitches per inning, including 10–15 fastballs
- 9 Minutes rest between innings

Axe et al, 1996, 2001

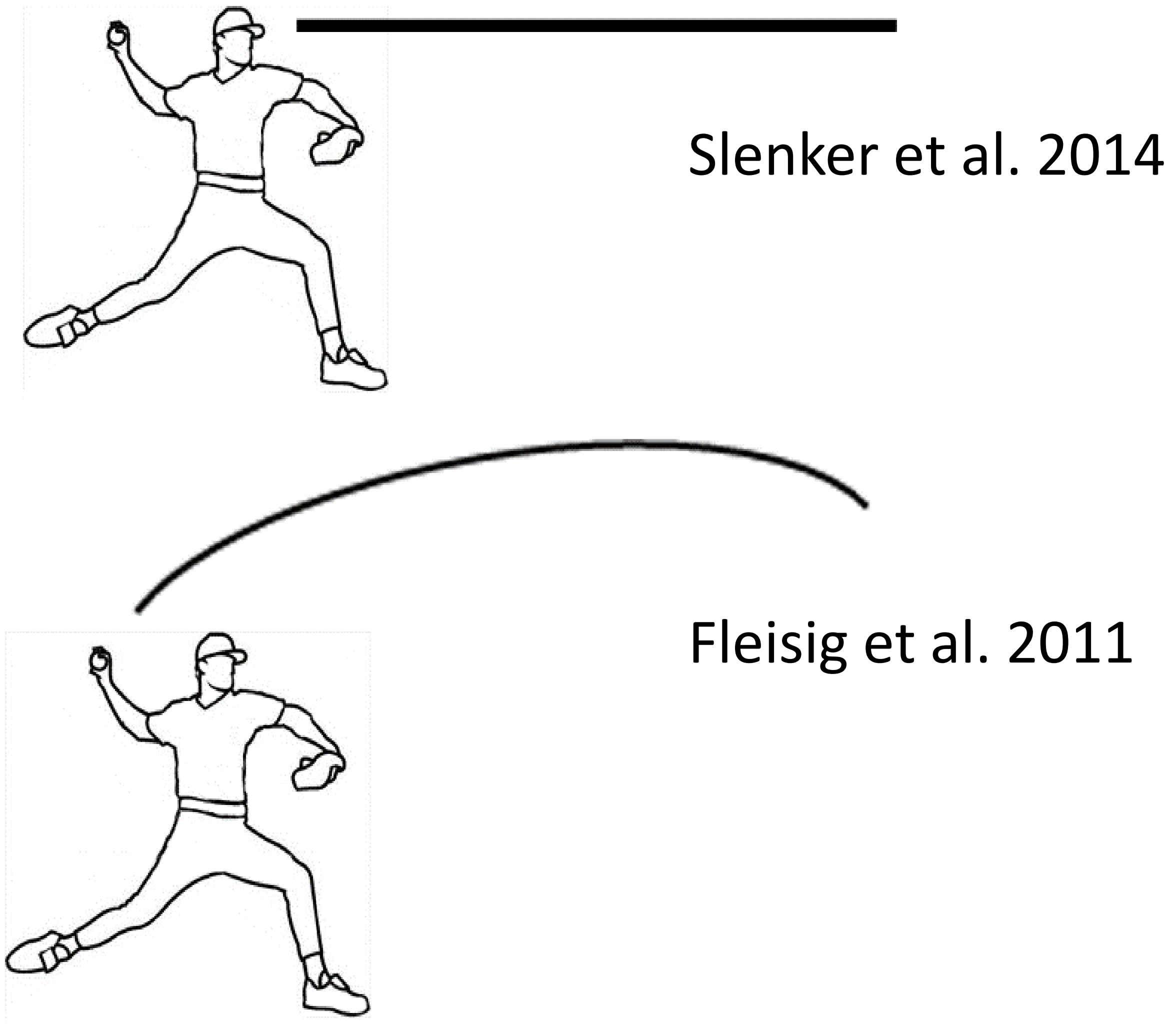
How far is long-toss?

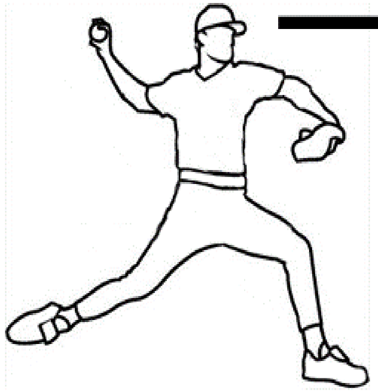
120 ft – 180 ft
&
Maximal distance
260 ft ± 30 ft

Fleisig et al, 2011

180 ft

Slenker et al, 2014


Slenker et al. 2014
Fleisig et al. 2011



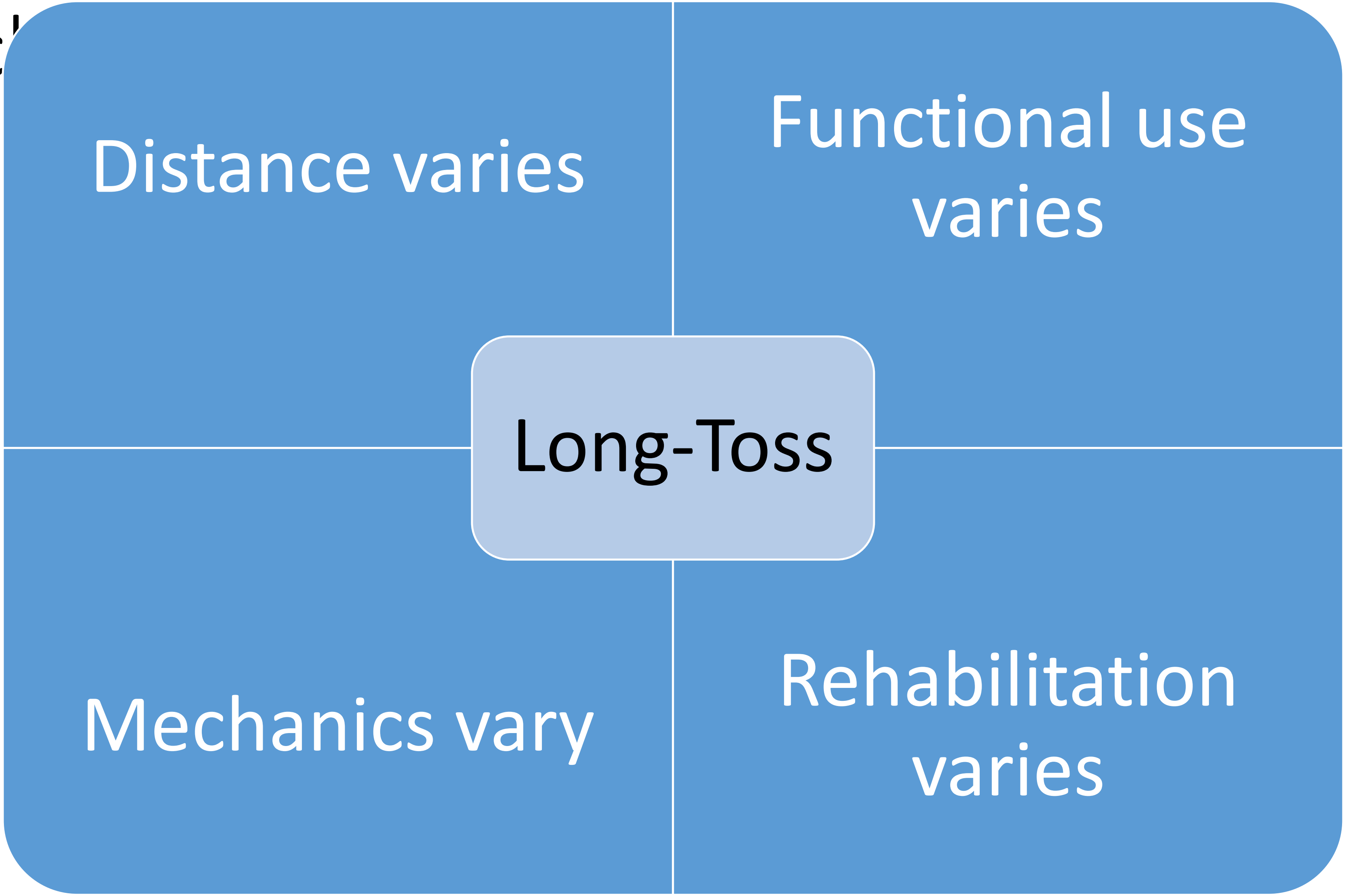
Slenker et a

No differences in humeral internal rotation torque with increasing distances.
60 – 180ft

Fleisig et al.

Increased humeral internal rotation torque with maximal distance throw
260 ± 30 ft

Conc


Distance varies
Functional use varies
Long-Toss
Mechanics vary
Rehabilitation varies

Next Steps

- Concrete definition of the distance
- Purpose in strengthening and rehabilitation
- Goal in maintenance of strength

Questions

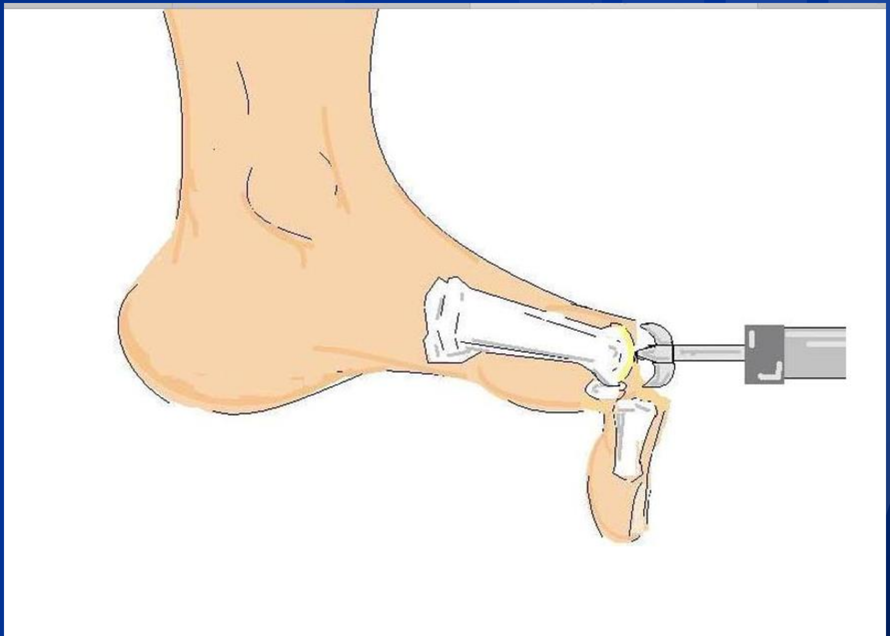
Acknowledgements

Michael T. Freehill, MD

Sandeep Mannava, MD, PhD

Department of Orthopaedic Surgery

Closing the gap: a novel technique for humeral shaft nonunions using cup and cone reamers



Brian T Nickel, M.D.; Mitchell R Klement, M.D.; Marc Richard, M.D; Bob Zura, M.D.; and Grant Garrigues, M.D.

Disclosures

- **Brian Nickel** (none)
- **Mitchell Klement** (none)
- **Marc Richard**
  - Consultant: Acumed, Depuy Synthes
  - Research support - Acumed
- **Bob Zura** (none)
- **Grant Garrigues**
  - Consultant/Royalties: Tornier, DJO
  - Fellowship/Education/Research Support: Zimmer, Breg, Stryker, Mitek

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Study Purpose

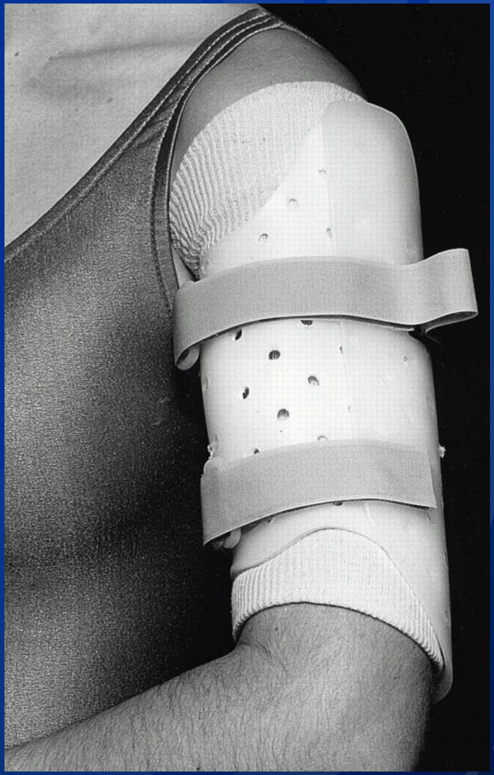
- Describe a novel surgical technique for humeral shaft nonunions using cup and cone reamers, originally designed for MTP arthrodesis

- Report three illustrative patient cases

Introduction

Humeral Shaft Fractures

- 5-8% of all fractures[1]
- Vast majority heal uneventfully with functional bracing
  - 5.5% nonunion rate following closed treatment [2, 3]
  - Significantly greater than initial rate of 0-2% reported by Sarmiento[4]



Surgical Techniques

Controversy continues around selecting best surgical strategy[6]

Closed: reduce risk of sepsis and radial paralysis

locked IM nailing or external fixation

Open: correct deformity and obtain absolute stability

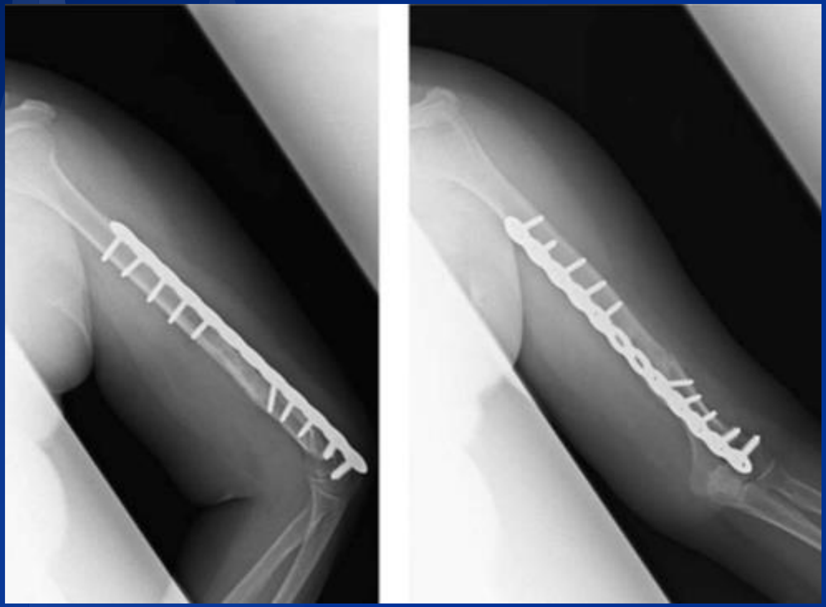
- compression plating and bone graft
- dual plating
- cortical strut allograft and autograft
- adding biologic augmentation (BMP)

Surgical Techniques

Controversy continues around selecting best surgical strategy[6]

Closed: reduce risk of sepsis and radial paralysis

locked IM nailing or external fixation



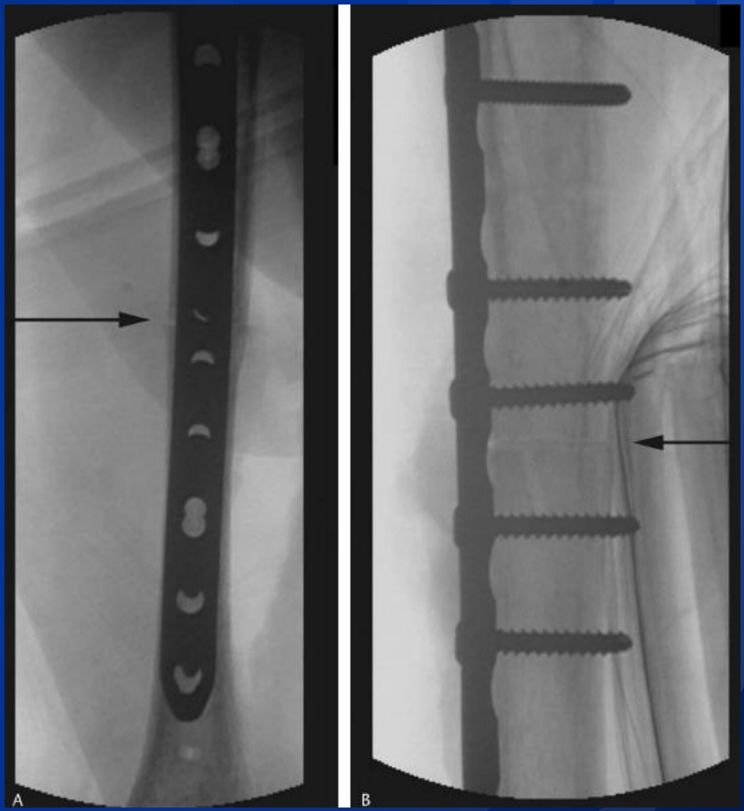
Open: correct deformity and obtain absolute stability

- compression plating and bone graft
- dual plating
- cortical strut allograft and autograft
- adding biologic augmentation (BMP)

Most widely used and standard of care is ORIF with rigid compression plating and autogenous bone grafting[2, 5, 6]

ORIF Not Perfect

Nonunion rate of open plating has been reported to be 4.3%–12.5%[7-9]

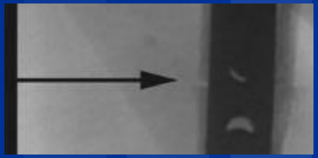


Bone Preperation

- Osteotomy[15]
- Decortication
- Grafting
  - Autograft
  - Allograft
- Limited fibrous callus removal[9]

- Optimal treatment: Resecting atrophic nonunions, shortening the bones, drilling sclerotic areas, and apposing bleeding diaphyseal surfaces[5, 15]

Closing the Gap

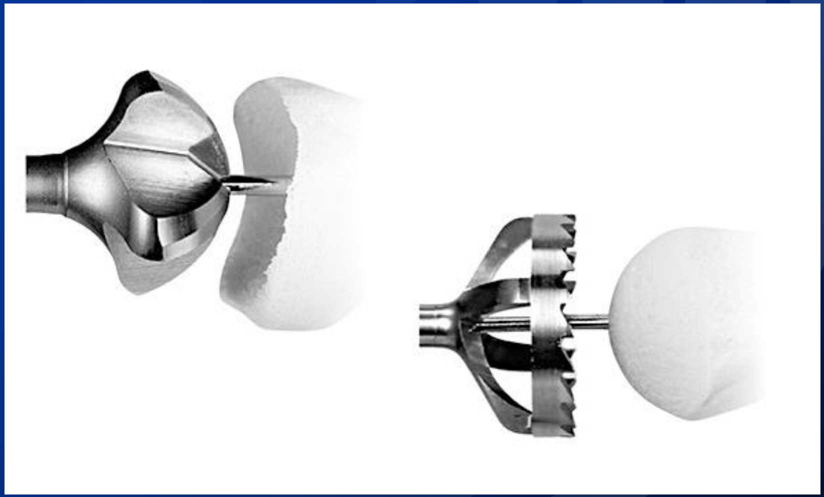


Osteotomes, curettes, motorized burrs/saws, and rongeurs have been used to fashion the bony ends

Tedious process and can result in imperfect apposition of the contiguous prepared surfaces which can be seen radiographically

Cup/Cone Reamer advantages:

- Maximize bone surface area contact
- Alignment correction in any plane
- Speed
- Simplicity

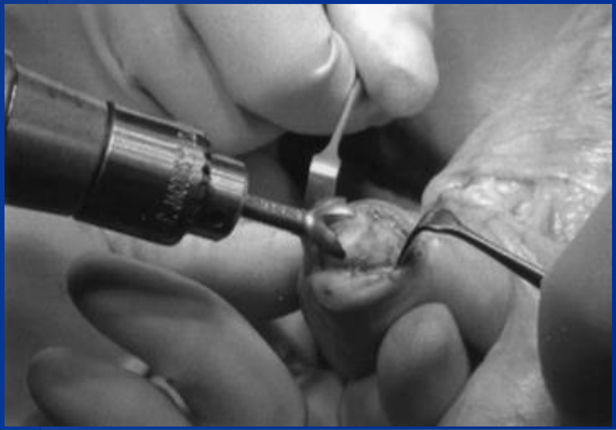


Convex to Concave Preparation

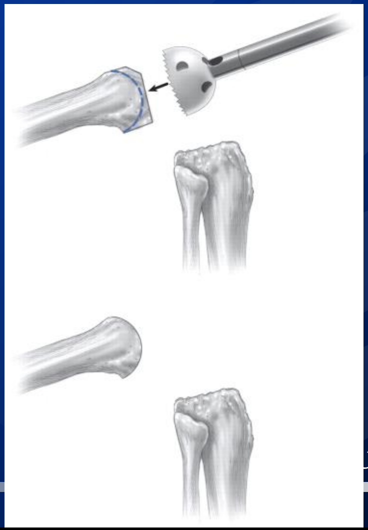
MTP[12]

Tibiocalcaneal[11]

Hand[13]

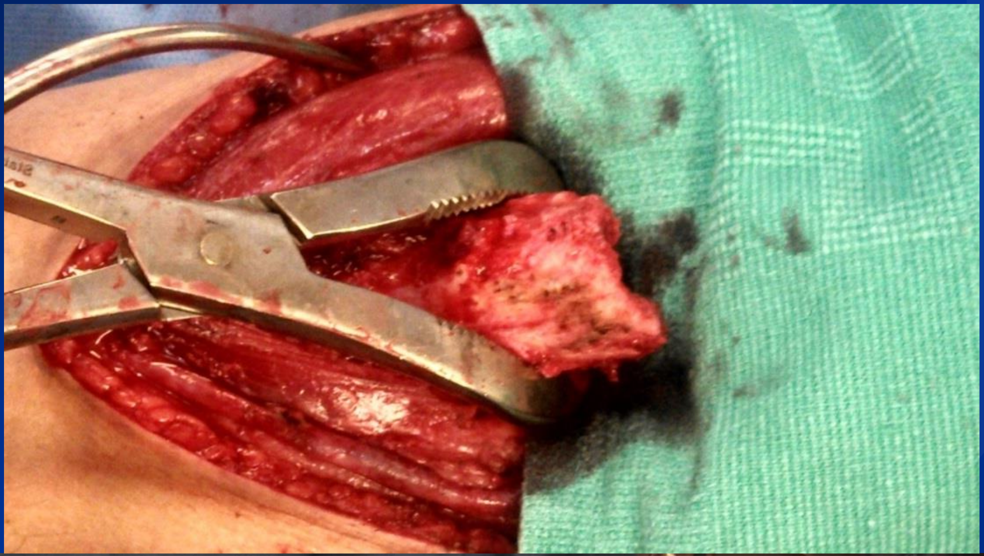


Knee[14]

