DIAGNOSTIC VALUE OF THE PRECENTRAL CEREBELLAR VEIN IN CASES OF THE POSTERIOR FOSSA TUMORS

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INTRODUCTION

Vertebral angiography is generally considered to be of little diagnostic value in the localization of the posterior fossa tumors except for the tumors showing abnormal vasculatures, because of its several weak points as followed:

(1) The branches of the vertebral and basilar arteries in the posterior fossa have numerous variations and lack constancy in their course.

(2) Since the bilateral branches of the basilar artery are visualized simultaneously on the lateral view, the discrimination of every branches in rather difficult on films.

(3) The shadows of the pyramids of the temporal bone overlapped upon the vascular branches obscure the individual course of the vessels.1,5,7

Accordingly, the pneumography was mainly used to decide the localization of the posterior fossa tumor. Recently, Huang et al (1964) described in detail the normal configuration of the veins of the posterior fossa, especially the precentral cerebellar vein. He pointed out the changes in the precentral cerebellar vein which could be overlooked in tentorial notch meningoma and chordoma. The constancy of the course of this vein and its location which lay in the fissure between the brain stem and the cerebellum encouraged us to perform this study.

ANATOMICAL DESCRIPTION OF THE PRECENTRAL CEREBELLAR VEIN

A pair of small veins (brachial veins), beginning over brachium pontis, runs medially over brachium conjunctivum and lingula to midline. These veins
meet in the fissure between the lingula and the central lobule of the cerebellum, from where a single midline trunk runs upward and forward behind the anterior medullary velum of the 4th ventricle. This is the precentral cerebellar vein. In a typical case, the precentral cerebellar vein is a single unpaired vessel in the midline. The vein continues backward and upward below the inferior colliculi and runs in front of the anterior aspect of superior vermis (culmen) with a gentle convexity anteriorly. Further, the vein follows this upward course in a slight curvature convex posteriorly within the cisterna ambiens. It joins the posterior end of the great vein of Galen at its junction with straight sinus (Fig. 1). This junction can be the great vein of Galen or the internal cerebral vein.

According to the anatomical investigation by Umezawa, in 18 cases (72%) out of 25 the precentral cerebellar vein formed one trunk; in 3 cases (12%) the precentral cerebellar veins were shown as completely independent vessels running a short distance from the midline and entering the internal cerebral vein of each side; and in 4 cases (16%) no vein existed.

In retrograde brachial angiography, this vein is generally demonstrated slightly earlier than the deep cerebral vein, being visible in 3–4 seconds after the injection of contrast media. The ratio of projectivity of this vein is 72% in our statistics. The projectivity, however, can be increased further by rapid serial angiography with 2 films per second.

In antero-posterior view, the precentral cerebellar vein is usually obscured by the overlying the great vein of Galen, the straight sinus, the medial inferior cerebellar vein or the bone shadows. However, by a half-axial projection method, this vein is demonstrated in high degree (Fig. 2(a)). In the lateral projection it is sometimes difficult to discriminate the precentral cerebellar vein from the veins of the cerebellar cortex or the tributaries pouring into the superior vermian vein. However, since this vein has a characteristics of, as stated above, showing a smooth convexity anteriorly followed by a gentle posterior convexity and running upward and backward into the posterior end of the great vein of Galen, it is not difficult to identify this vein from other veins by some experience (Fig. 2(b)).

THE DISTANCE BETWEEN THE COLLICULO-CENTRAL POINT AND THE CLIVUS

Huang et al called the obtuse angle of the precentral cerebellar vein in the posterior portion of the inferior colliculi as the colliculo-central point (C-C point). He measured the minimal distance from the most convex point forward to the
Fig. 3 Diagrammatic representation of the veins of the posterior fossa. We calibrated the minimal distance from the most convex point anteriorly of the precentral cerebellar vein (PcV) to the posterior aspect of the clivus (C). Other labeled veins are: the internal cerebral vein (ICV), the basal vein of Rosenthal (BV), the straight sinus (STS) and the transverse sinus (TS).

Fig. 4 Measurements of the minimal distance from the c-c.p. to the posterior aspect of the clivus in 40 normal cases.

posterior aspect of the clivus, which averaged 39 mm with a range of 36 mm to 43 mm, in 40 normal adults. We also calibrated the distance in 40 normal cases (Fig. 3). As shown in Fig. 4, the measured values for the cases of 3 to 65 years of age were between 31 to 43 mm with a mean of 38 mm. It shows lower value in children, considering the size of their cranium. The distance between the film and the focus is always set up 90 cm.

