Measurements

- above foramen magnum: normal
- <3 mm: also normal but the term benign tonsillar ectopia can be used
- 3 to 6 mm: indeterminate, and needs to be correlated with symptoms and presence of syrinx, etc
- >6 mm: Chiari 1 malformation
- Some authors advocate a simpler rule:
  - above foramen magnum: normal
  - <5 mm: also normal but the term benign tonsillar ectopia can be used
  - >5 mm: Chiari 1 malformation

Chiari 1

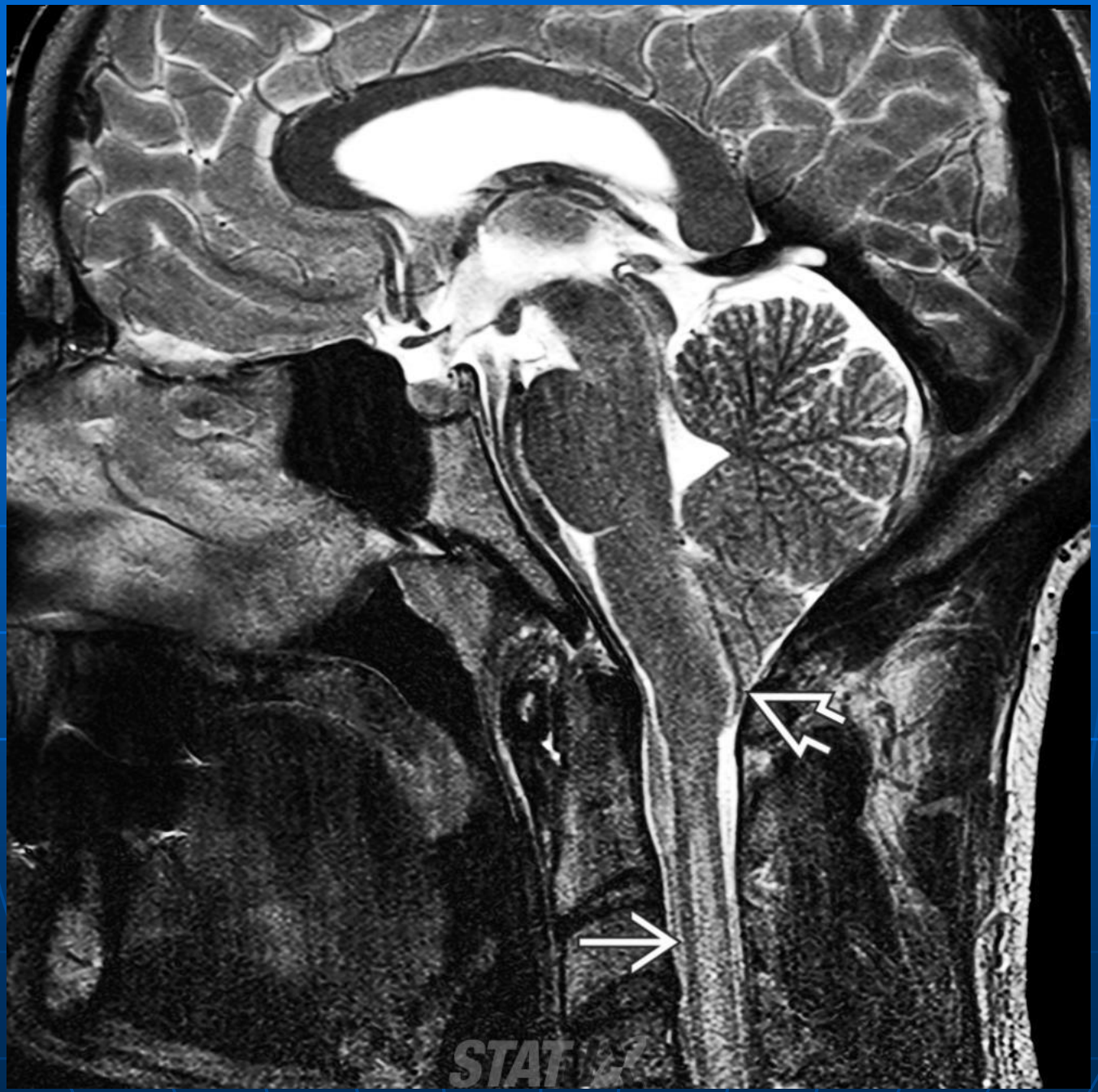
- Pointed cerebellar tonsils extend ≥ 5 mm below foramen magnum ± syringohydromyelia, scoliosis, hydrocephalus.
- Up to 50% of CM1 is asymptomatic
  - Surgical treatment for asymptomatic patients controversial
- Symptomatic patients
  - Surgical goal is restoration of normal CSF flow at foramen magnum
  - Posterior fossa decompression, resection of posterior C1 arch ± duraplasty, cerebellar tonsil resection
- Degree of tonsillar herniation correlates with clinical severity
- Tonsillar herniation > 12 mm nearly always symptomatic

