Section of Neurology

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Recent Advances in Neurosurgery

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Intracranial Microsurgery

The binocular operating microscope has been an indispensable tool in routine otologic surgery for almost two decades. The advantages are magnification, stereoscopic view and ideal illumination. Exact visualization and clear resolution lead to more precise dissection, isolation and mobilization of tissues than heretofore possible, permitting a finer execution of many delicate neurosurgical procedures. Although the possibilities of and need for these delicate microsurgical procedures in neurosurgery are obvious, the microtechnique is still not in common use.

Up to now the operating microscope has proved particularly useful when an avascular or poorly vascularized organ, such as the middle ear, the cornea or the lens, is to be approached surgically. A proper microvascular surgical technique was needed for intervention on highly vascularized areas or organs such as the brain or medulla; we have now developed such a technique at the Kantonsspital, Zürich, and have named it 'microtechnique'. This term covers the use not only of the binocular microscope, but also of the head holder, automatic brain retractor, dissection technique, microinstruments, microdrill, combined irrigation and suction technique, meticulous bipolar coagulation technique, microvascular clips and applicators, and microsutures and suture technique. Complete familiarity with these procedures enables the neurosurgeon to obtain benefits from atraumatic microtechnique. The skill should be gained in the laboratory because it can be acquired only by practice on animals; with the manual dexterity required for these difficult manipulations, one gains the confidence and ability necessary to carry out similar procedures in operating on humans. The microtechnique permits the improvement of classical neurosurgical procedures, and new approaches (transsphenoidal, transpetrosal, translabyrinthine and transclival) to the basal intracranial structures. Furthermore, the microtechnique has opened up new surgical approaches in patients with occlusive cerebrovascular diseases.

Intracranial and Spinal Tumours

At present the microtechnique is especially useful in the removal of basal tumours (medial and lateral sphenoidal meningiomas, adenomas, craniopharyngiomas, epidermoids, chordomas, chondromas, meningiomas and neurinomas of the clivus and cerebellopontine angle). Intraventricular and intramedullary tumours can be removed more accurately. The angle tumours are of special interest to neurosurgeons. On the basis of personal experience with 56 cases I believe that only small neurinomas in the internal auditory meatus should be removed by the translabyrinthine approach; larger tumours should be dealt with by the unilateral suboccipital, transmeatal route with the patient in the sitting position. Although the facial nerve could be saved anatomically in 51 out of 56 of these cases, a more or less pronounced temporary functional paralysis lasted from two to eight months in 60% of cases. In 5 patients the facial nerve could not be identified because it had split up in the tumour. Far more important was the preservation of adjacent vital structures (pons, medulla oblongata, cerebellum, basal nerves and vessels). In cases with parasellar, petrosal and retroclival extension of tumour (meningiomas, chordomas, chondromas, neurinomas of V nerve and epidermoids),

the subtemporal transtentorial approach allows radical or almost radical extirpation of tumours and the preservation of adjacent vital structures.

Rhizotomies
The microtechnique is especially helpful in sectioning trigeminal fibres either through the opening of Meckel's cave or by transtentorial exploration. In patients with spasmodic torticollis, sectioning of the spinal accessory and upper cervical nerves can be carried out more safely, with sparing of the very fine arteries accompanying the nerves.

Saccular Aneurysms
The microtechnique has many advantages in the exploration and elimination of saccular aneurysms. The aneurysm can be explored through a small frontolateral, sphenoidotemporal craniotomy. After extradural radical removal of the sphenoid ridge, the opened dura can be retracted toward the orbit. Arachnoidal fibres along the basal part of the sylvian fissure are dissected and the latter is opened without damage to the adjacent structures. The small triangular gap allows sufficient access to the middle cerebral and internal carotid arteries. The posterior communicating artery as well as the anterior cerebral arteries can be explored with minimal retraction of temporal and frontal lobes. This exploration is also ideal for aneurysms of the anterior communicating artery.

In the immediate vicinity of the aneurysm, normal and abnormal relationships can be clearly defined under 10- to 16-fold magnification and the neck of the aneurysm can be carefully explored. With gentle bipolar coagulation the neck of the aneurysm can be made to shrink and to elongate and the wall can be toughened, making room for the clip or ligature to be applied without deforming the wall of the parent vessel or destroying adjacent perforating vessels. Coagulation of an aneurysm neck requires familiarity with bipolar coagulation. This technique has been used successfully in 200 patients with saccular aneurysms.

Arteriovenous Malformations (Cerebral and Spinal)
With microtechnique the numerous feeding and draining vessels immediately round the malformation can be clearly seen, and can be isolated and eliminated by ligature, clipping or coagulation. The shrunken malformation can be removed.

Microsurgery of Occlusive Cerebral Arteries
Using the microtechnique, embolectomy or thrombectomy has been carried out in 13 patients, and end-to-side anastomosis between the temporal superficial artery and a cortical temporal artery in 21 patients. These operations have been performed with great apprehension and hesitation because the indications for such surgery have still not been delineated. Mastery of microsurgical technique in the animal laboratory is an essential prerequisite for the application of this technique in man, but the lack of precise criteria for operative treatment prevents us from taking full advantage of the technical advances achieved in animal research. Reconstructive intracranial vascular surgery must be considered largely elective or preventive in nature at present.

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Operational Factors in Microscopic Neurosurgery

There is no doubt that the introduction of neurosurgeons to the operating microscope is already contributing a great deal to everyday practice. We are now going through a phase of exploration and assessment of its uses and potentialities in the surgery of the central nervous system.

Before considering which factors are important in the introduction of the microscope, I should like to mention the complementary advance of bipolar diathermization, introduced by Malis (1969). This has greatly helped the precise dissection of tumours and aneurysms, and in the following case was indispensable in treating an anterior communicating aneurysm.

Case 1
Man, aged 47
This patient, who had congenital spastic paraplegia but normal sphincter function, had a brisk spontaneous intracranial hæmorrhage from a large anterior communicating aneurysm (Fig 1). No additional neurological deficit was sustained and fourteen days after the hæmorrhage the aneurysm was explored by a subfrontal approach through the gyrus rectus, a technique usually used at Frenchay Hospital. It was found to be a sessile expansion of the entire anterior communicating arterial complex; it was untreatable by clipping or ligation and much too large for wrapping without doing unwarrantable damage to the surrounding brain. Accordingly, both anterior cerebral arteries were clipped temporarily, with the mean arterial blood pressure being raised to more than 100 mmHg; the bipolar forceps were then used to squeeze, empty, and then plicate the loculi of the aneurysm to a prune-like configuration. All the entering and