

## High-resolution MRI of persistent metopic suture

Martin Krämer<sup>1</sup>, Karl-Heinz Herrmann<sup>1</sup>, Martin Stenzel<sup>2</sup>, Hans-Joachim Mentzel<sup>2</sup>, and Jürgen R Reichenbach<sup>1</sup>

<sup>1</sup>Medical Physics Group, Institute of Diagnostic and Interventional Radiology I, Jena University Hospital - Friedrich Schiller University Jena, Jena, Germany,

<sup>2</sup>Pediatric Radiology, Institute of Diagnostic and Interventional Radiology I, Jena University Hospital - Friedrich Schiller University Jena, Jena, Germany

### Target audience

Radiologists and clinicians handling head injuries in a clinical emergency setting.

### Purpose

The time of closure of the metopic suture dividing the two halves of the frontal bone of the skull in infants and children is reported to occur between birth and 6 years of age<sup>1</sup>. In rare cases the metopic suture can persist into adulthood either partially or totally<sup>2,3</sup>. Although of no clinical significance a persistent metopic suture in adults can be mistaken for cranial fractures<sup>3</sup> and is therefore a condition radiologists, surgeons and clinicians in general should be aware of. We report a case of a totally persistent metopic suture in a 28 year old male that was noticed during a routine research MRI scan.

### Methods

A high resolution 3D *gradient echo* (GRE) sequence with isotropic resolution of 0.68 mm<sup>3</sup> was used for imaging the superior parts of the head. Other acquisition parameters were: 1.72 ms echo time, 3.68 ms repetition time, 10° flip angle and 539 Hz pixel bandwidth. To improve SNR a total of 3 averages were acquired. With a total acquisition time of 14 minutes no fat saturation was used in order to keep acquisition time minimal. Measurements were performed on a clinical 3T system (Magnetom TIM Trio, Siemens, Erlangen, Germany).

To visualize the frontal and sagittal sutures a curved surface reconstruction was performed along the cranial surface as indicated in Figure 1. Reconstruction was implemented off-line by 3D interpolation using the Matlab software package. Thickness of the surface was 0.68 mm with a non-curved extension of 87 mm in through-plane direction.

Besides the 28 year old male with persistent metopic suture another male subject 24 years of age was scanned with the same imaging sequence.

### Results

Figure 2 shows the curved reconstruction of the cranial surface from the nasal to the occipital area (top to bottom, respectively). In both subjects, the coronal, sagittal and lambdoid sutures are clearly visible. The subject in the left image additionally shows a totally persistent metopic suture (arrow) reaching from the bregma to the nasal cavity.

### Discussion & Conclusion

The excellent visibility of the persistent metopic suture and the other sutures was only achieved by using curved surface reconstruction and the thereto necessary isotropic high resolution GRE data. However, with axially oriented slices that are typically acquired in routine scans, a persistent metopic suture could be misinterpreted as a vertical fracture<sup>3</sup>. It is thus important to be aware of this rare condition. If diagnosis of skull fractures cannot be made free of doubt, a curved surface reconstruction of the cranial surface is highly recommendable. Curved surface reconstruction must not be necessarily performed offline since most modern MRI workstations support this option. Although manual offline reconstruction is able to avoid several limitations encountered sometimes with commercial workstations, such as e.g., the maximal length of the surface, standard curved reconstruction on the workstations should be more than sufficient for clinical routine. If no high resolution MRI data is available, analysis could also be performed based on CT data which is typically obtained in an emergency setting.

### References

- [1] Caffey J, Pediatric X-ray diagnostics, 1978, 7<sup>th</sup> ed., Vol 1.
- [2] Ajmani ML et al., J Anat 137:177-83 (1983)
- [3] Bandemci T et al., Neurocirugia 18:238-240 (2007)

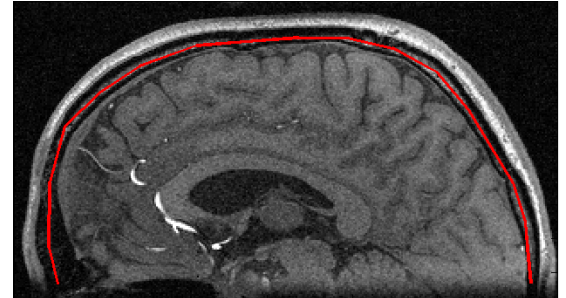


Fig. 1. Contour of the curved surface used to reconstruct the cranial surface from the 3D GRE data.

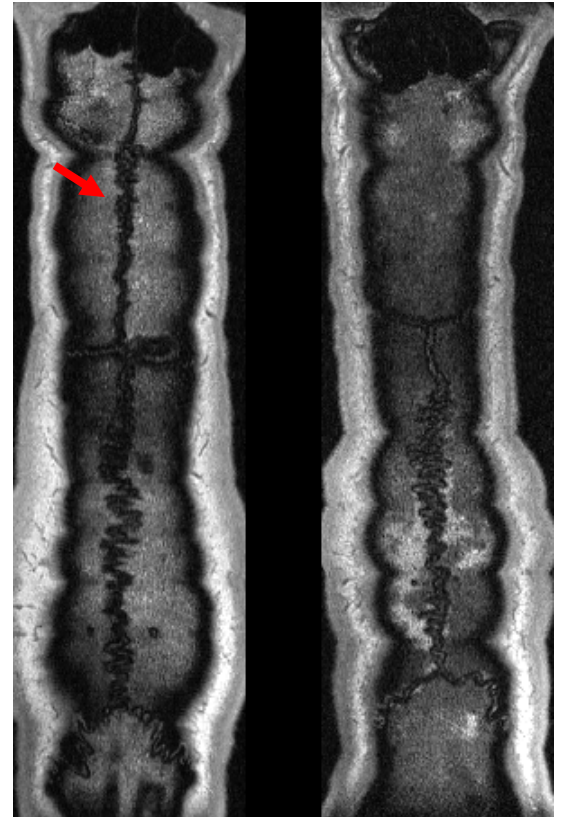


Fig 2. Persistent metopic suture (left) and closed metopic suture (right) of two male subjects aged 28 and 24 years, respectively.