

Greater Tuberosity fractures

New indications for fixation?

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Conflicts of interest

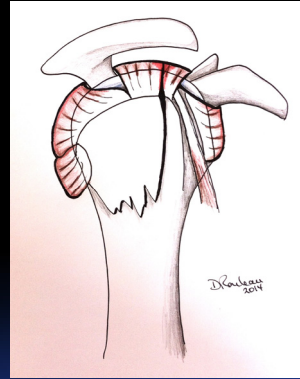
Senior Author

- Consultant for Wright
 - Design team on PHF plate
- Consultant for Bioventus
- Research or teaching funding's from: Arthrex, Conmed, Depuy-Synthes, Smith and Nephew, Stryker, Wright, Zimmer
- Associate editor OTSR-RCO



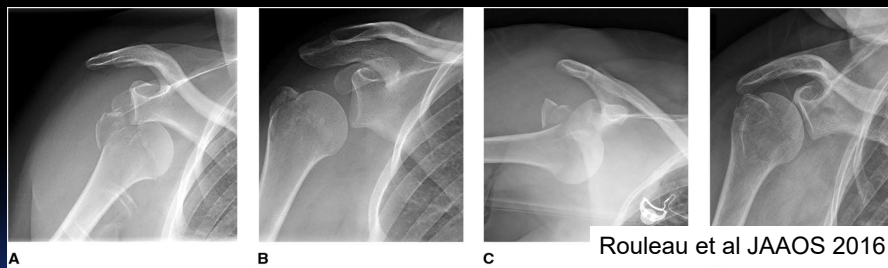
Outline

- Classification
 - Updates for 2017
- Displacement measurement
- Treatment algorithms
- Surgical tips and tricks



GT fracture

- ~20% of all Proximal Humerus Fractures
- Young men
- Occur in 15-30% of GH dislocation



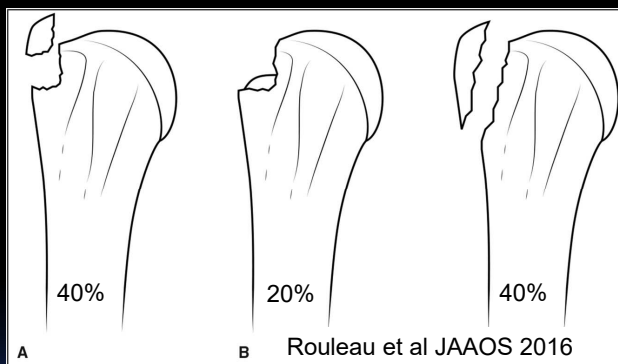
Classification...s

- AO and Neer classifications
 - Split type only
 - Poor Reliability
- AO inter/intraobserver
 - 0.35/0.65
- Neer inter/intraobserver
 - 0.35/0.63

Mutch et al BJJ 2014
Bahrs JSES 2006

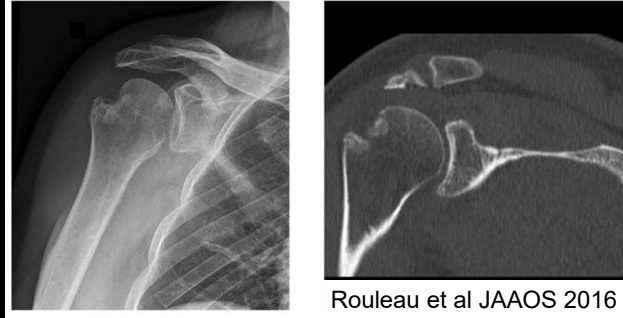
Classification...s

- 3 specific types of GT fractures
 - Avulsion
 - Impaction
 - Split



Mutch et al BJJ 2014
Bahrs JSES 2006

Impaction fractures are real!



