

21 year old male, FOOSH
injury in September while
Skateboarding.

09/03/2013



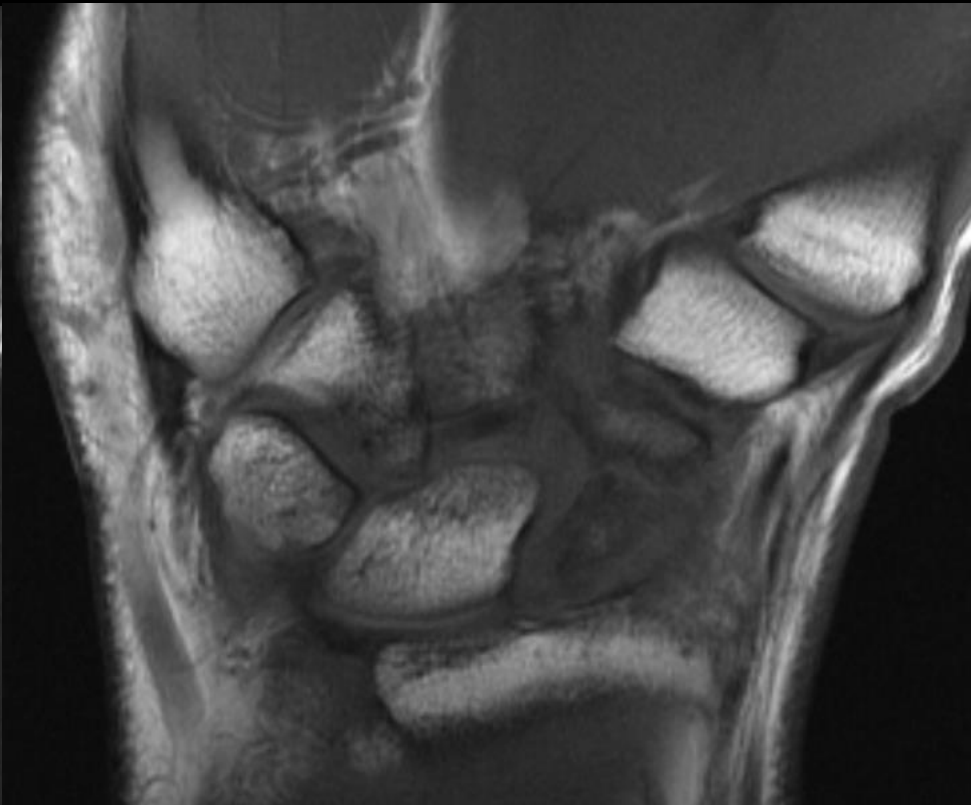
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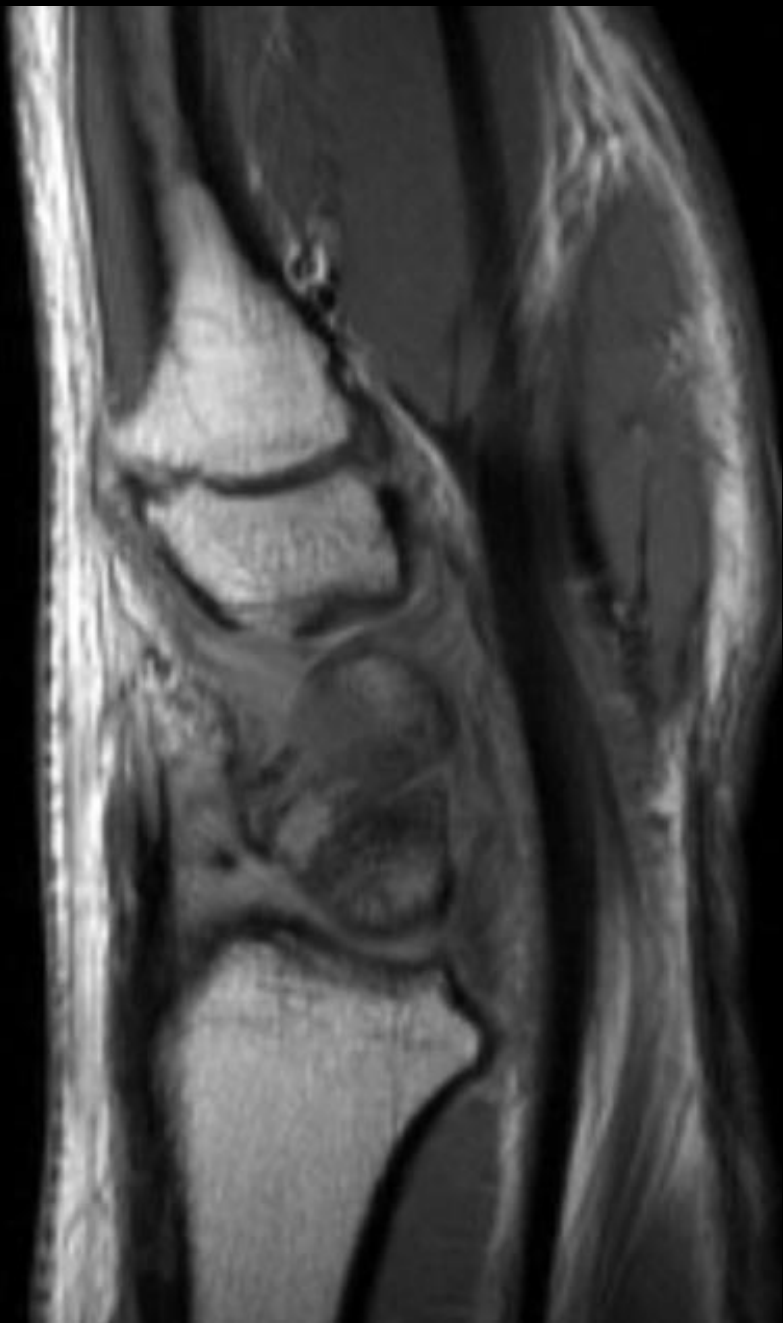