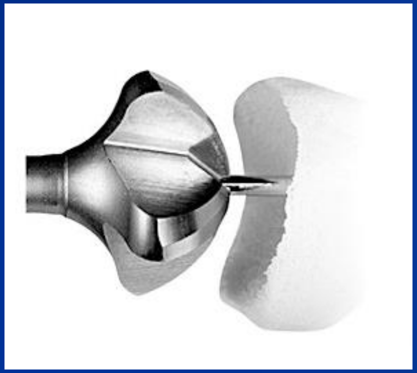


Surgical Technique

Expose fracture ends

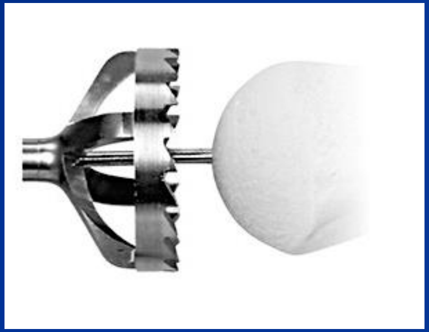


Video: Proximal Reaming



Cone Reamer creating Proximal Cup

Video: Distal Reaming



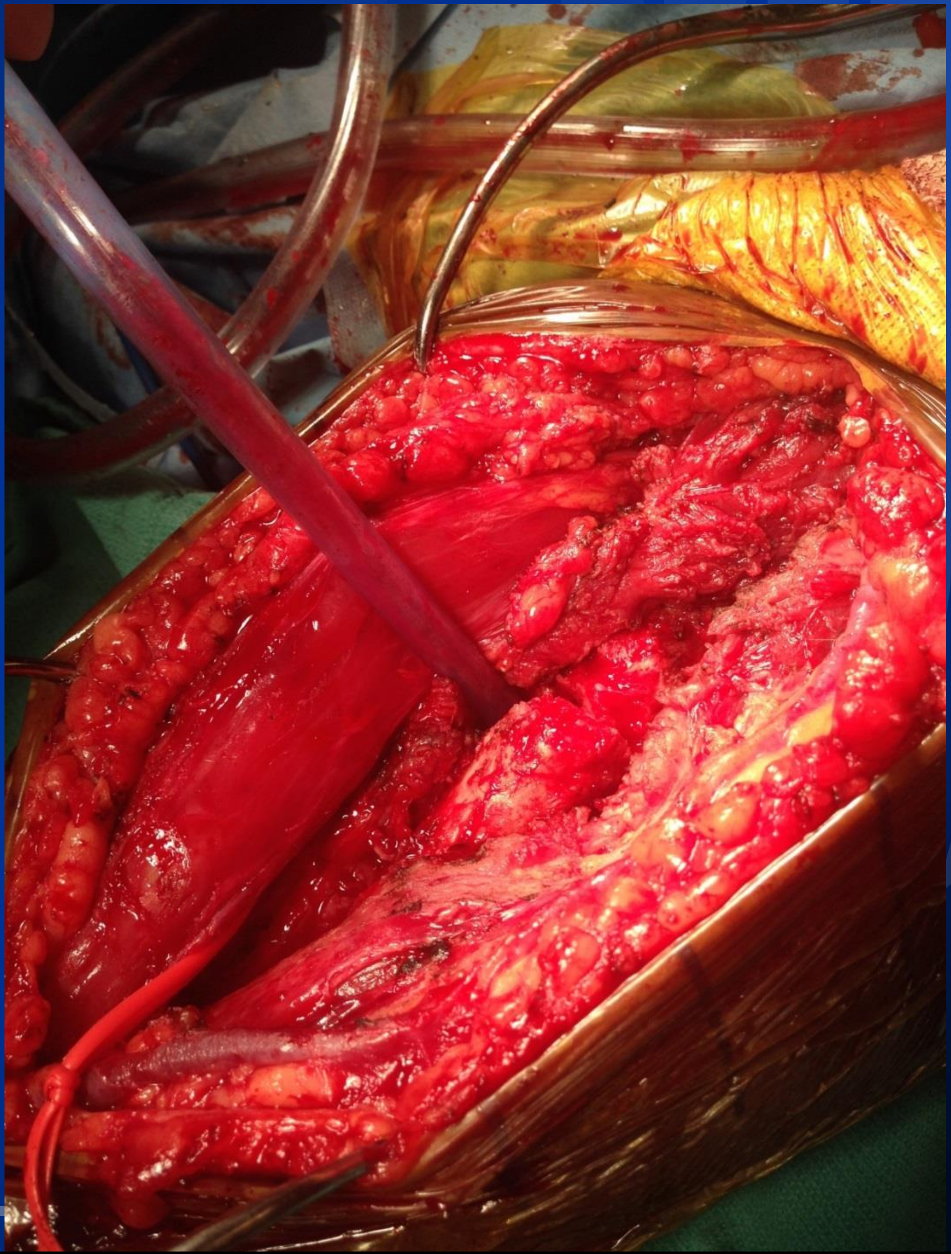
Cup Reamer creating Distal Cone

Surgical Technique

Expose fracture ends

Ream Cup/Cone

Reduce



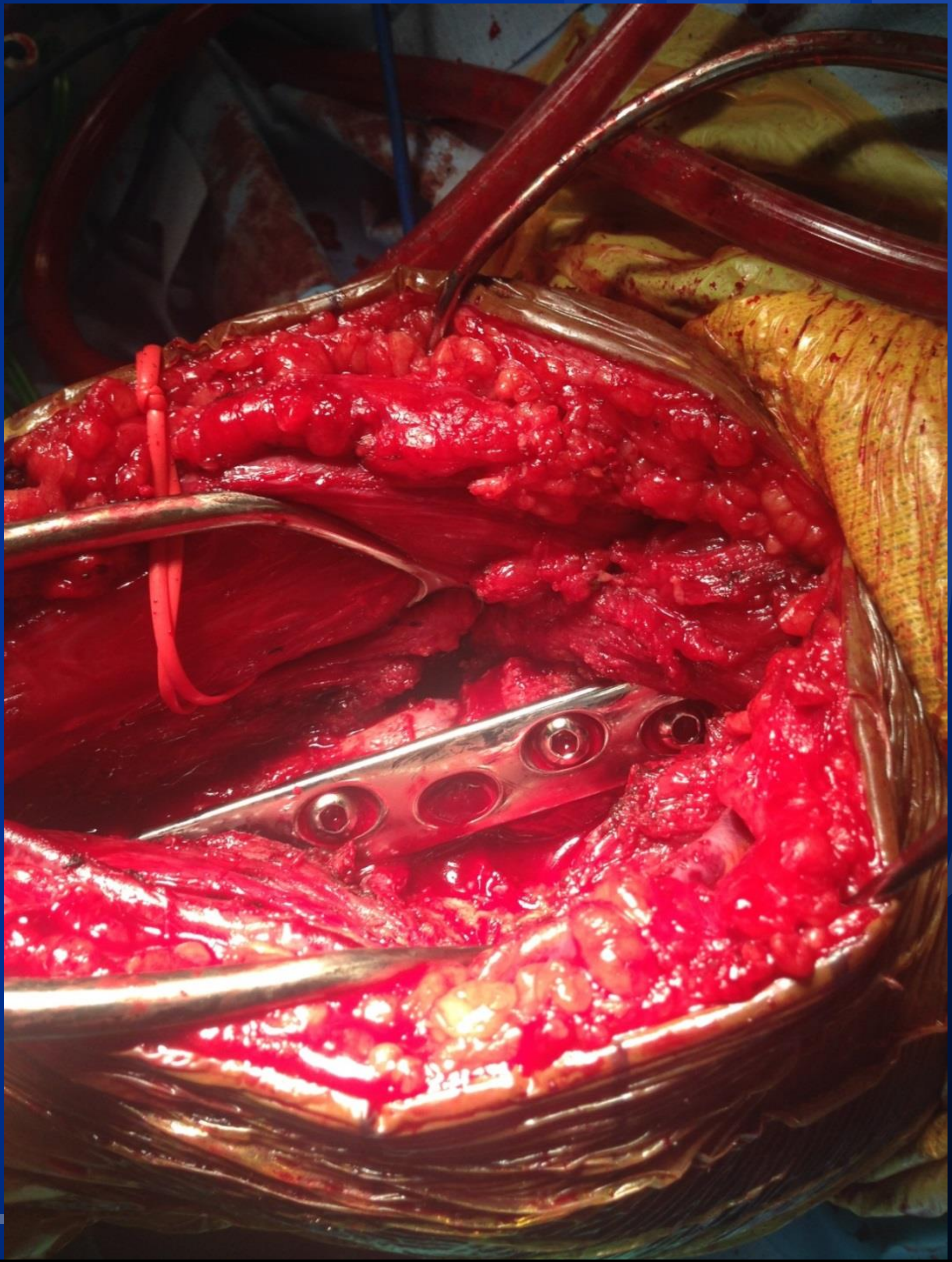
Surgical Technique

Expose fracture ends

Ream Cup/Cone

Reduce

Compression Plate



Case Examples

1. 30yr male aseptic nonunion
2. 48yr male aseptic nonunion
3. 31yr female deformed septic nonunion s/p ORIF, I&Dx2, ROH

Case Examples

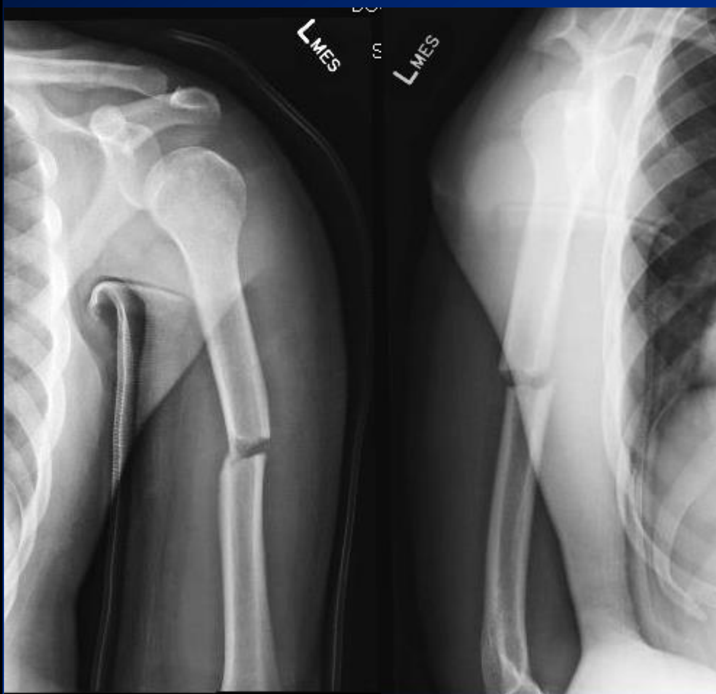
1. 30yr male aseptic nonunion
2. 48yr male aseptic nonunion
3. 31yr female deformed septic nonunion s/p ORIF, I&Dx2, ROH

Case 1: 30yr Male

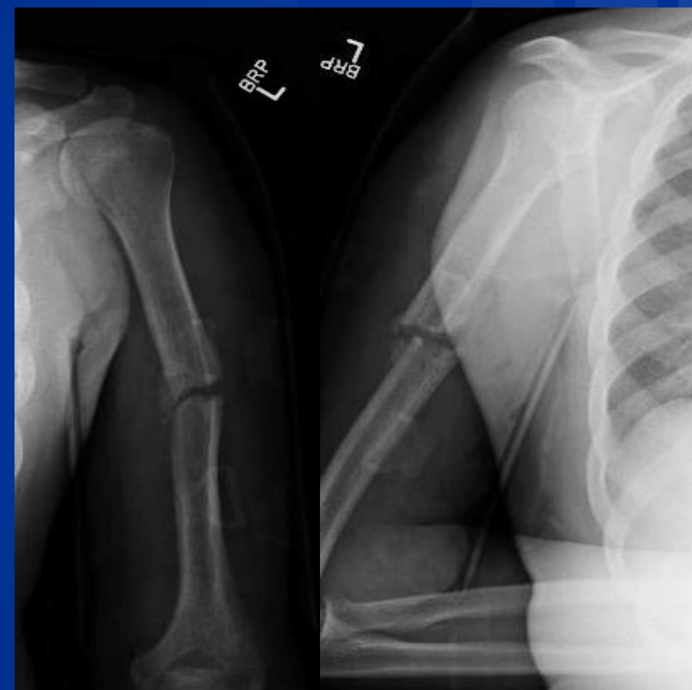
10 foot fall while roofing.

Case 1: 30yr Male

2 week Sarmiento



6 week

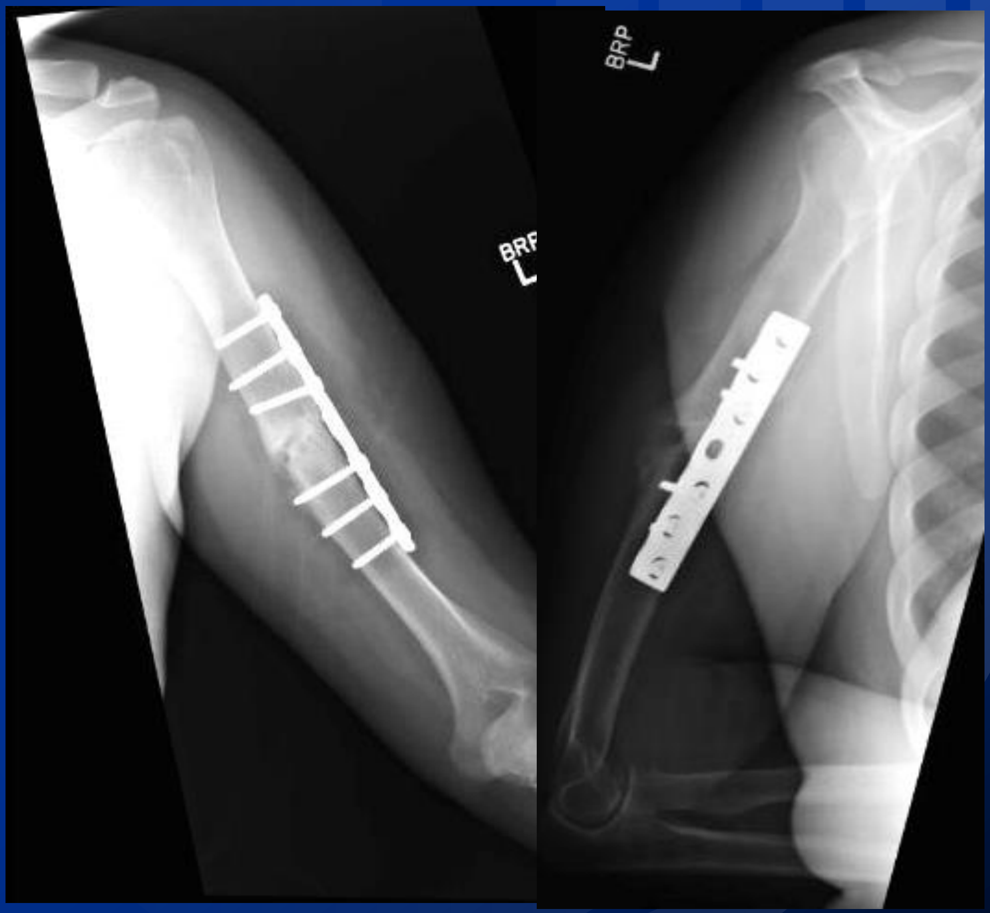


Case 1: Intraoperative Films

Postop Films

2 week

6 week



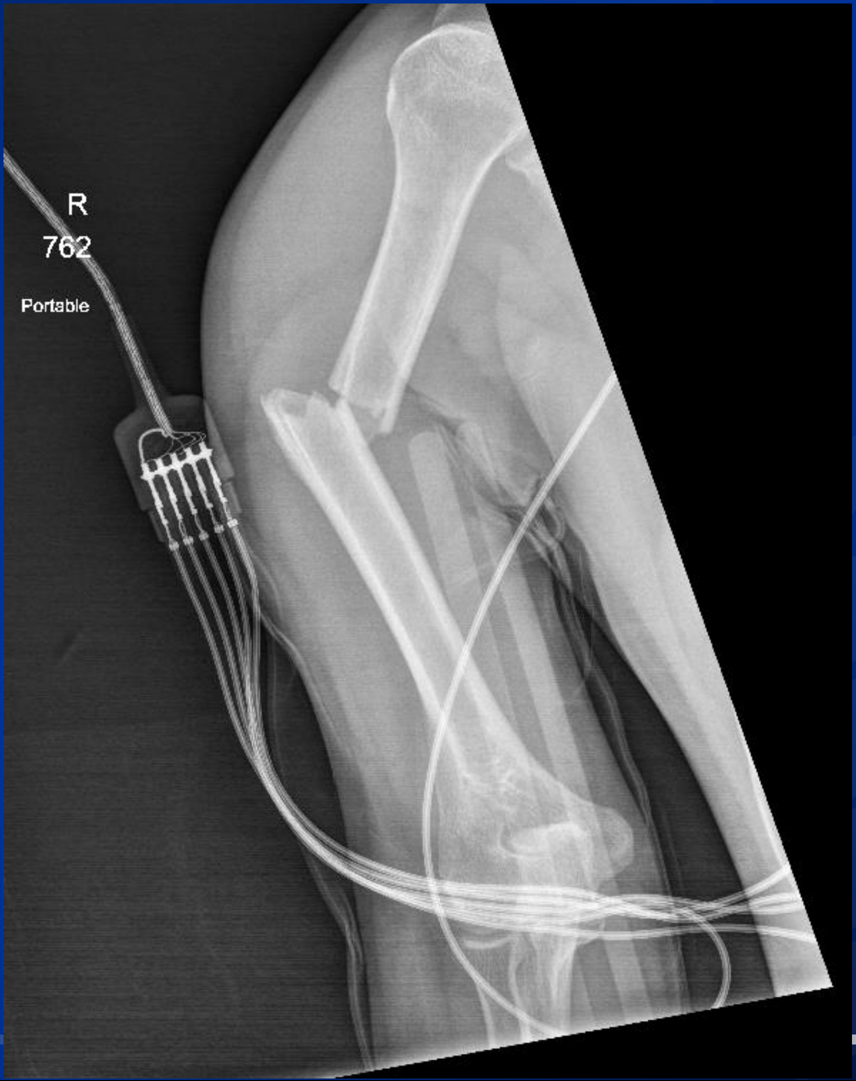
3 months

Case Examples

1. 30yr male aseptic nonunion
2. 48yr male aseptic nonunion
3. 31yr female deformed septic nonunion s/p ORIF, I&Dx2, ROH

