**Scoliosis Affects Surgical Outcomes In Adults**

March 31, 2007 -- While the link between scoliosis, an abnormal curvature of the spine, and CM/SM has been studied in children, little has been done to examine the role it plays in adult CM/SM patients. Pediatric scoliosis is actually one of the most active topics of Chiari research, and work in that area has resulted in the recognitions of what types of scoliosis warrant an MRI, and the understanding that decompression surgery should be tried before corrective, orthopedic surgery.

Despite the high level of attention, the fundamental link between scoliosis and CM/SM remains a mystery. Specifically, it is not known whether a syrinx leads directly to scoliosis by weakening the spine or back muscles, whether scoliosis somehow influences the development of a syrinx, or if both are secondary to the compression and disrupted CSF flow associated with Chiari. While it seems logical that a syrinx could lead to scoliosis, several studies have failed to find a connection between the size and location of a syrinx and the presence or severity of scoliosis.

Now, a recent study out of Japan, while not answering these questions conclusively, has shed some light on the role that scoliosis plays in the outcomes of adult CM/SM patients. The Japanese team, led by Dr. Atushi Ono, looked at 27 consecutive, adult CM/SM patients treated between 1995-2002. Although the criteria for inclusion in the study was those older than 20, the average age of the group was a much higher 55.

To study the role of scoliosis, the patients were divided into two groups based on whether they had 10 degrees or more of abnormal spine curvature. Using this method, 15 patients were placed in the scoliosis group and 12 in the no scoliosis group. In the scoliosis group, the average curve was a sizeable 23 degrees, with 10 of the patients exhibiting a single curve, four a double curve, and one a triple curve.

The researchers then compared the two groups across a number of parameters, including:

- length, width and shape of the syrinx
- degree of tonsillar herniation
- duration of symptoms
- muscle atrophy in the upper extremities
- abnormal leg reflexes
- cranial nerve symptoms
- pre-op and post-op clinical status as measured by the Japanese Orthopedic Association (JOA) scale
- calculated recovery rate

Their analysis revealed a number of significant differences between the groups (see Table 1) which were published in the March, 2007 issue of the Journal of Neurosurgery: Spine. Specifically, the average length of the syrinx in the scoliosis group was almost 13 vertebral segments long compared to 7 in the no-scoliosis group. Perhaps most strikingly, nearly three-fourths of the scoliosis group suffered from upper extremity muscle atrophy, but only 8% of the no-scoliosis group did. Similarly, a whopping 93% of the patients with scoliosis also exhibited abnormal leg reflexes, while less than half of the patients without scoliosis did. Both pre and post-op clinical scores, along with the calculated recovery rate, were significantly worse for the scoliosis group as well.

The researchers also found that the length of the syrinx and the duration of symptoms were correlated to the degree of scoliosis. In other words, patients with longer syrinxes, or who had suffered from symptoms for longer, tended to have worse cases of scoliosis. Interestingly, neither the width of the syrinx, nor the amount of tonsillar herniation were found to be related to the amount of scoliosis or the clinical scores.

Finally, the authors built a statistical model to determine which factors influenced the final JOA score (at the last follow-up). While the primary factor was the pre-op JOA score - meaning how bad symptoms were prior to surgery - they also found that the degree of scoliosis and the duration of symptoms significantly influenced outcomes.

Based on their findings, the doctors conclude that adults with CM/SM related scoliosis tend to have poorer...
scoliosis - abnormal curvature of the spine

thoracic - the middle part of the spine; the chest area

vertebra - the individual bony segments of the spine; often referred to by region and number, such as C3 for the third cervical vertebra

vertigo - dizziness, spinning sensation

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

cerebellum - part of the brain 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

While the exact connection between scoliosis and CM/SM remains somewhat fuzzy, it is clear, at least from this study, that doctors should pay attention to the presence of scoliosis in adult CM/SM patients.

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<tr>
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<th>W/Scol</th>
<th>W/out Scol</th>
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<tbody>
<tr>
<td>Avg Length of Syrinx</td>
<td>12.8</td>
<td>7.2</td>
</tr>
<tr>
<td>Duration of Symptoms</td>
<td>14 yrs</td>
<td>7 yrs</td>
</tr>
<tr>
<td>UE Muscle Atrophy</td>
<td>73%</td>
<td>8%</td>
</tr>
<tr>
<td>Abnormal Leg Reflex</td>
<td>93%</td>
<td>42%</td>
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<tr>
<td>Avg. Preop JOA Score</td>
<td>10.1</td>
<td>14.4</td>
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<tr>
<td>Avg Postop JOA Score</td>
<td>11.9</td>
<td>15.8</td>
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Notes: syrinx length is measured in vertebral segments; JOA stands for Japanese Orthopedic Association scale; UE=upper extremity; significant refers to the difference being statistically significant and likely to be due to chance

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