8 months later,
persistent wrist pain.

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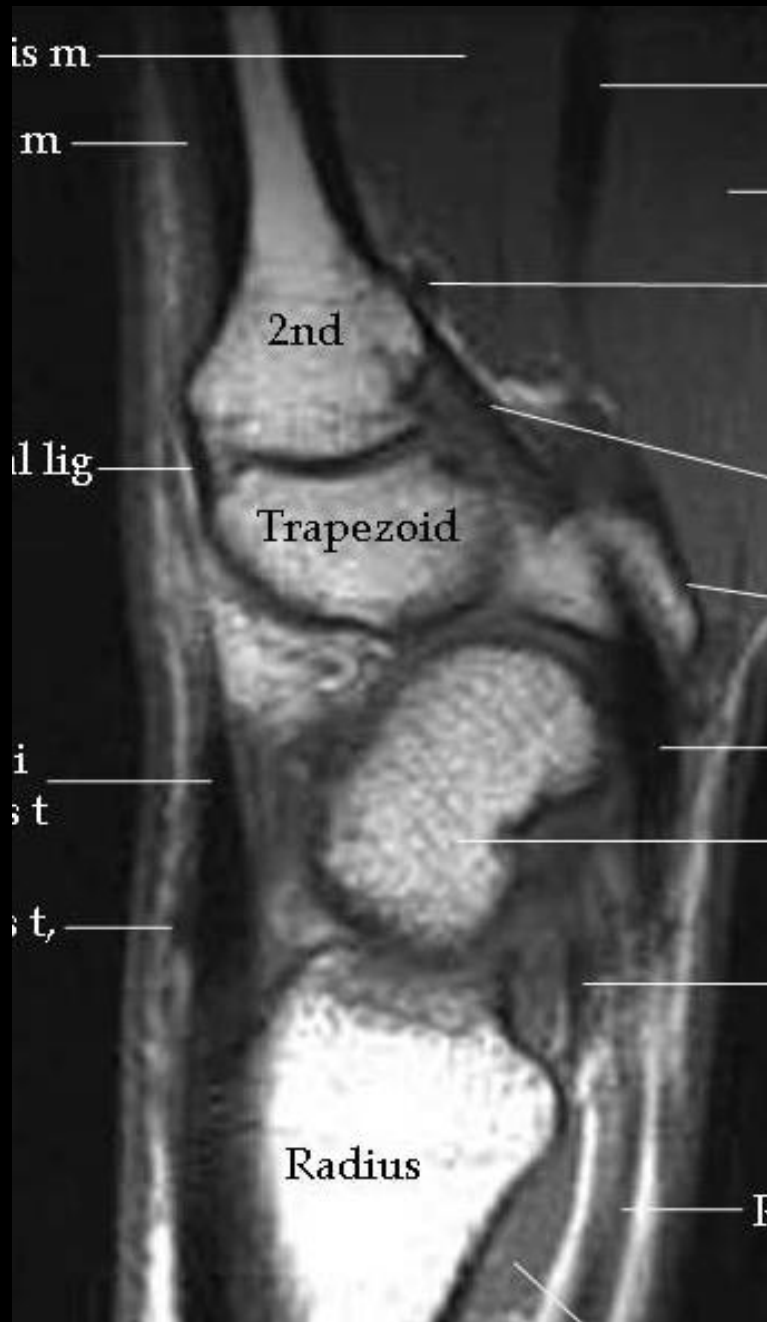




