Symposium I. Hemodynamic Studies

(Chairman) Masahiro Iio, Univ. of Tokyo

Effective Cerebral Blood Flow in A-V Malformation

H. NAGAI

Department of Surgery, University of Nagoya, Nagoya

According to the papers of Schenkin, Evien, and others, gas analysis by the nitrous oxide technique has proved that there is a circulatory increase up to three to four times the normal blood flow in A-V malformation. However, the value of such gas analysis may be subject to criticism. The blood passing the mlaformation, that is, the shunt, loses no N_2O to cerebral tissue; consequently N_2O concentration in the jugular vein may be calculated higher than the real value perfusing in the brain tissue. The difference in arteriovernous N_2O is therefore decreased. Although the resultant decrease in A-V difference is inversely proprotional to the increase of blood flow on calculation, greater value determined by this method does not always mean rise in the effective blood flow which perfused in the brain tissue. Since there is no vascular resistance in A-V malformation, more rapid circulation results in the malformation, and the intracranial blood pool is enlarged without increase in circulation within the brain itself. The relative ischemia thus produced often leads to neural malfunction characterized by epileptic seizures. For the purpose of studying the hemodynamics in A-V malformation, two different methods were employed to determine the cerebral blood flow in ten patients with A-V malformation; one is the krypton 85 clearance method, indicating the effective blood flow perfused in the brain tissue and contributing to the brain metabolism; the other is the RI cerebrogram using ^{131}I Hippurate which reveals the circulation time and the volume of the intracranial blood pool.

The cerebrogram on the side of the lesion showed acute upslope and downslope, and higher baseline activity, indicating a shortening in the circulation time and increase in the intracranial blood volume respectively. On the contrary, the effective blood flow determined by means of the krypton method was markedly decreased. In the beginning of the clearance curve, the typical peak followed by a slower phase of clearance was seen which on calculation showed a low blood flow for cerebral tissue. This initial high peak of clearance might show the flow in the anomaly and be helpful in a quantitation of A-V shunt. In seven cases of ten A-V malformations, the effective blood flow on the side of the lesion decreased in proportion to the size of the anomaly. Removal of the anomaly resulted in disappearance of the initial peak and rise in the effective blood flow.

Relative Shunt Flow in Cerebral Arteriovenous Malformations

K. SANO and M. JIMBO

Department of Neurosurgery, Faculty of Medicine, University of Tokyo, Tokyo

Recent advance in neurosurgical treatment of cerebral arteriovenous malformations requires more information about the abnormal hemodynamics of the shunt flow. Although some information can be obtained by a conventional cerebral angiographic technique, the

potential value of angiography has not been fully exploited in the quantitative measurement of the shunt flow of the arteriovenous malformations. For the purpose of quantitative measurement of the shunt flow of the arteriovenous malformation, a new radioisotopic technique using ^{131}I labeled macroaggregated human serum albumin (MAA) has been developed.

^{131}I-MAA was percutaneously injected into the common carotid artery of the patient with arteriovenous malformation on the affected side. Because of its particle size (20~100 micron), some amounts of ^{131}I-MAA can not pass through the capillary vessels and will lodge in the hemisphere while others transit the arteriovenous anastomosis and will lodge in the capillary vessels of the lungs finally.

After the carotid injection radioactivity of the skull and lungs was measured with the wide angle collimated scintillation detector. The blood flow through the arteriovenous shunt can be calculated from the following equation in terms of percentage of the total blood flow in the one side of the common carotid artery.

$$\text{relative shunt flow} = \frac{f \times L}{S + f \times L}$$

where S and L mean the radioactivities of the skull and lungs of the patient after carotid injection of ^{131}I-MAA and f is a calibration factor which is obtained from the angiographically normal subject and was calculated as follows:

$$f = \frac{S_1}{L_2 - L_1}$$

where, S_1 is radioactivity of the skull after intracarotid injection and L_2-L_1 is the net radioactivities of the lungs as a result of intravenous injection of the same dose.

Seven cases of arteriovenous malformation were investigated by means of this method. Technical details and results were presented and hemodynamic aspects of arteriovenous malformations were discussed in comparison with angiographic findings.

The Relationship between the Circulation and Disease of the Stomach

K. ASANO

Department of Internal Medicine, Okayama University Medical School, Okayama

The gastric blood flow and its distribution in rabbit and human were measured by means of scintiscanning and measurement of radio activity of ^{131}I-MAA administrated into the abdominal aorta.

The scintigram of rabbit and human have shown the difference of distribution of blood flow between antrum and corpus, and between anterior and posterior wall of corpus. The surrounding region and peripheral tissue of stomach cancer have been observed the abundant distribution of blood flow.

The gastric scintigram by RISA does not show the difference of distribution of ^{131}I between the antrum and corpus. The difference of distribution of gastric artery is not observed by means of angiography by softex. The size and distribution of mucosal capillary measured histologically is about the same between antrum and corpus.

The average stomach weighing approximately 28.4 g consisted of mucosa (51.4%) and muscularis (48.6%). The mean distribution of ^{131}I-MAA in mucosa was 71.4% and muscularis 28.6%. The gastric wall was weighed: antrum 23.3% and corpus 76.7%, the latter being partitioned between the gastric wall in the proportoin: anterior 40.6% and posterior 36.0%. The mean distribution of ^{131}I-MAA was found: antrum 20.1%, anterior corpus 47.6% and posterior 32.3%.

The response of the gastric blood flow to drug has been studied. Gastrin tetrapeptide affects the distribution of blood flow in the stomach, in which the blood volume shift from antrum to anterior wall of corpus.

Suggested conclusions include the following:

(1) The distribution of gastric blood flow are maximum in the anterior wall of corpus