

## Imaging and Health Metrics in Incidental Cerebellar Tonsillar Ectopia: Findings from the Adolescent Brain Cognitive Development Study (ABCD)

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### Purpose

Incidental cerebellar tonsillar ectopia (ICTE) refers to a herniation that meets the standard definition for Chiari (5mm or more) but without Chiari type symptoms. ICTE is an increasingly common finding, but its significance is unclear. This study examined the posterior cranial fossa (PCF) morphometrics (lengths, angles, and areas) and a broad range of health instruments of pediatric ICTE cases and matched controls selected from the Adolescent Brain Cognitive Development (ABCD) dataset.

### Methods

One-hundred-six subjects (age 9-10) with ICTE and 106 matched controls without ICTE were identified from 11,411 anatomical MRIs of healthy, screened pediatric subjects from the ABCD project. Subjects were matched by sex, age, body mass index, race, and ethnicity. Twenty-two skull and brain morphometrics and 22 health instruments were compared between the two groups to identify any unrecognized CMI symptoms—such as headaches, vision problems, hearing problems, seizures, and sleep apnea—and to assess the general health impact of ICTE.

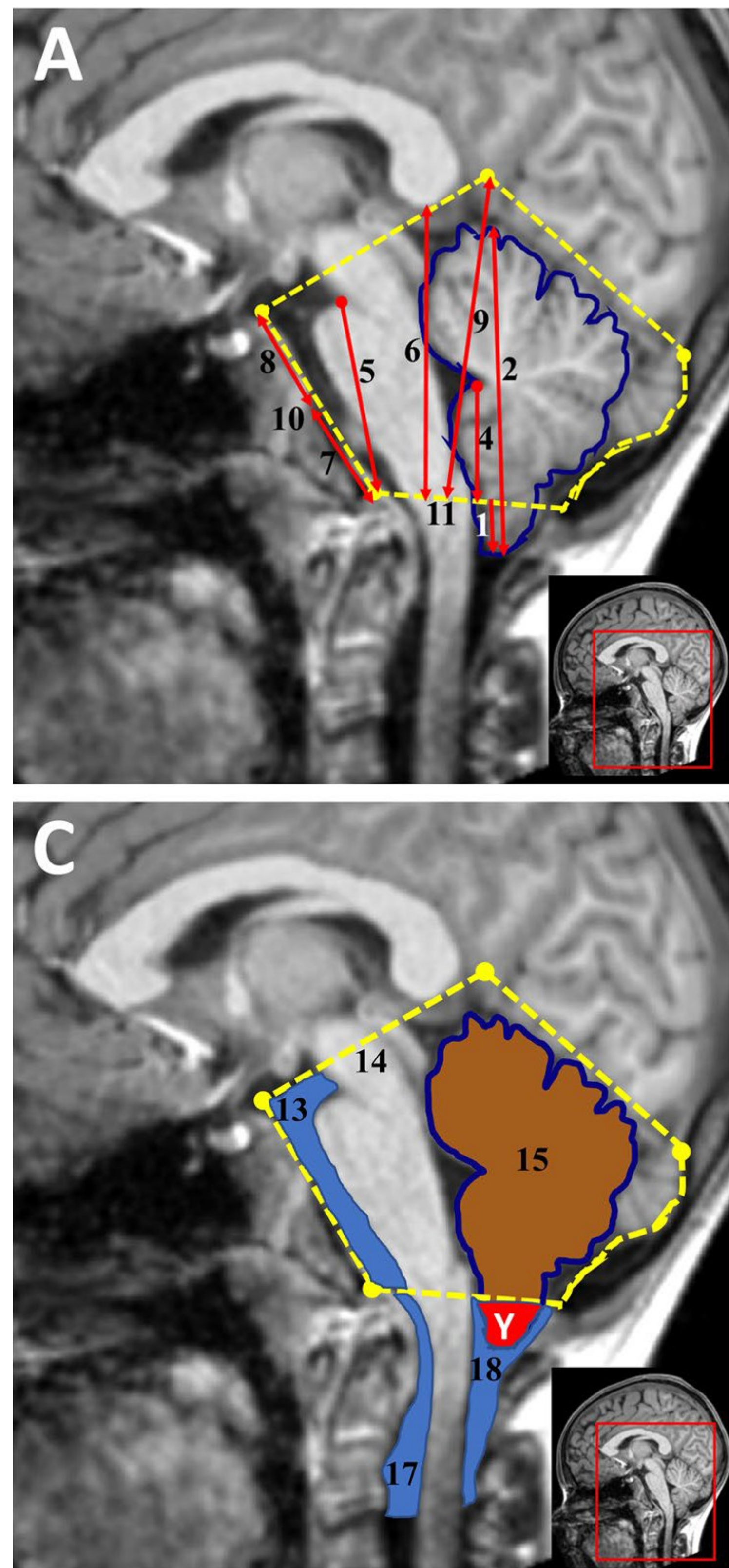
### Results

For the females, 12 of the morphometric measures were significantly different between the ICTE and control groups, including the anterior cerebrospinal fluid (CSF) space which was 19% smaller on average in the ICTE group. For the males, 15 measures were significantly different, including the clivus bone which was over 2mm shorter on average in the ICTE group. No significant differences were found among the 22 health instruments between the two groups or for any specific Chiari related symptoms.

### Conclusions

This study looked at a large number of truly asymptomatic pediatric ICTE subjects compared to carefully matched controls and found that their posterior fossa morphology (size and shape) is similar to that of adult Chiari cases in terms of the height and crowding of the PCF structures and reduction of the CSF spaces in the spinal area. However, these differences appeared to have no impact on the overall health of the ICTE subjects and did not cause Chiari type symptoms. It is not clear if any of these children are at risk for developing Chiari symptoms as adults.

### Selected Morphometric Measurements Used in Study



*In the ICTE cases, the posterior fossa heights and lengths (A) were significantly shorter and the spinal CSF spaces (B17-18) were significantly smaller compared to controls as is seen with adult Chiari. However, the clivus angle was similar for the two groups, whereas in adult Chiari it is flatter.*