Rouleau et al JAAOS 2016

- Associated with glenohumeral dislocation
 - Up to 46% of cases

Mutch et al BJJ 2014
Davies Injury 2000
Kaspar JSES 2004



GT split sizes CT scan

Thickness 15 mm

Height 34 mm

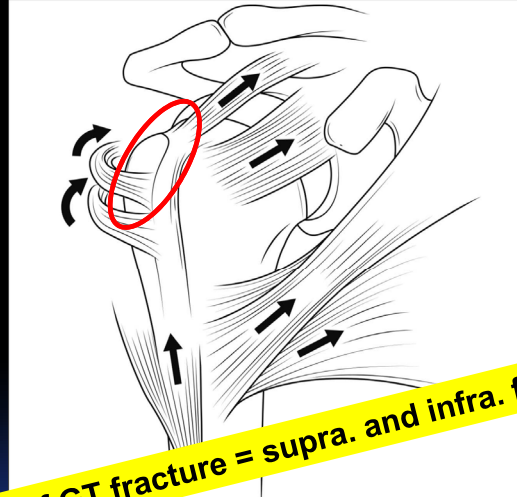
Fx angle 37°

AP diameter 31 mm



Boaretto, Rouleau et al, submitted JSES

Displacement

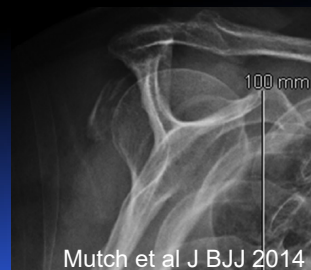


57% of GT fracture = supra. and infra. facets

Rouleau et al JAAOS 2016

Displacement

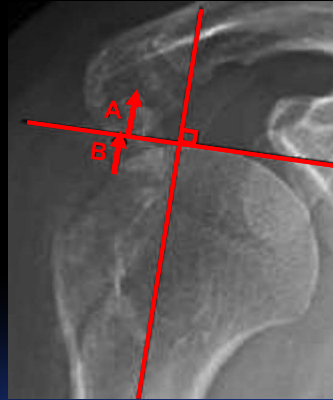
- >5 mm displacement = worse outcomes
 - Either posterior or superior
- Severe RC muscular atrophy is seen when displacement is of > 7mm
 - Rouleau et al. SE UK 2016



Mutch et al J BJJ 2014

GT Ratio on AP x ray

- **Ratio = $A+B / B$**
 - <0 : Conservative
 - 0-0.5 : CT scan
 - >0.5 : Surgery
- **High correlation with CT**
R=0.852
- **less radiation**



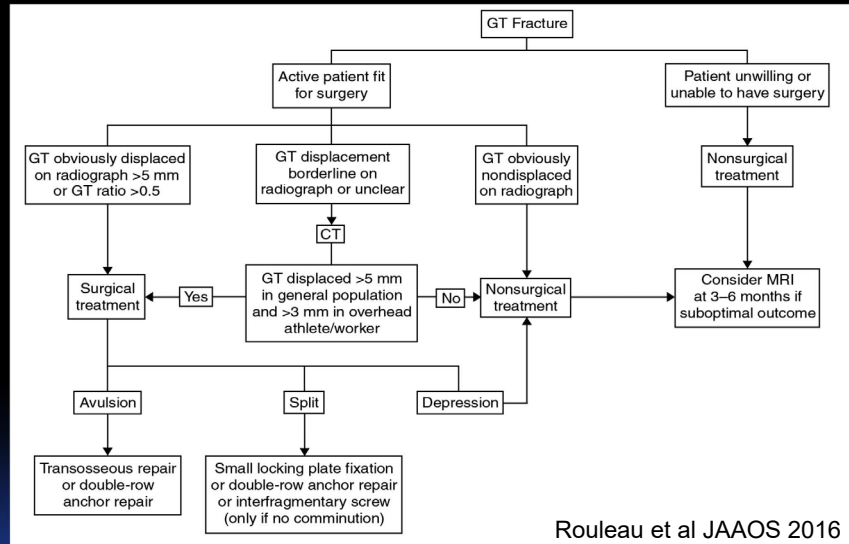
Mutch, Rouleau et al JOT 2014
Rouleau et al JAAOS 2016

Associated Dislocation

- Hebert-Davies et al 2015 JOT
- “Undisplaced” fractures after reduction
 - 20% will displace
 - Close follow-up warranted

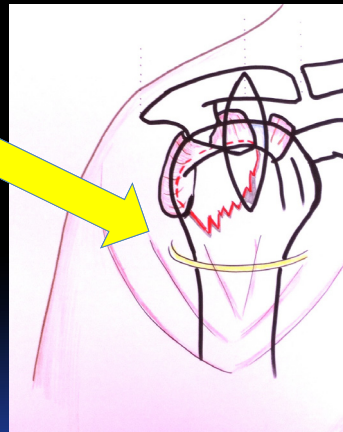


Treatment algorithm

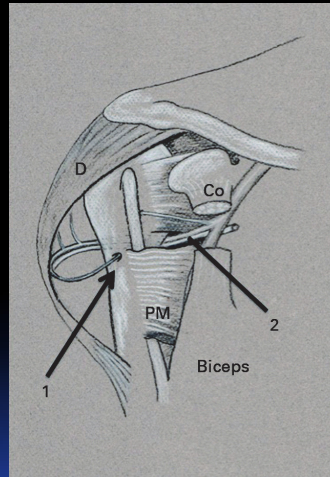


Surgical Treatment

- Standard Deltoid-Split Mini-open approach
- Axillary Nerve
– ≥ 5 cm from acromion



