TECHNICAL NOTE

The Jugular Dural Fold—A Helpful Skull Base Landmark to the Cranial Nerves

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Abstract—During a retrosigmoid (or combined retrolabyrinthine-retrosigmoid) approach to the posterior fossa for vestibular neurectomy or removal of small acoustic neuromas, a white dural fold is a consistent landmark to cranial nerves VII through XII.[1] This fold of dura appears as a white linear structure extending from the foramen magnum across the sigmoid sinus, attaching to the posterior aspect of the temporal bone, anterior to the vestibular aqueduct. The name "jugular dural fold" is suggested for this landmark. The jugular dural fold overlies the junction of the sigmoid sinus and the jugular foramen. As measured in formalin-fixed cadaver heads, the overall length of the jugular dural fold is 20.8 mm (± 2.9 mm). The cochleovestibular nerve lies 9.9 mm (± 1.5 mm) anterior to the superior aspect of the jugular dural fold, the glossopharyngeal nerve lies 9.5 mm (± 1.6 mm) anterior to the midpoint of the jugular dural fold, and the operculum of the vestibular aqueduct lies 6.6 mm (± 0.7 mm) posterior to the jugular dural fold. Intraoperative measurements in patients undergoing combined retrolabyrinthine-retrosigmoid vestibular neurectomy show an overall length of the jugular dural fold of 16.3 mm (± 1.9 mm). The cochleovestibular nerve lies 8.6 mm (± 1.3 mm) anterior to the superior aspect of the jugular dural fold, the glossopharyngeal nerve lies 8.6 mm (± 1.3 mm) anterior to the midpoint of the jugular dural fold, and the operculum lies 7.5 mm (± 0.8 mm) posterior to the jugular dural fold. The jugular dural fold can be used as a reliable landmark for rapidly locating cranial nerves in the posterior fossa. (*Skull Base Surgery, 5(1):57–61, 1995*)

The anatomy of the posterior fossa can be complex. However, identifying the cranial nerves in the posterior fossa is usually not difficult. The use of certain constant landmarks on the cranial surface of the skull makes accurate localization of the cranial nerves quicker and easier. One such landmark that has been helpful in identifying cranial nerves VII, VIII, IX, X, and XI is a white linear structure overlying the cranial nerves exiting the jugular foramen (Fig. 1). The purpose of this study is to describe the anatomic relationship of this dural fold to the cranial nerves and to present the surgical significance of this structure. We propose using the name "jugular dural fold" (JDF) for this structure.

METHOD

The JDF was studied in 14 whole-head cadaver specimens. The cadaver head was placed in the standard surgical position with the head turned away from the surgeon and a combined retrolabyrinthine-retrosigmoid approach was performed entering the posterior fossa behind the sigmoid sinus.[1] The lateral portion of the cerebellum was excised to provide wide exposure of the JDF and cranial nerves V, VII, VIII, IX, X, and XI. Measurements were taken from the superior aspect of the JDF to the operculum of the vestibular aqueduct and to the cochleovestibular

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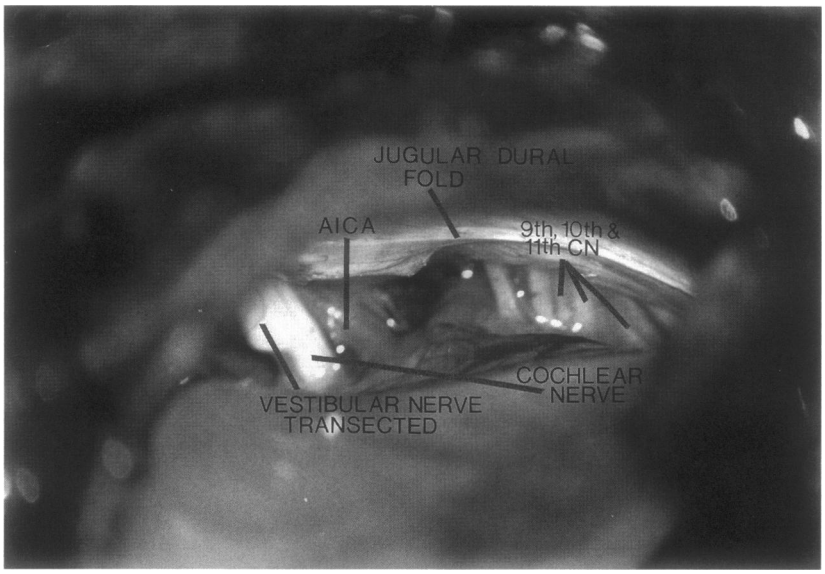

Figure 1. Photograph of right combined retrolabyrinthine-retrosigmoid vestibular neurectomy showing the transected vestibular nerve, jugular dural fold, and cranial nerves IX, X, and XI.

nerve, and from the midpoint of the JDF to the glossopharyngeal nerve. The length of the JDF was measured and then the fold was excised to determine the relationship to the underlying structures.