EVALUATION OF THE CASES

Fifty-four cases were evaluated, which were confirmed the posterior fossa tumors by means of the operation or autopsy in the past 3 years in our institute. They are consisted of 17 cases of the cerebellar hemisphere tumors, 10 cases of the 4th intraventricular or the invading tumors from the medio-inferior portion cerebellum, 10 cases of the pontine tumors and 17 cases of the cerebello-pontine angle tumors, as shown in Table 1. The serial vertebral angiography was performed in 44 out of 54 cases. The precentral cerebellar vein was visualized in 32 cases (72%).

Group of the tumors of cerebellar hemisphere: As listed in Fig. 5(a), the measured values averaged 29 mm with a range of 23 mm to 33 mm, which in-
Table 1
Posterior fossa space occupying lesions evaluated in this series

<table>
<thead>
<tr>
<th>Posterior fossa tumor</th>
<th>No. of cases</th>
<th>Serial vertebral angiography</th>
<th>cases calibrated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cerebellar hemisphere tumor</td>
<td>17</td>
<td>15</td>
<td>10</td>
</tr>
<tr>
<td>4th intraventricular tumor or the invading tumor from the medioinferior part of the cerebellum</td>
<td>10</td>
<td>10</td>
<td>8</td>
</tr>
<tr>
<td>Pontine tumor</td>
<td>10</td>
<td>9</td>
<td>8</td>
</tr>
<tr>
<td>Cerebellopontine angle tumor</td>
<td>17</td>
<td>10</td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
<td>54</td>
<td>44</td>
<td>32</td>
</tr>
</tbody>
</table>

![Graph of Cerebellar hemisphere tumor](image1)

**Cerebellar hemisphere tumor**
Fig. 5 (a)

![Graph of 4th intraventricular tumor](image2)

**4th intraventricular tumor or the invading tumor from the medioinferior part of the cerebellum**
Fig. 5 (b)

![Graph of Pontine tumor](image3)

**Pontine tumor**
Fig. 5 (c)

![Graph of Cerebellopontine angle tumor](image4)

**Cerebellopontine angle tumor**
Fig. 5 (d)

Fig. 5 (a–d). Measured values of c-c.p.–clivus distance in the posterior fossa tumors.
dicates an obvious deviation forward. The normal convexity of the precentral cerebellar vein is usually intensified anteriorly and superiorly (Fig. 6).

**Group of the 4th intraventricular or the invading tumors from the medio-inferior part of the cerebellum:** The vein deviates evidently backward and the distance averaged 48 mm with a range of 38 mm to 56 mm as shown in Fig. 5 (b). The vein is compressed upward and backward, showing an undulated form (Fig. 7(a) and (b)). However, in the tumors of the medio-inferior parts of the cerebellum such as the inferior vermis and the tonsil, the ones growing posteriorly before blocking the 4th ventricle displace the precentral cerebellar vein forward.

**Group of the pontine tumors:** A posterior displacement of the vein is noted in this group. The values averaged 42 mm with a range of 37 to 45 mm (Fig. 5(c)). The reason of the trivial deviation posteriorly is thought to be that the calibration was mainly performed in younger group. In the cases of pontine tumors without compressing the aqueduct and the 4th ventricle posteriorly, the precentral cerebellar vein remains in the normal position (Figs. 8(a) and (b)).

**Group of the cerebello-pontine angle tumors:** Few cases in this group show the marked displacement of the precentral cerebellar vein. An average is 40 mm with a range of 35 to 45 mm as shown in Fig. 5(d). This reason is due to the fact that the enlargement of the aqueduct and the 4th ventricle is minimal so far as the tumor is small.

**Group of the other tumors:** In the tumors of pineal body invading posteriorly downward, a gentle posterior convexity in the posterior part of the precentral cerebellar vein is intensified downward in a convexity, and then C-C point is displaced downward and backward.

**DISCUSSION**

The vein initially reported roentgenologically as the medial superior cerebellar vein by Johanson⁴ in 1954 was named as the precentral cerebellar vein by Huang et al in 1964. They examined its normal configuration in detail by means of cerebral angiography and the deviation and the significance of this vein were discussed concerning the two cases of chordoma and tentorial notch meningioma. In addition, he reported three abnormal cases in 1965.²

The vein locates in the midline between the brain stem and the cerebellum. It runs anteriorly upward behind the anterior medullary velum of the 4th ventricle. Therefore, it may be said that its course indicates the shape of the superior part of the 4th ventricle, especially its posterior portion. Accordingly, the con-
figuration of this vein shows the size, shape and displacement of the 4th ventricle. This fact can be proved by comparing the configuration and displacement of this vein in angiography with the 4th ventricle or the aqueduct in ventriculography, with lateral projection films in the posterior fossa tumors (Fig. 7(a), (b) and Fig. 8(b), (c)).

