CHAPTER 15
SURGICAL TECHNIQUES - INVESTIGATION AND TREATMENT

(1)
THE INVESTIGATION OF CEREBRAL PERFUSION USING INTRA-ARTERIAL INJECTION OF ISOTOPICALLY LABELLED ALBUMIN MACRO-AGGREGATES

Allcock, J.M. and Chamberlain, M.
Department of Radiology
University Hospital, London, Ontario, Canada

We have to accept that even with the refinements of magnification and subtraction and selective injection the delineation of the small vessels of the brain leaves much to be desired and we really have no way at all of showing in any kind of detail the arterioles and capillaries.

The information gained from angiography is to a certain extent complemented by that supplied by routine scanning with isotopes. However, this method really gives more of a measure of tissue perfusion. Cerebral blood flow studies by methods such as the injection of xenon gives some information but unfortunately, it is not easily related to cerebral topography except in a gross manner.

In order to try to fill in some of these gaps, we have been using macro-aggregates of albumin. These at present have a mean size of 20 \( \mu \). Approximately 80% of them lie within a 10% variation from this but they do range up to 60 \( \mu \). At present, these aggregates are being labelled with iodine 131 or technetium 99. 150 microcuries of iodine or 300 microcuries of technetium are used, one being injected into one vessel and the other into a second. 10 - 20,000 particles of each are used, and because of their size, they are held up mainly in the distal arterioles. Their biological life is approximately 5 hours so that the patient can be scanned in a routine manner within 3-4 hours of injection. The scan obtained represents a visual freeze of the distribution of these particles in the territory of the vessel injected at the time of injection even though the imaging may be several hours later. There may have been a change in the circulation prior to the time of scanning but this does not affect the situation because there was no reservoir of particles in large vessels to pass on into smaller vessels and
change the situation if for instance, dilatation of the smaller vessels does occur after the time of injection.

I would like to show you some representative slides of various studies that we have done. I am not going to show the xrays and will just describe them briefly to save time. The first one is a young man with a normal arteriogram and the anterior cerebral arteries each fill from their own side. The scan shows that there is a very slight crossflow from left to right of blood and no crossflow from right to left. The colour coding represents the distribution of activity analogous to a relief map, but the scale varies with different patients.

The next one shows a man, in whom both the anterior cerebral arteries filled from the left side and you can see isotopes pulling over to the right.

In this next patient, one isotope was injected into the right common carotid and one into the right vertebral and you can see the distribution of blood from these two vessels.

In the next patient, one isotope was injected into the external carotid and one into the internal on the same side and again you can see the distribution.

This next patient had a subarachnoid hemorrhage and had moderate arterial spasm on the right side and very severe spasm on the left and you can see the difference in the perfusion on the two sides.

These two cases show examinations of patients with tumors. In one there was a large left occipital tumor which was very vascular and presumably all the aggregates passed through shunts. The other one was on angiography an avascular frontal tumor but again no isotope is seen within the tumor.

This next one was a lady with a small meningeoma and you can see a concentration of isotope in the external carotid injection in the region of the tumor in the parietal region but not in the internal carotid.

In this next couple, in one there is an old left frontal area of infarction on the angiogram and no isotope was seen within that area. The other lady has had a recent infarct in the posterior frontal region. Angiography showed increased vascularity and this shows on this study also.

The next patient had bilateral carotid stenoses which appeared on angiography to be roughly equal in degree. However, you can see there is good crossflow from right to left, and no crossflow from