The JDF was also studied in 10 patients undergoing combined retrolabyrinthine-retrosigmoid vestibular neurectomy. After the posterior fossa dura and arachnoid were opened, cerebrospinal fluid was aspirated from the cerebellopontine cistern. This allowed the cerebellum to fall away from the surgical field providing excellent visualization of the posterior fossa. In a manner similar to that described above, measurements were made of the JDF and its relationship to the cochleovestibular nerve, the glossopharyngeal nerve, and the operculum of the vestibular aqueduct at the anterior border of the endolymphatic sac.

RESULTS

Cadaver Whole-Head Dissections (Formalin Fixed)

The average length of the JDF is 20.8 mm (± 2.9 mm) (Table 1). The JDF arises from the lateral aspect of the foramen magnum and extends superiorly over the jugular foramen to attach like a fan over the temporal bone 6.6 mm (± 0.7 mm) posterior and medial to the operculum of the vestibular aqueduct (Figs. 2–4). The dural fold ascends the cranial surface intersecting the junction between the sigmoid sinus and the jugular bulb. The JDF sometimes projects several millimeters away from the temporal bone (seen as a prominent white line near fold) as it overlies cranial nerves IX, X, and XI exiting the jugular foramen. It may appear flat, blending into the sigmoid sinus and temporal bone. The inferior edge of the endolymphatic sac blends into the superior aspect of the fold where it attaches to the temporal bone. The cochleovestibular nerve can be found traversing the posterior fossa 9.9 mm (± 1.5 mm) anterior and cephalad to the superior limit of the JDF. The glossopharyngeal nerve exits the jugular foramen 9.5 mm (± 1.6 mm) anterior and caudal to the midpoint of the JDF. The vagus and spinal accessory nerves lie together several millimeters posterior to the exit of the glossopharyngeal nerve. The endolymphatic duct is 7.5 mm (± 0.8 mm) anterior and lateral to the superior limit of the JDF.

Table 1. Anatomic Measurements of the Jugular Dural Fold (JDF) in 14 Cadaver Specimens (in mm)

	Mean	*Standard Deviation*
Length of JDF	20.8	2.9
Superior limit of JDF to cranial nerve VIII	9.9	1.5
JDF to cranial nerve IX	9.5	1.6
Operculum to JDF	6.6	0.7

Surgical Findings

The average length of the JDF is 16.3 mm (± 1.9 mm) (Table 2). The endolymphatic duct lies 7.5 mm (± 0.8 mm) anterior and lateral to the superior limit of the JDF. The cochleovestibular nerve lies 8.6 mm (± 1.3 mm) anterior and cephalad to the superior aspect of the JDF and the glossopharyngeal nerve lies 8.6 mm (± 1.3 mm) anterior and caudal to the midpoint of the JDF.

DISCUSSION

The dural fold has been described by Rhoton and Buza as the dural roof or lip over the glossopharyngeal meatus.[2] They found that the

