Gross and Histologic Comparison of Acute and Chronic Skull Fractures to Typical and Accessory Sutures of the Infant Skull

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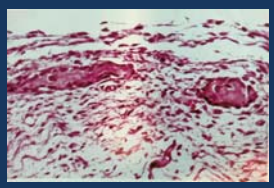
Objectives

- Review normal and variant sutures of the infant skull
- Review gross and radiographic features of normal and variant sutures of the infant skull
- Compare histology of sutures and bone fractures with typical and atypical sutures of the infant skull
- Discuss the value of identifying aberrant sutures in cases of infant death

Formation of the Skull

- Membranous ossification
  - Fuse
  - form sutures
- Atypical or incomplete *fusion* results in the formation of atypical sutures[2]
- Aberrant ossification centers form islands of bone with surrounding sutures ("Wormian bones")[1]

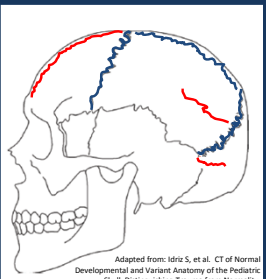


Bullough, PG. Orthopaedic Pathology. 5th Ed. Missouri. 38; 2010

1 Bellary SS, Steinberg A, et al. Wormian Bones; A Revie. Clinical Anatomy 2013; 26: 922-927
2. Brogdon BG, Shwayder T. Elifritz J. Child Abuse and Its Mimics in Skin and Bone. Boca Raton: CRC Press Taylor & Francis Group, 2013. 127-127

Suture of the Infant Skull

- Typical sutures:
  - Coronal
  - Sagittal
  - Lambdoid
- Three most commonly confused with fractures[2] :
  - Metopic suture
  - Intraparietal suture
  - Mendosal suture

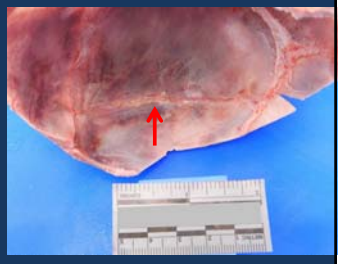


Adapted from: Idriz S, et al. CT of Normal Developmental and Variant Anatomy of the Pediatric Skull: Distinguishing Trauma from Normality. RadioGraphics 2015; 35:1585-1601

2. Brogdon BG, Shwayder T. Elifritz J. Child Abuse and Its Mimics in Skin and Bone. Boca Raton: CRC Press Taylor & Francis Group, 2013. 127-127

Gross Features of Atypical Sutures

- Feature similar to adjacent sutures
- Bilateral or asymmetrical
- Dural connection; interdigitations



Radiographic Features

Fractures

- Sharp, lucent edges
- Absence of sclerosis
- Displacement

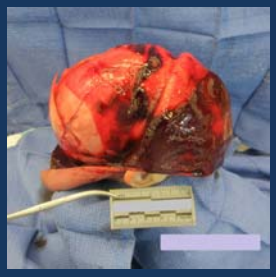
Sutures

- Scalloped borders
- Sclerosis of the margins

Sanchez T, Stewart D, Walvick M. Skull fracture vs. accessory sutures: how can we tell the difference? Emergency Radiology 2010; 17: 413-418

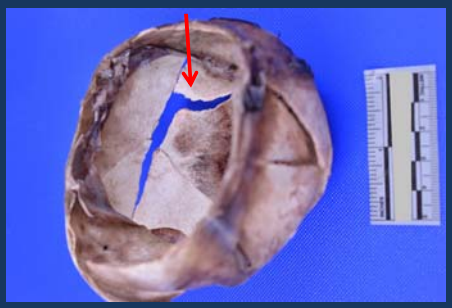
Radiographic Features of Skull Sutures

Acute Fracture

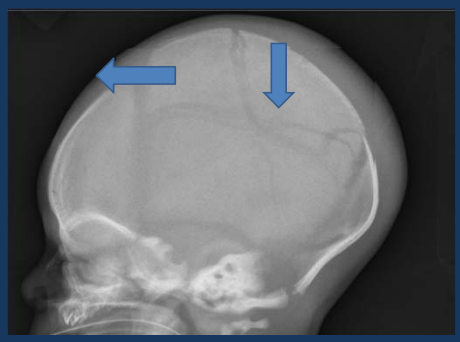


Acute Fracture vs Atypical Parietal Suture

Absence of Interdigitations

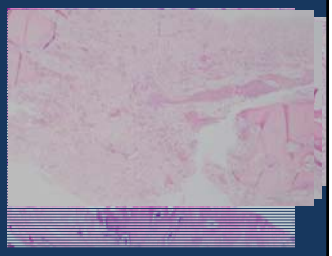


Radiographic Features



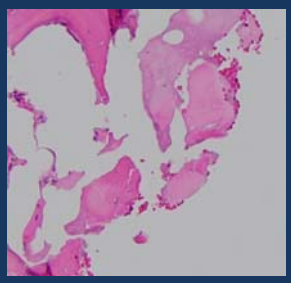
Histologic Feature of Sutures

- Fibrovascular core
- Smooth edges of ossified bone
- Rim of osteoblasts in periostium
- Small foci of woven bone formation



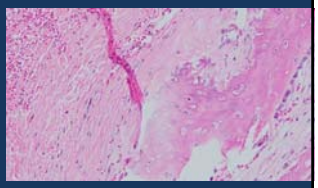
3. Tharp AM, Jason DR. Anomalous Parietal Suture Mimicking Skull Fracture. The American Journal of Forensic Medicine and Pathology 2009; 30 (1): 49-51
4. Furuya Y, Edwards MSB, Alpers CE, et al. Computed Tomography of Cranial Sutures Part I: Comparison of suture anatomy in

