Immediate postoperative biplanar and rotational angiography during neurovascular surgery.

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Disclosure

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Abstract

Introduction: Due to high investment costs the availability of intraoperative high-resolution rotational and biplanar angiography is limited. The purpose of this study was to evaluate the authors' initial experience with the integration of immediate postoperative angiography after neurovascular operative procedures.

Methods: 20 patients with ruptured and unruptured intracerebral arteriovenous malformations (AVMs) or dural arteriovenous fistuals (dAVF) underwent surgical treatment of their lesions in a standard neurosurgical suite. After resection of the AVM intraoperative indocyanine green videoangiography was then performed to exclude residual nidus. Following surgical closure, the patient was transferred directly into the angiosuite. Biplanar or rotational 3D angiograms were obtained under continued general anesthesia to confirm satisfactory treatment.

Results: The completeness of treatment was confirmed on immediate postoperative biplanar 3D rotational angiography in all cases, and there were no procedure- or transfer related complications. Due to the absence of headclamps and pins the image quality was excellent.

Conclusions: Immediate postoperative biplanar and rotational angiography performed directly after neurovascular surgeries is a safe and useful adjunct and enables neurovascular surgeons to provide surgical procedures for the treatment of complex vascular lesions also in average equipped centers.

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Introduction and background

Incomplete surgical obliteration of dAVFs or nidal remnants of AVMs are associated with increased risk of postsurgical hemorrhage or rehemorrhage compared to conservative treatment.

The role of intraoperative 2D-, 3D and rotational angiography for surgery in those conditions has been previously described in several reports. There are different strategies presented in current literature to achieve the desired goal of intraoperative angiographical control.

However conventional portable C-arm-systems have limitations associated with suboptimal image quality, uniplanar image guidance, and lack of 3D acquisition. On the other hand high-end hybrid room solutions for treatment of neurovascular diseases require tremendous investment cost, that overtax the budget of many ambitious neurovascular centers.

Although related to potential risk of intrahospital patient transfer the gain of image quality and the loss of OR-room restrictions may justify immediate postoperative angiography control outside the OR.

In this present study the authors evaluated their initial experience with the integration of immediate postoperative angiography after neurovascular operative procedures in an standard biplanar angiography suite.
Setup and workflow

20 patients with ruptured and unruptured intracerebral arteriovenous malformations (AVMs) or dural arteriovenous fistulas (dAVF) underwent surgical treatment of their lesions in a standard neurosurgical suite.

After resection of the AVM intraoperative indocyanine green videoangiography was then performed to exclude residual nidus. Following blood pressure challenge and surgical closure patient was transferred directly into the angiosuite.

Meanwhile OR-room and surgical team was kepted in stand-by in case of further surgery would be required.

Biplane or rotational 3D angiograms were obtained under continued general anesthesia to confirm satisfactory treatment. Results were evaluated by an interdisciplinary neurovascular team.

Finally patient was transferred to neurosurgical intensive care unit. General anesthesia and meticulous blood pressure control were continued for the following 24 hour. Weaning procedure was initiated when postoperative CT excluded any complications.
Illustrative Case:

AVM SM^III right temporal lobe

42 yrs. old female, incidental finding on MRI which was initiated after two events of short-time loss of consciousness.

DSA shows typical nidus type of AVM at the basal portion of the right temporal lobe which was mainly fed by cortical branches of the MCA. There was only a minor attribution from the right PCA and no shunt from the external carotid artery. Generous venous drainage only took superficial veins into charge.

After one year of counseling patient decided for surgical treatment.
A right temporal approach was performed to resect the superficially located AVM. Intraoperative microscopic photographs show thickening of the arachnoid covering the nidus and the draining veins. Repeated ICG-videoangiography elucidates microangioarchitecture and finally demonstrates complete resection of the nidus.
Illustrative Case:

AVM SM°III right temporal lobe

Postoperative DSA confirmed surgical cure and complete nidus resection.

Examination under general anaesthesia was straight forward and took 30 minutes to be finished. Due to the absence of artifacts of head clamp and pins image quality was excellent. There were no restrictions in defining the most appropriate acquisition plane and therefore comparison with preoperative angiography is facilitated.
Results:

Our technique was applied successfully in all 20 neurovascular cases. All angiographies could be completed.

In all cases angiography demonstrated obliteration of dAVFs and complete resection of the nidus in AVM. Further surgical exploration was unnecessary. The results could be additionally confirmed in follow-up angiography after 12 months.

There were no new major neurological complications after surgical treatment. Two patients experienced partial hemianopsia in occipital AVMs as predicted preoperatively.

Biplanar or rotational angiography provided excellent image quality in all cases with reliable interpretation. Average examination time was 42 minutes. Angiography or patient transfer related complications were not observed.
Conclusion:

Immediate postoperativ angiography in standard diagnostic suite is technically feasible and can be safely performed in an acceptable procedure time.

Image quality is excellent due to unrestricted plane availability and absence of any artifacts of surgical instruments.

It does not replace all the aspects of diagnostics and treatment that can be taken care of in a high-end hybrid surgical theater.

However, it seems to be a reasonable alternative to specialized neurovascular centers without high-end, cost-intensive equipment.