

Foramen magnum

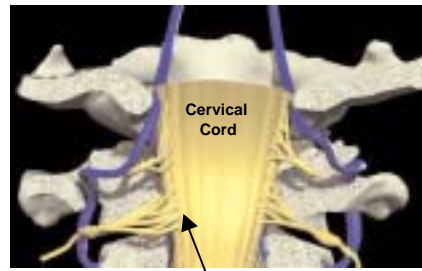
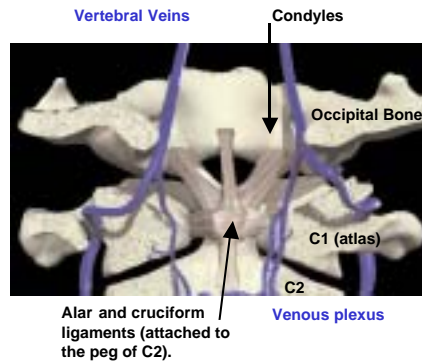
The basics. The foramen magnum (La: big hole) is the large oval opening in the base of the skull through which the spinal cord connects with the brain. It is wider behind than in front where it is encroached upon by the occipital **condyles**. It marks the boundary between the medulla oblongata and cervical cord. It contains:

- The cervical cord.
- The spinal division of the accessory nerve ascending to join the cranial division to exit through the jugular foramen.
- The vertebral arteries and veins.
- The anterior and posterior spinal arteries.
- The tectorial membrane (which becomes the posterior longitudinal ligament).
- The cruciform and alar ligaments. These secure the odontoid peg of the axis (the second cervical vertebra) to the atlas (the first cervical vertebra) as well as the condyles of the occipital bone at the lip of the foramen magnum.

Lesions at the foramen magnum give many misleading clinical pictures, with classic presentations being clockface limb weakness, cruciate hemiplegia and wasted hands.

Comparative anatomists study the position of the foramen magnum in the skull as an indicator of how the animal walks. For instance, in apes, the foramen magnum is at the back of the skull, so the spinal cord enters it at 45-degrees. This reflects the 'knuckle walking' posture of apes. Hominoids and humans have a foramen magnum located underneath the skull, where the spinal cord enters at a 90-degree angle as we walk fully upright on two feet.

Foramen magnum, viewed from behind, with posterior surface of vertebral bodies exposed



Second cervical nerve roots

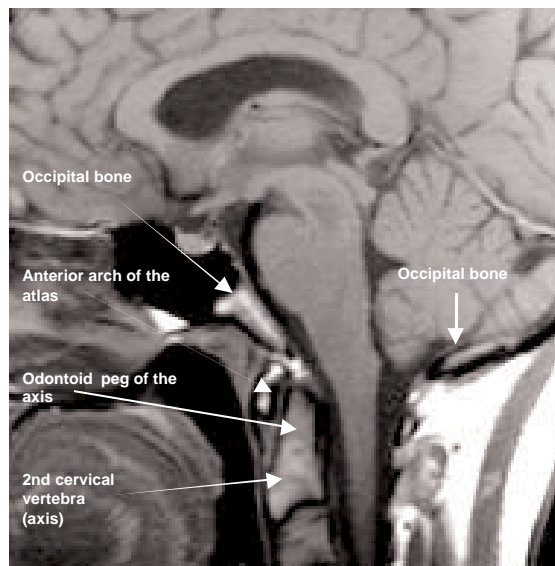
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Sagittal section of the foramen magnum



Foramen magnum

This shows the normal relation of the tonsils to the foramen magnum as well as the alignment of the peg with the anterior foramen magnum.



“Suppliers of advanced neuro embolisation coils”

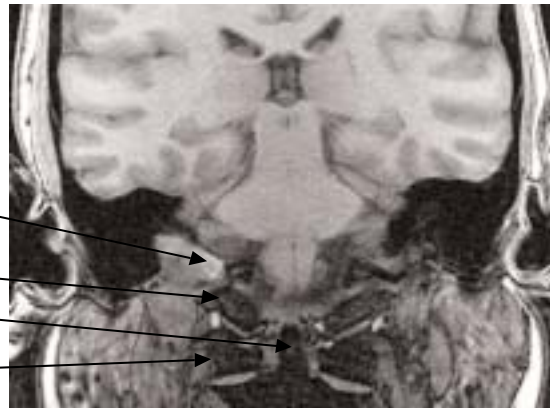
Coronal section of the foramen magnum

This coronal section shows a large right jugular bulb and its relation to the foramen magnum. The bony structures are quite well seen with the occipital condyles sitting on top of the lateral masses of C1.