Histologic Examination-Fracture



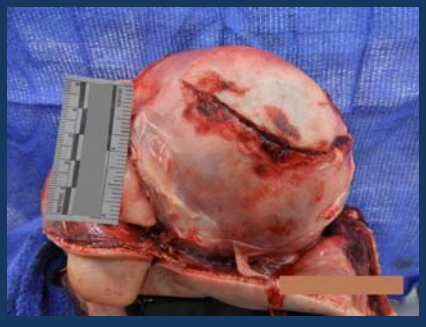
Histologic Feature of Sutures

- Free of inflammation, hemorrhage
- Free of hemosiderin-laden macrophages
- However, diastatic fractures and healing fractures may share histologic feature

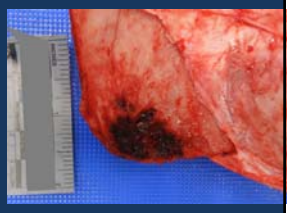


3. Tharp AM, Jason DR. Anomalous Parietal Suture Mimicking Skull Fracture. The American Journal of Forensic Medicine and Pathology 2009; 30 (1): 49-51
4. Furuya Y, Edwards MSB, Alpers CE, et al. Computed Tomography of Cranial Sutures Part I: Cmparison of suture anatomy in children and adults. Journal of Neurosurgery 1984; 61: 53-58

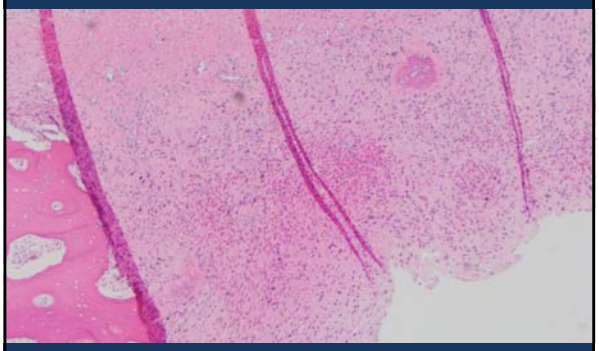
5 Week Old Infant Female



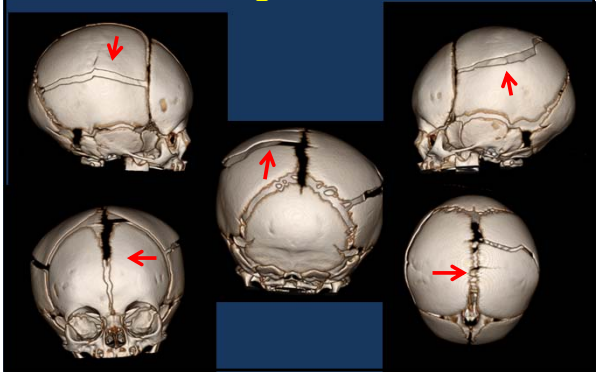
Internal Examination



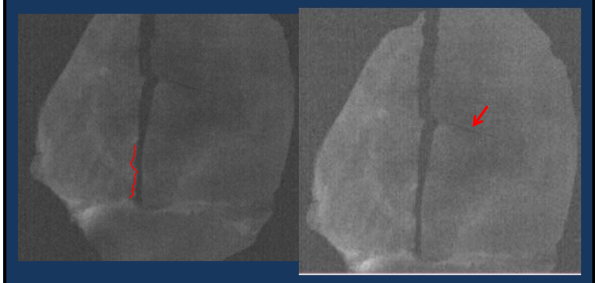
Parietal Fracture



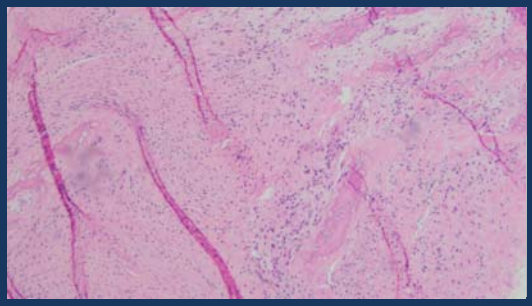
Radiologic Evaluation



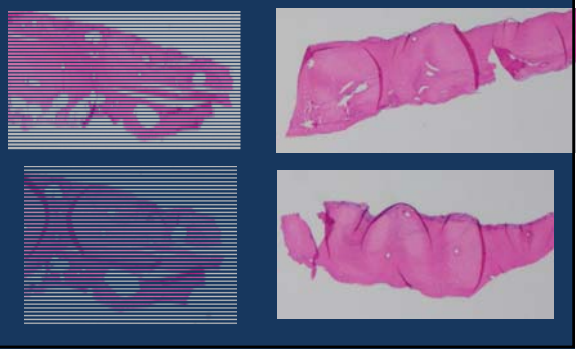
Postmortem Radiographs



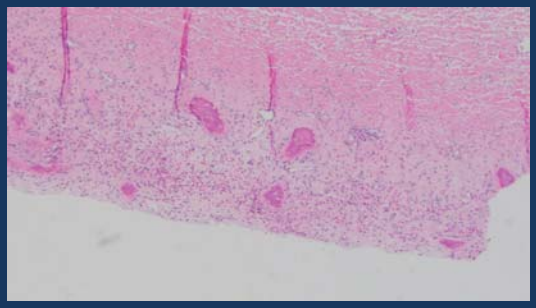
Coronal Suture



Parietal Fracture



Diastatic Parietal Suture Fracture



In Conclusion

- It is important to be familiar with the normal anatomic variants of the infant skull
- Normal variants and trauma can overlap, and may be missed for lack of examination
- Combining features of radiology, gross examination and histology can help differentiate acute and remote fractures from atypical sutures
- This presentation includes a small number of cases; further examination and documentation is warranted

Thank You