

The “Hyperaemic Wall Sign” – A Warning From Imminent Aneurysm Rupture

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Here we present a surgical case of intraoperative aneurysm rupture. We want to highlight hyperaemic transformation of the aneurysm wall during clipping as warning sign shortly preceding rupture.

Clinical case: 61 year old male patient who complained of visual disturbances for months. Initial imaging with MRI revealed a giant aneurysm of the left internal carotid artery (ICA) immediately distal to the ophthalmic artery. Pre-operative angiography was performed and 3D reconstruction helped to plan the surgery. **Figure 1A** shows the angiography before surgery.

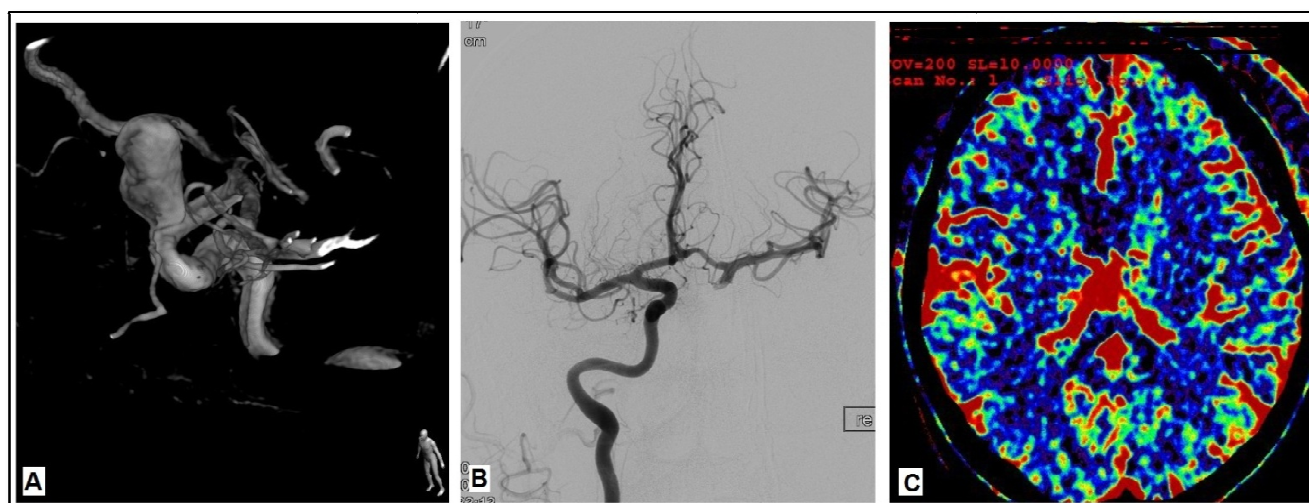


Figure 1. A. Preoperative angiography (3D reconstruction) showing the configuration of the ICA aneurysm
B. Postoperative angiography showing occlusion of the left ICA (the aneurysm is removed) and the right ICA perfuses both hemispheres
C. Perfusion CT scan shows no perfusion deficit in the brain after occlusion of the left ICA

Surgery was performed through a pterional subfrontal approach. The most important surgical steps are shown in **Figure 2**. The aneurysm was highly atherosclerotic and impossible to be mobilized from the optic nerve. Next aclinoidectomy to achieve control of the ICA proximal to the ophthalmic artery was performed. Afterwards we dissected the aneurysm neck and applied a straight clip away sparing the ophthalmic artery. On slow release the clip slipped down and obliterated the ophthalmic artery. The clip was exchanged with a 45° angulated clip which still slipped down and obliterated the ophthalmic artery. We then decided to reapply a straight clip and to deflate the aneurysm. Because of important atherosclerotic deflation was almost without any effect. Nevertheless it was attempted to place a second clip over the first in order to remove the proximal clip and avoid obliteration of the ophthalmic artery. At that moment, we did not pay attention to the hyperaemic aneurysm wall which occurred after replacing the first clip. After little further manipulation of the aneurysm neck it ruptured. The ICA had to be clipped. As the aneurysm was ruptured at its neck and the wall extremely thin direct repair was

impossible. There was no time left for an anastomosis at this point. Fortunately, there was excellent flow of the distal ICA perfused by the opposite ICA. The aneurysm was then trapped by clips. We removed parts of the aneurysm and decompressed the optic nerve. Immediately after surgery an angiography was performed which showed an excellent perfusion of both hemispheres from the opposite ICA (**Figure 1B**). Perfusion CT scan showed no perfusion deficit (**Figure 1C**).