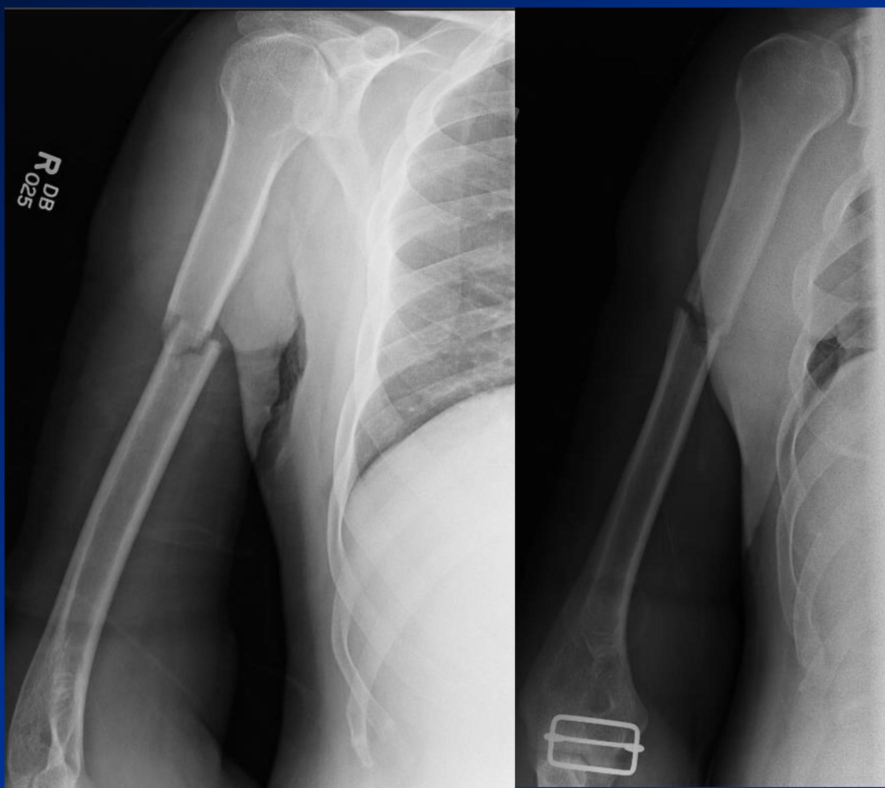
Case 2: 48yr male

fall from ladder

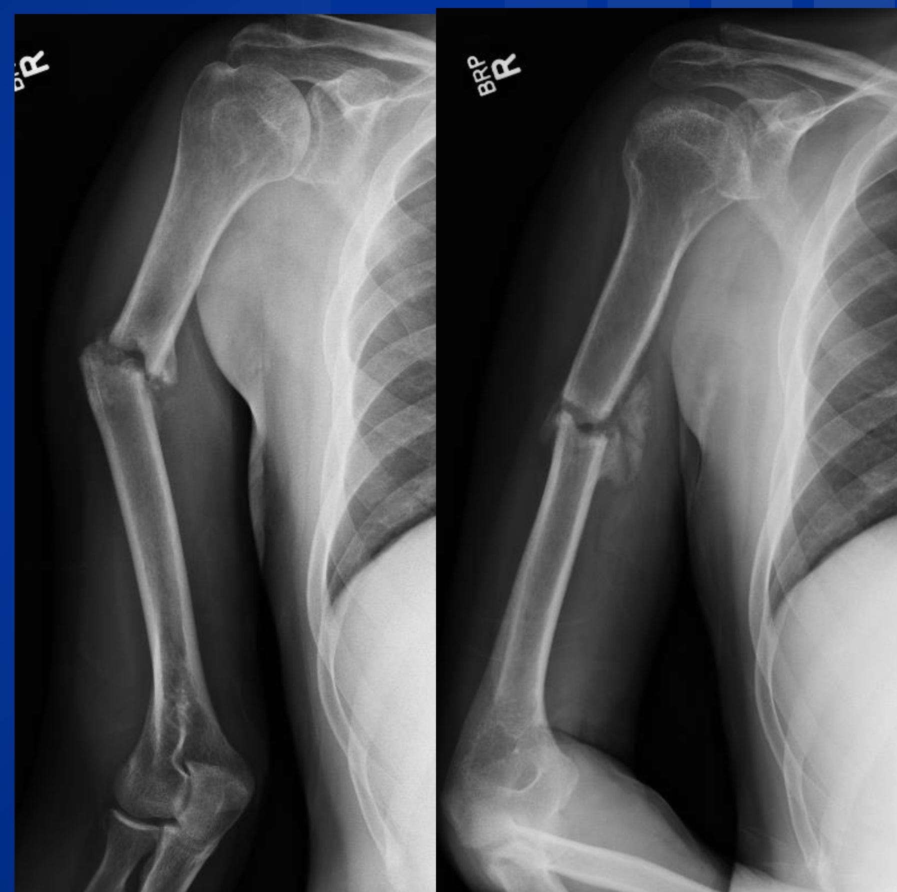


Case 2: 48yr male

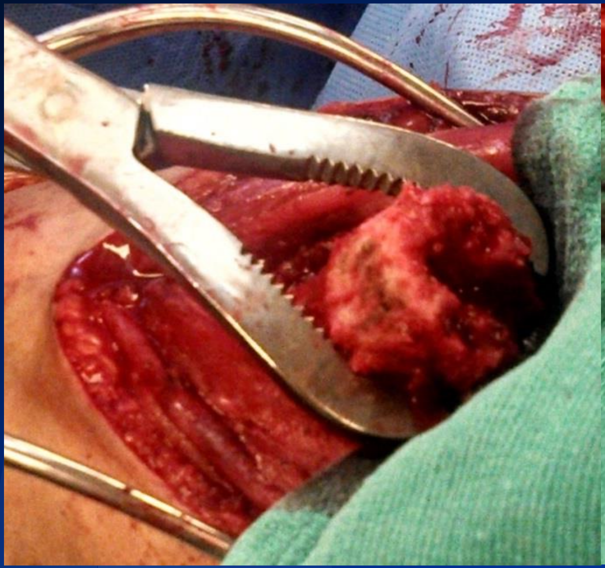
2 weeks

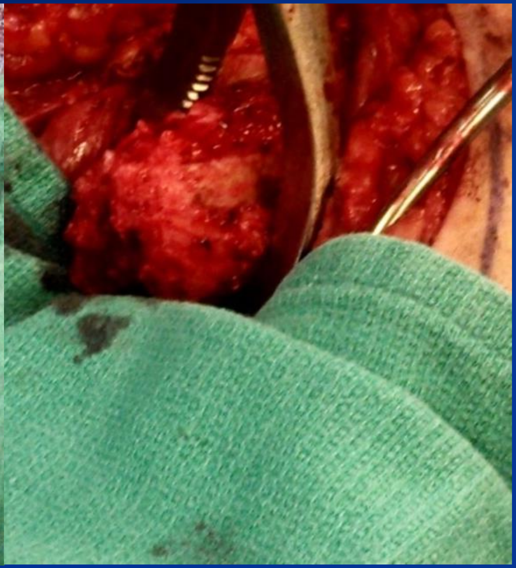


6 months

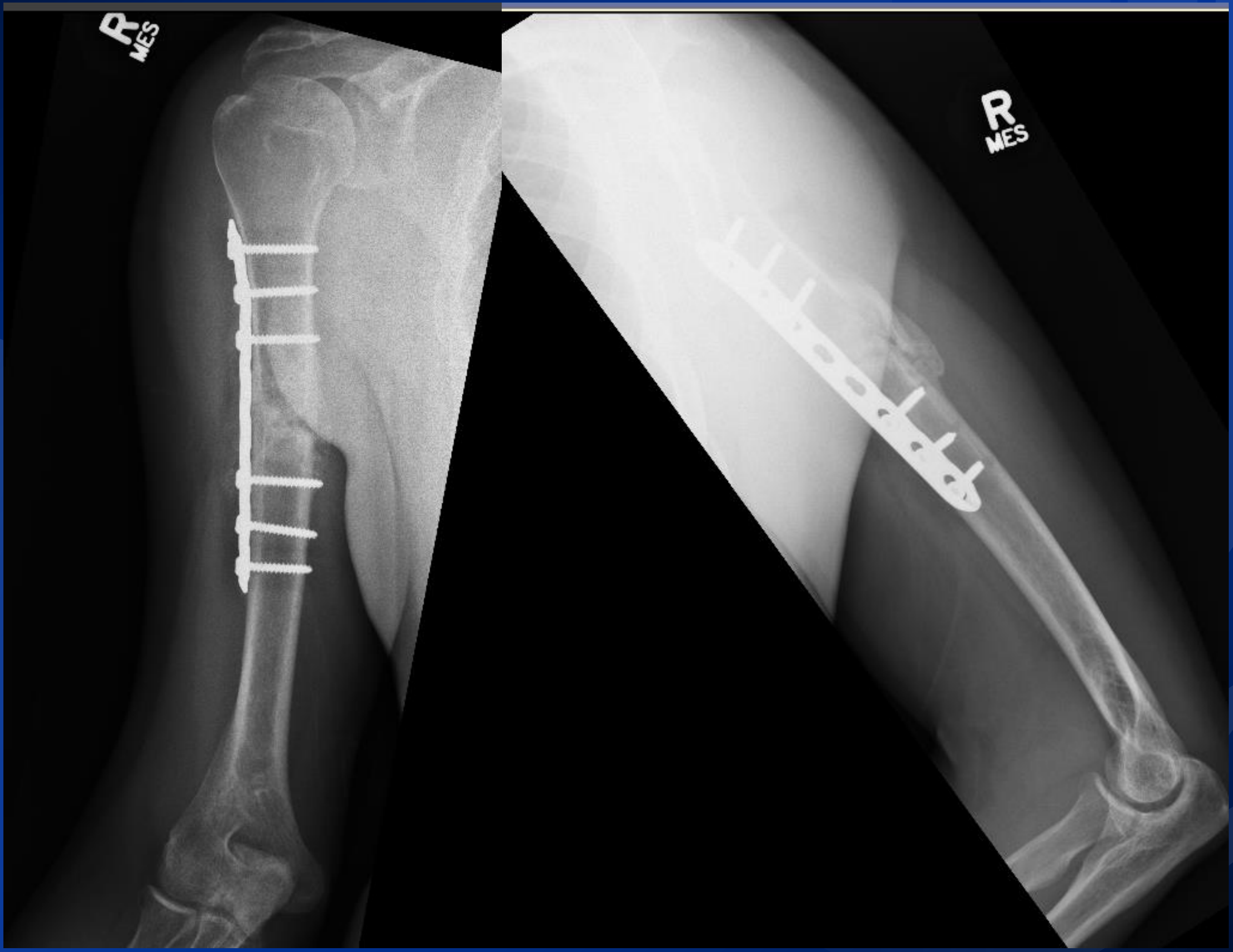


Case 2: Intraoperative

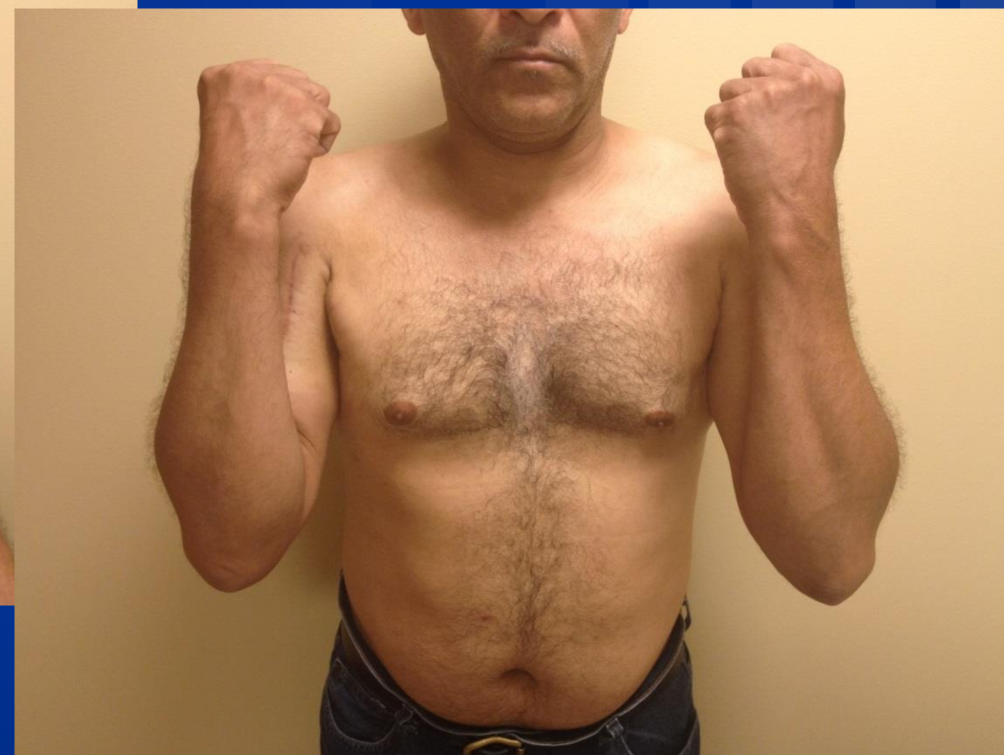




3 months post op



3 months post op



Case Examples

1. 30yr male aseptic nonunion
2. 48yr male aseptic nonunion
3. 31yr female deformed septic nonunion s/p ORIF, I&Dx2, ROH

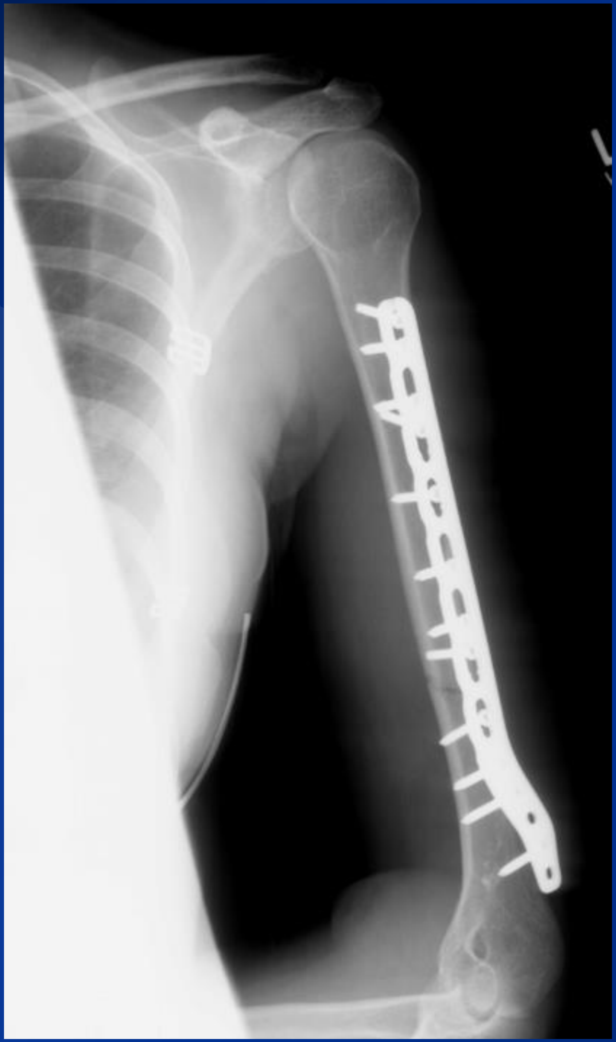
Case 3: 31yr female

Presents to us for the first time 1.5 years after fracture in MVC, ORIF with acute infection 5 weeks post op requiring I&Dx2 then ROH 4 months post op

Case 3 Intraoperative

Case 3: 31yr female

3 month post op

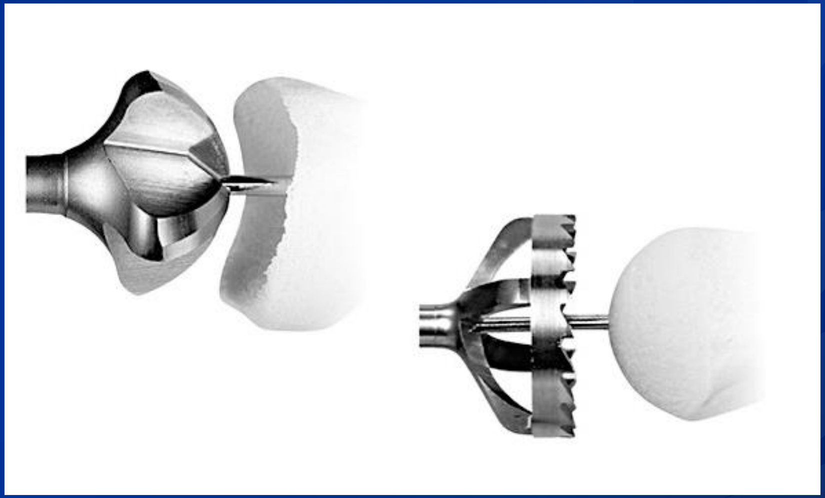


Results

- All patients achieved union
- Zero pain and full functional outcomes

Conclusion

We describe a simple and effective technique for humeral shaft nonunions which has been successful in both septic and hypertrophic nonunions, as well as from multiple approaches-both anterolateral and posterior



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Perioperative Transfusion Predicts Early Prosthetic-Related Complications In Total Shoulder Arthroplasty

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Purpose/Hypothesis

- 90-day prosthetic related complications are an important metric in hip and knee arthroplasty in the Medicare population, yet these guidelines have not been established for total shoulder arthroplasty (TSA).
- TSA utilization is rising in the Medicare population, however the transfusion rate has remained relatively constant.
- Transfusion in THA/TKA associated with increased odds of mortality, with mixed results in for infection. (1)(2)
- Limited data in TSA, but transfusion has been associated with increased surgical site infections. (3)

Materials and Methods

Design:

- Retrospective Medicare database review of TSA and RTSA patients from (2005-2012) using PearlDiver Technologies.
- Analyzed complications with index operation performed between 2005 and 2010, guarantee 2-year follow up minimum.

Outcomes:

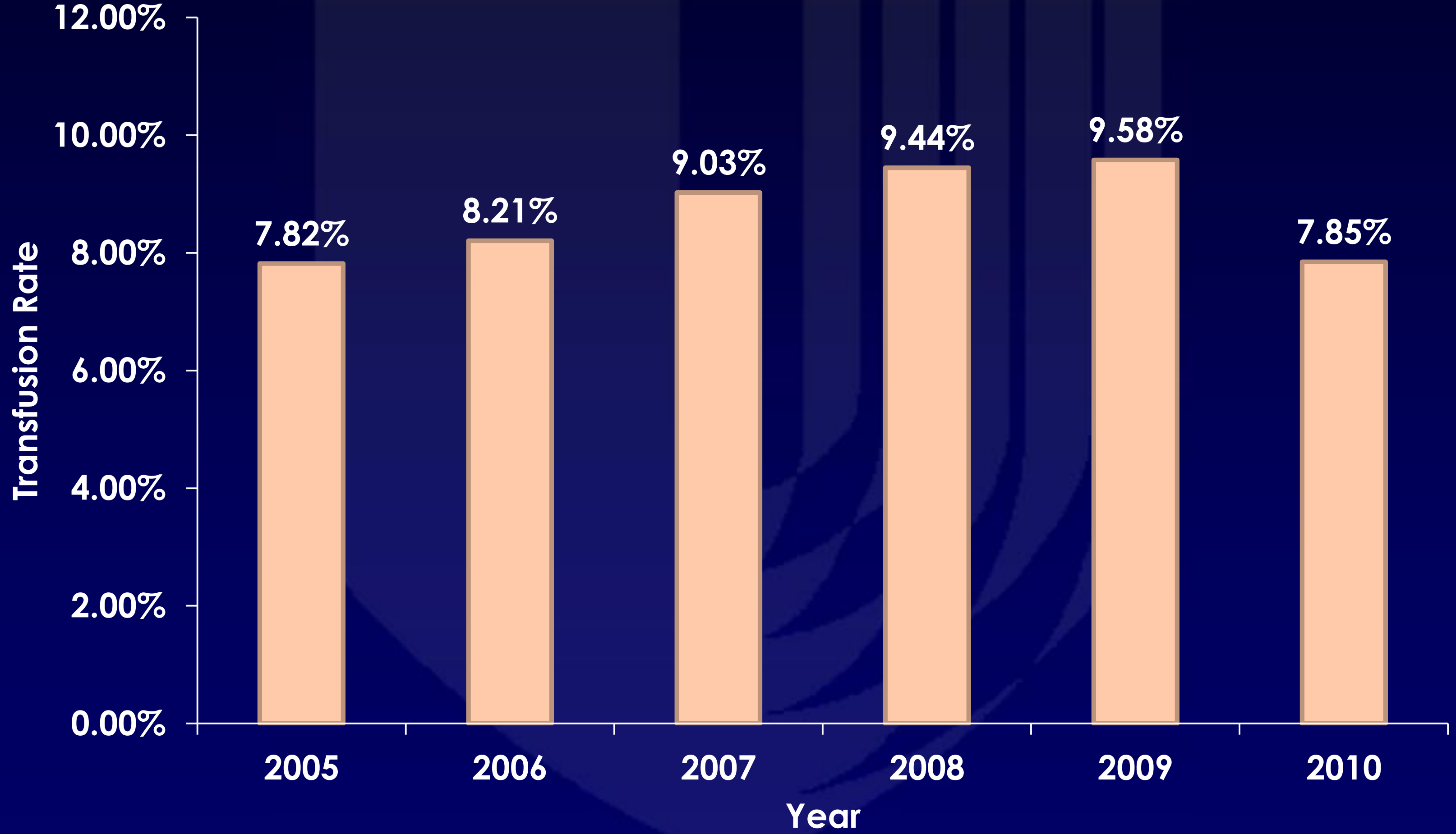
- Used ICD-9-CM and CPT codes for Elixhauser comorbidities, medical complications, and surgical complications.
- Measured outcomes at 7 days, 30 days, 90 days, 1 year, 2 years, and overall.

Analysis:

- Analysis comparing groups using chi-squared (statistical significance defined as alpha of <0.05)
- Incidence (IN), Odds Ratios (OR), 95% Confidence Intervals (CI), p-values calculated. Results illustrated as Forest plots.

Transfusion Rate

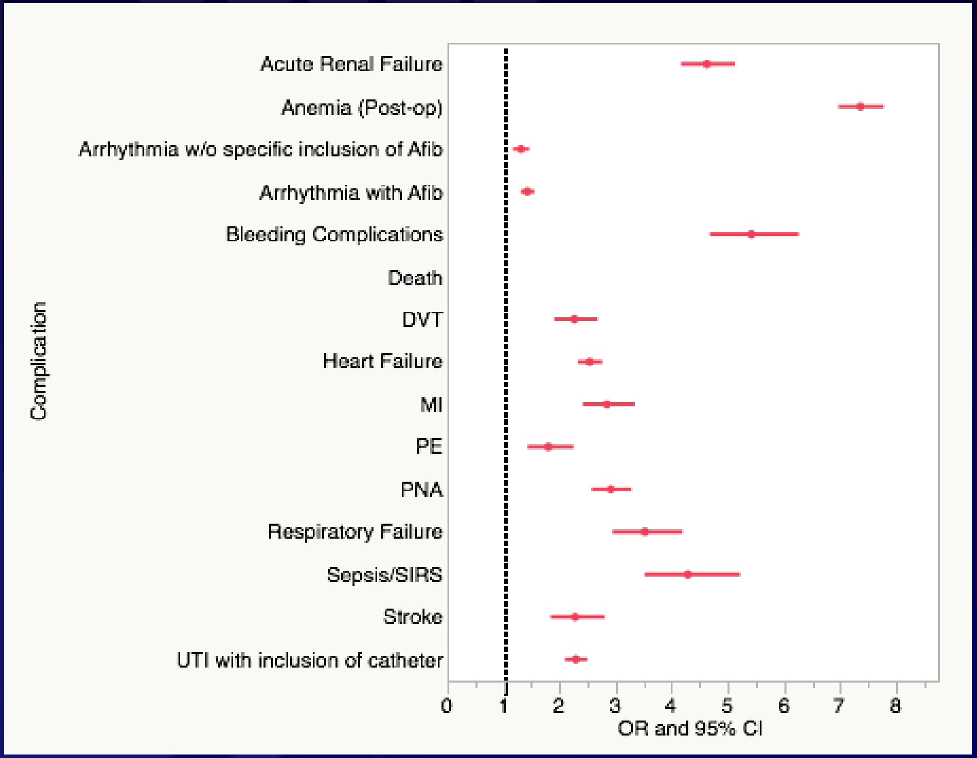
Transfusion Group: 7,936 | No Transfusion: 83,619 | Overall: 9.5%



Results

90 Day Medical Complications

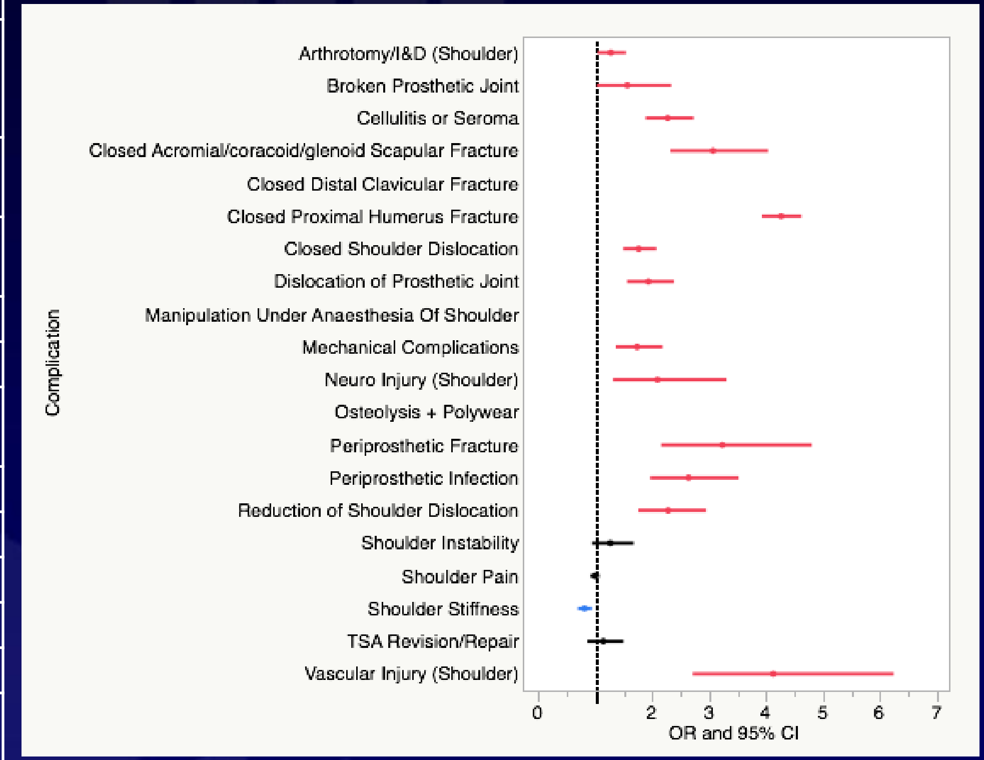
Complication	Transfusion	No Transfusion
Acute Renal Failure	7.64%	1.76%
Anemia (Post-op)	42.74%	9.20%
Arrhythmia with Afib	17.87%	13.23%
Arrhythmia w/o specific inclusion of Afib	7.67%	5.96%
Bleeding Complications	3.83%	0.73%
Death		0.07%
DVT	2.51%	1.12%
Heart Failure	12.61%	5.38%
MI	2.77%	0.99%
PE	1.32%	0.74%
PNA	5.33%	1.90%
Respiratory Failure	2.34%	0.68%
Sepsis/SIRS	1.92%	0.45%
Stroke	1.55%	0.69%
UTI with inclusion of catheter	13.02%	6.13%