Chiari 1

- No clear consensus definition of what constitutes CM1Traditional: Elongated, peg-shaped cerebellar tonsils extend below foramen magnum into upper cervical spinal canal
- The "5 mm" criterion for tonsillar displacement below basion-opisthion line is flawed criterion
  - Tonsillar position is a morphometric distribution and also changes with time
  - Tonsillar position **plus** shape/configuration (elongated, pointed)
  - Tonsillar position also risk factor for syrinx (the lower the tonsils, the higher the risk)
- "Crowding" of posterior fossa with compression of CSF spaces
- Evaluate skull base, upper cervical spine
  - PF may be undersized, shallow (especially children)
  - Short clivus, CVJ assimilation anomalies common

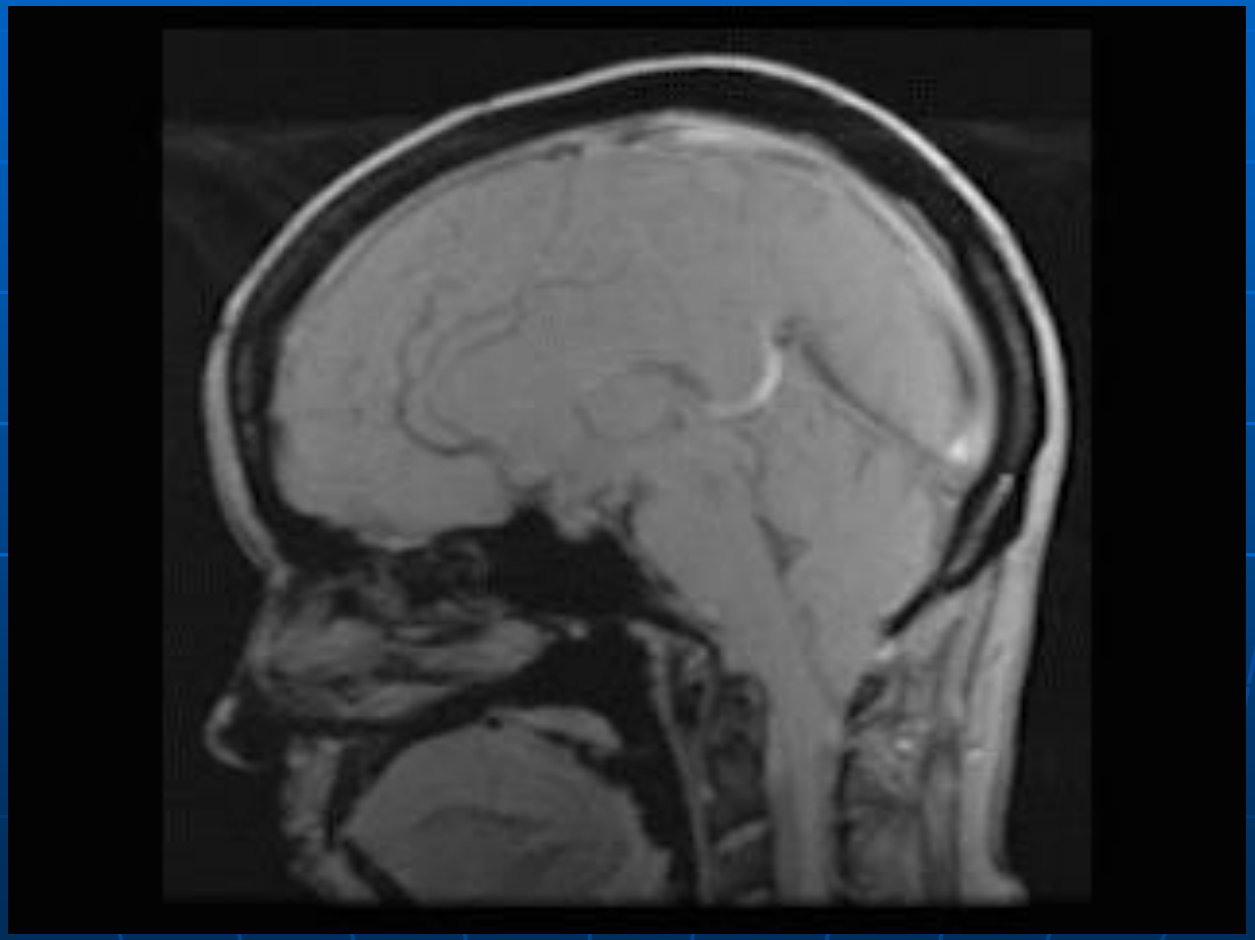
MR Findings

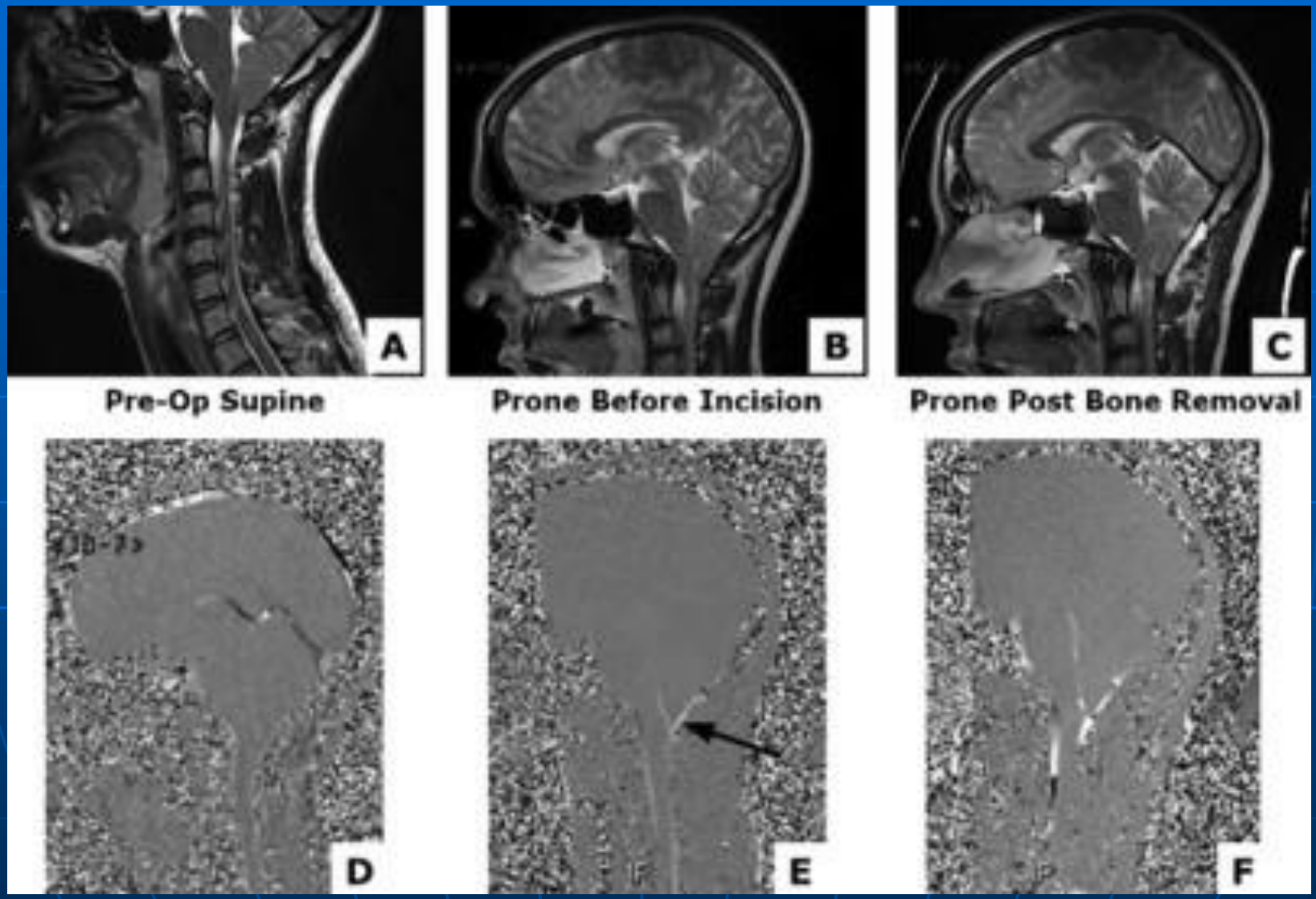
- T1WI
  - Pointed (not rounded) tonsils ≥ 5 mm below foramen magnum
  - "Tight" foramen magnum with small/absent cisterns
  - ± 4th ventricle elongation, hindbrain anomalies
- T2WI
  - Oblique tonsillar folia (like "sergeant's stripes")
  - ± short clivus → apparent descent of 4th ventricle, medulla
  - ± syringohydromyelia (14-75%)
- MR cine
  - Disorganized CSF pulsation, ↑ brainstem/cerebellar tonsil motion → ↑ peak systolic velocity, ↓ flow through foramen magnum