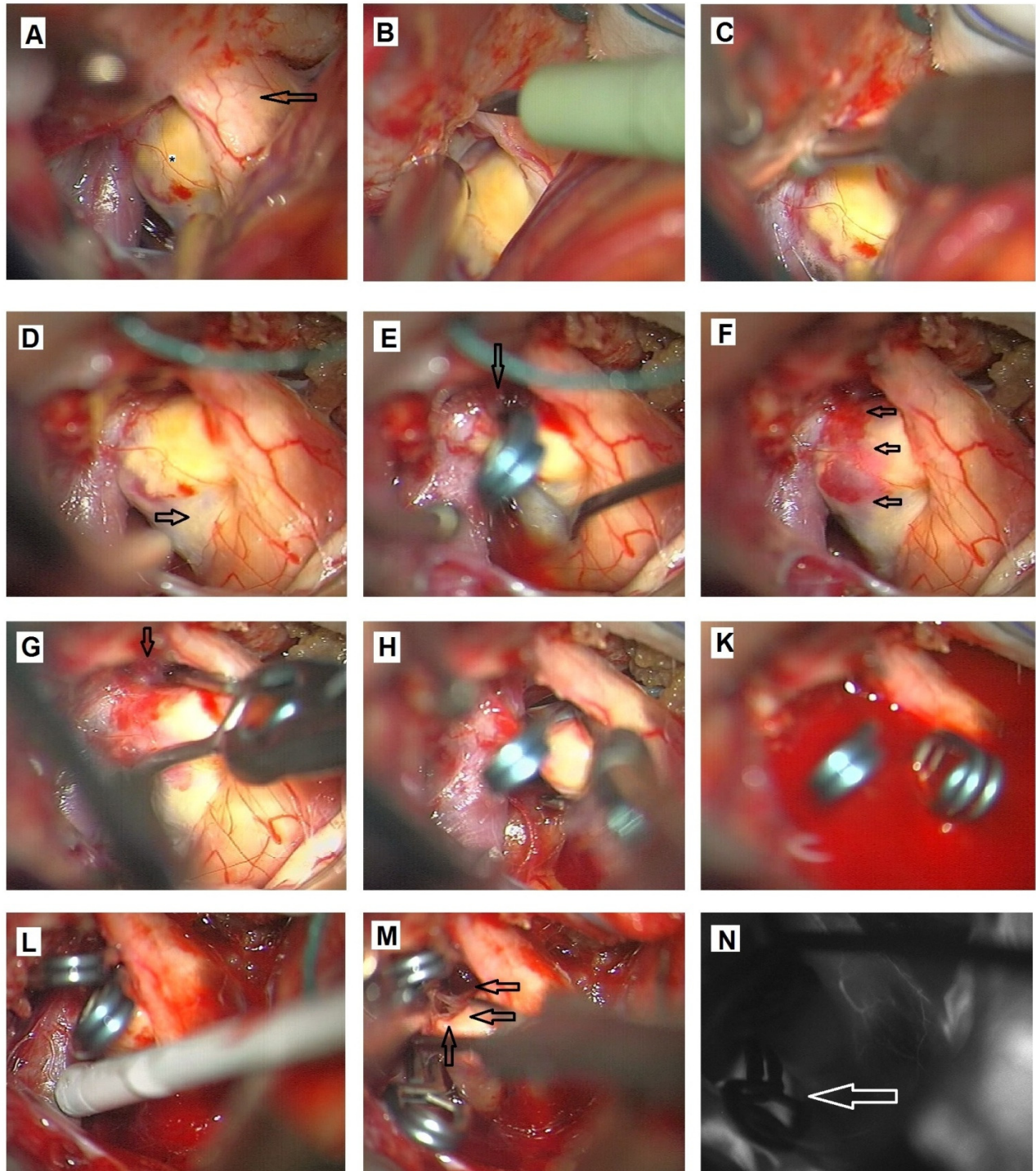


Figure 2. A. Giant left ICA aneurysm (asterisk) compressing the optic nerve (arrow)
B. Falciforme ligament is opened.

- C. Partial clinoidectomy from intradural
- D. The optic nerve is adherent to the aneurysm (arrow)
- E. Clipping (straight clip). The neck of the aneurysm was dissected. The atheromatous nature of the aneurysm caused the clip to slip over the ophthalmic artery (arrow) and occlude the vessel when slowly releasing the clip.
- F. Clip removal. Then the wall of the aneurysm became hyperaemic. A warning sign.
- G. Reclipping with a 45° angulated clip in the direction shown. (Arrow: ophthalmic artery)
- H. Again compression of the ophthalmic artery. A second clip is placed over the first (at this point the aneurysm was punctured) in order to remove the more proximal clip and avoid compression of the ophthalmic artery.
- K. Aneurysm ruptures.
- L. Proximal clipping of the ICA. Microdoppler shows good flow of the distal ICA.
- M. Trapping of the aneurysm. The arrows show the ruptured localization. The wall was too thin to perform any kind of reconstruction.
- N. Indocyanin green (ICG) video angiography showing complete exclusion of the aneurysm and excellent signal of the ICA distally to the clips.

The patient showed a delayed recovery. The blood pressure was kept at 160 mmHg for the first 6 days. At day 7 the patient awoke. No neurologic deficits could be seen. Obliteration of the ophthalmic artery had no consequence. The visual disturbance decreased.

SUMMARY

There are some important points in this case:

1. Atheromatous aneurysms tend to rupture close to the neck
2. A hyperaemic transformation of the vessel wall is a warning sign of imminent rupture
3. In case of rupture of para-ophthalmic aneurysms the surgeon has to be prepared to perform a bypass unless sufficient distal perfusion is achieved by collateral flow Even with a “good” aneurysm neck a safe proximal control is mandatory

We would like to discuss how other vascular neurosurgeons would have proceeded.

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