Surgical Treatment of Ruptured Aneurysms of the Basilar Artery
Experience with 14 Cases

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In 1961 a discussion of the surgical treatment of 4 ruptured aneurysms of the basilar artery was presented, together with a review of the literature. A fifth case was included as an addendum to the paper and will be described further (Case 5).

At the time, it was concluded that direct surgical attack was feasible and worth while under exceptional circumstances, when life was threatened as after repeated hemorrhages. Since then 7 more ruptured aneurysms of the basilar artery have been operated upon in the same fashion. A review of these 12 cases will form the basis of this paper.

Aneurysms arising from the vertebral-basilar circulation comprise about 15 per cent of the total. They are discovered when this system is outlined with contrast medium in cases of spontaneous intracranial hemorrhage in which bilateral carotid angiography is negative. Previously it was suggested that the site of bleeding will be discovered by vertebral angiography in about 1 of every 4 such cases. Until recently angiography of the posterior circulation has not been pursued vigorously because of the difficulties encountered in direct puncture of the vertebral artery and the feeling that aneurysms of these vessels were not readily amenable to surgical treatment. A number of reports have appeared in which aneurysms arising from the vertebral, and branches of the vertebral and basilar arteries, have been obliterated safely. Logue has recently reported on 10 such cases with 3 deaths. In addition, he explored 2 aneurysms arising from the basilar bifurcation but was unable to occlude the sacs. Höök et al. have described in some detail 28 cases of aneurysms of the vertebral-basilar system. Of the 12 which were operated upon, 4 arose from the basilar bifurcation. One of these was successfully clipped. The 2nd presented as a 3rd ventricle tumor and was not discovered by a transcallosal approach. The remaining 2 patients died from brain stem softening, one after unsuccessful attempts at clipping (Bohm) and the other in spite of successful occlusion (Norlén). Jamieson has operated on 10 basilar aneurysms with only 2 long term survivors, both severely disabled.

For completeness it can be recorded that in addition to the 7 basilar aneurysms from this unit (5 were operated upon elsewhere), 7 other aneurysms of the vertebral basilar system have been discovered. Three arose from the vertebral artery and 4 from the posterior cerebral artery. Two of the vertebral aneurysms were fatal before an operation could be done, but the 3rd, arising at the origin of the posterior inferior cerebellar artery was ligated without sequelae. One patient with a posterior cerebral aneurysm refused operation and remains disabled with a hemiplegia and 3rd nerve palsy. The other 3 were operated upon and ligated. One of these patients with intra-cerebral and intra-ventricular hemorrhage died, but the 2 survivors are well.

In our unit, vertebral-basilar angiography has been carried out by direct puncture in the neck. The advent of the indirect methods by retrograde filling from the brachial or subclavian arteries has made the procedure more routine on most neurosurgical services. "Four vessel" angiography is a term now used to denote the ideal investigation of these patients. In Logue's view the majority of aneurysms arising from the vertebral artery or its branches are on the left side.

Received for publication January 8, 1965.
The operative approach originally described\(^1\) was used in the succeeding 8 cases. In 2 patients a left subtemporal route was chosen because of the eccentric origin of the aneurysm. Three patients were operated upon under deep hypothermia (12–14°C.) using cardiopulmonary by-pass and ex-sanguination as part of a project to determine the usefulness of this method.\(^2\)

**Case Reports**

In follow up of our first 4 cases it may be said that the 2 survivors (Cases 1 and 2) remain well and active. Case 1 is leading a normal life on his farm and has no neurological deficit. The sole residuum of the stormy postoperative course in Case 2 is in relation to her vision. There is a complete right homonymous hemianopsia and, although the left field is full, visual acuity is reduced to counting fingers and reading newspaper headlines. She does the housework and remains the delight of her large family who say that aside from being slightly forgetful “Mother is as good as she ever was.”

Case 5, H.C., may be summarized again in view of the final result.

On December 18, 1960, a 48-year-old man suffered his first hemorrhage and was admitted in a drowsy state with bilateral extensor planter responses and bloody spinal fluid. Bilateral carotid angiography was negative but a vertebral arteriogram demonstrated a small saccular aneurysm arising and projecting forwards and upwards from the bifurcation of the basilar artery (see Fig. 9). He recovered quickly and it was decided to delay operation for 7 days.

**Operation.** Unfortunately, on December 26th, right hemiparesis and dysphasia developed gradually without marked change in consciousness. Left carotid angiography again was normal and in view of the presumed recurrent bleeding, operation was carried out on December 27th under hypothermia (28°C.) with urea. Three periods (3, 5 and 1½ min.) of complete occlusion of the vertebral and carotid arteries were used to complete the dissection of the aneurysm and occlusion of its neck with a McKenzie clip. There was little evidence of bleeding to account for his sudden deterioration the day before.

**Postoperative course.** The postoperative angiogram showed the aneurysm to be obliterated and no other abnormality. The postoperative course was encouraging. The 3rd nerve palsy improved as well as the hemiparesis and dysphasia. However, after 3 weeks he was not so responsive and had a high spinal fluid pressure. Ventriculography showed a moderate communicating hydrocephalus and a lumbo-peritoneal shunt done on February 4th was followed by marked improvement. Three weeks later he was up and about on the ward talking and understanding quite well. Then he again deteriorated with ventricular and spinal fluid pressures of 200 mm. of water. With the thought that the shunt was not functioning, external ventricular drainage was established to no avail. He died on March 7, 1961, in coma with acute suppurative bronchopneumonia.

**Comment.** The brain weighed 1600 gm. and had the flattened gyri and narrowed sulci of chronic high pressure. The vessels of the base were intact and the aneurysm was occluded by the clip (Fig. 1). There was a moderate internal hydrocephalus but brain sections did not reveal the cause of the defective CSF absorption or solve the puzzle of the peculiar course of events, viz. the pre-

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**Fig. 1.** Case 5. Post-mortem specimen. The neck of the aneurysm has been occluded by a clip. The patient died 2½ months later from communicating hydrocephalus and malfunctioning lumbo-peritoneal shunt.