Lesions at the foramen magnum

- Meningioma
- Syringobulbia
- Arnold-Chiari malformation
- Atlanto-axial dislocation
- Intrinsic lesions (especially demyelination)

Jugular bulb
Occipital condyles of the foramen magnum
Odontoid process of C2 (axis)
Lateral masses of C1 (atlas)



Symptoms of foramen magnum compression

(Meyer & Reese, 1984 and Symonds & Meadows 1937)

- Suboccipital or neck pain (described as a 'tight collar'.) (65% in Meyer and Reese's series), often exacerbated by neck movement.
- Pain in the hand (59%) or arm (55%); especially 'burning' along the ulnar border of the contralateral arm in unilateral lesions.
- Pain in the leg (26%) and face (7%) is much less common.
- Gait disturbance (50%).
- Weak arm (40%) or leg (30%).
- Hand clumsiness (27%).
- Bladder dysfunction (22%).
- Dysphagia (13%).
- Headache (11%).
- Dizziness (4%).
- Dysarthria (3%).
- Lhermitte's (3%).

Signs of foramen magnum compression

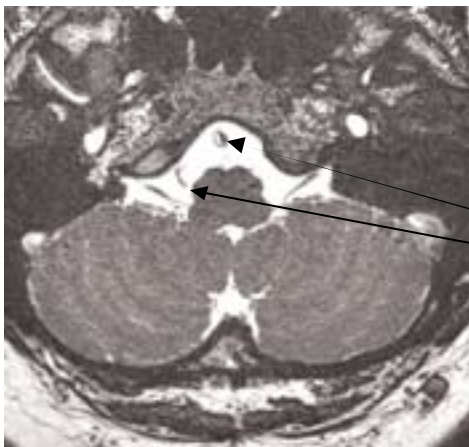
(Meyer & Reese, 1984 and Symonds & Meadows 1937)

- Hyperreflexia and limb weakness are seen in 70% of cases, with a Babinski sign in 60%.
- Cruciate paraplegia (arms affected more than legs). With unilateral compression, this may present in a 'clockface' way with ipsilateral arm, then leg, then contralateral leg, then finally contralateral arm weakness.
- Wasting of the hand muscles (13%)
- Disproportionate weakness of sternocleidomastoid and trapezius through compression of the spinal accessory (30%).
- Sensory loss is usually dissociated, with bilateral spinothalamic loss (40%) (caused by ipsilateral root and spinothalamic tract compromise) and dorsal column dysfunction (26%).
- Rarely: papilloedema (7%), Horner's (4%), hiccups (2%).

Intracranial extension of the lesion is indicated by:

- Downbeat nystagmus (25%)
- Cruciate hemiplegia (ipsilateral lower limb and contralateral upper limb weakness caused by a lesion at the motor decussation in the medulla).

Axial section of the foramen magnum



Hand wasting in foramen magnum compression

This intriguing sign has yet to be satisfactorily explained. The most plausible suggestions are ischaemia of the anterior horns following compression of the anterior spinal artery or venous congestion from obstruction of the vertebral veins.

This axial section shows cranial nerves IX, X heading to the jugular foramen as well as the outline of the medulla showing the bulges formed by the pyramids, inferior olive and inferior cerebellar peduncle.

Basilar artery

Cranial Nerves IX, X

References

1. The interactive spine. Primal Pictures.
2. Symonds CP and Meadows SP. *Compression of the spinal cord* in the neighbourhood of the foramen magnum. *Brain* 1937; 60: 52-84
3. Meyer FB, Ebersold MJ, Reese DF. *Benign tumors of the foramen magnum*. *J Neurosurg*. 1984 Jul;61(1):136-42.