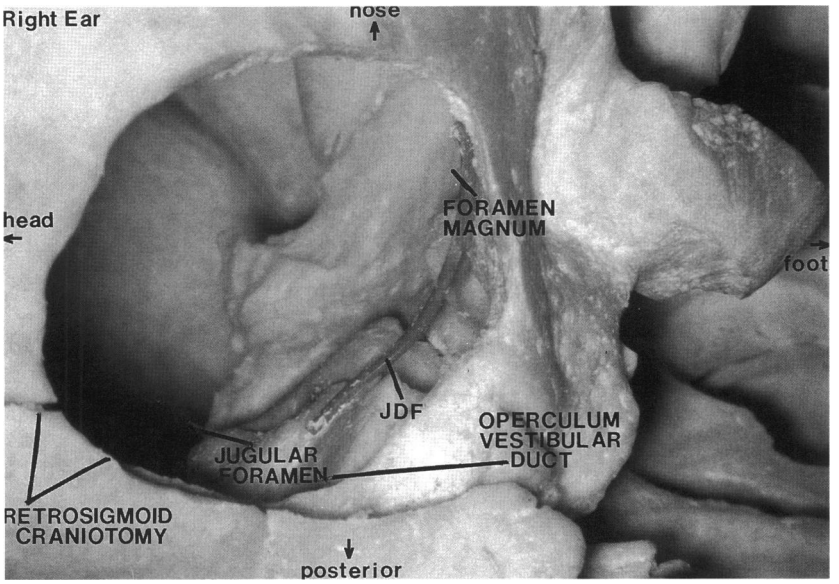

Figure 2. Photograph of a dry skull dissection showing the course of the jugular dural fold (JDF) through a retrosigmoid craniotomy.

dura over the jugular foramen had two characteristic perforations forming a glossopharyngeal meatus through which the ninth cranial nerve passed to enter the pars nervosa, and a vagal meatus through which the vagus and spinal accessory nerves entered the anteromedial part of the pars venosa and jugular bulb. The glossopharyngeal and vagal meatus were constantly separated by a dural septum. The anterior and lateral margins of the glossopharyngeal and vagal meatus frequently formed a roof or lip that projected posteromedially over the respective dural exits of the nerves. This lip projected over the glossopharyngeal meatus in 49 of 50 specimens and was comparable to but smaller than the posterior lip of the acoustic meatus. It was either predominantly bony or fibrous and projected a maximum of 2.5 mm over the margin of the meatus.

Lang described the JDF as the "Plica Occipitalis Obliqua."[3] In two thirds of his dissections, Lang found that the dural folds were running from the posterior part of the foramen magnum forward and laterally in the direction of the jugular foramen.

We suggest naming this dural fold the jugular dural fold rather than the "dural roof or lip over the glossopharyngeal nerve" or "Plica Occipitalis Obliqua". The term *jugular dural fold* describes the surgical anatomy and is easy to remember.

The JDF as a landmark in the posterior fossa is useful in the following manner. After the dura is opened over the cerebellum, a flat Penrose drain is placed over the cerebellum for protection. The cerebellum is then gently retracted to expose the posterior portion of the temporal bone and arachnoid over the cerebellopontine angle. When approaching the posterior fossa from behind the sigmoid sinus, the surgeon usually sees the jugular dural

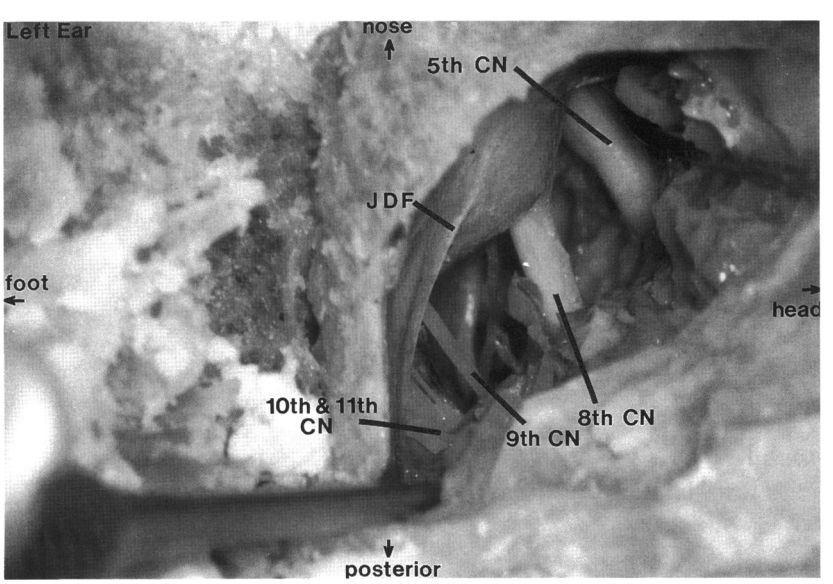

Figure 3. Cadaver specimen showing the anatomy of the left posterior fossa. JDF = jugular dural fold, CN = cranial nerve.

