some with large haematomata had some neurological deficit. He stressed that these good results had been achieved using simple and easily available methods.

BIOCHEMICAL ASPECTS OF RUPTURED ANEURYSMS

M. BUCKELL (London) outlined research in progress at Atkinson Morley's Hospital on three biochemical aspects: examination of local changes in haematoma and cerebrospinal fluid, biochemical profile at all stages of illness, and investigation of general metabolism by means of balance studies.

Reappearance of oxyhaemoglobin in cerebrospinal fluid absorption spectrum was helpful as evidence of re-bleed. Enzyme measurements were disappointing. Cerebrospinal fluid GOT exceeded plasma when there was obvious infarction. 5 HT-like activity was found in three of four haematomas from patients with spasm and not in five comparable specimens from cases without spasm; all nine contained a polypeptide active on smooth muscle and present in greater amount in spasm cases. Dr. Anne Uttley had found a prolonged thromboplastin generation time in 10 of 50 patients.

On admission cases of unexplained subarachnoid haemorrhage had little biochemical disturbance. Patients with aneurysms, angiomas, and primary intracerebral haemorrhage showed increased osmolality, urea, protein, haematocrit, haemoglobin, and whole blood specific gravity with less frequent, mild rises in transaminase and transient elevation of blood sugar. All these changes were more marked in comatose cases. Reduced bicarbonate concentration was often found in patients with demonstrable lesions, regardless of conscious level. Reduced arterial $p\text{CO}_2$ and raised $p\text{H}$ were confirmed in another group of patients. Investigation of hypothalamic damage after ruptured aneurysm, with Dr. J. S. Jenkins, revealed a reversed diurnal cortisol rhythm in 21 of 60 cases.

Results of nitrogen, sodium, potassium, and fluid balance, with calorie intake, steroid excretion, and blood chemistry were presented for four patients.

EXPERIENCE WITH TWO CASES OF MUSCLE EMBOLIZATION OF CAROTID-CAVERNOUS FISTULA

C. B. SEDZIMIR and J. OCCLESHAW (Liverpool) described two cases of carotid-cavernous fistula which had been treated with muscle embolization. The first case, a man of 19, had probably developed a carotid-cavernous fistula after an extensive gun-shot wound of the left side of the head and face two years before admission though the diagnosis had not been made at the time. At present admission he had sustained a subarachnoid haemorrhage and angiography demonstrated the fistula. A muscle strip was inserted into the internal carotid artery in the neck via the common carotid and allowed to embolize into the cavernous sinus with cessation of the intracranial bruit. A faint bruit returned 10 days later and radiographs showed that the muscle had moved on from the cavernous sinus to a cerebral vein.

The second patient, a woman of 44, was admitted with signs and symptoms of a fistula five days after a road accident. Angiography demonstrated the fistula. On this

occasion a muscle embolus was inserted in the neck after the intracranial internal carotid had been occluded with a clip above the cavernous sinus. Control of the fistula with complete regression of abnormal physical signs was achieved by this procedure.

DURAL SINUS THROMBOSIS

R. M. KALBAG (Newcastle) discussed the problem of dural sinus thrombosis. He noted that only 217 cases had been recorded in the Registrar General's returns for the period 1952-61 and he felt that many cases were probably unrecognized during life and at necropsy. Even when a clinical diagnosis had been made this was seldom confirmed by angiography. He said that the angiographic findings included extreme slowing of the cerebral circulation and deep venous filling in the arterial phase but that final diagnosis depended on the persistent failure to fill of all or part of one of the dural venous sinuses. The presence of small anastomotic venous channels, usually in the region of the superior and inferior anastomotic veins, indicated a favourable prognosis, whilst failure to fill the Galenic venous system usually implied a fatal outcome.

He noted that opinions on prognosis had varied considerably but it seemed certain that the slower the evolution the greater the chance of recovery. The use of anticoagulants to limit the area of thrombosis could be dangerous and should probably be applied before there was spread to cortical veins, if at all.

SUBTRACTION TECHNIQUE FOR CEREBRAL ANGIOGRAPHY

G. SULLIVAN (Preston) described subtraction radiography as a technique of after treatment of radiographs taken during contrast medium injection. He said that it was used to reveal the shadows of the contrast medium which were apparently invisible, being hidden by the shadows of the radiopaque parts of the patient.

The method of obtaining a subtraction radiograph was demonstrated. This was followed by an illustration of the way in which subtraction radiography helped in obtaining diagnostic information from films taken of four patients who were investigated by arteriograms of the head and neck during injection by catheter of contrast medium into the aortic arch and main arteries arising from the arch.

He concluded that subtraction radiography was not only useful in improving poor radiographs but could show structures which, due to their position, were normally hidden by radiopaque parts of the body.

VARIATIONS OF INTRACRANIAL PRESSURE RECORDED DURING EXTENDED OBSERVATIONS

J. C. M. CURRIE (London) reported a study of intracranial pressure using a radio-pressure transducer. The method was described and illustrated in clinical use. Pressures were recorded in patients over several weeks. Observed changes in pressure were then shown due to the pulse, respiration, jugular compression, and posture in patients with normal and raised intracranial pressure.