

and visualization of the middle cerebral artery in the compression angiograms facilitated the discrimination of the anterior cerebral artery and its branches from the middle cerebral artery and its branches because of the variation of contrast filling.

Subtraction of compression angiograms one from the other resulted in the presentation of flow patterns in one picture and may add to better identification of particular vessels.

#### REFERENCE

Verbiest, H., and Dokkum, Th. A. (1970). Artificial slow flow carotid angiography. Carotid angiography with compression proximal to the site of injection. *J. Neurosurg.*, 32, 180-196.

#### CORRELATION BETWEEN REGIONAL CEREBRAL BLOOD FLOW AND ANATOMICOPATHOLOGICAL DATA

L. SYMON, J. E. REES, and J. MARSHALL (London) stated that current methods of examining regional cerebral blood flow have given valuable information about physiological mechanisms responsible for maintenance and variation of cerebral blood flow in relation to changing arterial blood pressure and  $p\text{CO}_2$ . They described a method of isotope clearance using  $^{133}\text{Xenon}$  with particular stress on accuracy of collimation to study cerebrovascular disease, especially in relation to subarachnoid haemorrhage. The details of collimation were described and the two-compartmental analysis used to obtain five analytical values for each of 16 regional detectors was outlined. Comparisons of abnormal cases with a group of normal cases in which the standard deviation of each variable for each individual area had been worked out produced valuable information which correlated well with circumstances of cerebral infarction seen either at operation or necropsy. Five illustrative cases were described and the potential of the method for the detailed analysis of regional cerebral blood flow in relation to subarachnoid haemorrhage was outlined. It seemed possible that, with increasing experience, the adequacy of perfusion of areas of brain supplied by branches of the major cerebral vessels might be subject to a reasonable assessment.

#### INFLUENCE OF THE CIRCULATION ON THE CSF PRESSURE WAVE

H. PONSSEN and G. C. VAN DEN BOS (Amsterdam) had investigated the influence of the pulsatile phenomena of the circulation on the form of the CSF pressure curve recorded in the cisterna magna in anaesthetized dogs. Common carotid artery flow, central arterial pressure, central venous pressure, and CSF pressure in the cisterna magna were recorded. To illustrate the interaction between the circulation and the CSF a simple model was described. The skull was represented by a rigid cylinder with two compartments. One of these represented the intracranial blood volume, the other the CSF space. They were separated by a piston which simulated the blood vessel walls and the surrounding brain tissue. The CSF space continued into the spinal canal, where it was contained in

the expandable dural sac. The spinal canal was simulated by a rigid cylinder also, but with a small cross-sectional area. The dural sac was considered in association with the peridural veins and because both were situated in the spinal canal, expansion of the former was possible only at the expense of the latter. With an increase of intracranial blood volume, the piston drove CSF into the spinal canal with a higher velocity than that of the piston, due to the difference in cross-sectional area of the cylinders. The CSF pressure in the cisterna magna was the result of the intracranial blood volume, the impedance of the spinal canal for the inflow of CSF during systole, and of the pressure in the peridural veins related to the central venous pressure. In the CSF pressure wave an arterial and a venous component could be recognized.

From the relationship between the acceleration and the deceleration phases of the flow velocity in the carotid artery and prominent points in the CSF curve it was concluded that inertial forces occurring when the CSF was driven into the spinal canal were the cause of the form of the curve at these points. These forces could occur because a small change in volume of the brain caused a larger change of the velocity (= acceleration or deceleration) of the CSF. The a-wave of the central venous pressure curve appeared in the CSF pressure curve as a small peak, just before the arterial peak. Transmission of this peak to the CSF occurred via the peridural veins. The venous CSF pressure peak never disappeared, not even when the CSF pressure was higher than the central venous pressure. The authors concluded that the peridural veins never became totally compressed and that the dural sac was always expandable.

#### MONITORING OF INTRACRANIAL PRESSURE IN NEUROSURGICAL PATIENTS

A. HULME, J. C. CHAWLA, and R. COOPER (Bristol) presented their experiences with continuous monitoring of intracranial pressure (ICP) and described some of its applications in clinical management. Most of the studies had been made with implanted subdural pressure transducers and only a small number of ventricular fluid pressure recordings had been made. Different types of miniature transducers suitable for insertion through a burr hole into the subdural space were described. In many cases additional recordings were made of local cortical blood flow and cortical available oxygen monitored by subdural thermistors and gold electrodes. Data were recorded by means of a modified 16 channel Beckmann EEG machine and also on analogue tape fed into a Link 8 computer.

Recordings for periods between a few hours and several weeks had been investigated by implanted transducers in 75 patients. The largest group consisted of patients with intracranial space occupying lesions, mainly tumours. In conjunction with clinical and other observations these records provided useful information of the patient's progress and the effect of therapeutic measures as they influenced ICP. Examples of such records were shown and the most obvious feature was the large plateau waves which were always pathological and represented a partial breakdown in intracranial compensation, their frequency and amplitude increasing in deteriorating