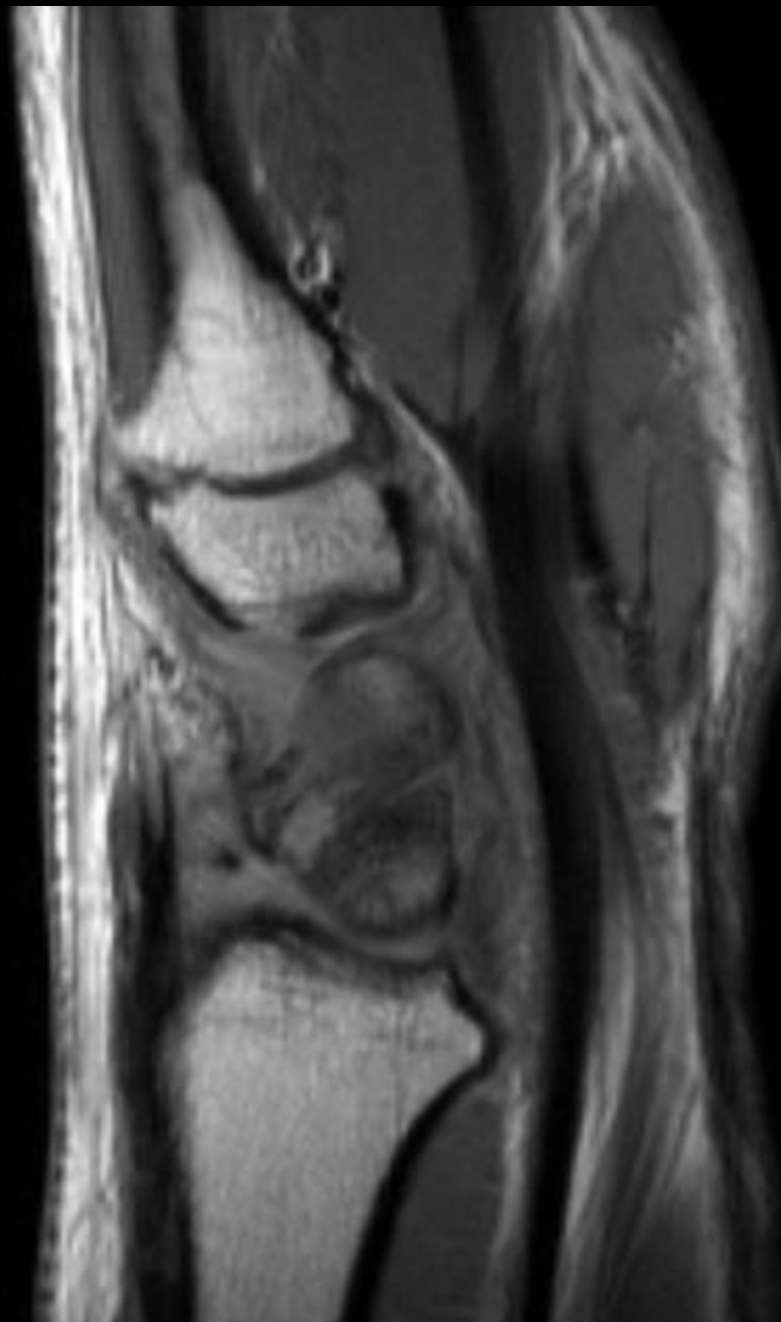






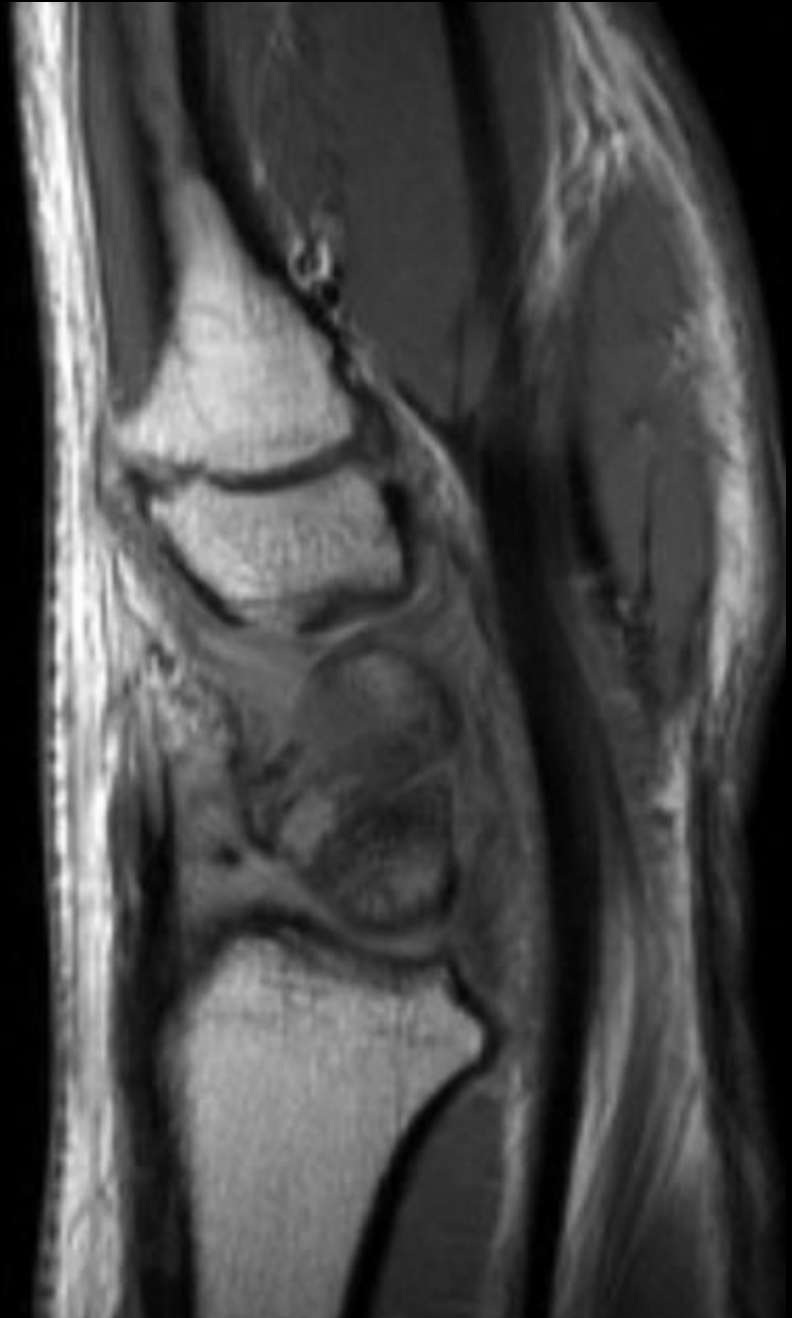


[Normal]



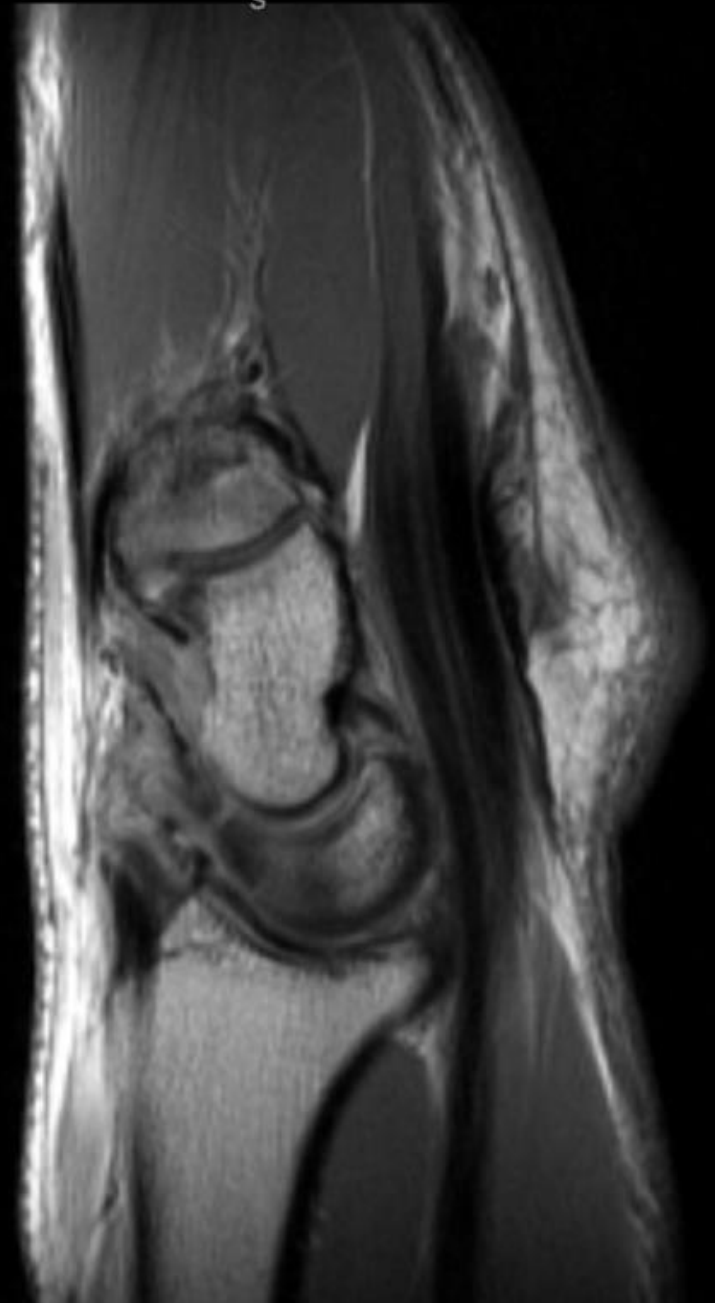
Humpback Deformity of the Scaphoid:

- Complication of scaphoid waist #: rotation and increased flexion of the DP wrt PP, with resultant “humpback”
 - Non-union/malunion, progressive collapse of scaphoid
 - High risk of **AVN**
- Altered wrist kinetics
 - **DISI and arthrosis**
- Operative management, with IF and bone graft
 - *Standard non-vascular or vascularized bone graft.*



Humpback Deformity of the Scaphoid:

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Identifying and quantifying HB deformity...