Results

Complication	Transfusion	No Transfusion
Arthrotomy/I&D (Shoulder)	1.90%	1.50%
Broken Prosthetic Joint	0.37%	0.23%
Cellulitis or Seroma	2.03%	0.90%
Closed Acromial/coracoid/glenoid Scapular Fracture	0.88%	0.29%
Closed Distal Clavicular Fracture		
Closed Proximal Humerus Fracture	13.42%	3.51%
Closed Shoulder Dislocation	2.63%	1.51%
Dislocation of Prosthetic Joint	1.50%	0.78%
Manipulation Under Anaesthesia Of Shoulder		0.10%
Mechanical Complications	1.20%	0.69%
Neuro Injury (Shoulder)	0.29%	0.14%
Osteolysis + Polywear		0.04%
Periprosthetic Fracture	0.42%	0.13%
Periprosthetic Infection	0.78%	0.30%
Reduction of Shoulder Dislocation	0.97%	0.43%
Shoulder Instability	0.78%	0.62%
Shoulder Pain	26.79%	26.91%
Shoulder Stiffness	4.11%	5.02%
TSA Revision/Repair	0.86%	0.75%
Vascular Injury (Shoulder)	0.40%	0.10%

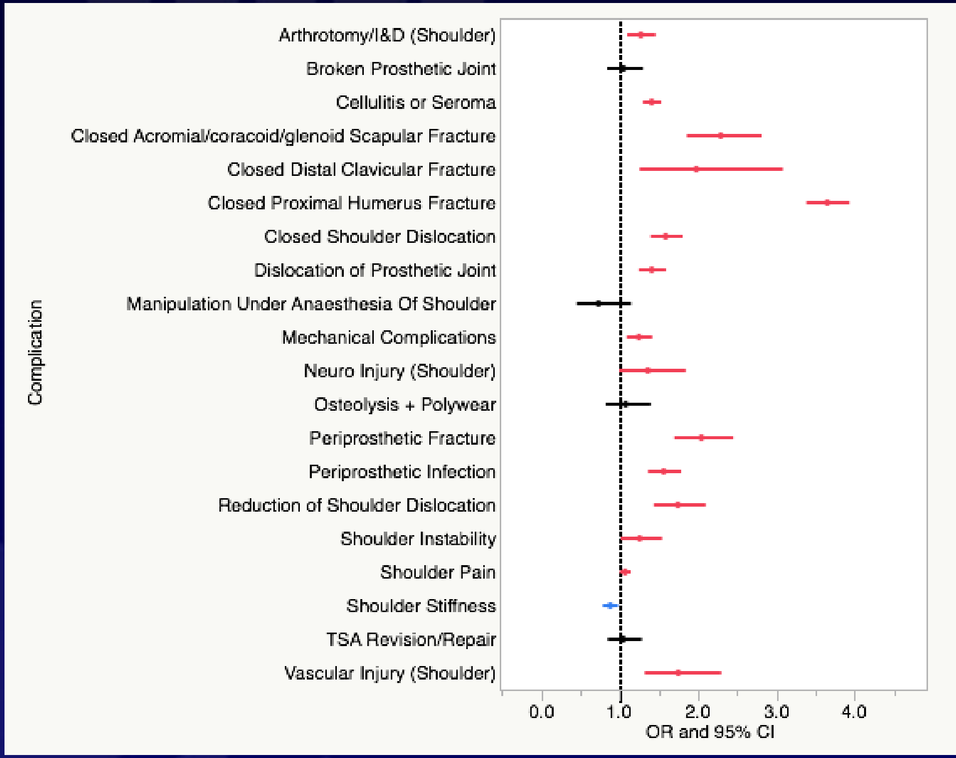
90 Day Surgical Complications



Results

Complication	Transfusion	No Transfusion
Arthrotomy/I&D (Shoulder)	3.67%	2.90%
Broken Prosthetic Joint	1.42%	1.35%
Cellulitis or Seroma	13.77%	10.16%
Closed Acromial/coracoid/glenoid Scapular Fracture	1.52%	0.67%
Closed Distal Clavicular Fracture	0.30%	0.15%
Closed Proximal Humerus Fracture	14.99%	4.61%
Closed Shoulder Dislocation	4.30%	2.74%
Dislocation of Prosthetic Joint	5.03%	3.61%
Manipulation Under Anaesthesia Of Shoulder	0.28%	0.38%
Mechanical Complications	4.52%	3.65%
Neuro Injury (Shoulder)	0.64%	0.47%
Osteolysis + Polywear	0.91%	0.84%
Periprosthetic Fracture	1.95%	0.97%
Periprosthetic Infection	3.91%	2.53%
Reduction of Shoulder Dislocation	1.83%	1.06%
Shoulder Instability	1.50%	1.20%
Shoulder Pain	46.23%	44.47%
Shoulder Stiffness	7.35%	8.24%
TSA Revision/Repair	1.55%	1.48%
Vascular Injury (Shoulder)	0.82%	0.47%

Overall Surgical Complications



Discussion

- Major Medical Complications:
  - Excluding Bleeding Related
    - ARF
    - Sepsis/SIRS
    - Respiratory Failure

- Major Surgical Complications:
    - Closed Fracture (Humerus, Scapula)
    - Periprosthetic Fracture

- No Difference In:
    - TSA Revision (90 Day and Overall)

Conclusion

Summary:

- TSA remains an important treatment modality for numerous indications.
- Surgeons should be aware that these patients may have higher rates of early complications and should pre-emptively counsel patients during admission and at discharge.

Significance:

- First study to examine multiple medical and surgical complications for TSA/RTSA with transfusion.
- Perioperative blood transfusion may serve as a useful metric to identify sicker patients.

Thank you!

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THE USE OF ULTRASOUND AS THE SOLE DIAGNOSTIC TOOL FOR ROTATOR CUFF TEARS

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M.D. Candidate, Class of 2018)

Dr. Deanna Boyette M.D. (Boyette Orthopedics-Greenville, NC)

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The Use of Ultrasound as the Sole Diagnostic Tool for Rotator Cuff Tears:

ABSTRACT

- Purpose:

  To show that ultrasounds can be an adequate diagnostic tool for rotator cuff tears when compared to MRI

ABSTRACT

Inclusion criteria:

- Retrospective study
- 51 shoulder arthroscopy patients
- shoulder ultrasounds prior to the procedure

ABSTRACT

- Comparisons:
  - Accuracy versus MRI
  - Cost versus MRI

ABSTRACT

- Discussion:

Ultrasonic positioning alternative to

Crass technique

STATISTICAL ANALYSIS

	Arthroscopy Findings	
Ultrasound Findings:	Cuff tear	Cuff intact
Rotator Cuff tear	**30**	**1**
Rotator Cuff intact	**7**	**13**

The Use of Ultrasound as the Sole Diagnostic Tool for Rotator Cuff Tears:

STATISTICAL ANALYSIS

Sensitivity: **0.81** (95% confidence interval: 64.8-92.0)

Specificity: **0.93** (95% confidence interval: 66.1-99.8)

Positive Predictive Value: **0.97** (95% CI: 83.3-99.9)

Negative Predictive Value: **0.65** (95% CI: 40.8-84.6)

The Use of Ultrasound as the Sole Diagnostic Tool for Rotator Cuff Tears:

COMPARISON

Ultrasound sensitivity: 81.1%

MRI sensitivity: 87.8%[1]

1: de Jesus, J. O., & Parker, L. (2009). Accuracy of MRI, MR Arthrography, and Ultrasound in the Diagnosis of Rotator Cuff Tears: A Meta-Analysis.*American Journal of Roentgenology*, *192*(6), 1701–1707.

COMPARISON

Ultrasound cost

- Medicare: **$110.56**
- Blue Cross Blue Shield: **$166.31**

MRI cost

- Medicare: **$222.67**
- Blue Cross Blue Shield **$564.87**

The Use of Ultrasound as the Sole Diagnostic Tool for Rotator Cuff Tears:

DISCUSSION

Crass and Modified Crass Positioning:

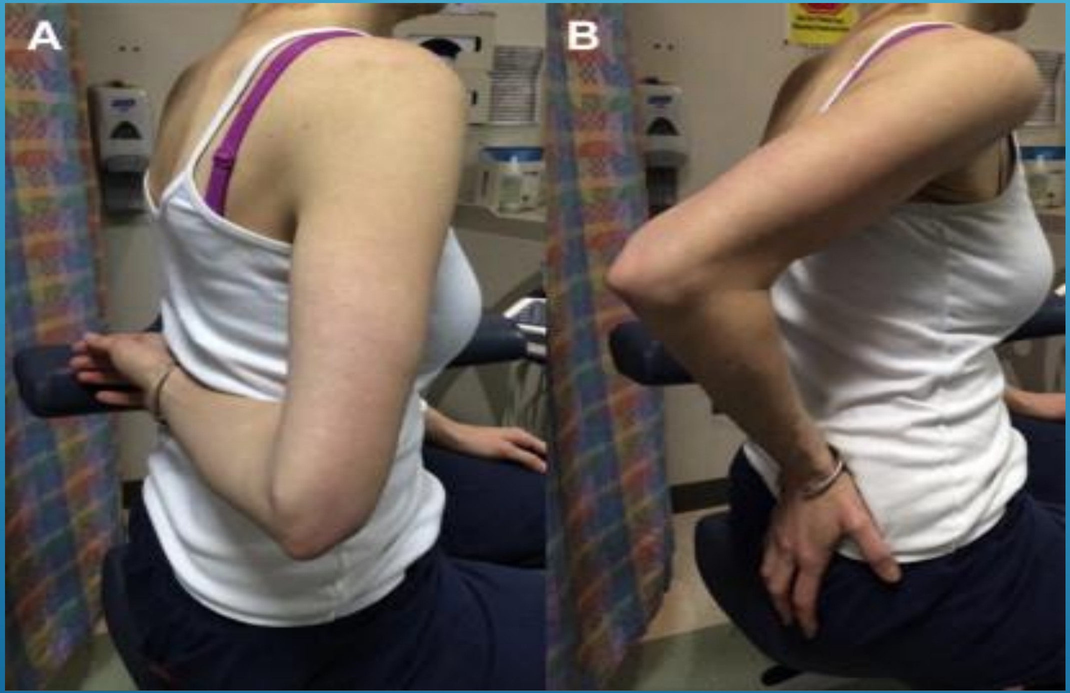

Photo Credit: Nissman, D. B. (2014). Ultrasonography of Tendons. *Ultrasound Clinics*,*9*(3), 489–512.

DISCUSSION

New Positioning technique:

THE USE OF ULTRASOUND AS THE SOLE DIAGNOSTIC TOOL FOR ROTATOR CUFF TEARS

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Distal Radius Fractures

How to Stay Out of Trouble & Avoid Complications!!

Sanj Kakar MD, MRCS
Associate Professor of Orthopaedics
Mayo Clinic
Rochester, MN

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Disclosures

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  - Arthrex
  - Skeletal Dynamics

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Avoiding and Treating Perioperative Complications of Distal Radius Fractures

Peter C. Rhee, DO[a], David G. Dennison, MD[b], Sanjeev Kakar, MD, MRCS[b,*]

- Alex Shin MD
- Rob Medoff MD
- David Dennison MD
- Jorge Orbay MD

CURRENT CONCEPTS

Management of Severely Comminuted Distal Radius Fractures

David M. Brogan, MD, MSc,† Marc J. Richard, MD,† David Ruch, MD,† Sanjeev Kakar, MD*

Distal radius fractures are among the most common fractures of the upper extremity. Indications for operative and nonsurgical management have evolved over time, as have fixation techniques. Volar locking plates are commonly used in the treatment of selected distal radius fractures such as low-energy or relatively uncomplicated fractures. They have limitations, however, in the management of highly comminuted fracture patterns and in polytrauma patients. In these patients, other methods ranging from spanning fixation to fragment-specific fixation have emerged as useful alternatives in the surgeon's armamentarium for treatment of these challenging fractures. (*J Hand Surg Am. 2015;40(9):1905–1914. Copyright © 2015 by the American Society for Surgery of the Hand. All rights reserved.*)

Key words Distal radius fracture, fragment specific fixation, dorsal bridge plate, external fixation.

Upper extremity fractures have been estimated to account for up to 1.5% of all United States emergency room visits, and 44% of these are attributed to fractures of the radius and ulna.[1] Distal radius fractures tend to occur in a bimodal age distribution: young patients involved in high-energy trauma and elderly patients with low to moderate energy injuries secondary to osteopenia or osteoporosis. Higher-energy fractures are more likely to result in greater articular involvement and comminution.[2] Risk factors for these higher-energy fractures include younger age, rural areas, and the summer season.[3] Men have a 5-fold higher risk of sustaining a high-energy distal radius fracture than women (Fig. 1). Despite this, the overall age-adjusted incidence of distal radius fractures is 4 to 5 times greater in women than men.[3–5] In women, the greatest lifetime risk for a distal radius fracture occurs in the postmenopausal years, owing to a reduction in bone mass,[5] and the incidence of comminuted intra-articular fractures increases in both sexes with advancing age.[6]

The increasing incidence of distal radius fractures with advancing age has a profound impact on health care expenditures. In 2007, Medicare spent $170 million on distal radius fracture care.[7] A review of Medicare claims over a 10-year period ending in 2005 demonstrated an increase in internal fixation of distal radius fractures in the elderly from 3% to 16%.[8] In short, patients are living longer, sustaining more fractures, and undergoing more surgery than before.

DIAGNOSIS

Assessment of the patient begins with an examination of the injured limb, noting any deformity, ecchymosis, and swelling or breaks in the skin that may indicate an open fracture. A careful neurovascular examination should be performed, particularly to assess for associated median nerve injury or perhaps acute carpal tunnel syndrome. After a thorough history and physical examination, the next step in treatment is an evaluation of the injury with plain radiographs. X-rays (including posteroanterior, oblique, lateral, and 10° tilt lateral views) and sometimes computed tomographic scans are used to examine the fracture. There are a number of classification systems, including Gartland and Werley, Mayo, Melone, the AO, Fernandez, Frykman, and

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D.R. is a consultant for Acumed. S.K. is a consultant for Skeletal Dynamics and Arthrex. M.J.R. is a consultant for Acumed and DePuy-Synthes.

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0363-5023/15/4009-0033$36.00/0
http://dx.doi.org/10.1016/j.jhsa.2015.03.014

Current Concepts

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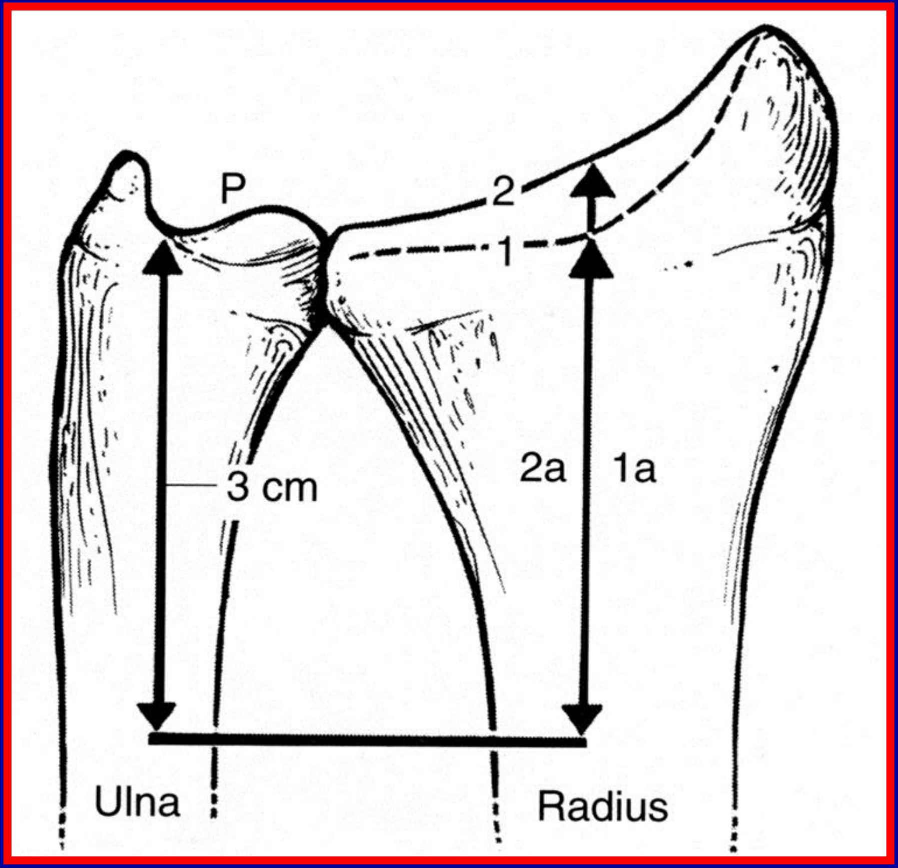
Functional Anatomy of Distal Radius

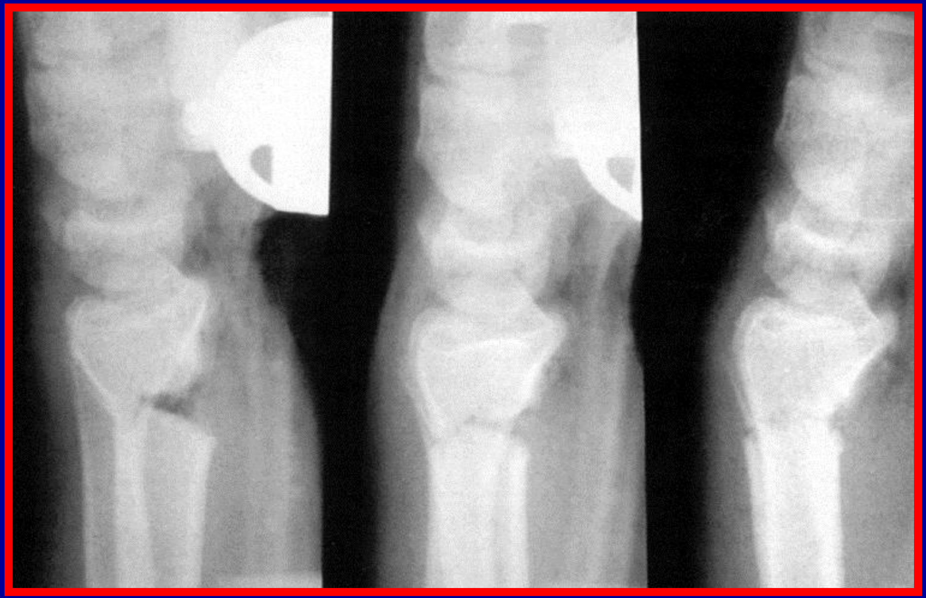
- **Distal Radius composed of 3 concave articular surfaces**
  - **Scaphoid fossa**
  - **Lunate fossa**
  - **Sigmoid notch**

- **Stability maintained by intrinsic & extrinsic ligaments**



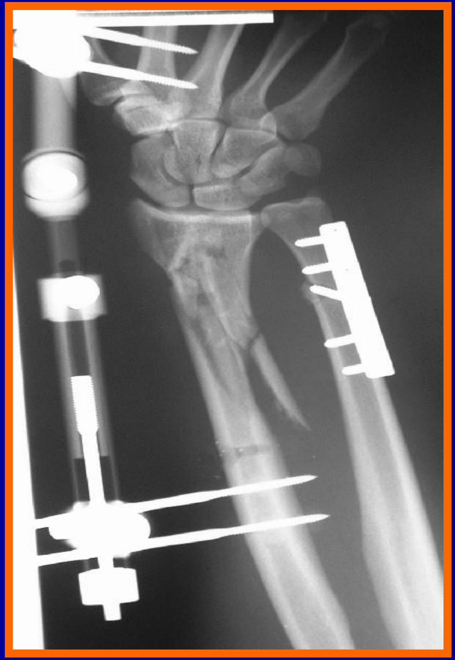
Anatomic Goals In Management of Distal Radius Fractures

- Articular congruity within 1mm
- Loss radial inclination < 5^0
- Radial shortening < 2-3mm
- Neutral to volar tilt better (0 to 11^0 volar)



Treatment Methods

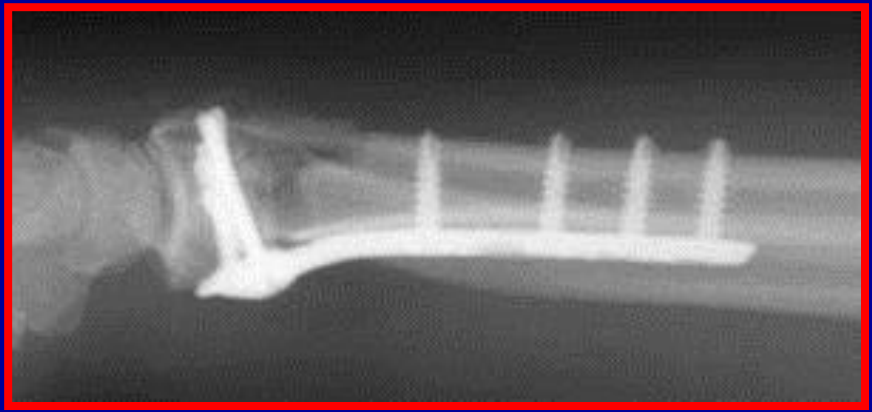
- Cast
- Pins & plaster
- Intrafocal pinning
- External fixation +/- k wire fixation
- Dorsal plates
- Volar plate fixation
- Distraction plating
- Intramedullary fixation
- Fragment specific fixation



One Treatment Does Not Suit All !!!

