Suture fusion

Available normative references of cranial bone development and suture fusion are incomplete or based on simplified assumptions due to the lack of large datasets. Liu et al. presented a fully data-driven normative model that represents the age- and sex-specific variability of bone shape, bone thickness, and bone density between birth and 10 years of age at every location of the calvaria.

The model was built using a cross-sectional and multi-institutional pediatric computed tomography image dataset with 2068 subjects without cranial pathology (age 0-10 years). They combined principal component analysis and temporal regression to build a statistical model of cranial bone development at every location of the calvaria. They studied the influences of sex on cranial bone growth, and the bone density model allowed quantifying for the first time suture fusion as a continuous temporal process. They evaluated the predictive accuracy of our model using an independent longitudinal image dataset of 51 subjects.

The model achieved temporal predictive errors of 2.98 ± 0.69 mm, 0.27 ± 0.29 mm, and 76.72 ± 91.50 HU in cranial bone shape, thickness, and mineral density changes, respectively. Significant sex differences were found in intracranial volume and bone surface areas ($P < 0.01$). No significant differences were found in the cephalic index, bone thickness, mineral density, or suture fusion.

Liu et al. presented the first pediatric age- and sex-specific statistical reference for local cranial bone shape, thickness, and mineral density changes. They showed its predictive accuracy using an independent longitudinal dataset, they studied developmental differences associated with sex, and quantified suture fusion as a continuous process [1].

1)
Liu J, Elkhill C, LeBeau S, French B, Lepore N, Linguraru MG, Porras AR. Data-driven Normative Reference of Pediatric Cranial Bone Development. Plast Reconstr Surg Glob Open. 2022 Aug 10;10(8):e4457. doi: 10.1097/GOX.0000000000004457. PMID: 35983543; PMCID: PMC9377678.