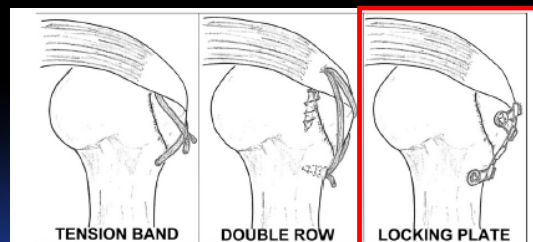
Posterior circumflex artery



Smith BJJ 2016

Displaced GT Split Fracture

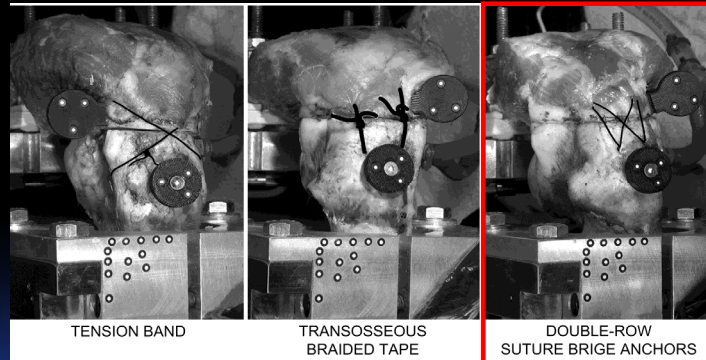
- Displaced Split combined treatment
- Biomechanical : Gaudelli et al 2014
- **Plate vs double row for SPLIT =**
 - 3x stronger
 - 5x stiffer



Gillespie RJ AJO 2015

Displaced GT avulsion fracture

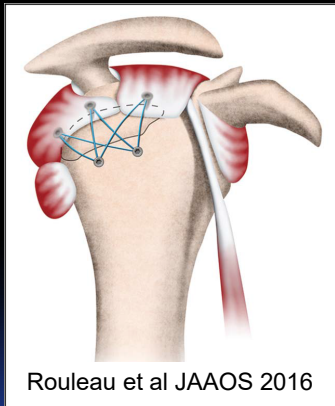
- Biomechanical study Brais et al 2015
 - Double Row = less displacement



Brais Rouleau et al, Injury 2015, Cheng-Li JSES 2015

Displaced GT avulsion fracture

- Preferred method of treatment
- Open or Arthroscopic



Arthroscopy vs open

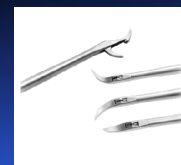
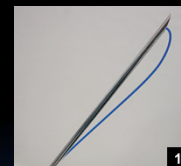


	Arthroscopy N=15	ORIF N=17	p
OR time (min)	95	62	<0.05
Flexion	153	138	<0.05
Abduction	146	132	<0.05
ASES	92	87	0.02

Liao et al CORR 2016

GT avulsion arthroscopic fixation

- Associated more blood
- Medial anchors in **normal** bone
- Suture passer **fracture/compress** the fragment
- Needle passer more precise



GT depression fracture

- Rarely displaced
- If displacement :
 - treat as avulsion
- Advanced imaging
 - R/O Cuff tear



GT outcomes?

- Not Always disappointing
- 80-100% good to excellent outcomes
- Identifying type + treatment = key
- Complications often treated with injections



- Rouleau et al SE UK 2016
- Maman E Orthop. 2014

GT outcomes?

- Residual Symptoms
 - Adhesive Capsulitis
 - Malreduction/displacement > 5mm
 - Rotator cuff tear (15%-30% full tear)
 - Long head of the biceps
 - Bursitis (57%)*
 - Previous surgery... P acnes

- Rouleau et al SE UK 2016
- Maman E Orthop. 2014

Conclusion

- Displacement of GT fracture
 - Difficult to quantify on X-ray
 - Superior, posterior or combined
- Indications for Surgery
 - 5 mm of displacement
 - GT ratio >0.5

Conclusion

- Avulsion fractures
 - Double row or suture bridge construct
 - Arthroscopic or open
- Split fracture
 - ORIF with plate
 - Combined with suture fixation
- Depression fracture
 - Mostly Non-operative treatment