The Jugular Foramen

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Recently we studied radiographically
a patient presenting a syndrome of
the cerebellopontine angle with a
striking change in the pitch of the voice. We
found normal internal acoustic meatuses and
asymmetrical jugular foramina, the left be-
ing considerably larger than the right (Fig. 1). A diagnosis of neuroma in the left jugular
foramen was made by one of us (GDC), but
at operation an acoustic neuroma in the usual
location was found. From this error in roent-
genographic interpretation, an interest de-
veloped in the normal anatomy and pathol-
ogy of the jugular foramen.

Anatomical Considerations

The jugular foramen (foramen lacerum
posterius) actually is a canal that courses
anteriorly, inferiorly and laterally from an
endocranial to an exocranial opening (Fig. 2),
both of which have distinct anatomic con-
fugurations (Fig. 3).2,4,36,55 The foramen is
subdivided into a “pars nervosa” and “pars
vascularis” by a fibrous or bony septum join-
ing the jugular spine of the petrous and jugu-
lar process of the occipital bone.29 It is tra-
versed by the glossopharyngeal (IX), vagus
(X), and spinal accessory (XI) nerves, the
inferior petrosal sinus, the posterior menin-
geal artery and the jugular vein (Fig. 4),36,39
and is in close proximity to the brain stem,
cerebellum, tympanic cavity and other sig-
nificant nervous and vascular structures
(Fig. 5).

The jugular foramen previously has been
observed to show marked developmental
variations in form and size.5,10,64,65 To better
define these normal variations, a study of
129 dry skulls was undertaken. No analysis
of the shapes of the foramina was made ex-
cept to note the occurrence of a bony septum
between the occipital and petrous bones uni-
laterally in 17 (13.2 per cent) and bilaterally
in 6 (4.7 per cent) of the skulls (Fig. 6). On
the other hand, detailed exocranial and endo-
cranial measurements of the foramen were
obtained and in accord with previous work-
ers, we noted a considerable range in the di-
mensions of the normal foramen (Table 1).
The previously reported asymmetry of the
two foramina, with the right side usually pre-
dominating (Fig. 7), was also confirmed
(Table 2). Using the sum of the width of the
pars nervosa, the width of the pars vascu-
laris, and the total length of the foramen as
an index of over-all size of the foramen (Fig.
8), we found that the two sides may differ by
1–18 mm. with 95 per cent of the cases hav-
ing an asymmetry less than 12 mm. This
asymmetry generally has been attributed to
differences in the size of the lateral si-
nuses.53,71 Our measurements of the pars
nervosa (Table 3) support this conclusion
by indicating that differences in size of the
foramina on either side are attributable
mainly to the pars vascularis.

Roentgenological Considerations

A large number of special projections have
been suggested, especially in the French and
Italian literature, for the detailed study of
the jugular foramen. These may be classified
broadly as oblique unilateral and symmetri-
cal bilateral, both of which may be combined
with tomography (Table 4). Because of the
double obliquity of the jugular “canal,” the
superior method for its demonstration is the
oblique unilateral with tomography, in
which the head is inclined or the tube is tilted
to permit the central ray to coincide with the
main axis of the canal. Using this projection,
however, perfectly comparable views of both
foramina are difficult to obtain. In our experi-
ence, symmetrical bilateral projections com-
bined with tomography represent a useful
compromise. The patient may be positioned erect, prone, or supine, the essential factor being the extension of the neck (about 45°). Three tomograms—one cutting through the external acoustic meatus and two behind it, separated 0.5 cm. from each other—generally

![Image of normal internal acoustic meatuses and asymmetrical jugular foramina](image)

**Fig. 1.** Normal internal acoustic meatuses (A) and asymmetrical jugular foramina (B) in patient with left acoustic neuroma.

### TABLE 1

<table>
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<tr>
<th>Author</th>
<th>No. of Cases</th>
<th>Right</th>
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<tr>
<td></td>
<td></td>
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<td>Width (mm.)</td>
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<tr>
<td></td>
<td></td>
<td>Average</td>
<td>Range</td>
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<tr>
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<td>100</td>
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<td>Aubaniac 1951</td>
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<td>Endocranial</td>
<td>71</td>
<td>14.5</td>
<td>7-20</td>
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* Presumably exocranial measurements.
† Measurements of the pars vascularis only.