The Determination of Cerebral Death by Cerebral Angiography

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In view of a sensible reanimation and considering organ transplantations the determination of death is unanimously oriented on the irreversible loss of function of the brain as the decisive criterium. Clinical signs and isoelectric-EEG do not allow the diagnosis of cerebral death with reasonable certainty. According to our experiences this can, however, be verified more reliably by cerebral angiography. As cerebral death is understood as the irreversible functional loss of cortex and brain stem, bilateral carotid – and vertebral angiography are necessary to fulfill this definition.

In comparative investigations with needle puncture, cerebral panangiography and transfemoral selective catheterangiography we found the latter to be the optimal method and carried it out in 23 patients in a total of 45 brain death determinations. It also appears to be advantageous to be able to carry out an angiogram of the donor organs with the same catheter. Before cerebral angiograms are carried out an isoelectric-EEG has to be present. Intracranial circulatory interruption leads to irreversible anoxic damage depending from the time. After the reanimation time of the brain has been exceeded, the irreversible loss of function can be proved by cerebral angiography.

An interruption of contrast medium in the internal carotid artery with normal filling of the external carotid artery prove cerebral death in the carotid angiogram (Fig. 1). In the vertebral angiogram a circulatory arrest in the basilar or vertebral artery suggest loss of cerebral functions (Fig. 2). The stop is typically localised at the siphon level for the internal carotid artery and at the atlanto-occipital level for the vertebral artery. If the circulatory arrest in these vessels occurs in the cervical region organic vascular occlusions have to be considered in the differential diagnosis. Selective angiography of the four leading cerebral arteries clarifies the anatomical and functional situation.

If initial areas of the medial and posterior cerebral artery have a rudimentary filling or the circulation is slowed down exceeding 15 sec not showing a venous phase, the interpretation of the findings for a cerebral death are more critical, as the fact of complete interruption of circulation is not present, although no sufficient circulation for brain function should exist in this extreme slowness of blood flow.

The question is whether in such cases minimal cerebral flow is present in these arteries or whether this phenomenon is produced by the unphysiological increased injection pressure which presses the contrast material into the arteries. The latter appears to be correct as the contrast material can be demonstrated in the arteries over a longer period of time. Furthermore, we were unable to obtain such findings with
Fig. 1. Right carotis angiogram. Stop of the contrast medium on the basis of the skull

Fig. 2. Right vertebralis angiogram: Stop of the contrast medium in the arteria basilaris