Key Points

1. Several research studies have shown that people with Chiari tend to have small posterior fossa regions compared to normal
2. This has led to the hypothesis that Chiari is due to a small skull crowding a normal sized brain
3. Study looked at the entire skull base, not just the posterior region
4. Compared 30 children with Chiari to a control group
5. Used computer aided analysis of MRIs to measure several angles and distances in the skull base
6. Found a significant difference in the Chiari group for 3 of the 4 distances and 2 of the 3 angles
7. Indicates that the entire skull base is abnormal with Chiari
8. Also found 2 significant differences between children with Chiari only and both Chiari and syringomyelia

Definitions

anterior - towards the front

control group - in a research study, a group of people who are similar to the subjects under study in age and gender but are assumed to be healthy; the control group serves as a basis for comparison

fossa - a depression

posterior - towards the back

posterior fossa - area of the back of the skull where the cerebellum is situated

skull base - the lower bones of the skull

cerebellar tonsils - portion of the cerebellum located at the bottom, so named because of their shape

cerebellum - part of the brain

More Findings On Chiari & Abnormal Skull Geometry

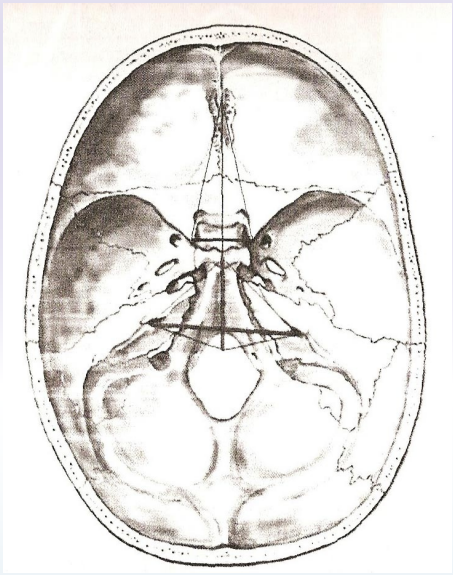
November 30, 2007 -- Over the past few years, several research studies have shown that people with Chiari tend to have small posterior fossas. The posterior fossa is the depression on the inside of the back of the skull and is where the cerebellum is situated. This finding has led many to refer to Chiari as a problem involving underdevelopment of the skull which in turn crowds a normal sized brain.

Now, a study from Birmingham Children's Hospital in England (Sgouros et al.), and published in the September 2007 issue of the Journal of Neurosurgery: Pediatrics, has found that the skull abnormalities associated with Chiari extend to the entire skull base, not just the posterior region.

In the study, Dr. Sgouros and his colleagues were looking to expand on their previous findings involving posterior fossa size and Chiari. In their earlier work, they had compared various measurements of the posterior fossa in children with Chiari, children with both Chiari and syringomyelia, and a control group of normal children. While they did find a small posterior fossa volume like other researchers, they only found this difference among the children with both Chiari and syringomyelia. In other words, the children with just Chiari tended to have normal sized posterior fossas, but the children with both Chiari and syringomyelia had small posterior fossas. In explaining this finding, the researchers pointed out that other research studies had failed to separate the two groups and that a group of subjects with a high percentage of syringomyelia patients would result in a significant difference for the entire group.

To investigate this finding further, and try to determine why there was a difference between the children with Chiari only and with both Chiari and syringomyelia, the researchers decided to look at the entire skull base, not just the posterior measurements. Specifically, they compared 4 distances and 3 angles (see Figure 1) of 14 children with Chiari only, 16 children with both Chiari and syringomyelia, and a control group of 42 children without Chiari or other skull type problems. The group used computer aided analysis of MRIs to acquire the data.

Figure 1: Skull Base Distances and Angles Measured



Interestingly, they found that in both the CM and CM/SM group, 3 of the four distances and 2 of the 3 angles were significantly different from the control group (see Table 1). The geometric differences mean that children with Chiari tend to not only have small posterior fossas, but the front of the skull base tends to be longer than normal. Since the growth of one portion of the skull can affect other portions of the skull, it is not clear if these findings are due to the small posterior fossa or a direct result of a developmental problem.

In comparing the children with Chiari only to those with both CM and SM, the scientists found two measurements which were significantly different between the groups. The authors admit it is difficult to interpret this finding and draw any conclusions from it, but they do raise an interesting question. Namely, is Chiari with syringomyelia simply a more severe form of Chiari, or does it represent something distinctly different.

It is natural to assume that syringomyelia comes with more severe cases, but if there is more than one underlying cause for Chiari, it could be the case that Chiari by itself is due to one thing, and Chiari with syringomyelia is due to something else entirely. Regardless, continued advances in quantifying the geometric characteristics of the Chiari skull could lead to significant advances in understanding the root cause(s),

located at the bottom of the skull, near the opening to the spinal area; important for muscle control, movement, and balance

cerebrospinal fluid (CSF) - clear liquid in the brain and spinal cord, acts as a shock absorber

Chiari malformation I - condition where the cerebellar tonsils are displaced out of the skull area into the spinal area, causing compression of brain tissue and disruption of CSF flow

decompression surgery - general term used for any of several surgical techniques employed to create more space around a Chiari malformation and to relieve compression

Source

Sgouros S, Kountouri M, Natarajan K. Skull base growth in children with Chiari malformation Type I. J Neurosurg. 2007 Sep;107 (3 Suppl):188-92.

improving diagnoses, and refining surgical treatments.

Table 1
Skull Base Distances and Angles, CM, CM& SM, Control

	Control	CM	CM/SM	Sig
Distance				
1	135	145	151	Y
2	110	122	123	Y
3	96	97	101	N
4	34	29	29	Y
Angle				
1	58	75	63	Y
2	46	50	40	N
3	32	31	27	Y

Note: *Sig refers to whether the difference between the CM groups and the control group is statistically significant and not likely due to chance.*

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