Intracranial Surgery for Aneurysm

Effect of Hypothermia upon Survival*

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The stimulating papers of Longheed and Botterell and their associates in 1955 and 1956 suggested that cooling patients to around 30°C permitted temporary arterial obstruction and direct attack upon aneurysms of the circle of Willis more easily and more safely than in a normothermic environment. Experimental evidence derived from animals furnished the rationale for this maneuver. The technic has been adopted widely, and gradually the technic of arterial occlusion became less important than the hypothermia. Finally the impression has developed that operation under normothermic conditions upon patients with such lesions might even be reprehensible.

During my experience at the Buffalo (New York) General Hospital, between 1956 and 1960, surgery for intracranial aneurysms was done by separate teams routinely employing one of the two technics. In the small series of cases that so developed, it was found that the patient’s temperature played little part in improving results. In fact, the normothermic cases had a modest advantage.

At the Cleveland Clinic, all intracranial aneurysmal surgery done between May 23, 1955 and May 26, 1960, except in a few cases, was performed under general body hypothermia, usually of about 30°C. Some results of this work recently have been reported elsewhere, with emphasis on the anesthetic technic. The selection of cases for that report depended upon completeness of anesthetic records, and it was considered desirable to review a consecutive series of cases. The anesthetic and hypothermic technics employed in this series of patients also are detailed in that report.

Material

Consecutive cases were assembled of patients a) having suffered subarachnoid hemorrhage, b) from angiographically disclosed aneurysms of the circle of Willis, c) which were treated by intracranial attack, d) under hypothermia of the type mentioned. From the consecutive list of aneurysmal operations the only cases excluded were a) those in which the aneurysms ruptured massively before the dura mater was opened, and b) those in which the aneurysm was not found at operation. These were considered surgically untreated. The methods of attack varied: the majority were treated by isolation of the lesion from the parent vessel by clips or ligation; some by “trapping,” in which parent arterial continuity was interrupted; a few by wrapping with muscle or fabric; and a few by simple packing of a bleeding area with muscle, if that was all that could be accomplished under the presenting circumstances. Forty-seven such cases comprised the series studied here.

A second consecutive series of 47 then was assembled satisfying the same criteria, except that they were operated upon in normothermic status. Six of these operations had been done during the period of the hypothermic series, 5 thereafter, and 36 over a period extending back to September 17, 1948. Most of the operations in both series were performed by the same four surgeons and a few by surgeons temporarily serving the Department of Neurological Surgery. Since the hypothermic series developed later than did the bulk of the normothermic, the
increasing surgical experience of the operators favored the former series.

Analysis of Data

It is recognized that many subtle variables influence results obtained even in operating upon patients having similar aneurysms arising from the same parent artery. In this series the variables are too numerous to permit statistically valid comparisons to be made on any but the broadest bases. The final result determined here was confined to survival or death. In so small a series no matching of significant groups having lesions even on the same vessels was possible, yet a certain value probably pertains to a gross analysis.

Table 1 reveals that under normothermia, 12 (25.5 per cent) of 47 patients died after operation, while under hypothermia, 18 (38 per cent) of 47 patients died. Thirty (62 per cent) of the 94 failed to survive operation. Although the figures are not adequate for statistical comparison, the vessels bearing the lesions are detailed for completeness of presentation.

Time of Operation after Hemorrhage. Table 2 reveals that of 36 patients operated upon within the first week after a subarachnoid hemorrhage, 47 per cent died. Of those operated upon in the second week 27.5 per cent died, in the third week 18 per cent, and in the weeks thereafter 17 per cent died. Such a generality has been reported by several writers on the subject of aneurysmal surgery.

The last two figures here are higher than usual, influenced again by unusual circumstances: a postoperative brain abscess, rupture of an unsuspected second aneurysm, etc. Even this analysis, however, suggests no advantage attributable to hypothermia; the death in the third week of the normothermic series was the one caused by the brain abscess.

Clinical Status of Patients. In 1956 Botterell and coworkers reported a system of grading of patients’ clinical status prior to operation, and several reports have appeared since detailing additional risks incurred in operating upon those more severely injured by their disease. For this report the patients in this series were graded similarly from data appearing in their records. There are minor variants in reported gradings. The criteria used here were:

Grade I—Patient alert, with subarachnoid blood or not; no neurological deficit.

Grade II—Drowsy, meningeal signs, no specific neurologic deficit.

Grade III—Drowsy or confused, neurologic deficit, probable hematoma.

Grade IV—
a) Stuporous, major neurologic deficit suggesting probable hematoma, status deteriorating, or

b) Stuporous older patient with less severe deficit, but with degenerative cerebrovascular disease.