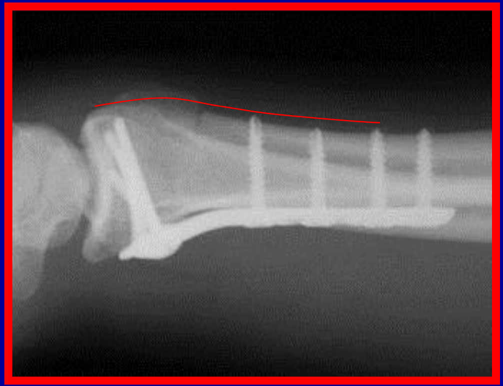
Individualise tx based on the <u>FRX</u> & the <u>PATIENT</u>

Volar Plating



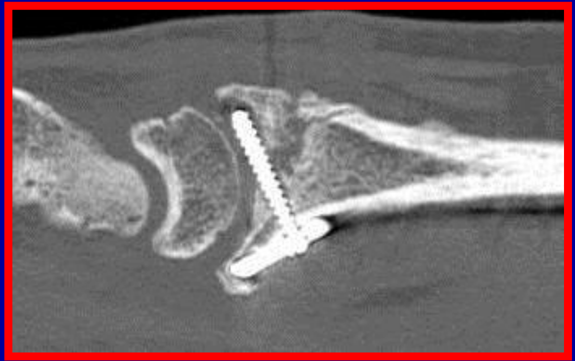
Volar Plating - Advantages

- Good soft tissue envelope
- Can see volar cortex well for frx reduction
- Fixed angle construct
- Promotes early ROM

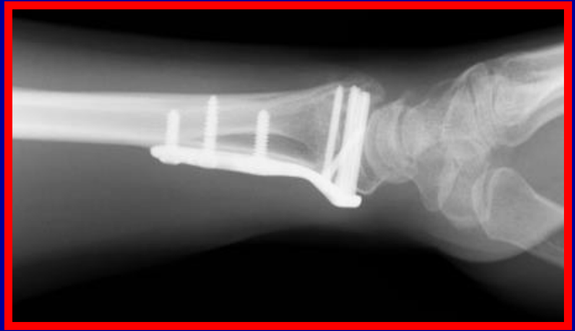


Volar Plating - Disadvantages

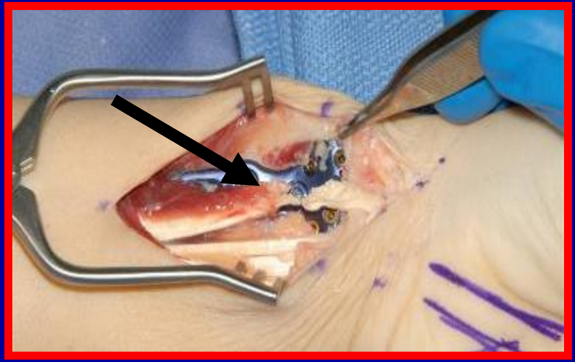
- Extensor & flexor tendon rupture



- One plate doesn't suit all fractures !!!!



- If placed too distal → intra-articular hardware



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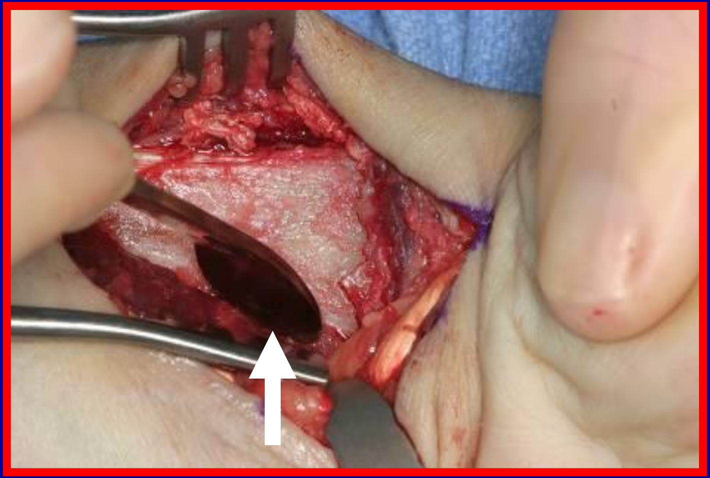
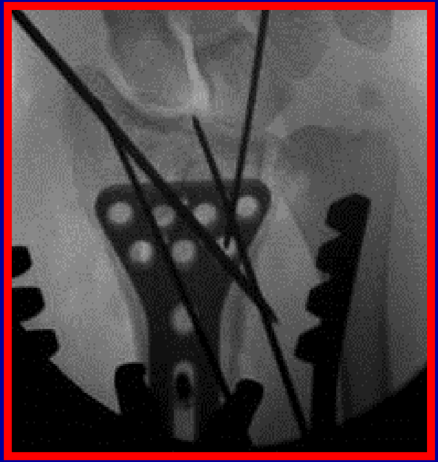
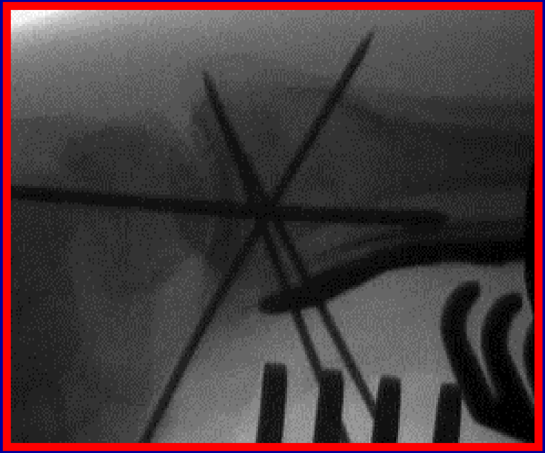
You Need To Get An Adequate Reduction

Reduction & Fixation

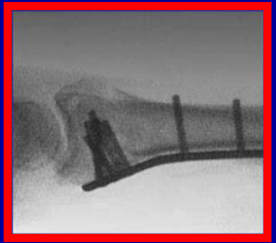


"Lift" the metaphysis





- Release BR
- Reduce volar-ulnar corner
- Provisional K-wire fixation (styloid & volar cortex)



- Keep distal screw/peg tips in the bone
  - (-1 or 2 mm)
  - 75% AP screw length ≡ bicortical screws [rigidity] Wall 2012
- Don't drill out the other side
  - Use tactile feel of finger on dorsal cortex

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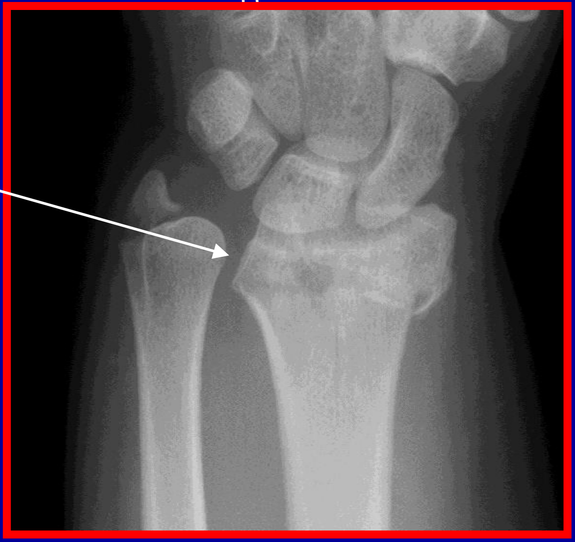
Restore the Obliquity of Sigmoid Notch

- Obliquity of sigmoid notch
  - 88% (straight or oblique)
  - 12% reverse obliquity (Tolat)
- Obliquity should be restored w/ORIF



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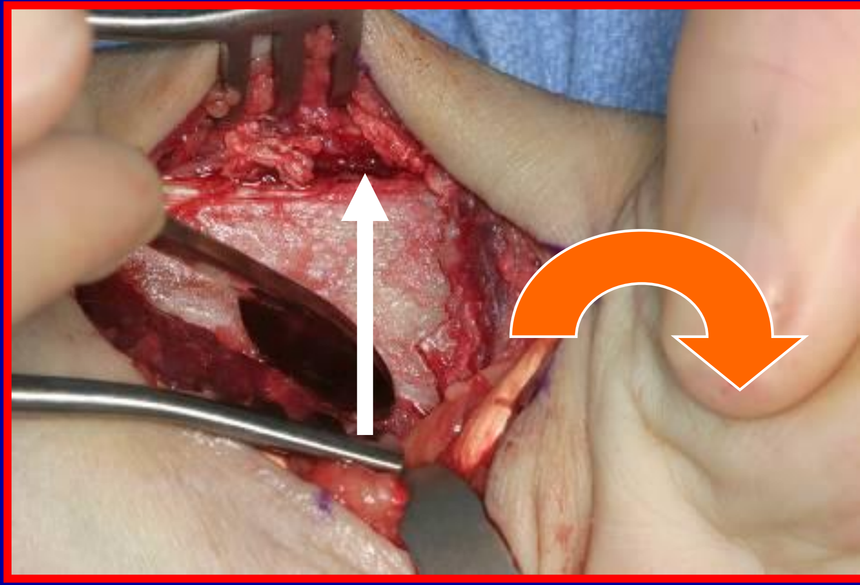
Reduction of the fracture

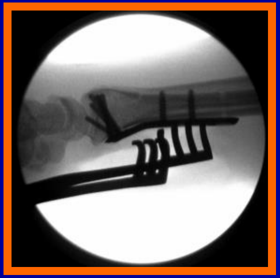
- Restore obliquity of sigmoid notch
  - "Lift" the metaphysis
  - Restore tension to DIOL & soft tissue
  - Allows reduction of the TFC and ulnar styloid



Volar-ulnar corner

Dorsal Collapse

- Upto 8% incidence after volar plating



- Prevention
  - Placing distal screws/ pegs into subchondral bone
    - Placing at least 4 screws distally

Mehling et al. 2010

    - No difference in stiffness or load to failure between 4 & 7 distal locking screws Moss et al. 2011

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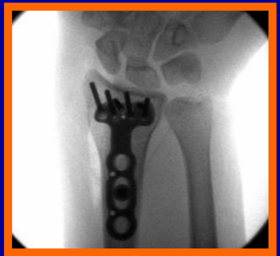
How To Prevent Radial Shortening

- Release BR
- Wrist in ulnar deviation (plate application)
- Placing distal screws within 3-4mm of subchondral bone
  - Distal fixation > 4mm proximal to subchondral bone → 50% loss radial height & 50% reduction in construct stiffness

Weinenger et al. 2010



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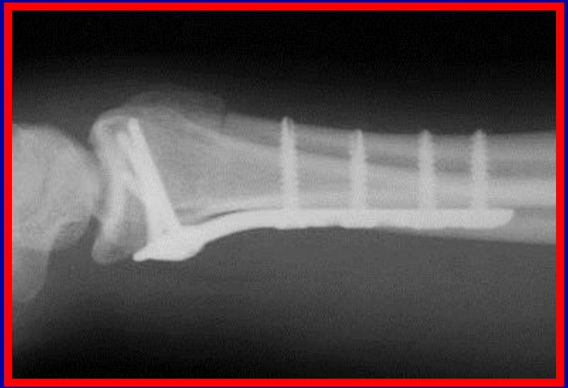
Reduction & Fixation

- Stability of construct
  - Screws stronger than pegs
    - Torsional & cyclic loading Weininger 2010; Mehling 2012
  - Make sure fixation is stable by manipulation
    - Direct inspection & live fluoro
  - Consider additional fixation
    - Bone grafting
    - K wires
    - External fixator
    - Dorsal bridge plate



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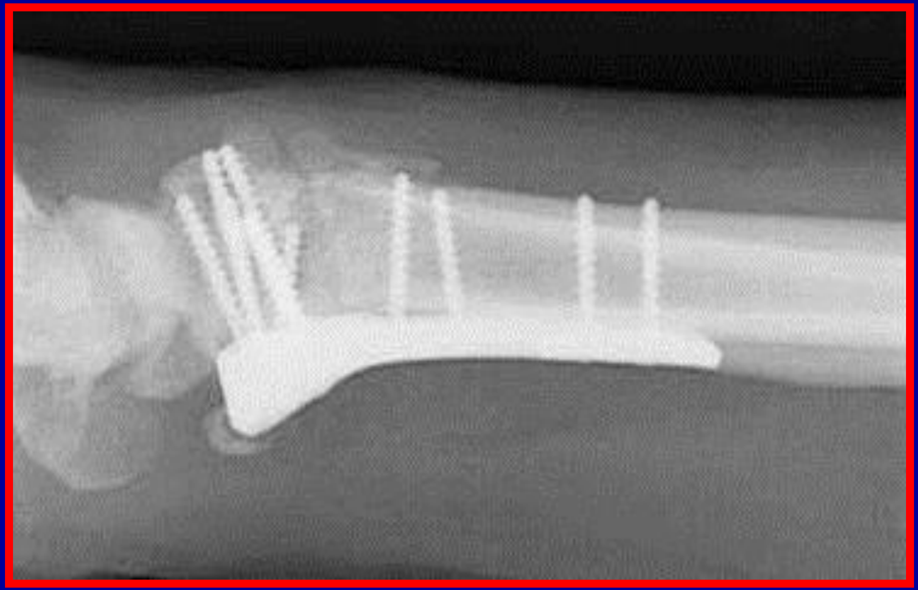
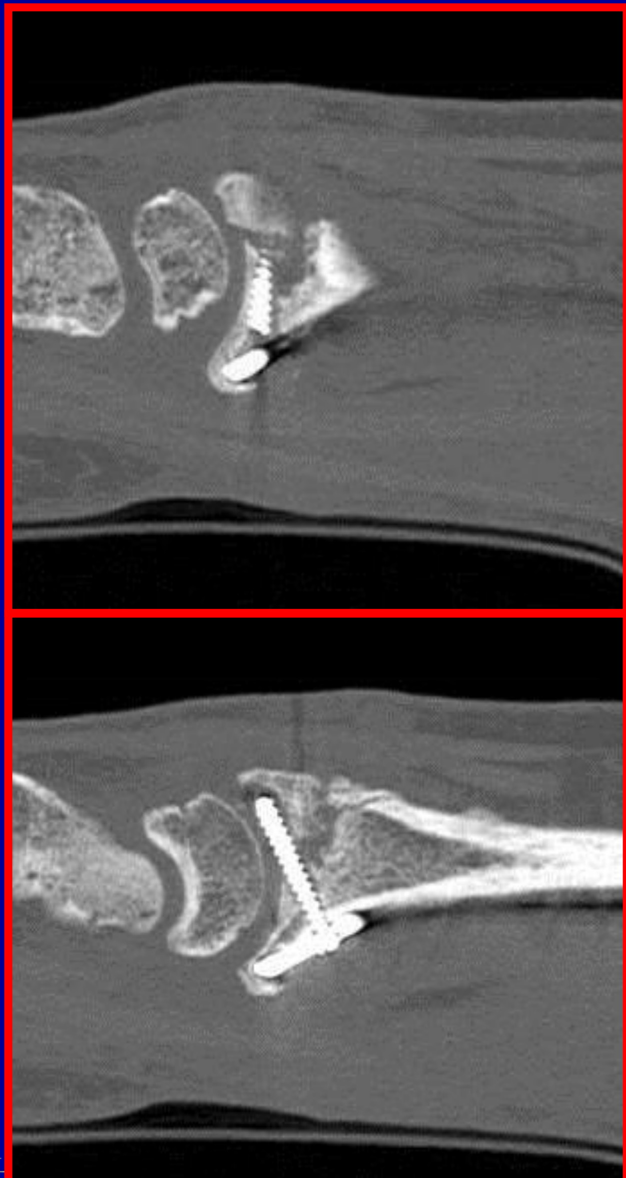
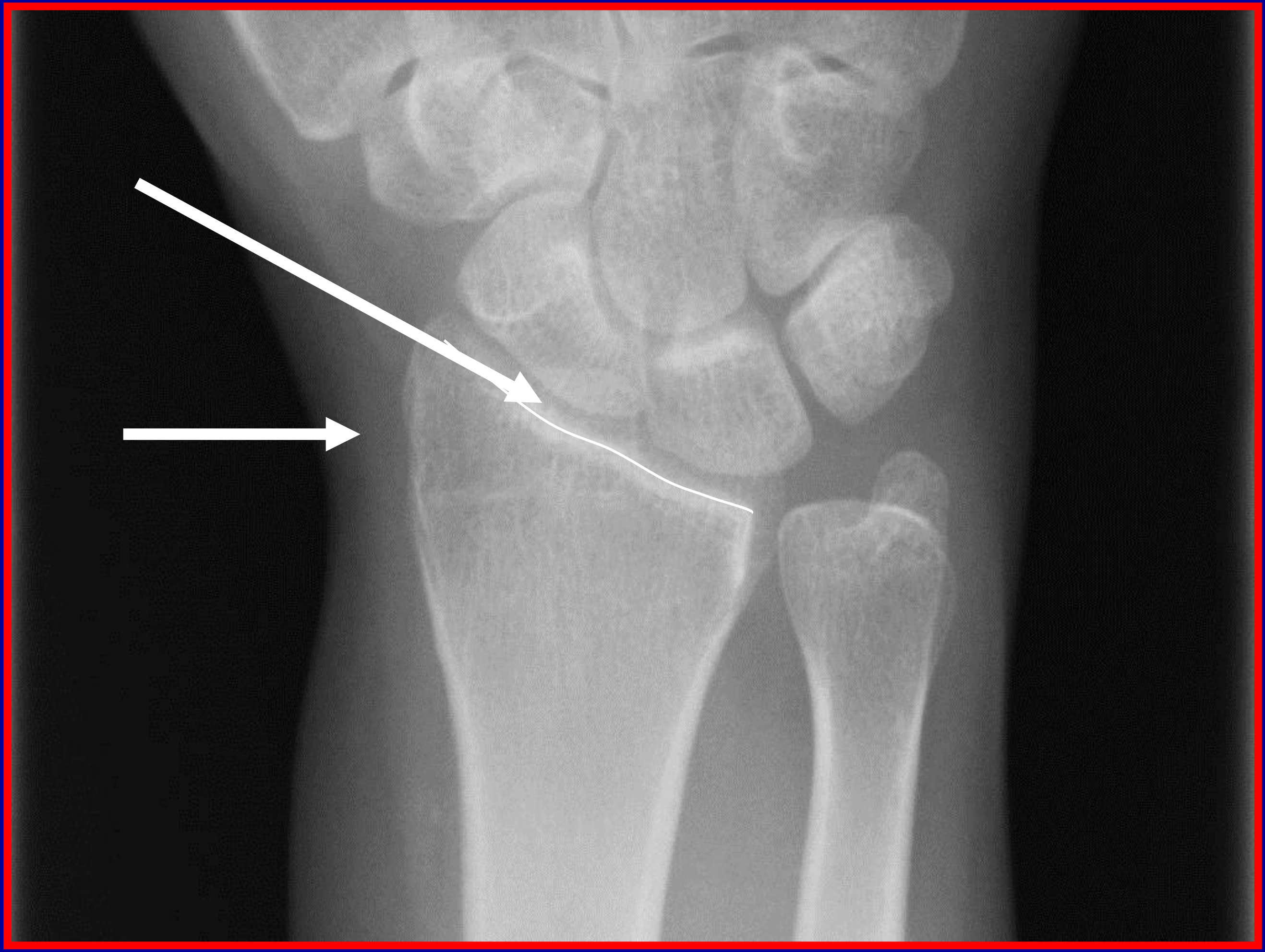
How To Prevent Intra-Articular Hardware



Problem



Radial Tilt



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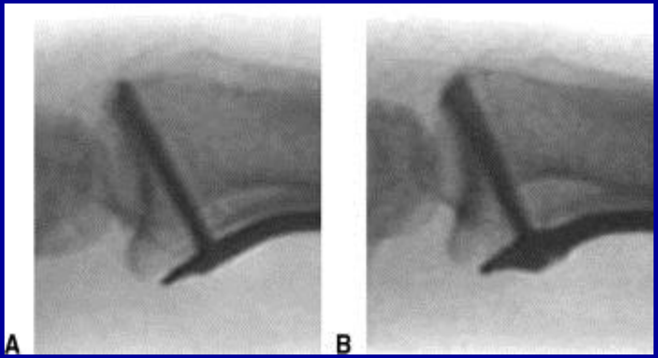
Radial Tilt

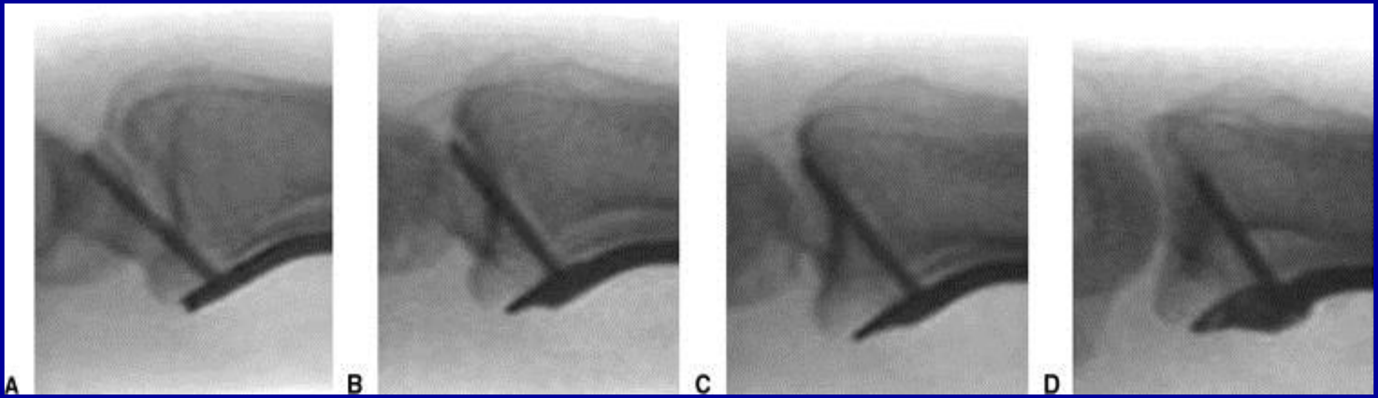
- **Styloid**

- **Radial Tilt (15-23^0)**
  - **Can see the joint space**

Fluoroscopic Evaluation of Intra-Articular Screw Placement During Locked Volar Plating of the Distal Radius: A Cadaveric Study

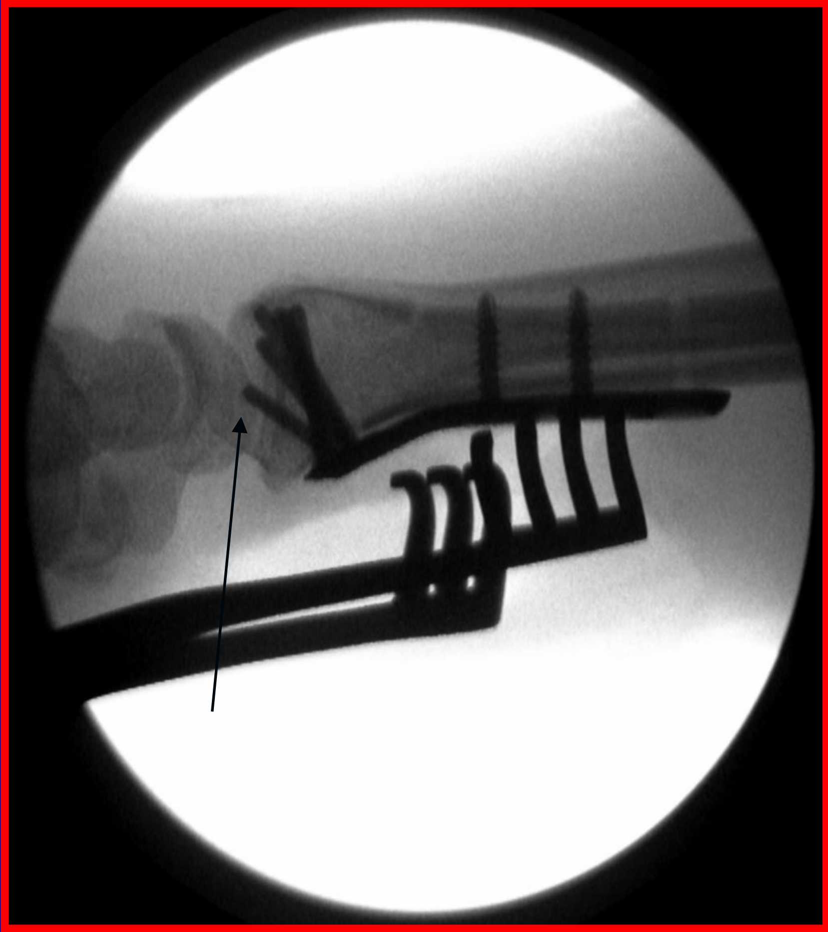
Soong et al. 2008





Lat 15º 23º 30º

Lateral View



Tilt Lateral Views

↑ tilt → scaphoid fossa

↓ tilt → lunate facet

Ulnar column fixation is easier to see when placed first

45° Pronated Oblique

- ***Smith et al, JHS, 2004***

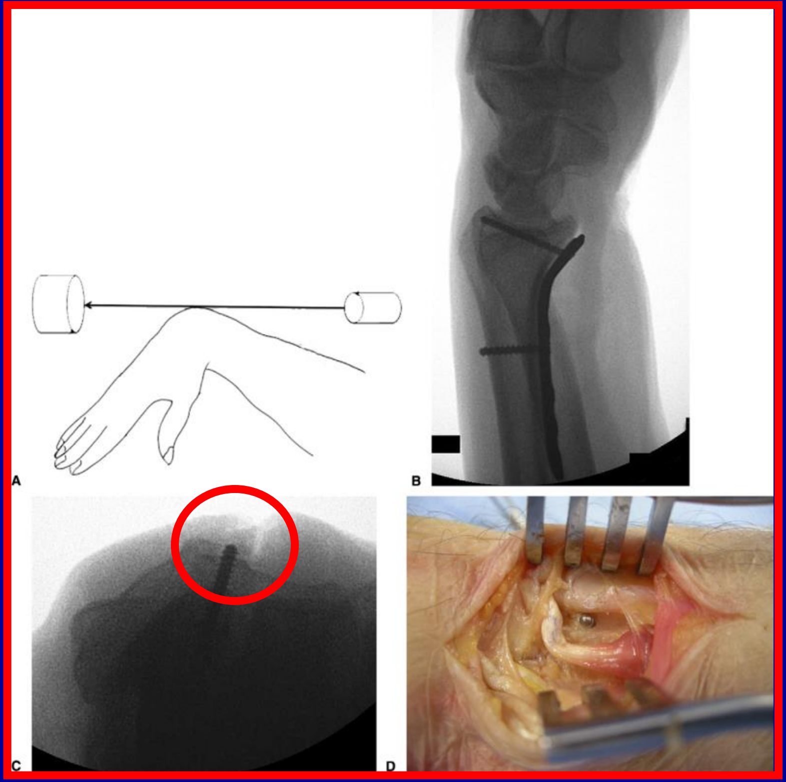
45° Supinated Oblique
Dorsal ulnar cortex

11^0 Tilt AP View

Comparison of 4 Fluoroscopic Views for Dorsal Cortex Screw Penetration After Volar Plating of theDistal Radius

Kagan Ozer et al.