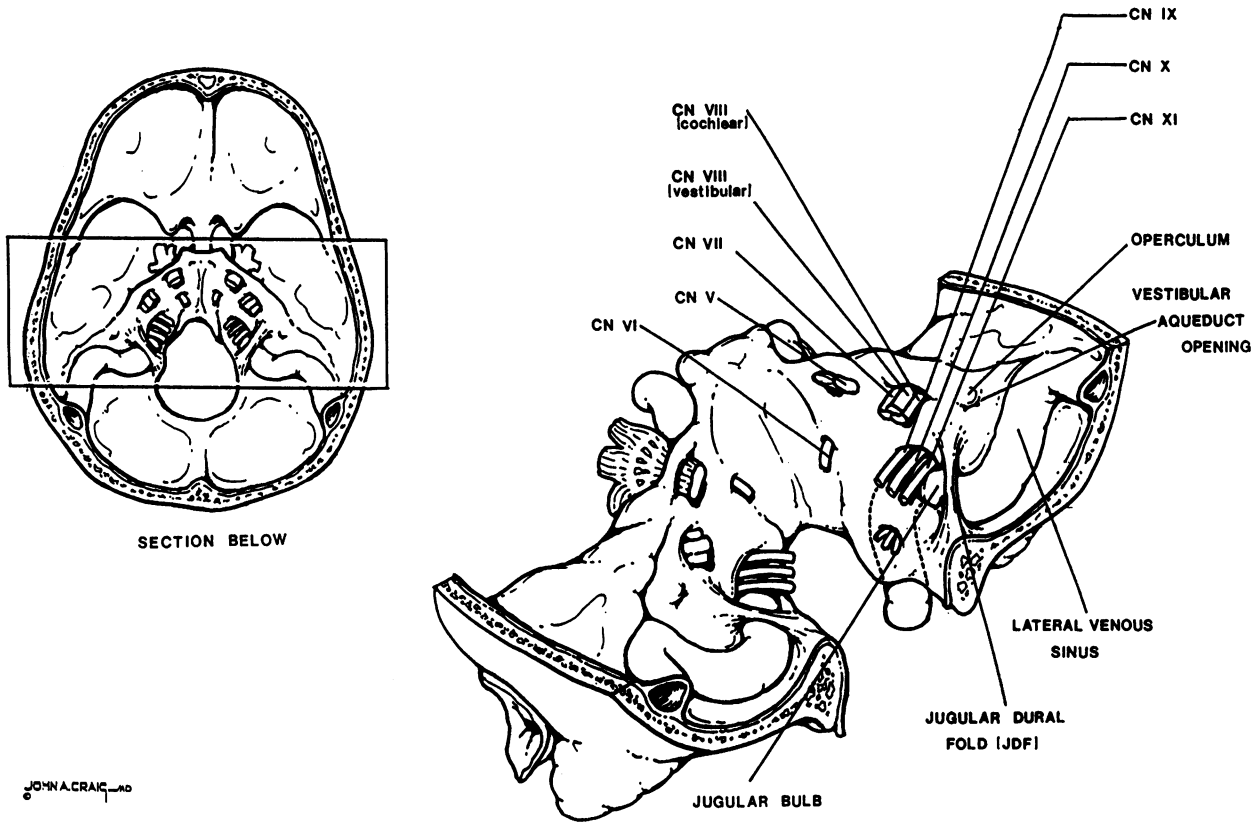

Figure 4. Artist's drawing of the skull showing the jugular dural fold (JDF) and the cranial nerves.

fold as the first constant landmark. From the retrolabyrinthine approach (anterior to the sigmoid sinus), the fold may not be seen well. This is because the microscope light must illuminate the JDF at an oblique angle for the dural fold to appear as a white linear structure (Fig. 5). The arachnoid is opened deep to the JDF along the edge of the glossopharyngeal nerve. This allows release of the cerebrospinal fluid and also allows the cerebellum to fall away giving a wide exposure of the posterior fossa. About 1 cm anterior to the superior extent of the dural fold lies the cochleovestibular nerve. The JDF in the posterior fossa is a constant and reliable landmark to cranial nerves VII, VIII, IX, X, and XI.

Finding that the JDF overlies the junction of the sigmoid sinus and the jugular bulb helps orient the surgeon to the anatomy of the jugular foramen. Location of the operculum and vestibular aqueduct is made easier by looking approximately 7 mm anterior and lateral to the superior limit of the JDF.

Finding the JDF was helpful in teaching students the surgical anatomy of the posterior fossa. It was also a helpful landmark in the following difficult surgical situations: locating the cranial nerves when a large tumor obstructed visualization of the cranial nerves, finding the cranial nerves covered by a thick arachnoid layer, and in a case where the temporal bone had been fractured and rotated during forceps delivery.

Although the JDF is recognized and seen by all experienced surgeons working in this area, the description of this structure and its relationship to surrounding structures adds a landmark for locating the anatomy in the posterior fossa.