As stated above, the diagnosis of the posterior fossa tumor by means of cerebral angiography is considered to be extremely difficult. We reevaluated the angiographical method by observing in detail the course of the superior, anterior inferior and posterior inferior cerebellar arteries by vertebral angiography. The precentral cerebellar vein is located, in the region of a blind spot in the usual arterial phases, in the precentral fissure, and it has become possible to elucidate the state of the midbrain, the aqueduct, the upper half of the 4th ventricle and the superior vermis by analysing this vein. In conclusion, evaluating the arteries, precentral cerebellar vein and medial inferior cerebellar vein in the posterior fossa tumors, the diagnostic value of vertebral angiography is highly appreciated and recommended.

SUMMARY

1) The precentral cerebellar vein begins between the lingula and the central lobe and runs upwards behind the anterior medullary velum in midline.
2) The normal course and configuration of this vein was described. The minimal distance from this vein to the posterior aspect of the clivus averaged 38 mm with a range of 31 to 43 mm as measured in 40 normal cases.
3) The deformities and displacement of this vein indicate the changes in the aqueduct and the upper part of the fourth ventricle caused by tumors of mesencephalon, pons and cerebellum.
4) Diagnostic value of this vein is highly evaluated in the vertebral angiography by the authors.

REFERENCES

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Fig. 1. Anatomical representation of structures in midline sagittal section. The precentral cerebellar vein (unlabeled arrows), which is a single unpaired vessel in the midline, begins in the fissure between the lingula (L) and the central lobule (CeL) of the cerebellum. This vein runs upward and forward behind the anterior medullary velum, and then it turns backward below the inferior colliculi (IC) and continues in front of the anterior aspect of the superior vermis. The Vein joins the posterior end of the great vein of Galen (G) at its juncture with the straight sinus (SS). Other labeled structures are: pons (P), aqueduct (Aq) and internal cerebral vein (ICV).

Fig. 2. Normal precentral cerebellar vein. (a) Venous phase of vertebral angiography, antero-posterior half-axial view. The two tributaries of brachial veins (lower thin arrows) run medially and upward for a short distance before they fuse to form a single unpaired trunk, the precentral cerebellar vein (upper thick arrow, left), which follows upward in the midline. The terminal portion of the vein is obscured by the great vein of Galen and the straight sinus. Right thick arrow indicates the medial inferior cerebellar vein.

Fig. 2. (b) Lateral view. The most anterior portion (anterior arrow of the precentral cerebellar vein (posterior arrows) corresponds to the colliculo-central point. The vein runs upward in front of the cerebellum and then in the cisterna ambiens to enter the posterior end of the great vein of Galen.
Fig. 6. Meningioma in the cerebellar hemisphere. 37-year-old, male. Vertebral angiography, venous phase, lateral view. The precentral vein (arrows) is displaced markedly forward and upward. The c-c.p.—clivus distance is 23 mm.

Fig. 7. Medulloblastoma. 16 year-old, female. (a) Ventriculography, lateral projection. Inferior two arrows indicate the shadow of the 4th intraventricular tumor (T) invading from the medio-inferior portion of the cerebellum. The dilated aqueduct (superior arrow) shows a undulated form. The 4th ventricle is also dilated and the anterior medullary velum (posterior arrow) is dislocated upward posteriorly.

Fig. 7. (b) Vertebral angiography, venous phase, lateral view. An undulated form of the precentral cerebellar vein (arrows) corresponds to the aqueduct in ventriculography. The minimal distance from the c-c.p. to the clivus is 44 mm.
Fig. 8. Pontine glioma. (a) 8 year-old, male. Vertebral angiography, venous phase, lateral projection. The precentral vein (arrow) is displaced markedly backward and runs vertically. The c-c.p. − clivus distance is 45 mm.

Fig. 8. (b) 39 year-old, male. Vertebral angiography, lateral venous phase. The precentral cerebellar vein remains in normal position. This is a case without compressing the aqueduct and the 4th ventricle posteriorly.

Fig. 8. (c) Ventriculography, lateral view in (b) case. The precentral cerebellar vein corresponds the configuration of anterior medullary velum of the 4th ventricle (inferior arrow) and the aqueduct (superior arrow).