Advanced technology in AVM surgery: combined neurovascular approach in hybrid OR
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Objective: To report our experience of arteriovenous malformations (AVMs) surgery in hybrid operating room (BRAIN OR) following or in combination with endovascular transarterial-embolization.

Methods: During the past 2 years we surgically treated 39 patients (M:F = 25:14, mean age 37.4 y.o.) with AVMs. Spetzler-Martin grades were I in 6, II in 15, III in 14, and IV in 4. 21 patients (53.8%) had undergone ONYX and/or NBCA and/or coil embolization (1 to 3 times/patient) before surgery, and the AVM was partially embolized after craniotomy and subsequently removed in 3 patients. All scheduled surgeries (35/39) were performed in hybrid operating room where both microsurgical and endovascular surgeries are available. Intraoperative microcatheter 3D-angiography, ICG videoangiography, Doppler sonography, electrophysiological monitoring were routinely used. Conversely, 4 patients underwent urgent craniotomy for hematoma evacuation and small AVM resection to avoid brain herniation. In all patients, the AVMs were totally removed without major morbidity, and the histopathological changes of the resected tissue were investigated.

Results: At surgery, embolized AVMs were elastic hard and easily dissected from adjacent brain with minimal bleeding. Intraoperative selective 3D-angiography (and subsequent intraoperative embolization in selected cases) was very helpful for understanding of the microstructure of the complex lesions, and preserving passing normal vessels. In some patients, subclinical minor bleeding and/or necrotic tissue were noted within/around the nidus. Histopathologically, even small vessels under 10 micrometer or less were occluded. On the other hands, some vessels seemed to be recanalized. Perivascular inflammation and angionecrosis were detected in many cases.

Conclusions: The presentation will assess the role of advanced technology in the surgical treatment of AVMs.