Table 2. Anatomic Measurements of the Jugular Dural Fold (JDF) in 10 Patients Undergoing Combined Retrolabyrinthine-Retrosigmoid Vestibular Neurectomy (in mm)

	Mean	*Standard Deviation*
Length of JDF	16.3	1.9
Superior limit of JDF to cranial nerve VIII	8.6	1.3
JDF to cranial nerve IX	8.6	1.3
Operculum to JDF	7.5	0.8

SUMMARY

The JDF is a consistent, reliable anatomic landmark visible during a retrosigmoid (or combined retrolabyrinthine-retrosigmoid) approach to the posterior fossa that can assist the surgeon in rapidly locating cranial nerves VII, VIII, IX, X, and XI.

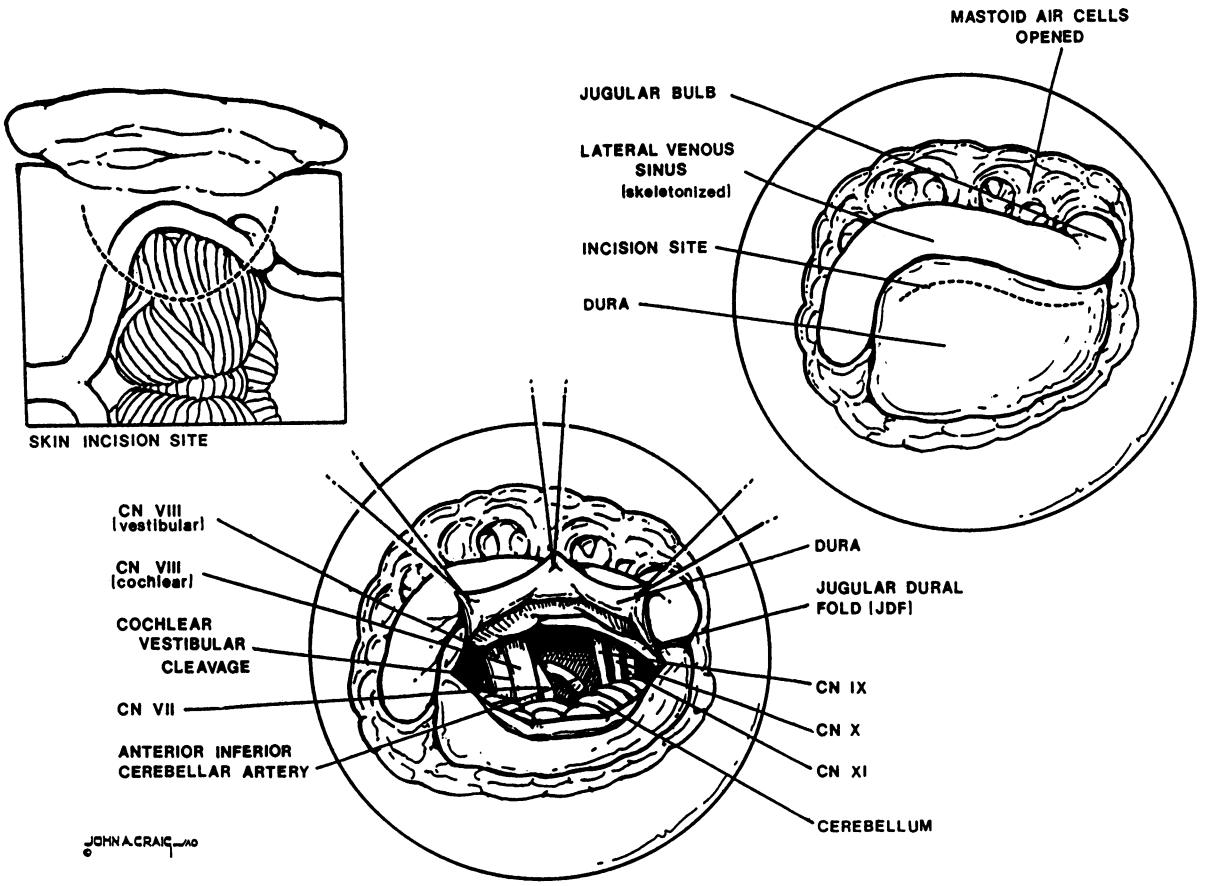

Figure 5. Artist's drawing of a right combined retrolabyrinthine-retrosigmoid vestibular neurectomy showing the anatomy of the posterior fossa.

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