

Intraoperative Microvascular Doppler in Intracranial Aneurysms Surgery

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Introduction

The outcome of surgical treatment of cerebral aneurysms may be severely impaired by local cerebral ischaemia, or by infarction resulting from the inadvertent occlusion of an adjacent vessel. Incomplete aneurysm occlusion, on the other hand, increases the risk of haemorrhage. It is therefore of the utmost importance that both aneurysm occlusion and inadvertent clipping of neighbouring vessels be avoided during the surgical act.

Learning Objectives

The present study was performed to investigate the reliability and practicability of intraoperative microvascular Doppler (IMD) during cerebral aneurysm surgery, and to assess the influence of this method on the surgical procedure.

Methods

We conducted a retrospective analysis of 92 patients with a total of 101 intracranial aneurysms, who were evaluated with intraoperative microvascular Doppler (IMD). Blood flow velocities in the aneurysmal sac and in the parent artery were determined by IMD before and after aneurysm clipping. The findings of IMD were analysed and compared with those of visual inspection of the surgical site and of postoperative angiography. Analysis was also made of the cases in which the clip was repositioned due to IMD findings.

Results

The vascular murmur could be easily detected by IMD in all aneurysms. The findings of IMD helped in adjusting timely the clip placement. In 11 out of 101 (10.9%) aneurysms, IMD revealed a persistent weak blood flow spectrum through the aneurysmal sac after clip application and the clip was repositioned. A relevant stenosis of the parent artery induced by clip positioning that had escaped detection by visual inspection was identified by IMD in 19 out of 101 (18.8%) aneurysms. Among paraclinoid or ophthalmic segment large or giant aneurysm were clipped with 2-3 clips and internal carotid artery was reshaped.

Influence of IMD results on the surgical procedure

No complications occurred due to the use of IMD. The mean duration of IMD was 4.2 minutes (3.5 to 5.2 minutes).

Conclusions

IMD could detect the cerebral hemodynamic changes with aneurysms and parent artery in noninvasive way. The clip could be repositioned on the basis of the IMD results. It is recommended that IMD be used routinely in aneurysm surgery, especially in those large and giant aneurysms with wide neck or without neck.

Intraoperative monitoring techniques

Blood flow velocities in the aneurysmal sac and in the parent artery and adjacent vessels were determined before and after clipping of the aneurysm using IMD. 20-MHz microprobe with a diameter of 1.5 mm was placed with an insonation angle of 30–60 degrees, depending on the anatomic features of the surgical field. Complete aneurysm obliteration was confirmed by absence of flow in all aneurysms after clipping. Any flow within the aneurysm sac was considered indicative of incomplete exclusion from the circulation.

Qualitative analysis comprised evaluation of the wave form, flow spectrum, and of the acoustic signal compared with the initial values. Quantitative analysis included measurement of systolic, mean and diastolic blood flow velocities at all of the above sites as well as the calculation of pulsatility and resistance index. A decrease or increase in flow velocity compared with the initial values of at least 20% was considered significant. In cases of very high grade stenosis a decrease in blood flow velocity may occur. Detection of any stenosis by qualitative or quantitative criteria led to repositioning of the clip.