Sagittal T2WI in a 23-year-old male with classic Chiari 1 malformation shows low-lying pointed tonsils (white open arrow) and hyperintensity in the upper cervical cord (white solid arrow) that may represent "presyrinx" state.

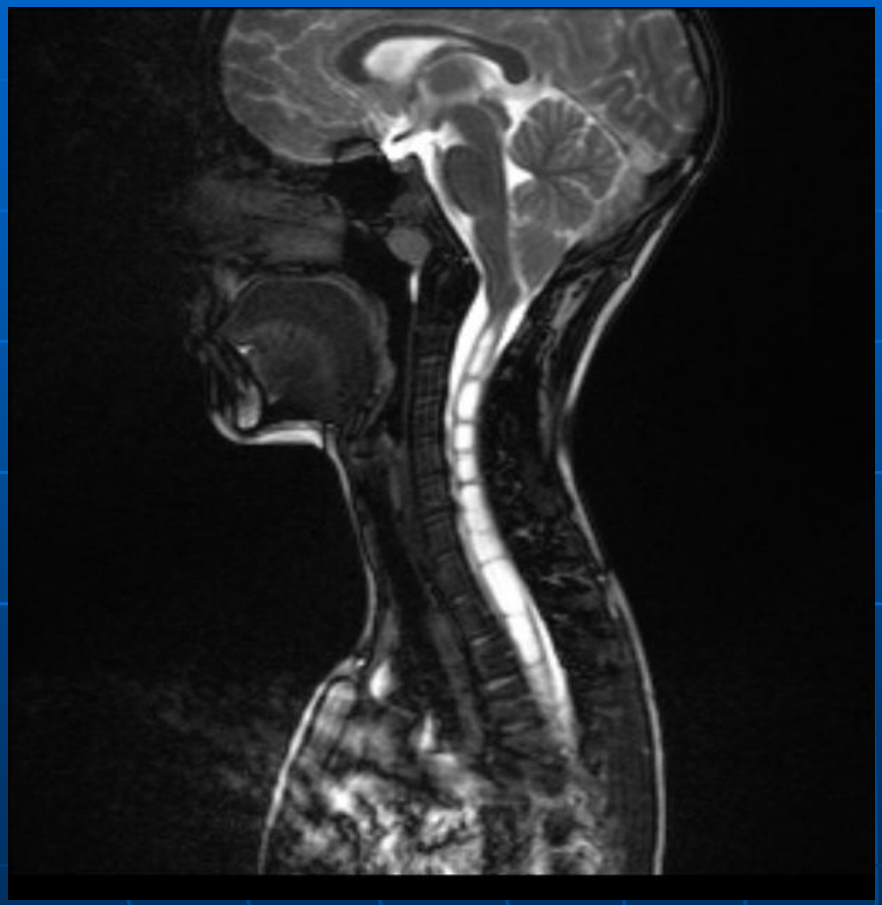
Decreased Flow

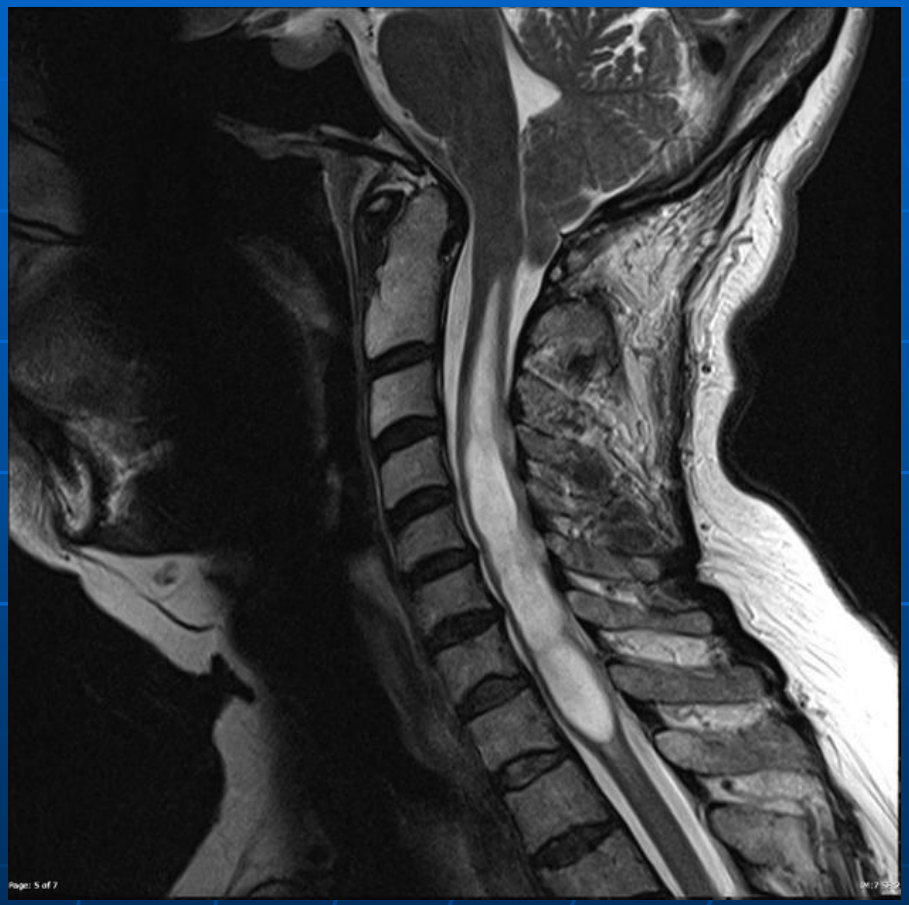



A
B
C
Pre-Op Supine
Prone Before Incision
Prone Post Bone Removal
D
E
F

CM1 hyperreflexia demonstrates marked odontoid retroflexion (white open arrow) and enlargement of the anterior C1 ring (white solid arrow), which abnormally articulates with the remodeled clivus.

Sagittal bone CT in a patient with severe CM1 hyperreflexia demonstrates marked odontoid retroflexion (white open arrow) and enlargement of the anterior C1 ring (white solid arrow), which abnormally articulates with the remodeled clivus

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