Transverse Anastomoses of the Veins at the Base of the Brain

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Summary. Venous anastomoses at the base of the brain are represented by the anterior and posterior communicating veins. The anterior communicating vein anastomoses with the anterior cerebral veins. The posterior communicating veins join the basal veins through the interpenduncular veins. The functional value of these venous anastomoses is less important than that of the arterial polygon of Willis. This anastomotic function depends on anatomical constancy and on the calibre of these transverse veins. Under certain pathological conditions the variations of intracranial pressure result in contralateral venous drainage through these anterior and posterior anastomotic veins.

Key words: Cerebral veins, Basal veins, Communicating veins, Venous anastomoses.

Anatomical Study

The anterior communicating vein links transversely an anterior cerebral vein with its contralateral homologue. It courses in close contact with the lamina terminalis opposite the roof of the prechiasmatic cistern. According to the anatomical studies made by Poirier [3] and Duvernoy [1], this anterior communicating vein occurs in a little more than half of the time and is unilateral as a general rule. Its diameter is generally smaller than that of the anterior cerebral artery; sometimes the diameters are equal (Fig. 1) The basal segment of the anterior cerebral vein may be absent or atrophic going, no further than the lateral aspect of the chiasm. In such cases the anterior cerebral vein courses in the longitudinal fissure without a transverse connection [3].

However, it can be replaced by two or three venules of slender calibre whose course reveals numerous variations which are most often in relationship with the morphology of one or two anterior cerebral veins, that is, atrophy of the posterior segment of the anterior cerebral vein which joins its contralateral homologue directly via the anterior communicating vein or atrophy of the anterior segment of the anterior cerebral vein which is replaced by several small inferior frontal venules. These veins join the deep sylvian vein forming the origin of the basal vein of Rosenthal [4].

The posterior communicating vein links the lateral mesencephalic and basal veins transversely on one side with their contralateral homologues. This vein courses on the anterior aspect of the cerebral peduncles at the level of the interpeduncular fossa behind the mamillary tubercules. This vein is almost always present. Johannson [2] finds it in 72 to 75% of the cases studied. In a certain number of cases, the pos-
The anterior communicating vein courses on the lateral walls of the posterior perforated space and in such cases it is often hidden by the perforating arteries.

The diameter of the posterior communicating vein is quite different than that of the anterior communicating vein. The functional value of the posterior communicating system depends on the similarity in diameter of the interpeduncular veins, that is, the greater the difference, the lesser the value. Other less important morphological and functional elements join this posterior venous system, namely the premmamillary and retrochiasmatic veins, which drain the venous blood from the floor of the diencephalon. In order to complete this enumeration let us recall the transverse venous communications of the posterior fossa, that is, the transverse network of the pontine veins and the vein of the lateral recess of the 4th ventricle which vein joins the superior perrosal veins.

**Radiographic and Anatomical Comparison**

A study of the venous system is possible after venous dissection and the injection of an opaque solution of 10% jellified barium into the system of the vein of Galen, the basal veins and the anterior cerebral veins. At times the anterior and posterior venous communications are opacified.

The anterior communicating veins are seen in a lateral view to consist of small vascular elements of slender calibre, coursing at the anterior extremity of the basal veins. The anterior cerebral veins contribute to the formation of the origin of the basal veins. Their route passes over the related inferior frontal veins. In a frontal view, the anterior cerebral veins appear as small vascular elements, a few microns in diameter, which are connected to their terminal section by the anterior communicating vein (Fig. 2).

Posterior communicating veins of larger calibre than the anterior communicating veins form the junction between the lateral mesencephalic veins on one side and their homologues on the other through anastomosis with the interpeduncular veins. In a frontal view the course of the posterior communicating vein is characteristic and well opacified. It proceeds above the pontine veins and joins the lateral mesencephalic veins in the pontomesencephalic sulcus. In a lateral view the course of the posterior communicating veins proceeds above the longitudinal veins of the pons and below the basal vein. In this view, however, it appears tangent to the course of the veins and shortened (Fig. 4).

**Normal Phlebography**

The anterior cerebral vein courses in front and within the anterior and middle segment of the basal vein. Two segments are apparent:

a) A vertical segment where the vein leads to the inferior part of the interhemispheric fissure and whose point of reflection is located more or less low, depending on the case.

b) A horizontal segment, which forms an angle between 30° and 45° in a frontal view, corresponds to the course of the anterior cerebral vein on the inferior aspect of the frontal cortex. The horizontal segment joins the proximal segment of the basal vein. In a lateral view the anterior cerebral veins are situated at the level of the anterior extremity of the basal vein and appear as small vessels whose diameter measures a few microns. The course proceeds below the vein of