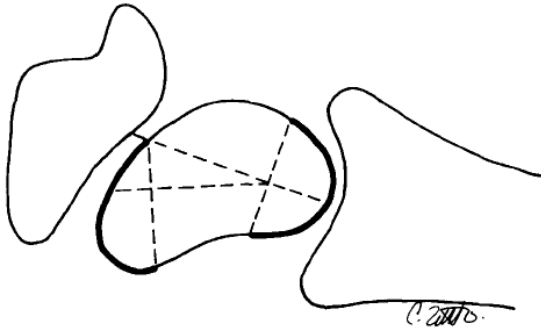


Figure 2. Intrascaphoid angle. A perpendicular line is drawn to the proximal and distal articular surfaces and the resulting angle is measured.

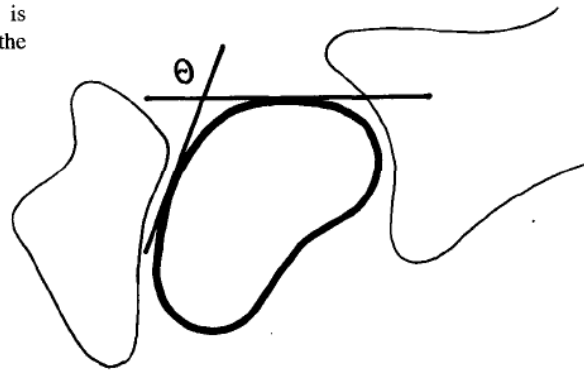


Figure 3. Dorsal cortical angle. A line is drawn along the dorsal cortex of the proximal and distal halves of the scaphoid and the angle between these lines is measured.