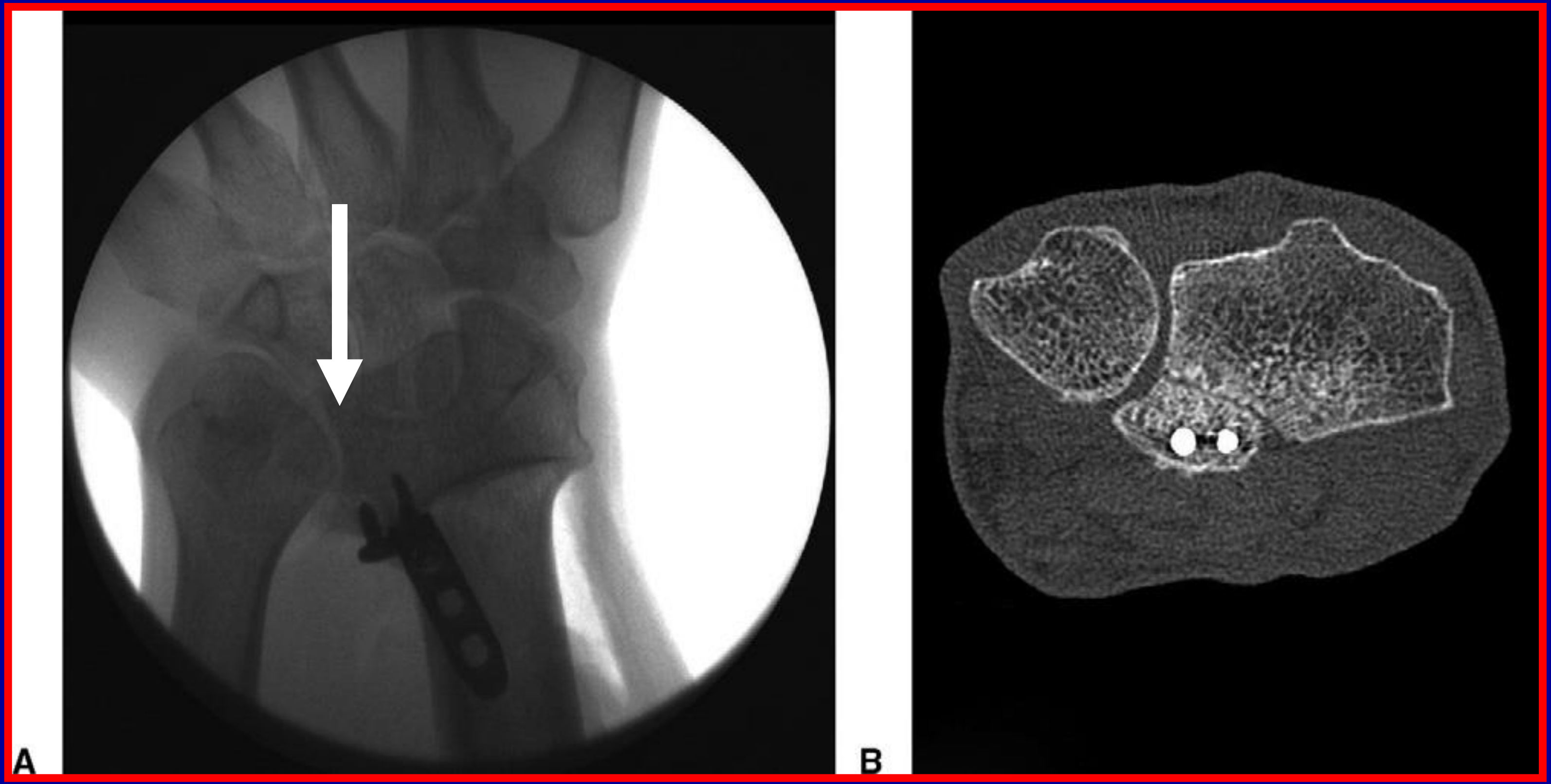
- **Dorsal tangential view**
  - **95% sensitivity for 1 mm penetration**
  - **98% for 2 mm for the 3rd compartment**
- **Oblique views were needed for 2nd and 4th compartments**



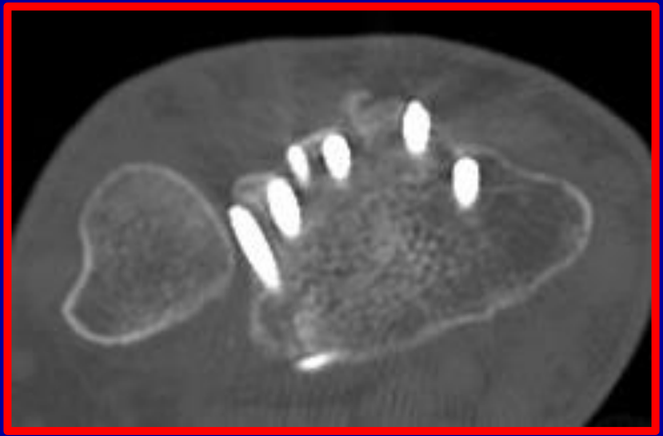
Intraoperative Imaging of the Distal Radioulnar Joint Using a Modified Skyline View

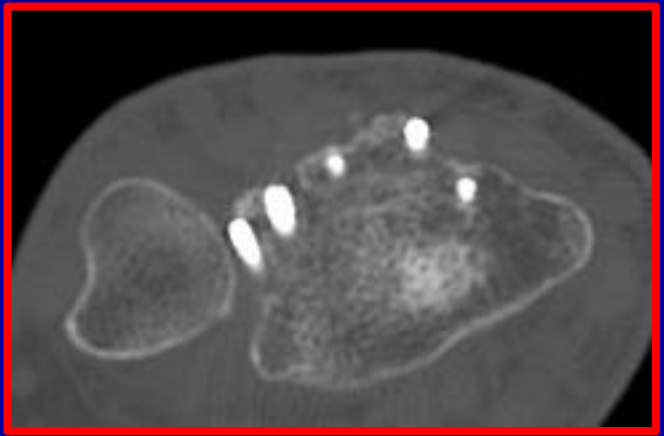
Klammer et al.

The wrist is extended and not flexed when evaluating the DRUJ



Tangential view to avoid DRUJ screws





Use of Volar Plate?

- ? role in mx of HIGHLY comminuted fractures

- ? role in frx with diaphyseal extension e.g. osteoporosis

Bridge Plate

Internal Exfix For ↑Comminuted DRF

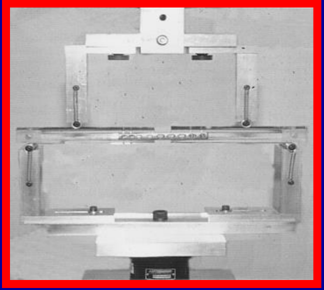
- Provides stable construct via ligamentotaxis
- Direct buttress to dorsal displacement of frx
- Avoids bulk & complications of external fixation
- Early weightbearing through injured extremity

ADD DD CASE 7247962

Biomechanical Efficacy of an Internal Fixator for Treatment of Distal Radius Fractures

Abhinav Chhabra, MD; Joseph E. Hale, PhD**; Todd A. Milbrandt, MD*; David V. Carmines, PhD*; and Gregory G. Degnan, MD**

- Biomechanical testing of internal vs external fixation
- Internal fixators (dorsal bridge plate)
  - ↑ axial load stiffness
  - ↑ maintenance of palmar tilt
  - ↓ loss of reduction
- Internal fixators Behrens et al.
  - ↓bone to bar distance →↑ rigidity

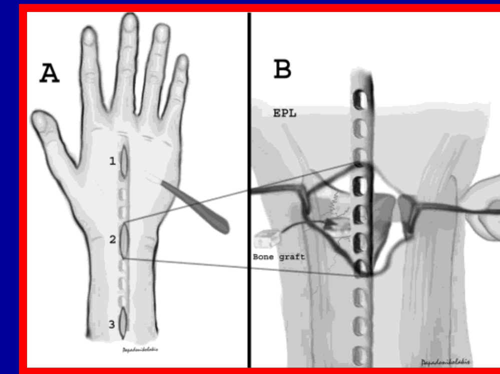



Techniques in Hand and Upper Extremity Surgery 9(1):2–6, 2005 © 2005 Lipp

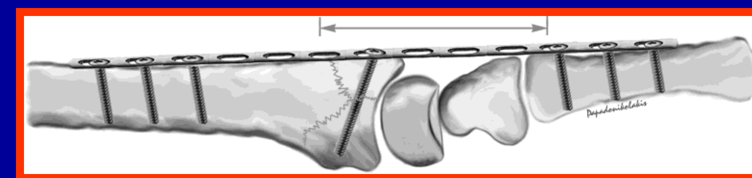
TECHNIQUE

Internal Distraction Plating of Distal Radius Fractures

Anastasios Papadonikolakis, MD and David S. Ruch, MD



- **Modified technique**
  - **3.5mm plates (thin pts: 2.4mm, 2.7mm)**
  - **Locking plates**



- **3 incisions**
  - **1st: midshaft 3rd metacarpal**
  - **2nd: 4cm proximal to site of comminution**
  - **3rd: Lister's tubercle to mobilise EPL & aid plate passage**

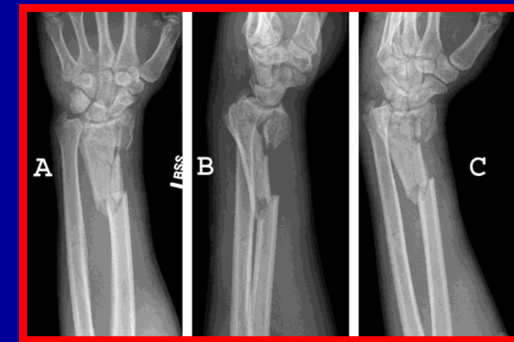
- **Pass plate from distal to proximal**
- **Fix plate distally & txn to obtain radial length**
- **Reduce & fix diaphyseal fragments to shaft**
- **Reduce articular surface [bone graft/k wires]**


Techniques in Hand and Upper Extremity Surgery 9(1):2–6, 2005 © 2005 Lipp

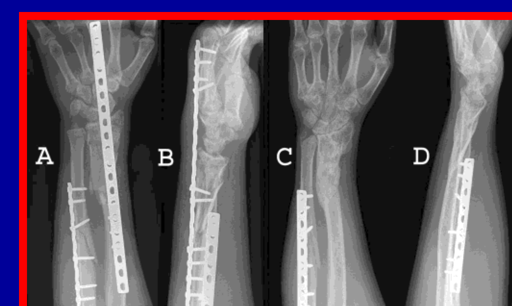
TECHNIQUE

Internal Distraction Plating of Distal Radius Fractures

Anastasios Papadonikolakis, MD and David S. Ruch, MD



- **Indications**
  - **Highly comminuted frx** (osteoporotic, intra & extra articular, open & closed)
  - **Significant <u>diaphyseal</u> extension**
  - **Pts unwilling to undergo exfix**
  - **Polytrauma pts**



- **Contraindications**
  - **Palmar lunate facet** (need volar approach)
  - **Loss of dorsal soft tissue coverage**
  - **Frx 3rd metacarpal** (use 2nd)

Use of a Distraction Plate for Distal Radial Fractures with Metaphyseal and Diaphyseal Comminution

By David S. Ruch, MD, T. Adam Ginn, MD, Charles C. Yang, MD, Beth P. Smith, PhD, Julia Rushing, MStat, and Douglas P. Hanel, MD

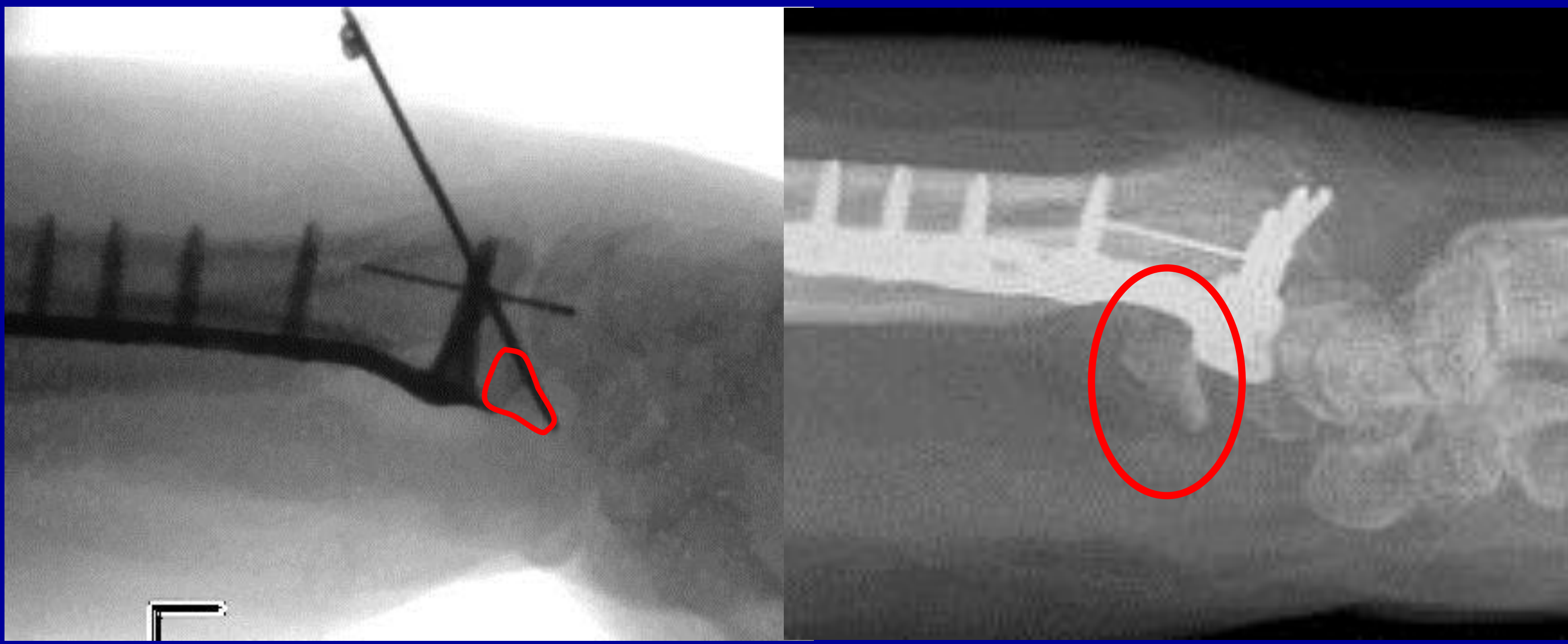
- **22 pts** (high energy DRF with at least proximal diaphyseal extension 4cm from RC jt)
  - 11/22 — Bone graft
  - Time to union — ~ 15 wks
  - ROH — ~ 17 wks
- **Xrays**
  - Volar tilt 4.6^0 & Ulnar variance 0^0
- **ROM**
  - Flexion 57^0, exten 65^0, pron 77^0, supin 76^0
- **DASH** — 11.5 @ 25M f/up
- **Gartland & Werley** — 14 exc, 6 good, 2 fair

Volar Plate - Limitations

- **Indirect reduction**
  - **No visualization of the articular surface or interosseous ligaments**

- **Difficult to address**
  - **Unstable dorsal-ulnar frx**
  - **Communited radial styloid frx**
- **? role in mx of volar rim fractures (past watershed line)**

Volar Marginal Rim Fractures

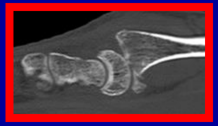


Inadequate fixation

Loss of Fixation of the Volar Lunate Facet Fragment in Fractures of the Distal Part of the Radius

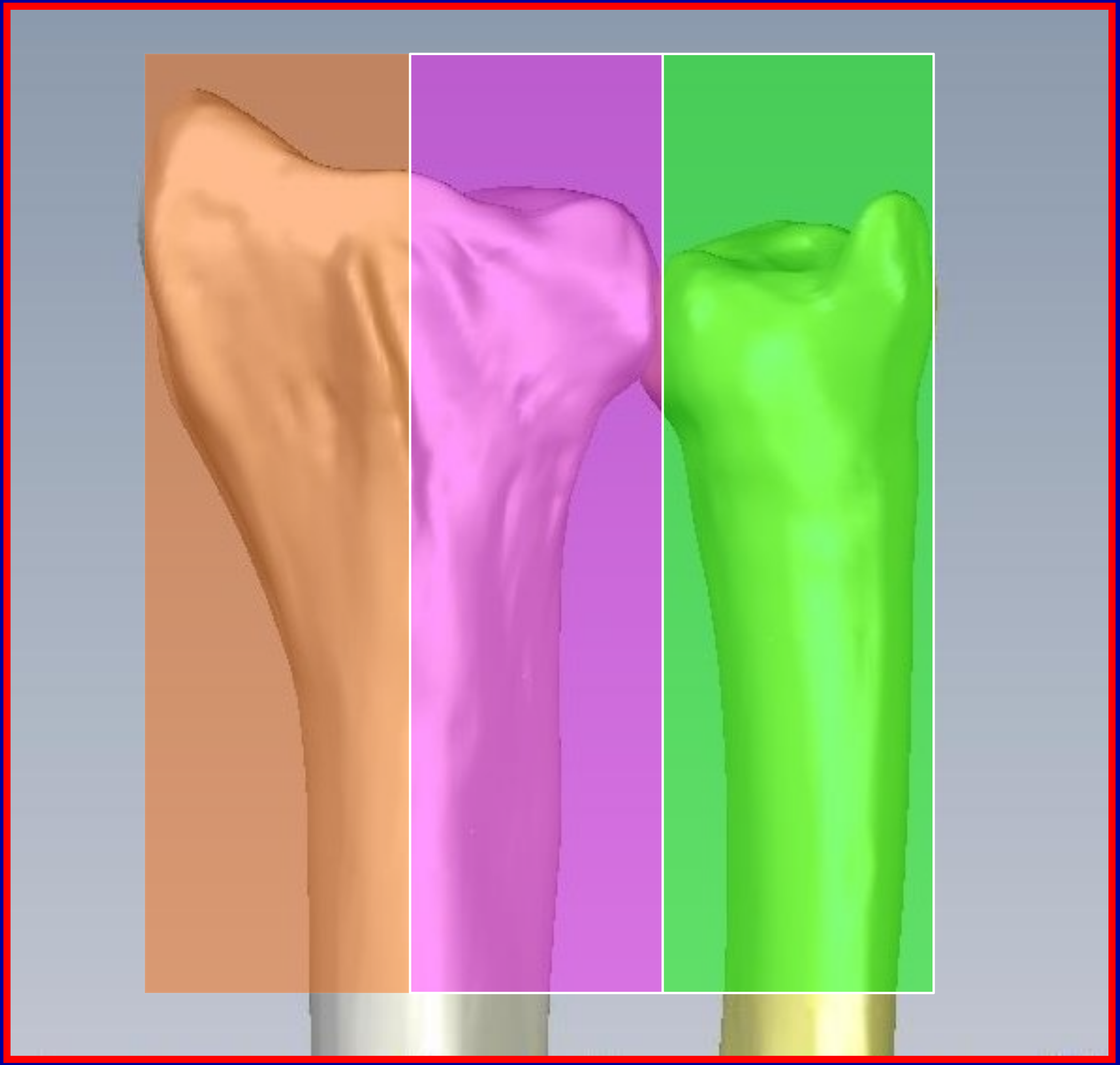
By Neil G. Harness, MD, Jesse B. Jupiter, MD, Jorge L. Orbay, MD,
Keith B. Raskin, MD, and PD Dr. med Diego L. Fernandez

- **7 pts (volar shearing frx)**
- **ORIF (volar plate)**
- **ALL pts → carpal subluxation (loss of volar corner fixation)**
- **4 pt → repeat ORIF, 1 pt → radiocarpal fusion**

