The Ponticulus Posticus

By Roy W. Sweat, D.C., and Hal S. Crowe, Sr., D.C.

Part Two

The figures strongly indicate that the ponticulus posticus is a genetically-inherited variant as opposed to being an acquired anomaly.

Thirty subjects in the study had other family members included also. Of the 30, 12 were first-generation members, 17 were second-generation members, and one was a third-generation member. Due to the number of variants affecting a statistical approach, we cannot be conclusive, but these figures strongly indicate that the ponticulus posticus is a genetically-inherited variant as opposed to being an acquired anomaly.

In determining through dissection as to whether the posterior atlanto-occipital membrane is indeed a membrane, several pertinent anatomical considerations were discovered. Only occasionally are the attachments of the dura mater reported to include the posterior atlanto-occipital. We found, in all three cervical spines dissected, the anterior surface of this ligament intimately attached to the dura mater of the posterior cervical spinal cord. Thus may be the reason it is demoted as a membrane, but in reality it is a ligamentous structure. The oblique ligament of atlas is simply the inferior border of the posterior atlanto-occipital ligament.

In the comparison of the cervical curvature of the 189 lateral x-rays, further evidence concluded that the ponticulus posticus is not related to ligamental stress. Eighteen subjects exhibited a hyperlordotic curve; 22 exhibited a straight military curvature; and 61 exhibited a kyphotic curve, totaling 101, or 53 percent, having abnormal cervical curvature. It was noted that during flexion and extension of the cervical spine on video-fluoroscopy that the atlas containing ponticulus posticus moved independently of the occiput without abnormal restriction.

Two dry specimens complete with axis, atlas, and skull contained variations in occipital foramina unilaterally as the atlas ponticulus of one set, and bilaterally, the same as the ponticulus on the other set. The particular foramina most notably altered were the condylar canal, the hypoglossal canal, and the jugular notch. One set contained a left unilateral incomplete ponticulus posticus, an absent condylar canal on the left, and a subdivided hypoglossal canal ipsilaterally. The other dry specimen had bilateral ponticulae and bilaterally closed jugular notches forming foramina.

In 1912, Le D'cuple described the anargyte foramen (or foramen arcuale) of the ponticulus posticus as being a normal feature of most vertebrates, including primates. Hyman's Comparative Vertebrate Anatomy relates that typically in mammals the atlas is a ring-shaped bone with wide lateral projections which represent ribs and are perforated by the vertebralarterial canal. Also that the neuroarch of atlas is perforated for the passage of the first spinal nerve, a situation often encountered in lower vertebrates. A macerated specimen of a raccoon's cervical spine showed the foramen for the first cervical nerve to be located and positioned identically to the ponticulus posticus of a human specimen, whereas the foramina transversarium were perpendicular in their planes relative to articulation with the occiput and axis when compared to the human vertebra.

The ponticulus of one dry human atlas specimen was partially removed for examination of the bony make-up of the structure. A definite cortex and cancellous bone matrix with easily distinguishable circular lamellar patterns were observed.

Clinical Studies

Several studies (Bidmond, 1951; Williams and Wilson, 1962; Radojevic and Negovanovic, 1963; Ercegovac and Davidovic, 1970; Lamberty-Zivonic, 1973; and others) have indicated that in the presence of the bony rings of atlas, there is occlusion upon the vertebral artery and that patients with the ponticulus posticus often display symptoms of vertebro-basilar insufficiency such as headache, vertigo, and diplopia. In 1972, Graham and Adams reported two cases of idiopathic thrombosis of the vertebro-basilar arterial system in the absence of identifiable arterial disease but in the presence of ponticulus posticus. White and Punjabi point out the stretching and...
linking effect upon the vertebral artery with head rotation. In discussing the "following injuries to the upper part of ponticulus, Ruth Jackson states that the cervical spine, adhesions may form between the artery, the first nerve root, and the bony arch or canal through which they pass." In our study, notes were kept of patients' two major complaints upon entrance.

Possible symptoms of cerebrovascular disease represented 25.9 percent of the entrance complaints of the patients in our study, but neuromuscular complaints far outweighed those of circulation in nature. Neck, back, brachial, and lumbo-sacral complaints totaled 68.1 percent. This figure is probably influenced due to the practice being chiropractic, but is still very significant when compared to other complaints (see Table 2).