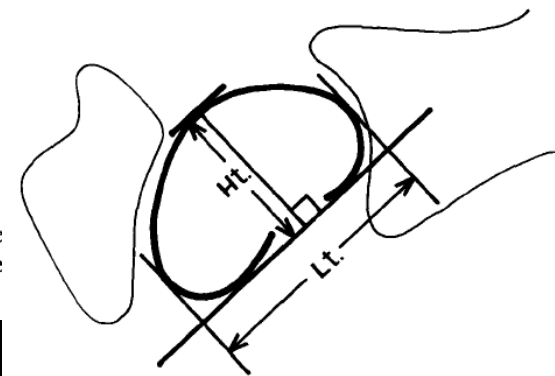
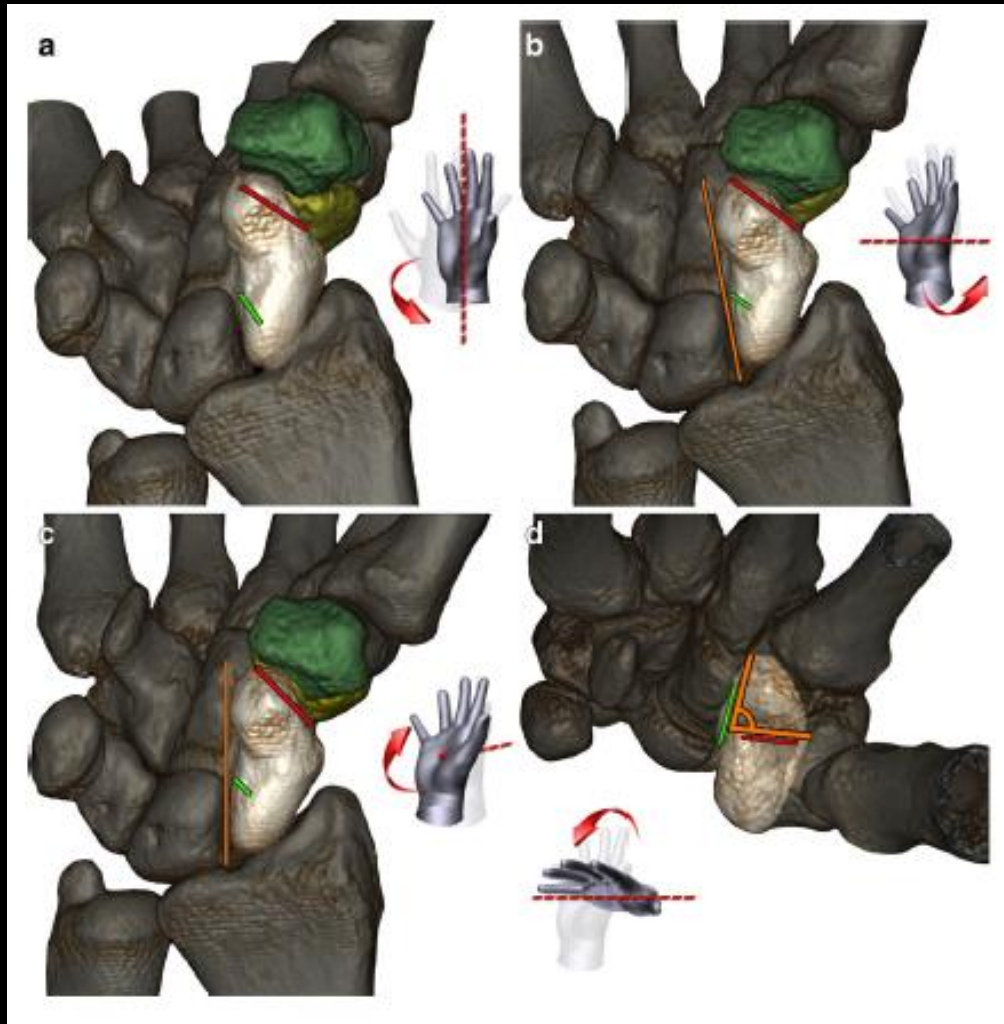
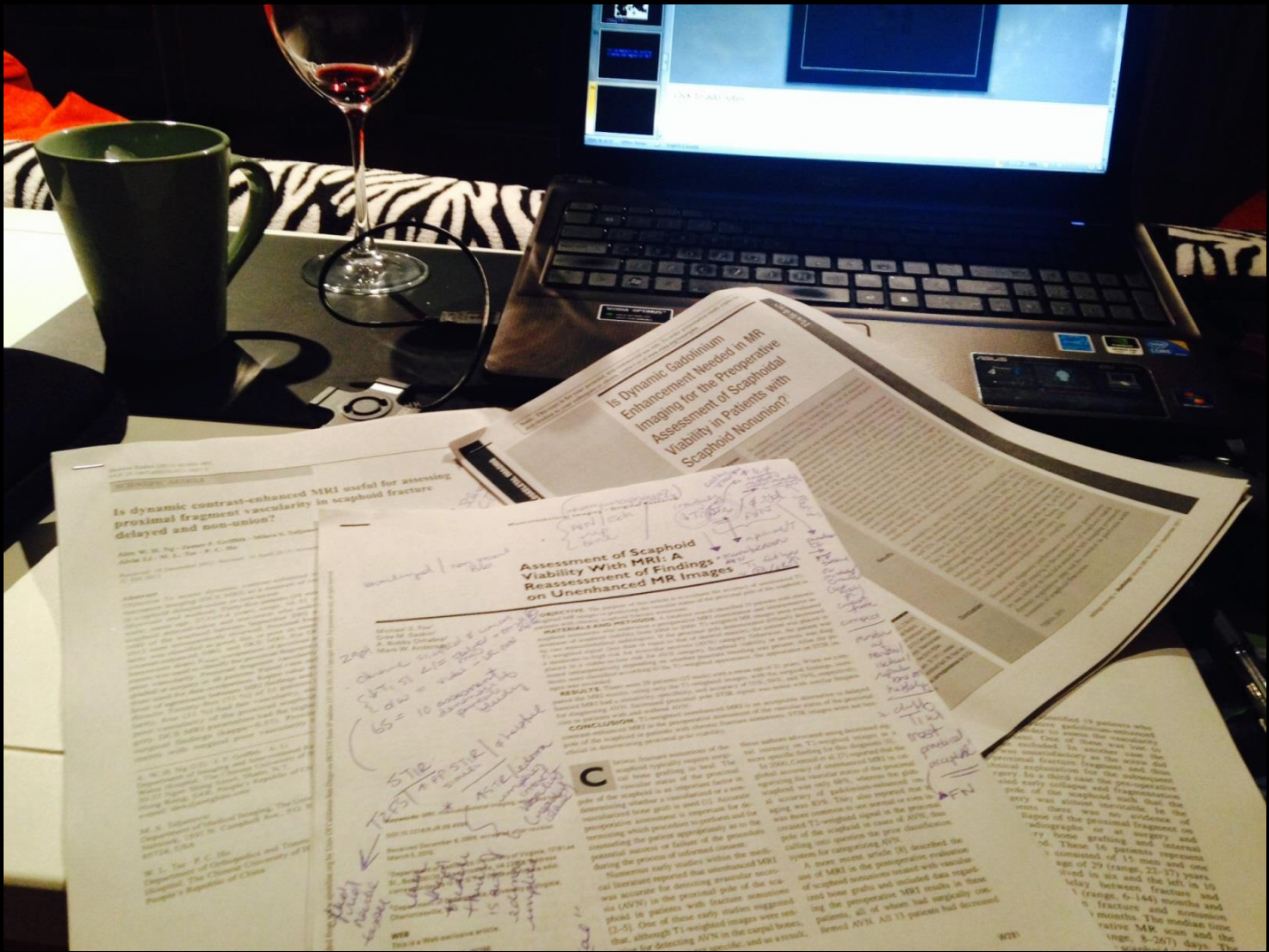


Figure 4. Height-to-length ratio. A baseline is drawn along the volar aspect of the scaphoid. The length of the scaphoid along the baseline is measured, as is the height of the scaphoid perpendicular to the baseline. The height-to-length ratio is recorded as a percentage.

Identifying and quantifying HB deformity...



Can we assess for viability of the proximal pole fragment on MRI?



Is dynamic contrast-enhanced MRI useful for assessing proximal fragment vascularity in scaphoid fracture delayed and non-union?