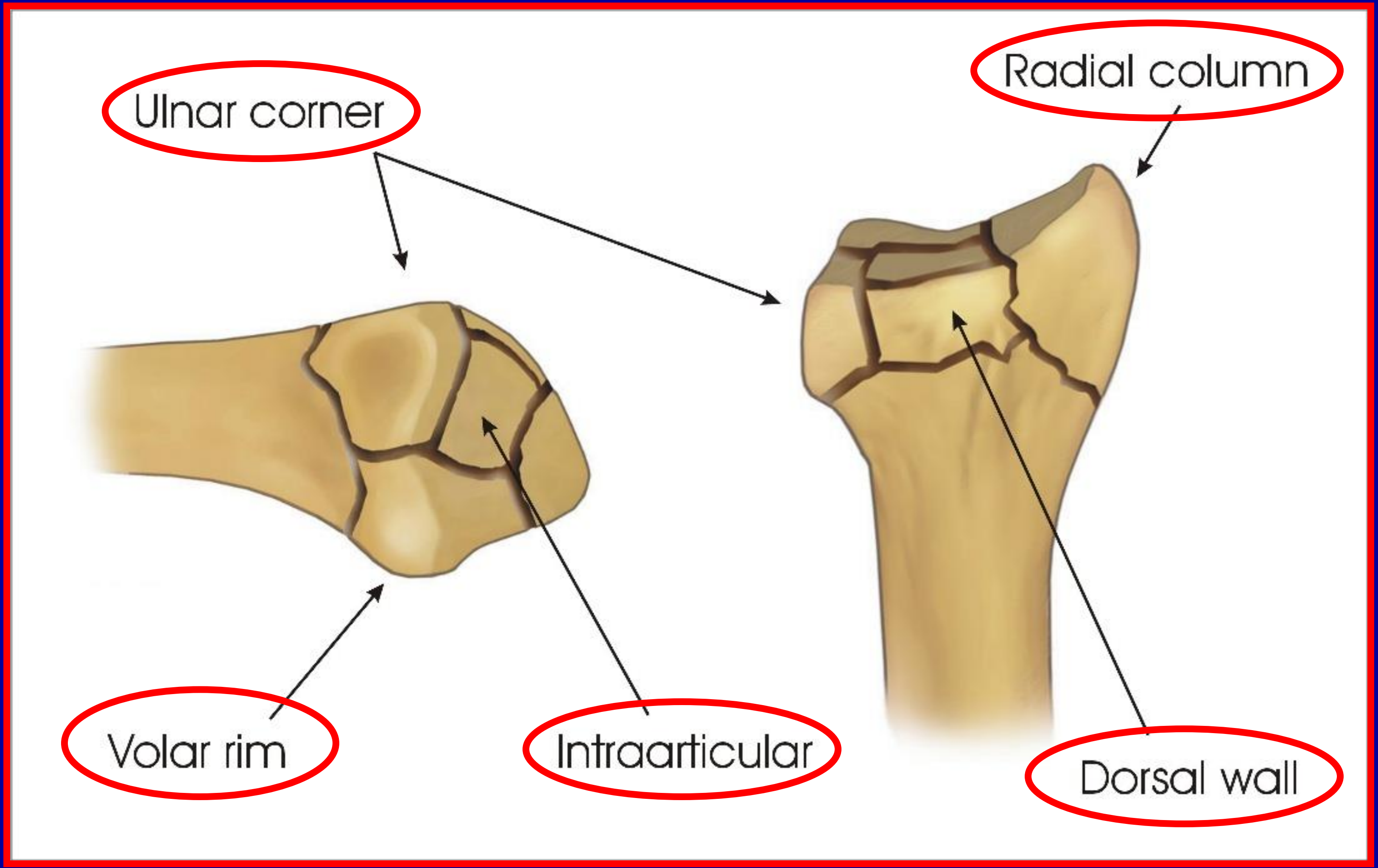


Principles of Fragment Specific Fixation

Understand the Columns of the Wrist

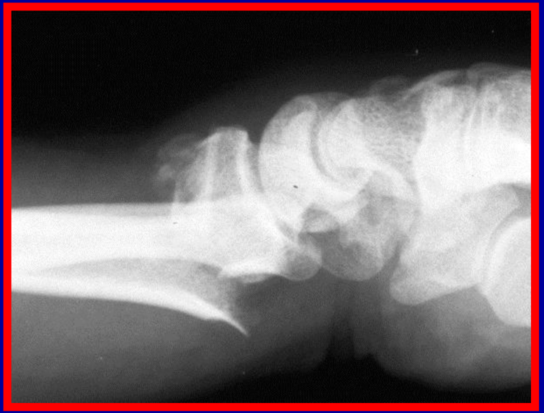


What are the fracture fragments ?



Putting this back into the column concept

- Radial Column
  - Radial styloid
- Intermediate Column
  - Dorsal ulnar / volar ulnar corner
  - Dorsal wall
  - Free intra-articular
  - Metaphyseal defects
- Ulnar Column
  - Ulnar fractures



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Where to Start?

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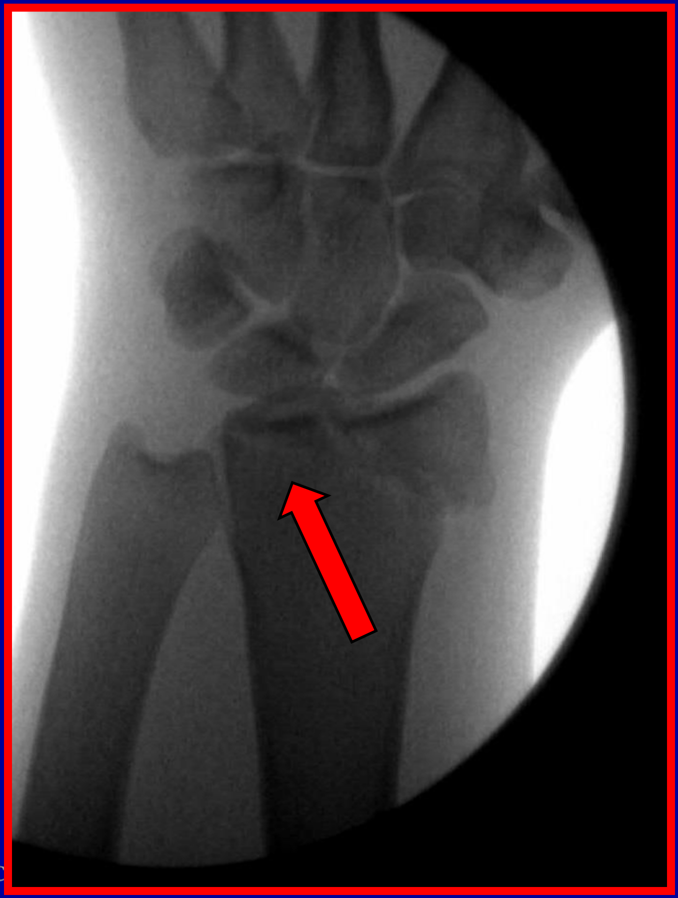
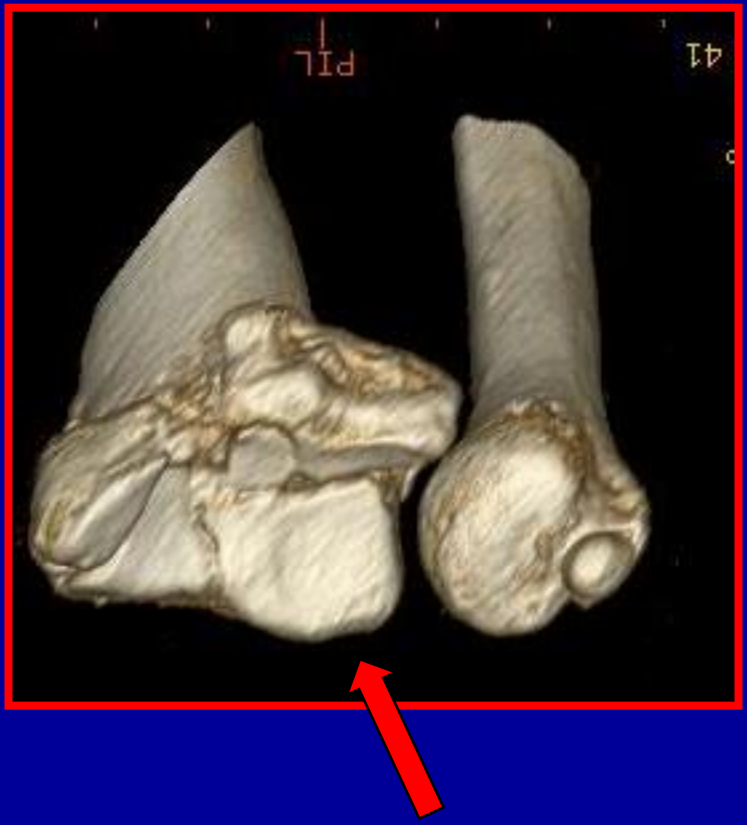
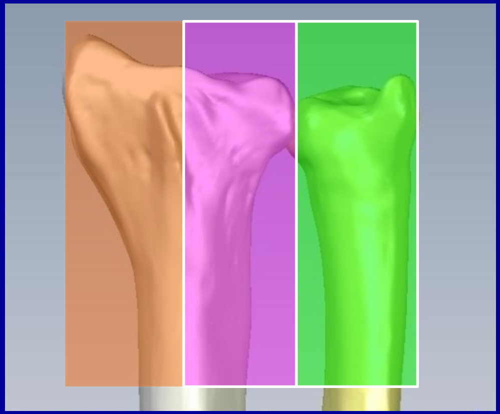
Build from the strongest foundation

- **Volar Ulnar Corner**





Intra-articular Fractures



- Order of Fixation
  - Volar ulnar corner → Sigmoid notch
  - Dorsal ulnar corner
  - Dorsal column/intraarticular components
  - Radial Column
  - Ulnar Column (if DRUJ unstable)

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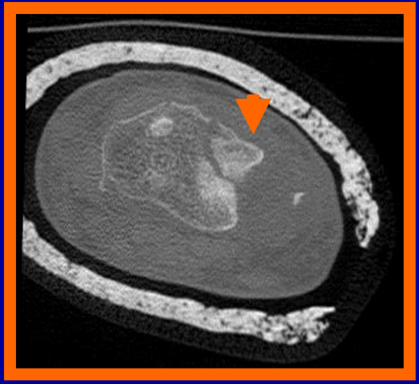
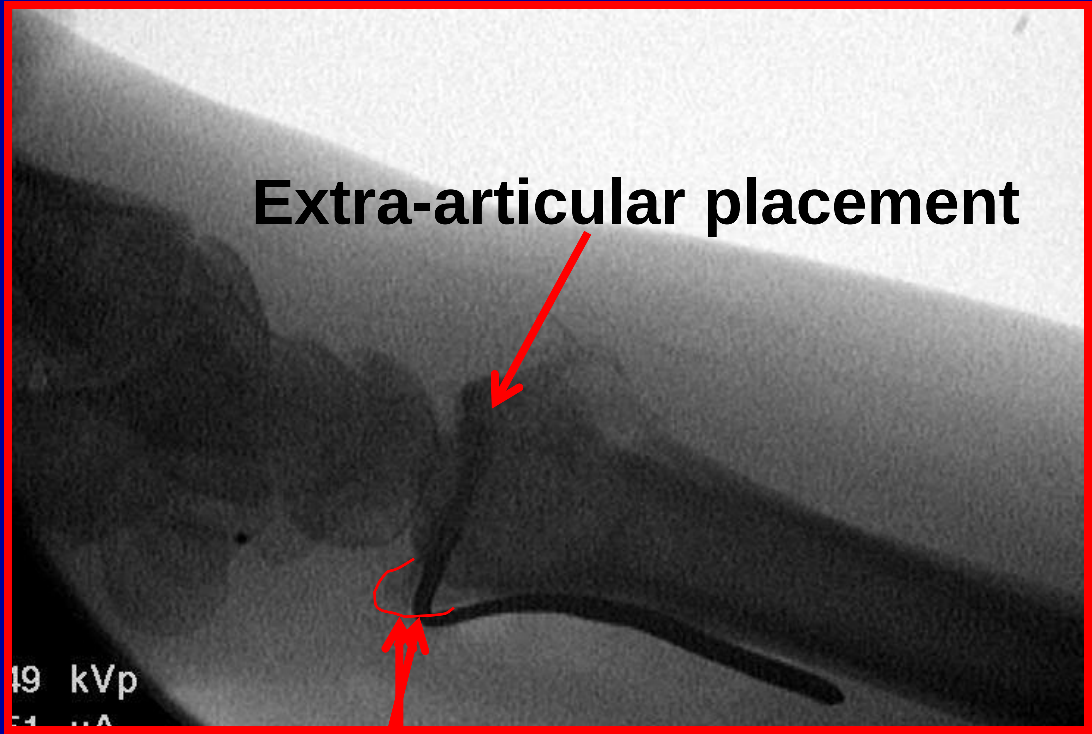
Preoperative Planning

- General considerations
  - Understand the CT scan
    - What are the fractured pieces
      - Order of fixation
    - Know your equipment
      - Many systems



Fixation Sequence

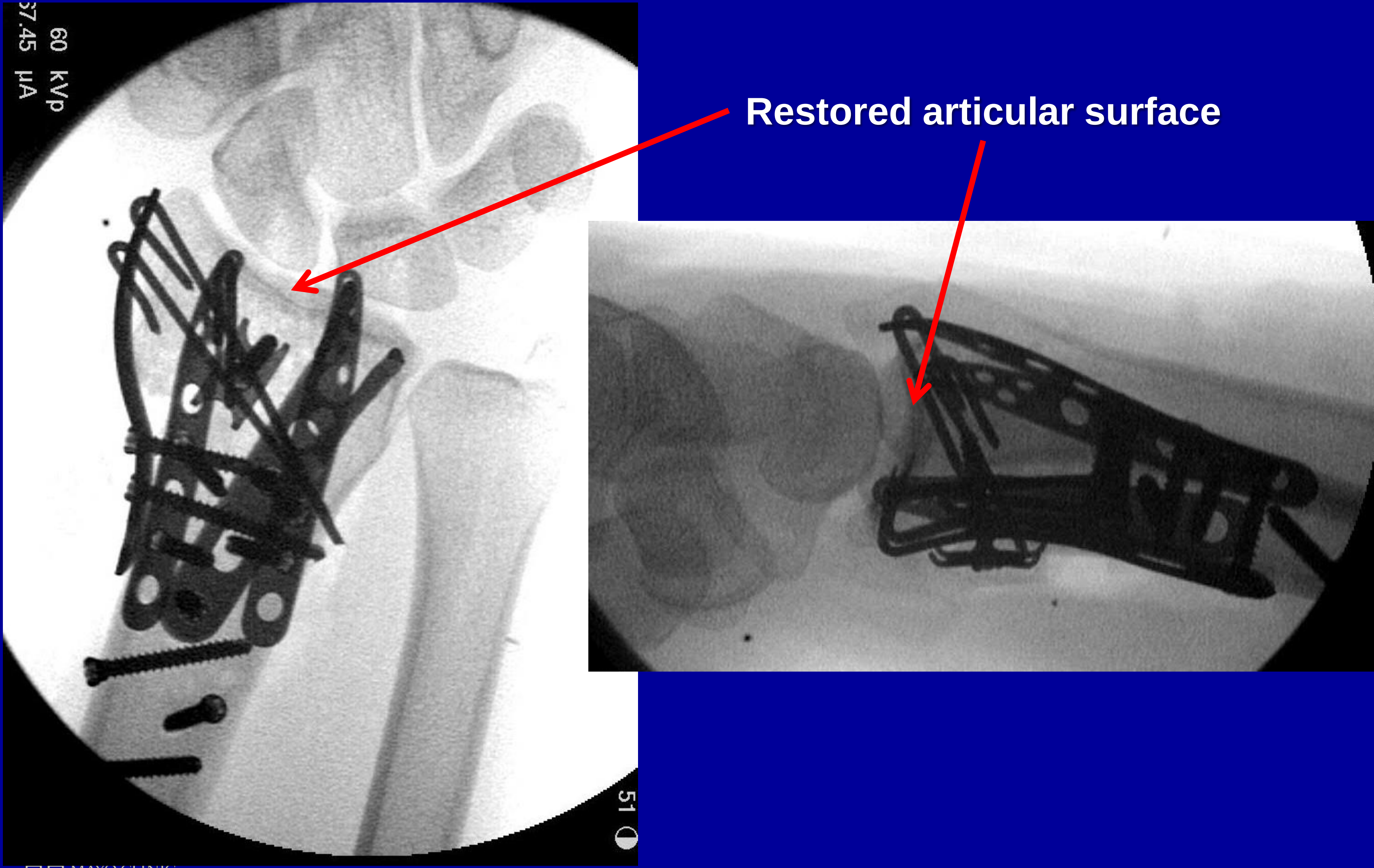
1) Address volar ulnar rim fragments



Small volar ulnar corner

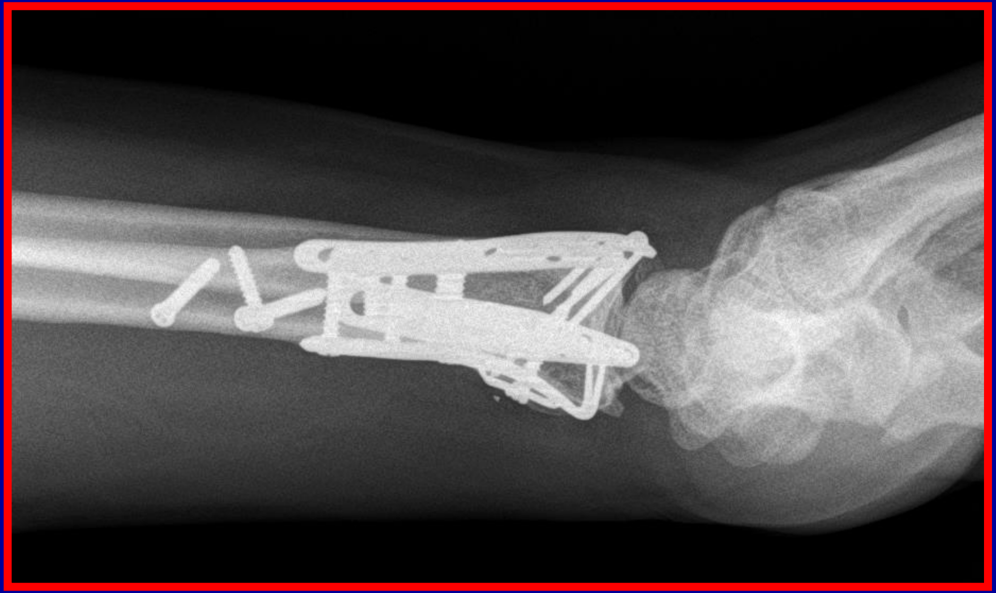
Place tynes to engage distal volar fragment & tap down

