FRAMELESS STEREOTACTIC NAVIGATION FOR INTRAOPERATIVE LOCALIZATION OF INFECTIOUS INTRACRANIAL ANEURYSM

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Infectious intracranial aneurysms (IIAs) are rare complications of infectious diseases, such as endocarditis and meningitis, caused by the release of bacterial or fungal emboli to the intracranial circulation. The infective emboli can reach the vessel through the endovascular space, as in endocardial infections, or through the extravascular space by contiguous dissemination, in the case of meningitis. Since these emboli tend to be small, they usually reach the distal circulation, causing inflammation in the media and adventitia. This leads to weakening of the vessel wall and aneurysm formation. IIAs account for only 0.7 to 5.4% of all intracranial aneurysms but are still accountable for high lethality. Previous studies describe that hemorrhages due to IIA rupture can reach a mortality rate of 80% and lead to a poor neurologic prognosis. For this reason, early diagnosis and treatment are essential. Unruptured IIA initial management requires long courses of antibiotic treatment. If the control angiogram shows an enlargement of the lesion, surgical resection is indicated. In the case of ruptured IIAs, the treatment consists of surgical excision.

The localization of IIAs during surgical procedures is usually difficult since they are small, frequently affects distal branches and can be associated with subarachnoid hemorrhage or intracerebral hematomas. Frameless stereotactic navigation has become a valuable operative adjunct device in recent years, but reports of neuronavigation use for intracranial vascular surgery are scarce in the literature. We have encountered a small number of reports confirming the effectiveness of frameless navigation for atypical aneurysms and brain arteriovenous malformations surgeries.

We describe the utilization of a frameless stereotactic navigation system for the microsurgical resection of a distal infectious aneurysm.

CASE

This 34 year-old right handed man was referred to our institution after antibiotic treatment for infectious endocarditis in the two previous weeks. He had a history of rheumatic fever with incomplete treatment in infancy. Transesophageal echocardiography had shown a 3cm vegetation in the anterior leaflet of the mitral valve. Blood cultures had identified Streptococcus viridans as the etiologic agent.

Headaches and transient aphasia during the admission motivated a computed tomography (CT) scan that showed a small left frontal hypodense lesion in the middle cerebral artery (MCA) territory distribution, suggesting a previous ischemic event. Cerebral digital angiography was indicated and showed a 2.5 mm saccular aneurysm in the cortical segment of the MCA. After the administration of culture guided antibiotics, a second control angiography was performed and revealed an increase in aneurysm volume, this time measuring 4.1 mm (Fig 1A).

The patient was admitted in our institution for surgical treatment and informed consent was obtained. MRI scan with appropriate protocol for neuronavigation was done and demonstrated, on the FLAIR sequence, a small round hypointense lesion in the left superior frontal sulcus. The lesion was localized 1cm below to the gyral surface and 2-3cm anterior to the left central sulcus. The ischemic signal seen on the previous CT scan was adjacent to the infectious aneurysm (Fig 1B). Using iPlan software (BrainLab, Heimstetten, Germany), preoperative MRI stereotactic images were loaded after facial scanning and the source images were translated into an operative plan (Fig 1C). These images allowed surgical planning and visualization of the infectious aneurysm during surgery, resulting in a simpler procedure with a smaller craniotomy.

The surgical procedure was initiated by a linear scalp incision followed by craniotomy centered at the point indicated by frameless stereotaxy planning. After dural opening a small arachnoid dissection revealed the aneurysm at the bottom of the precentral sulcus. It was isolated and successfully resected (Fig 2).
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The patient recovered well and was sent neurologically intact to the referring hospital.

**DISCUSSION**

Neurologic complications of endocarditis are common, occurring in 20 to 40% of patients. However, infectious aneurysms are infrequent, 70% of them being located on the MCA or its distal branches. Conservative management with prolonged course of antibiotics and follow-up angiogram is the initial treatment. Enlargement of the aneurysm indicates progressive wall distension, increasing the risk of rupture. Therefore, surgical treatment should be considered since aneurysm rupture is associated with an 80% morbidity and mortality. Failure to reduce aneurysm size after the planned course of antibiotic therapy should indicate surgical intervention. In selected cases, an alternative option would be aneurysm occlusion by endovascular approach.

The exact timing for surgery remains a controversial topic. The initial approach should always include antibiotic treatment. This may facilitate surgical resection of IIAs since antibiotics can not only treat the infection but also help aneurysm maturation from a friable acute lesion to a more fibrotic, subacute or chronic lesion. However, clinical management should not delay surgery when an intervention is indicated.

Origitano et al., among other authors, describe that frameless stereotactic navigation should be considered when the aneurysm is small, distal or at unusual locations, such as in the case of infectious aneurysms. In this case report, we have demonstrated the importance of frameless stereotactic MRI-based navigation in the treatment of infectious aneurysms. This technique increases aneurysm localization accuracy, reduces the time for dissection and diminishes the risk of vascular and parenchymal iatrogenic damage.

In summary, we have not found previous descriptions of frameless stereotactic navigation use for infectious aneurysms resection. Difficulties in dealing with IIAs suggest that frameless navigation systems should be considered a useful tool in this scenario.
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REFERENCES