John W. Ho, PhD, James R. Gardner, MD, Robert N. Salomon, MD, M. L. Lee, PhD, M. A. Lee, PhD

OBJECTIVE: The objective of this study was to determine the utility of dynamic contrast-enhanced MRI (DCE-MRI) for assessing proximal fragment vascularity in scaphoid fractures that are delayed unions or nonunions. **DESIGN:** Retrospective study. **SETTING:** Level I trauma center. **PATIENTS:** Thirty-two patients with scaphoid fractures that were delayed unions or nonunions. **MEASUREMENTS AND MAIN RESULTS:** DCE-MRI was performed on all patients. The mean age was 38 years (range, 20-65 years). The mean time from injury to presentation was 10 months (range, 3-24 months). The mean time from presentation to surgery was 10 months (range, 3-24 months). The mean time from surgery to final follow-up was 10 months (range, 3-24 months). The mean time from final follow-up to publication of this study was 10 months (range, 3-24 months). **CONCLUSIONS:** DCE-MRI was useful for assessing proximal fragment vascularity in scaphoid fractures that are delayed unions or nonunions.

KEY WORDS: scaphoid fracture, MRI, vascularity, delayed union, nonunion.

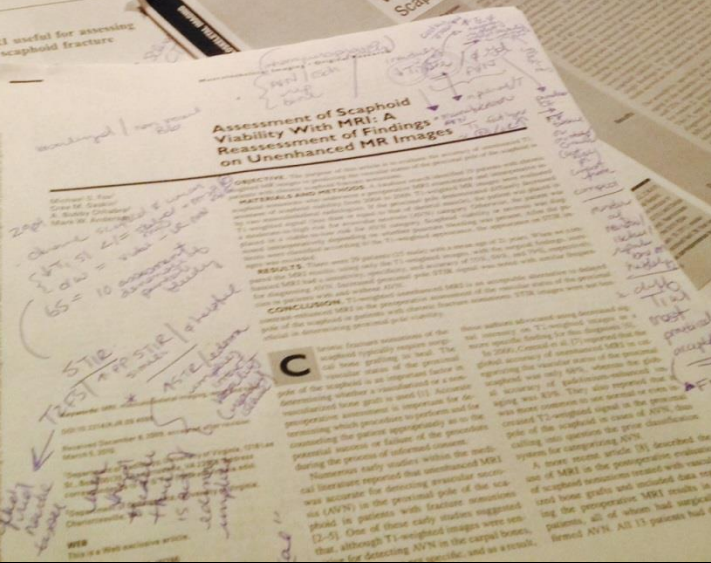
INTRODUCTION: Scaphoid fractures are common injuries of the wrist. They are often associated with significant morbidity and mortality. The scaphoid is a small, irregularly shaped bone that is located in the proximal carpal row. It is the only carpal bone that is not in contact with any other carpal bone. It is also the only carpal bone that is not in contact with any other bone of the hand or wrist. Scaphoid fractures are often difficult to diagnose and treat. The scaphoid has a rich blood supply, and fractures of the scaphoid are often associated with significant morbidity and mortality. The scaphoid is a small, irregularly shaped bone that is located in the proximal carpal row. It is the only carpal bone that is not in contact with any other carpal bone. It is also the only carpal bone that is not in contact with any other bone of the hand or wrist. Scaphoid fractures are often difficult to diagnose and treat. The scaphoid has a rich blood supply, and fractures of the scaphoid are often associated with significant morbidity and mortality.

Assessment of Scaphoid Viability With MRI: A Reassessment of Findings on Unenhanced MR Images

Michael C. Hunt, MD, James R. Gardner, MD, Robert N. Salomon, MD, M. L. Lee, PhD, M. A. Lee, PhD

