The occipital sinus

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Fresh dural preparations and dried occipital bones from 200 adult cadavers were examined to define the characteristics of the occipital sinus. The occipital sinus was found to be present in 64.5% cases. Different morphological types are classified into the following: median occipital sinus (35%), double occipital sinus (22.5%), left occipital sinus (4%), and right occipital sinus (3%). Communications with the confluence, superior sagittal, straight, transverse, and sigmoid sinuses are described. The normal findings and some notable anomalies are discussed in the light of the available literature.

The present study seeks its justification in the contradictory and inadequate description of the occipital sinus given in the anatomical texts in common usage. Confusion still prevails despite some valuable contributions. Hollinshead sums up the surgical importance of the occipital sinus in the following words: “The occipital sinus varies markedly in its size, however, and may also have an aberrant course, and is always therefore a potential source of difficulty in the posterior approaches to the posterior cranial fossa.” Streeter described three dural plexuses, anterior, middle, and posterior, draining into the primary head vein. The posterior dural plexus, with some minor alterations in its pattern, simply extends to become the occipital sinus of the adult and at the same time with its fellow, develops channels that empty into the plexus of the tentorium. These findings have been confirmed by Woodhall and Padget.

Various authors have studied the dural venous sinuses by making casts of the bone, by careful dissection of the dura mater with or without the injection of India ink, by x-ray and naked-eye examination of the dura mater, and by naked-eye examination of the bones and dura.

Material and Methods

The present study is based on the naked-eye examination of the occipital bones and the dura mater of the posterior cranial fossa in 200 adult cadavers. In 50 postmortem specimens, methylene blue was injected into the confluence of the sinuses to visualize the extent and communications of the occipital sinuses.

Observations

Incidence of Different Types of Occipital Sinus

A clearly visualized occipital sinus in the dural preparations or one that left its impression in the dried occipital bones was found in 129 out of 200 cases (64.5%).

There were five main morphological types:

1. A single occipital sinus was found in the midline of the posterior cranial fossa in 35% of the cadavers (Fig. 1). In 18% of these the median sinus divided into two channels skirting the posterior
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margin of the foramen magnum (Fig. 2).

2. Double occipital sinuses were observed in 22.5% of the cadavers (Figs. 3, 5, and 6).

3. Single left-sided occipital sinuses were detected in 4% (Fig. 4).

4. Single right-sided sinuses were present in 3%.

5. No occipital sinus was discernible in 35.5%.

Size

The length and breadth of the sinuses showed gross variation. The maximum length was 70 mm, the minimum 15 mm. The average length of more than 50% of the occipital sinuses was 35 mm. Similarly, the breadth was also very variable, not only in different specimens, but also in different parts of the same occipital sinus. It was usually widest near the confluence of sinuses and gradually tapered down toward the foramen magnum. The maximum breadth was as much as 19 mm in one case whereas the minimum was 1 mm. In more than 50% of the specimens the breadth was 2 mm.

Connection with the Sinuses

The occipital sinus communicated with the confluence of the sinuses in all cases, with the right transverse sinus in 10%, the left transverse sinus in 8%, the superior sagittal sinus in 8%, the straight sinus in 6%, the right sigmoid sinus in 6%, and the left sigmoid sinus in 3% of the cadavers examined.

Anomalies

In one specimen the superior sagittal sinus divided into two channels at the internal occipital protuberance; these sinuses were found to be continuous with the occipital sinuses. In two instances the superior sagittal sinus ended at the torcular Herophili, becoming continuous with the right transverse and occipital sinuses; the left transverse sinus was absent. A vertical groove replaced the internal occipital crest in four specimens (Fig. 1).

Discussion

Relation Between the Skull Markings and Dissected Dural Preparations

Our observations from dissected dural preparations and dried occipital bones are substantially in agreement with those of Woodhall and Seeds, who in a study of 100 good routine roentgenograms of the occipital region were able to interpret the condition of the lateral sinuses with sufficient accuracy for clinical purposes. They found about the same percentage of types of variation as we found in our study of specimens by dissection.

There appears to be a marked variation in the incidence of the occipital sinus as reported in the literature and observed in our present investigation. While Knott detected its presence in 42 out of his 44 cases, Browning observed: "Judging by their capacity they usually had no significance in the venous drainage; in some systems they were absent." Padget and Hollinshead believed that the occipital sinus is usually present "but small." During our study its presence was noted in 129 of 200 cases (64.5%).

Whereas Browning remarked that the occipital sinuses were sometimes paired, Davies maintained that two may be present. Only Knott appears to have given the numerical incidence. He found nine bilateral sinuses in 44 cases he examined (20.5%). In our study, double occipital sinuses were detected in 45 out of 200 cadavers (22.5%).

Knott also reported 33 instances of a single occipital sinus out of 44 specimens studied (75%); he gave no separate description of median, right-sided, or left-sided occipital sinuses. We observed a single occipital sinus in 84 of 200 (42%).

Size

Gibbs and Gibbs measured cross sections of the sinuses and found them to be extremely variable. Their average figure for the occipital sinus was 7 sq mm. Although we could not work out actual cross-sectional areas, there was marked variation in the length and diameter of the occipital sinus. These findings lend support to the opinion held by most other investigators.

Connections of the occipital sinus with the
The occipital sinus

Fig. 1. Four occipital bones each with a broad median (arrows) for the occipital sinus replacing the internal occipital crest.

Fig. 2. Four occipital bones each with a complete or partial bilateral groove (arrows) for double sinuses. The lower ends of the grooves are extending up to the respective jugular notches.

Fig. 3. Four occipital bones with complete bilateral grooves for double occipital sinuses.

Fig. 4. Three occipital bones with grooves for a right-sided occipital sinus.
internal vertebral plexus, confluence of
sinuses, and the sigmoid sinuses are well
known. Knott\textsuperscript{a} noted an important commu-
nication with the straight sinus in three out
of 44 cases, we found this communication in
6\% of the cases. Continuation of the su-
erior sagittal sinus directly into the occipital
sinus was found in 4\% of our specimens.
Hollinshead\textsuperscript{a} put great emphasis on the oc-
currence of the deviated occipital sinus and
warned that it may offer a definite hazard in
approaches to the posterior cranial fossa.
Anomalies in the formation, course, and
termination of the sinuses have been noted,
particularly in view of their established util-
ity to neurosurgeons in approaches to the
posterior cranial fossa. In two of our cadav-
ers where the superior sagittal sinus con-
tinued into the right transverse and occipital si-
nuses, the left transverse sinus was absent.
This supports the observations of Hollins-
head\textsuperscript{a} that sometimes a large occipital sinus
may even replace one of the lateral sinuses.

Conclusions
We found an occipital sinus in 64.5\% of
the cadavers examined. Judging from its ob-
vious surgical importance, we feel it deserves
a broader coverage in the textbooks of anat-
omy. Bilateral occipital sinuses occurred in
22.5\%, and median occipital sinuses were
quite frequently larger than the transverse si-
nus. In some one of the specimens examined,
the occipital sinus communicated with all the
sinuses situated in the posterior cranial fossa.

Acknowledgment
The authors are indebted to Dr. Dhanraj
Singh for his invaluable help in photography.

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Received for publication January 7, 1970.
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