Symptomatic response to minimal force vectored cervical adjustments was very favorable in the 189 cases with only 8.5 percent not responding. No adverse response was indicated. The reduction factors from the adjustment of the 65 bilateral complete ponticulae compared to the reduction factors of 100 post x-rays selected randomly but without ponticulae indicated 13.8 percent less reduction when the bilateral bony arch was present. This suggests that the ponticulus posticus may restrict the atlas in its ability to be adjusted towards normal.

We propose that the effects of the passage of the first cervical nerve through the arcuate foramen of atlas are and can be more detrimental than the effects of vertebral artery embarrassment, especially in the presence of adhesions, much in the same way that migration of the cervical spine in any direction can traction cervical nerves and cause symptoms of nerve root irritation. Very possibly, the symptoms of vertebr-basilar Insufficiency were alleviated by Ercegovac and Davidovic by the elimination of adhesions irritating the first cervical nerve root or the inadvertent alterations in the juxtaposition of the atlas vertebra.

In Figure 1, we see the complete unilateral x-ray view of the ponticulus posticus. In Figure 2, the complete bilateral view is presented, while in Figure 3, the incomplete ring is shown.

Conclusions
The common occurrence of 18.9 percent of the patients exhibiting ponticulus posticus exemplifies the need for radiographic study previous to any cervical manipulation. Correction of the atlas seems to be restricted in the presence of a bilateral ponticulus posticus, although symptomatic response is good. Forceful traction or rotary-type manipulations seem contraindicated as both the first cervical nerve and vertebral arteries are encased and surrounded by a bony mass as opposed to muscular or ligamentous soft tissue.

Lamellar patterns within bone matrix and an obvious cortex indicate endochondral ossification and support Hayek's view that the posterior ponticule derives from the embryonic tissue of the dorsal arch of the pro-atlas. Although the posterior atlanto-occipital membrane is indeed a ligament, it is

### Table 1

<table>
<thead>
<tr>
<th>Type</th>
<th>Occurrence of Ponticulus Posticae</th>
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<tbody>
<tr>
<td><strong>BILATERAL</strong></td>
<td></td>
</tr>
<tr>
<td>Complete, Both Rings</td>
<td>65 or 34.5%</td>
</tr>
<tr>
<td>Incomplete, Both Rings</td>
<td>22 or 11.6%</td>
</tr>
<tr>
<td>One Complete, One Incomplete</td>
<td>18 or 09.5%</td>
</tr>
<tr>
<td><strong>UNILATERAL</strong></td>
<td></td>
</tr>
<tr>
<td>Complete Ring</td>
<td>47 or 24.8%</td>
</tr>
<tr>
<td>Incomplete Ring</td>
<td>37 or 19.6%</td>
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**INCIDENCE OF 232 ENTRANCE COMPLAINTS/ 198 PATIENTS EXHIBITING PONTICULUS POSTICUS**

- Back Pain (Dorsal, Lumbar, Sacral) ........................................... 84 or 36.2%
- Headache, Vertigo, Diplopia .................................................... 60 or 25.9%
- Neck, Brachial Symptoms .......................................................... 55 or 23.7%
- Hip, Leg Pain ........................................................................ 19 or 08.2%
- Tension, Hypertactivity, Insomnia, High Blood Pressure .................. 10 or 04.3%
- Respiratory Illness ................................................................. 04 or 01.7%

Photos: Gary B. and Keith Crowe

Fig. 1: Lateral view of atlas ponticulus posticus.
Fig. 2: Unilateral Incomplete ponticulus posticus.
Fig. 3: Above: Human atlas with bilateral ponticulus posticus. Below: Raccoon atlas viewed at same angle. Note foramen in neuroarch for first cervical nerve.
Fig. 4: Unilateral ponticulus posticus with axis vertebra.
Fig. 5: Bilateral ponticulus posticus with axis.
unlikely that the ponticulus posticus is acquired due to stress in view of 7.9 percent of our subjects being children. It is also very comparable to the fora-men for the first cervical nerve common-ly seen in most vertebrates, most notably quadrupeds. As a result of our findings, it is our opinion that the pon-ticulus posticus of the atlas vertebra is a genetically inherited bony arch forma-tion and is not calcification of the poste-rior atlanto-occipital ligament.

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References
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