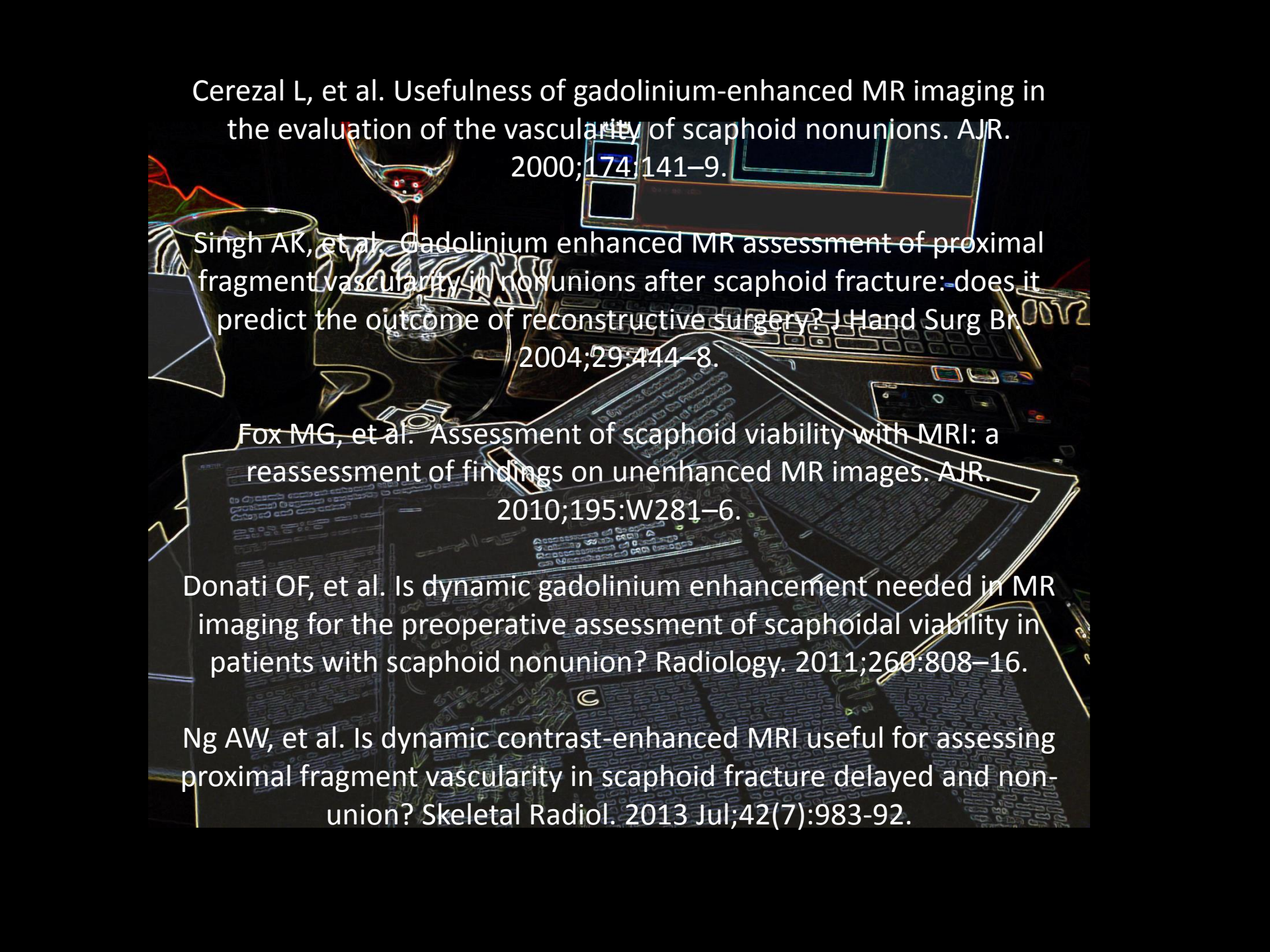
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KEY WORDS: scaphoid fracture, MRI, viability, delayed union, nonunion.



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Cerezal L, et al. Usefulness of gadolinium-enhanced MR imaging in the evaluation of the vascularity of scaphoid nonunions. *AJR*. 2000;174:141-9.

Singh AK, et al. Gadolinium enhanced MR assessment of proximal fragment vascularity in nonunions after scaphoid fracture: does it predict the outcome of reconstructive surgery? *J Hand Surg Br*. 2004;29:444-8.

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Ng AW, et al. Is dynamic contrast-enhanced MRI useful for assessing proximal fragment vascularity in scaphoid fracture delayed and nonunion? *Skeletal Radiol*. 2013 Jul;42(7):983-92.



Not well.

Assessment for Scaphoid Viability or MRI: *Traditional thinking... (and mine until last night)*

↓T1

↓T2 (STIR/T2-FS)

No Gd-CE = AVN

Gold Standard: punctate bleeding with probing during surgery...

Assessment for Scaphoid Viability or MRI: *How does this hold up?*

↓T1

↓T2 (STIR/T2-FS)

No Gd-CE = AVN

- =/< skeletal muscle
- Mummification of fat in necrosis
- TG breakdown, FFA's.

Assessment for Scaphoid Viability or MRI: *How does this hold up?*

↓T1

↓T2 (STIR/T2-FS)

No Gd-CE = AVN

- Converse not true.
- BM “Edema”
- ?imply some intact vascularity
- Reparative bone
- Ischemia
- Cystic necrosis

Assessment for Scaphoid Viability or MRI: *How does this hold up?*

↓T1

↓T2 (STIR/T2-FS)

No Gd-CE = AVN

- Conventional vs. Dynamic
- Late vascular phase:
- FV ingrowth
- Diffusion through cortex from ST's
- Reproducibility of DCE.

Assessment for Scaphoid Viability or MRI: *How does this hold up?*

↓T1

↓T2 (STIR/T2-FS)

No Gd-CE = AVN

- Not an “All or Nothing” event
- Histology is heterogenous.
- Patchy distribution of viable bone, necrotic bone and callus formation...

Assessment for Scaphoid Viability or MRI:

- No optimal imaging approach.
- T1 probably most useful
 - less invasive/time intensive
 - more reproducible.
- Combination → low vs. high risk of AVN
 - may be sufficient.
- Time lapse b/w imaging and surgery
 - research and for practical reasons

