Compartmentation of the jugular foramen

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The radiographic anatomy of the jugular foramen is described. Normal variations in size and configuration are discussed and principal pathological configurations listed. The radiographic features of complete separation of the jugular foramen into separate neural and vascular components are presented.

**Key Words**  ·  jugular foramen  ·  accessory skull foramen  ·  skull radiography

The jugular foramen is a large aperture in the posterior half of the skull base behind the carotid canal. Its anterolateral wall is formed by the petrous temporal bone and the posteromedial wall by the occipital bone (Fig. 1). The foramen varies considerably in size and shape, and there may be considerable normal asymmetry between the two sides.1,4

Two principal factors contribute to this asymmetry: 1) variability in bone formation around the primitive foramen lacerum posterius, and 2) unequal development of the transverse dural sinuses. The latter factor is usually more significant and is largely responsible for the major differences in the size of the jugular foramina in a given skull. Thus, when the transverse sinuses are equal in size, the jugular foramina are likely to be symmetrical (Fig. 2); when one transverse sinus is much larger than the other, the jugular foramen on the side of the large sinus is larger (Fig. 3).6,7

Classical anatomical textbooks divide the jugular foramen into the following three compartments: 1) the most anterior, transmitting the posterior portion of the inferior petrosal sinus as it enters the jugular vein; 2) the middle, transmitting the ninth, tenth, and eleventh cranial nerves; and 3) the posterior, transmitting the transverse dural sinus and meningeal branches of the occipital and ascending pharyngeal arteries.2,5 Radiologically, however, one can discern only two subdivisions in the jugular foramen. This incomplete partition is the result of the somewhat constricted contour of the anteromedial portion of the foramen compared with the larger posterolateral segment. The anteromedial compartment (pars nervosa) transmits the posterior end of the inferior petrosal sinus and the ninth, tenth, and eleventh cranial nerves, while the posterolateral compartment (pars vascularis) transmits the jugular vein and the meningeal branches of the occipital and ascending pharyngeal arteries (Fig. 4).

Di Chiro, et al.,1 have described three principal configurations of the jugular foramen that may result from pathological processes. The first is a generalized irregular enlargement of the entire foramen, with ill-defined bone margins due to chemodectoma. This appearance has also been noted in metastatic tumor and reticuloendotheliosis. The second is enlargement of the pars nervosa with maintenance of the cortical integrity of the foramen, due to neurinomas of the ninth, tenth, and eleventh cranial nerves; large neurinomas may enlarge the entire jugular fora-
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Fig. 1 Left: Radiograph of articulated right temporal and occipital bones of dried skull in submentovertical projection demonstrating the jugular foramen. Upper and Lower Right: Radiographs of the individual temporal and occipital bones in the same projection to demonstrate their contribution to the formation of the jugular foramen. s = jugular spine of petrous temporal bone; p = jugular process of occipital bone; f.m. = foramen magnum; arrow points to the petro-occipital fissure.

Fig. 2. Tomogram of skull in submentovertical projection demonstrating symmetrical jugular foramina.
men but the bone margins are well preserved. Finally, there is the sharply defined, smooth enlargement of the pars vascularis due to vascular malformations (Fig. 5).

Occasionally, there is complete separation of the partes nervosa and vascularis by a bony bridge joining the jugular spine of the petrous bone to the jugular process of the occipital bone (Fig. 6). This results in an accessory anterior foramen which transmits the ninth, tenth, and eleventh cranial nerves. The incidence of this anomaly is not definitely known. In this regard, it is interesting that Toldt in his anatomical text presents a diagram of a skull with complete compart-
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Fig. 6. Photograph of undersurface of dried skull showing partition of the jugular foramen. 1 = large jugular fossa and pars vascularis; 2 = pars nervosa; 3 = anomalous foramen for the ninth, tenth, and eleventh cranial nerves; 4 = carotid canal; 5 = anterior margin of foramen magnum; 6 = base of the styloid process of the temporal bone. Arrowhead points to bony bridge between the jugular spine of the petrous bone and the jugular process of the occipital bone.

mentation of the left jugular foramen. In a study of 100 human skull specimens, I found a single unilateral instance of this variation. On the other hand, Di Chiro, et al.,1 report "the occurrence of a bony septum between the occipital and petrous bones unilaterally in 13.2% and bilaterally in 4.7% of the skulls."

References

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