Final Construct

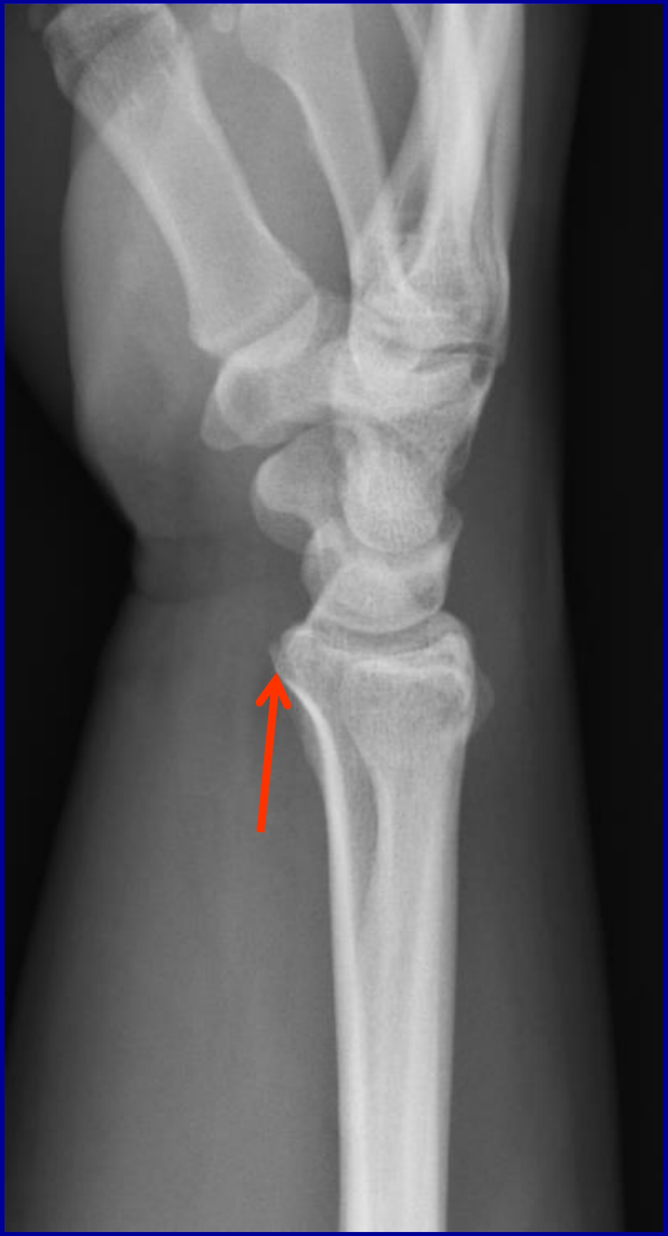


2 Years Post Op

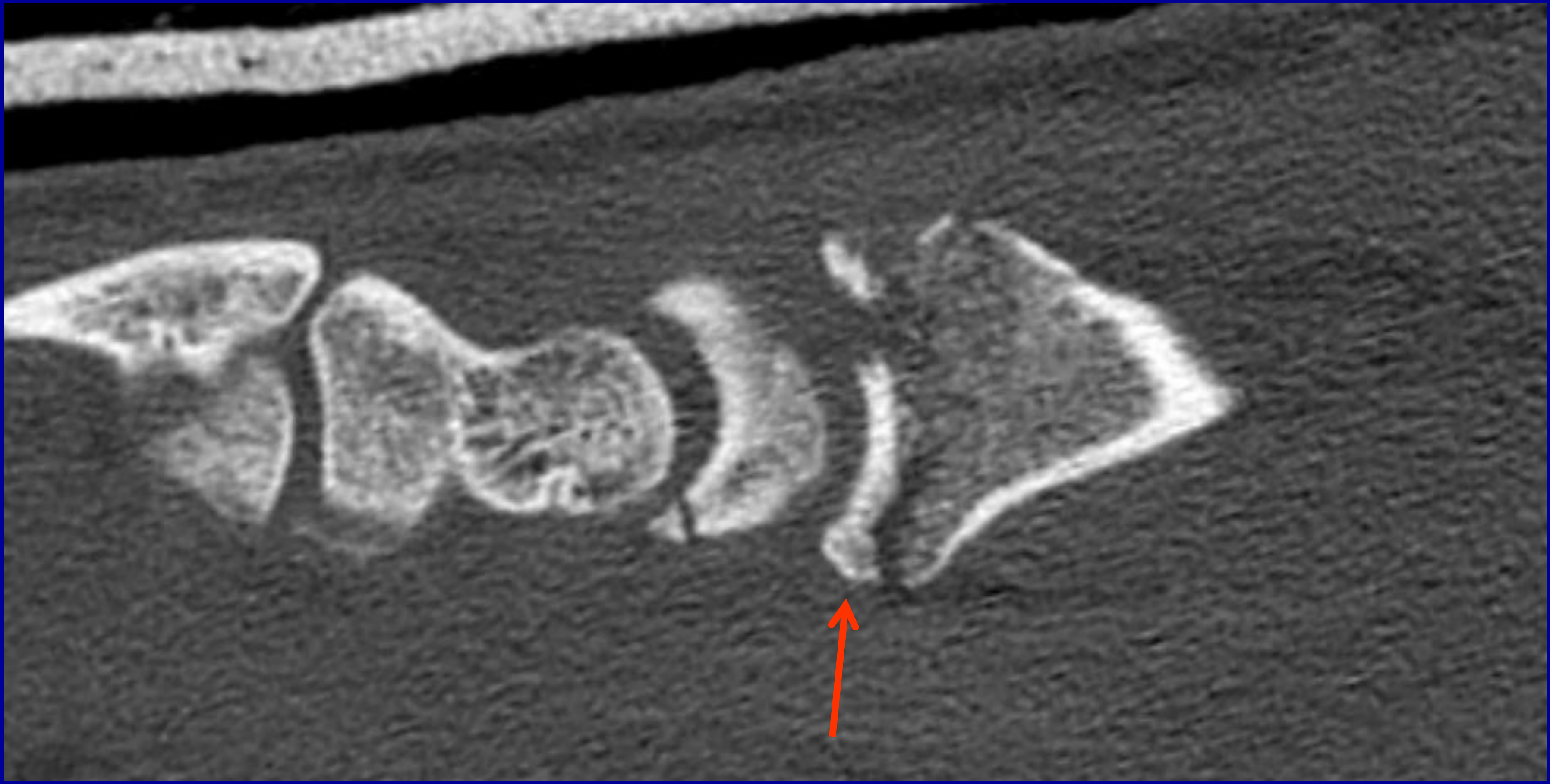
- No tendon issues

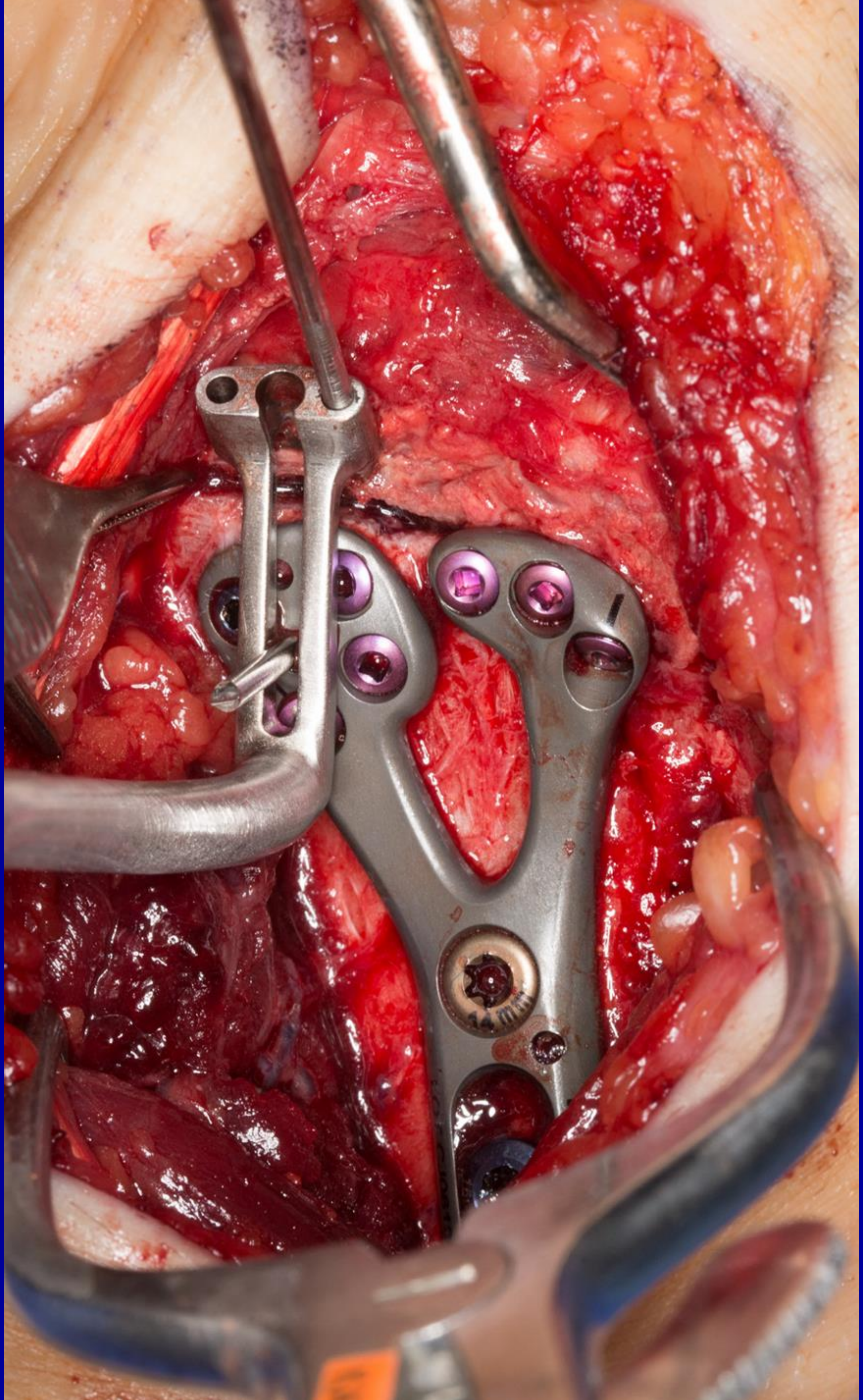


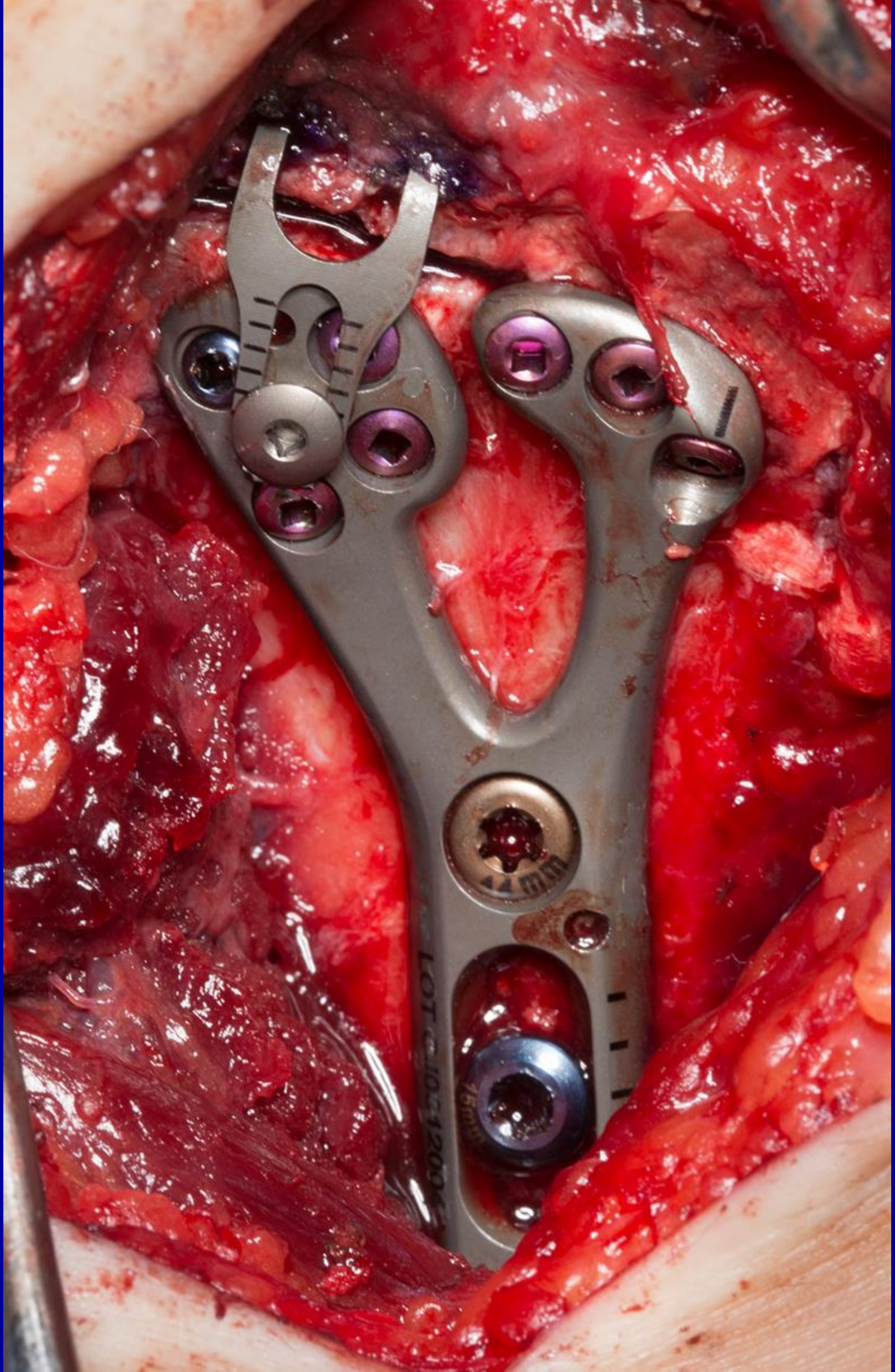
28M MVC



Distal Volar Rim







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Our Experience

O'Shaugnessy, Shin, Kakar 2015

- **25 pts (7M,18F)**
  - **55yrs (21-89)**
  - **AO B3 & C2-3 frx**
- **Follow up over 1 year**
- **2 hand surgery fellowship trained surgeons**
- **Order of fixation**
  - **Volar ulnar corner (hook plate)**
  - **Dorsal ulnar corner**
  - **Intermediate column**
  - **Radial column**

SCIENTIFIC ARTICLE

Volar Marginal Rim Fracture Fixation With Volar Fragment-Specific Hook Plate Fixation

Maureen A. O'Shaughnessy, MD,* Alexander Y. Shin, MD,* Sanjeev Kakar, MD*

Purpose To review the outcomes of patients treated with a volar hook plate specifically designed to capture volar marginal rim fractures.

Methods A retrospective study was performed over 18 months of patients treated with a volar hook plate in the management of AO type B or C distal radius fractures with a volar marginal rim fragment. Clinical and radiographic outcomes were evaluated.

Results The series included 26 wrists in 25 patients, average age 55 years. Average follow-up was 9 months (range, 3–30 mo). Twenty patients had AO type C fractures and 6 had AO type B fractures. All 6 AO type B were B3 fractures. Of the AO type C, 1 had C1, 7 had C2, and 12 had C3. No patients had loss of fixation of the critical volar ulnar corner and there was no evidence of carpal subluxation. Five patients required hardware removal. Four patients experienced hardware irritation requiring removal of all hardware including the volar hook plate. One patient required partial hardware removal that did not include the volar hook plate. All patients with volar hardware irritation had hook plates that were of second-generation design that had a prominent bend, which has since been modified. There were no cases of tendon rupture.

Conclusions Volar marginal rim fragments of intra-articular distal radius fractures are not amenable to standard volar plate fixation. Fragment-specific fixation using a volar hook plate designed specifically for these fragments allowed for stable fixation when combined with other fragment-specific fixation techniques. There was no loss of fixation of the critical corner in this series. Although hardware irritation can occur, fully seated hooks and subsequent modification of the design of the hook bend has diminished this complication. *(J Hand Surg Am. 2015;40(8):1563–1570. Copyright © 2015 by the American Society for Surgery of the Hand. All rights reserved.)*

Type of study/level of evidence Therapeutic IV.

Key words Distal radius fracture, fragment-specific fixation, lunate facet.

The restoration of articular congruity in the management of intra-articular distal radius fractures is necessary to optimize outcomes.[1,2] A subset of intra-articular fractures involves the volar marginal rim, also known as the volar ulnar corner or the critical corner. When this fragment is not appropriately stabilized, devastating carpal subluxation or malunion may occur.[3]

Recent focus on the volar lunate facet articular fragment has emphasized that this fracture pattern can be among the most difficult articular injuries to treat owing to its unique anatomy.[3] The distal extent of the radius is flat except at its very distal lip, which slopes volarly to form the volar lunate facet. The slope renders the standard fixed contour volar plate fixation unable to capture both scaphoid and lunate volar cortical margins adequately, leaving the volar marginal rim fragment inadequately supported.[3] Fracture fragments are often small and distal to the watershed line. Standard volar plates have a relatively thick profile in relation to the unique anatomical dimensions of the lunate facet.

From the *Department of Orthopedic Surgery, Mayo Clinic, Rochester, MN.

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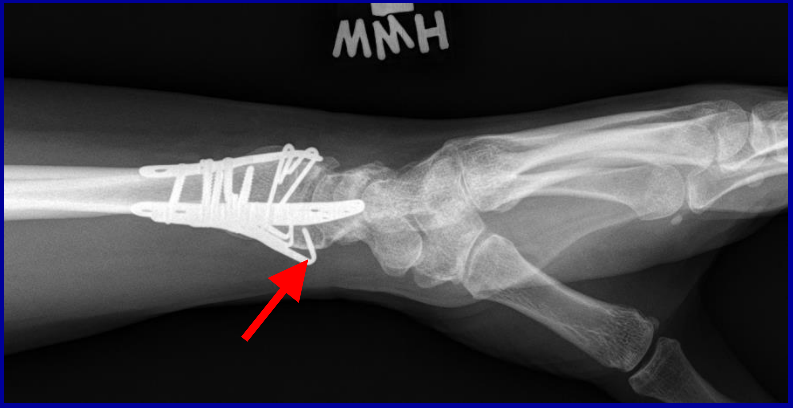
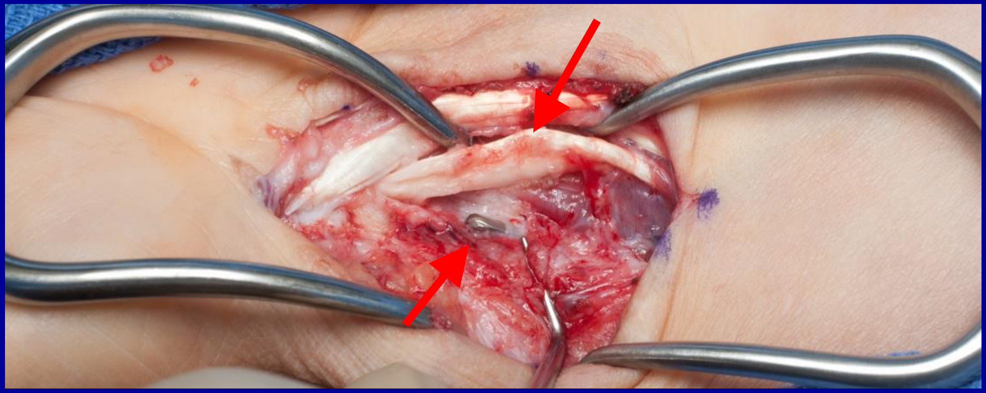
Our Experience

- Clinical Results
  - ROM: 94^0 arc (flex-exten)
  - Grip Strength: 84% (uninjured side)
- Radiographs
  - Radial inclination: 20^0
  - Radial height: 10mm
  - Volar tilt: 3^0
  - Articular surface: 1^0
  - Tear drop angle: 55^0 [normal: 70^0]

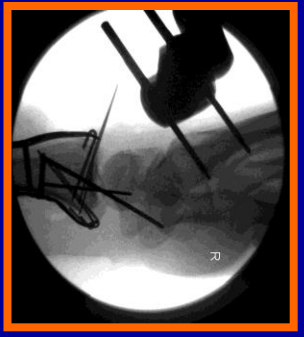
Our Experience

- 4 ROH (15%)
- FPL tenosynovitis (no ruptures)
  - Volar hooks proud
  - Technical modification:
    - Predrill holes for tynes
    - Thinner plates





Summary



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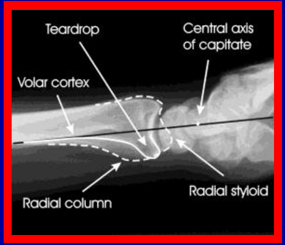
- Each DRF is unique & should be treated as such
- Carefully assess the frx to determine optimal fixation
- It's the **SURGEON** & <u>not the hardware</u> that is most important for the eventual outcome

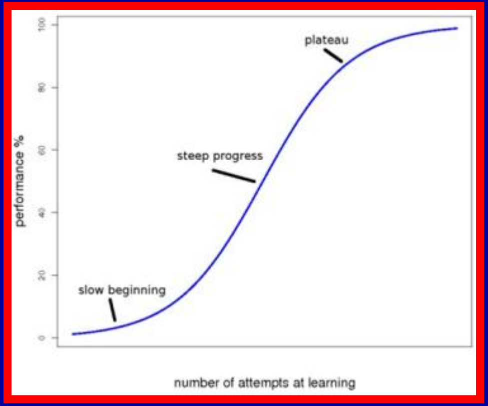


- **Adequate visualization** **(extended FCR approach)**

- **Fragment specific fixation is a powerful tool for tx of multifragmented DRF**

- **Restores articular congruity**

- ***Steep learning curve !!!***



Simple Fractures are Still Simple

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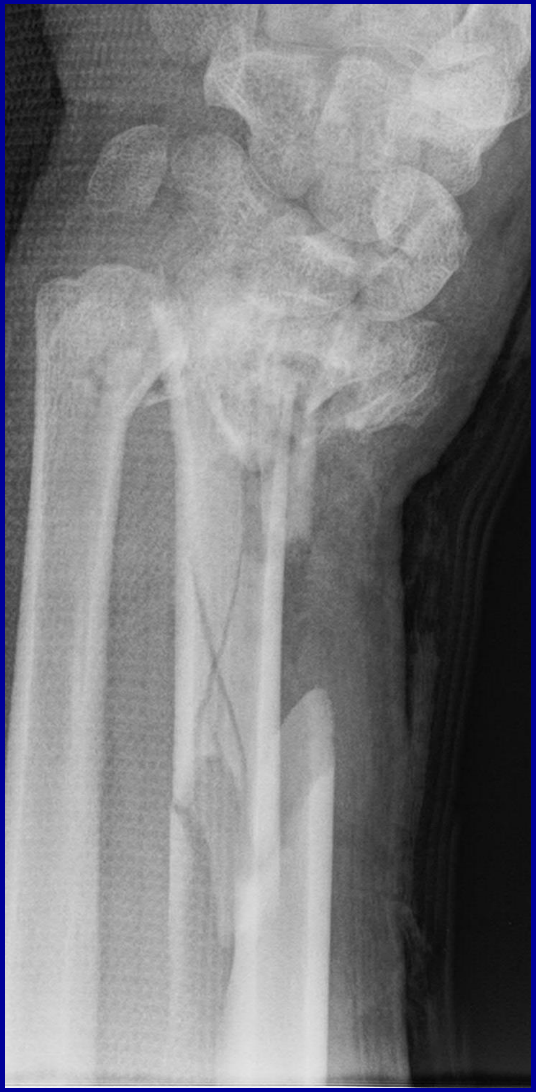
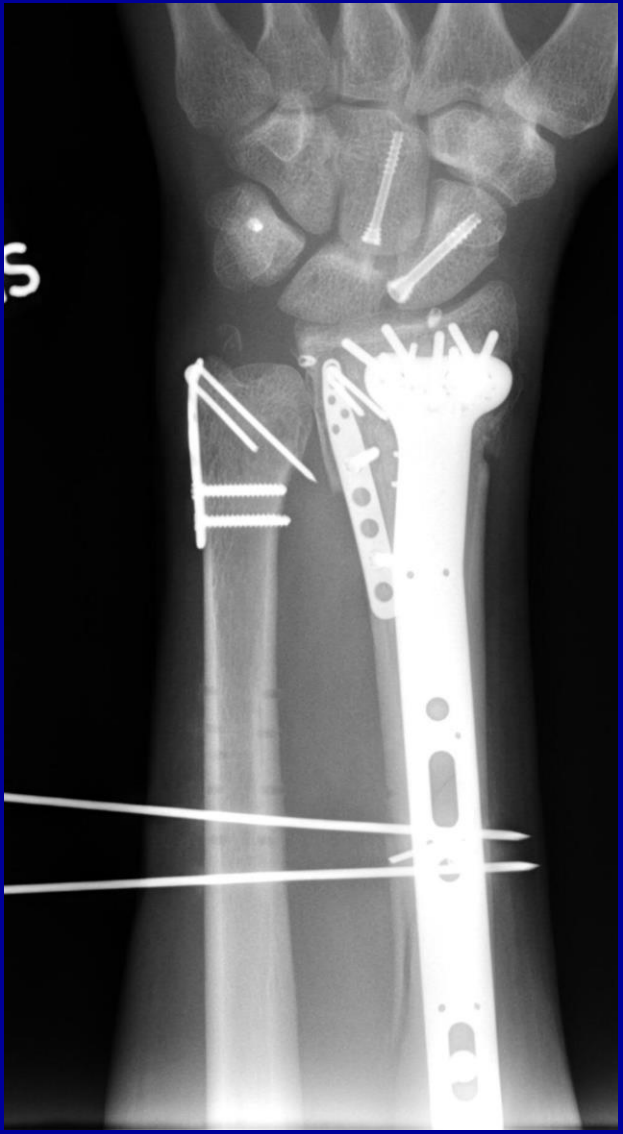
The Hard Ones

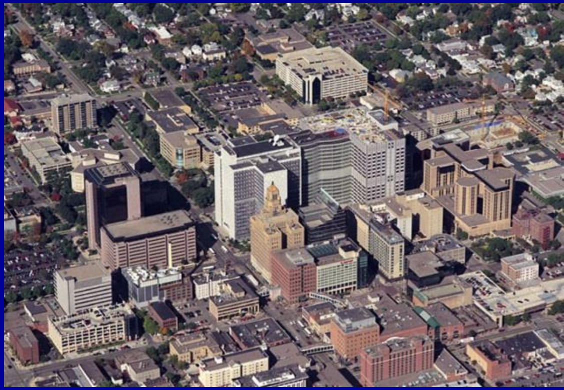


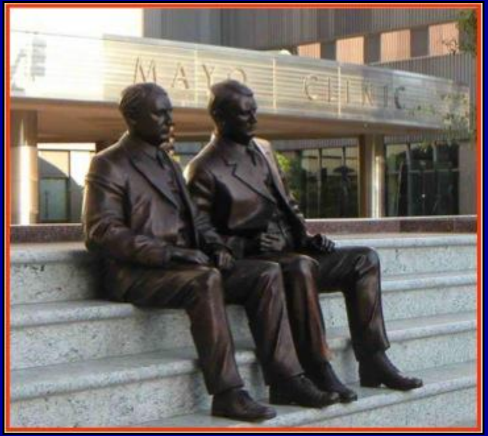
Are Still Hard !!!



So Have Multiple Tools in Your Tool Box in the Management of DRF

Thank You For Your Attention





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