*The Journal of Laryngology & Otology (2007), **121**, 698–701.*

doi:10.1017/S0022215107006780
Printed in the United Kingdom
First published online 23 March 2007

Clinical Record

Magnetic resonance angiography follow-up examinations to detect iatrogenic pseudoaneurysms following otorhinolaryngological surgery

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Abstract

Endoscopic endonasal surgery on a 36-year-old man was complicated by perforation of the right internal carotid artery. The immediate, substantial haemorrhage was controlled by packing the sphenoid sinus. Intra-arterial angiography of the right internal carotid artery showed small irregularities proximal to the ophthalmic artery. A follow-up examination two weeks later documented a large pseudoaneurysm in the initially irregular arterial segment, which was successfully treated by endovascular coiling.

This case report illustrates the need for angiographic follow-up examinations following traumatic intracranial vessel injury in order to identify late pseudoaneurysm development.

Key words: Intracranial Artery Diseases; Aneurysm; Otorhinolaryngologic Surgical Procedures; Magnetic Resonance Angiography; Follow Up Studies

Introduction

Iatrogenic injury of intracranial arteries is one of the most severe complications of neuro- and otorhinolaryngological surgery. It carries the potential for lethal intracranial haemorrhage and requires prompt management. Immediate control of bleeding by tamponade is usually followed by more definitive treatment, such as operative reconstruction of the damaged vessel. When this proves unsuccessful, sacrifice of the vessel by occlusion is occasionally required.[1] However, even after successful surgical treatment, the delayed formation of pseudoaneurysms carries the risk of rupture or intracerebral embolisation and is thus a severe complication. Approximately 11 per cent of iatrogenic wall penetration during surgery will result in traumatic aneurysms.[1]

The following case report demonstrates the value of non-invasive magnetic resonance angiography (MRA) for follow up after traumatic intracerebral artery injury.

Case report

A 36-year-old man underwent elective polypectomy for lesions in the paranasal sinuses. This was performed via endonasal access and included sinus fenestration and septoplasty. During polypectomy in the sphenoid sinus, severe haemorrhage occurred, which was successfully tamponaded by nasal packing with a cotton strip. Clinical examination showed an non-reactive right pupil, indicating increased pressure in the orbit. Therefore, the lamina papyracea was removed and the periorbital tissue was slit for decompression.

A cranial computed tomography (CT) scan documented no signs of cerebral ischaemia or cerebral haemorrhage. However, intra-arterial digital subtraction angiography showed minor vessel wall irregularities of the right internal carotid artery (ICA) proximal to the ophthalmic artery (Figure 1). In order to plan further treatment, the intracranial collateral perfusion was examined by compression of the ipsilateral extracranial ICA. This demonstrated sufficient collateral perfusion via the contralateral carotid artery. Based on interdisciplinary discussion of different therapeutic approaches (e.g. occlusion of the damaged ICA, emergency stenting), conservative antithrombotic therapy (preventing embolisation for at least three weeks; PTT 45-50, Glexane, Clexane®, Aventis Pharma, Frankfurt, Germany) and blood pressure normalisation was chosen. Anticoagulation was initiated on day one, as the risk of thrombus formation and embolisation to the intracranial arteries (especially the ophthalmic artery) was felt to be very high.

An ophthalmological examination showed an exophthalmic eye with intact direct and indirect light reaction. On day two, the cotton pack was removed (as cotton is appropriate for first aid treatment only) and an 'organic pack' (i.e. muscle, fascia and fat) was implanted. This organic material was pressed into position over a Silastic® shield and over a cotton gauze strip containing antibiotic ointment. The operative outcome was monitored by daily ophthalmological and rhinolaryngological follow-up examinations.

On day six, a follow-up magnetic resonance angiography (MRA) (using a three-dimensional (3D) time-of-flight application) documented vessel wall irregularities in the initially damaged area of the ICA. No sinus cavernosus fistulisation was seen. Diffusion weighted imaging revealed two minor subcortical infarctions in the territory of the right ICA.

On day 13, the cotton material was extracted without further haemorrhage. Long term anaesthesia was discontinued. On clinical examination, the right eye remained exophthalmic but there was ptosis, loss of visual acuity and absence of light reflexes.

On day 20, another intracranial 3D time-of-flight MRA (Figure 2a) documented a 7.5 × 10.5 mm pseudoaneurysm at the site of the internal carotid artery (ICA) injury,

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Accepted for publication: 13 December 2006.

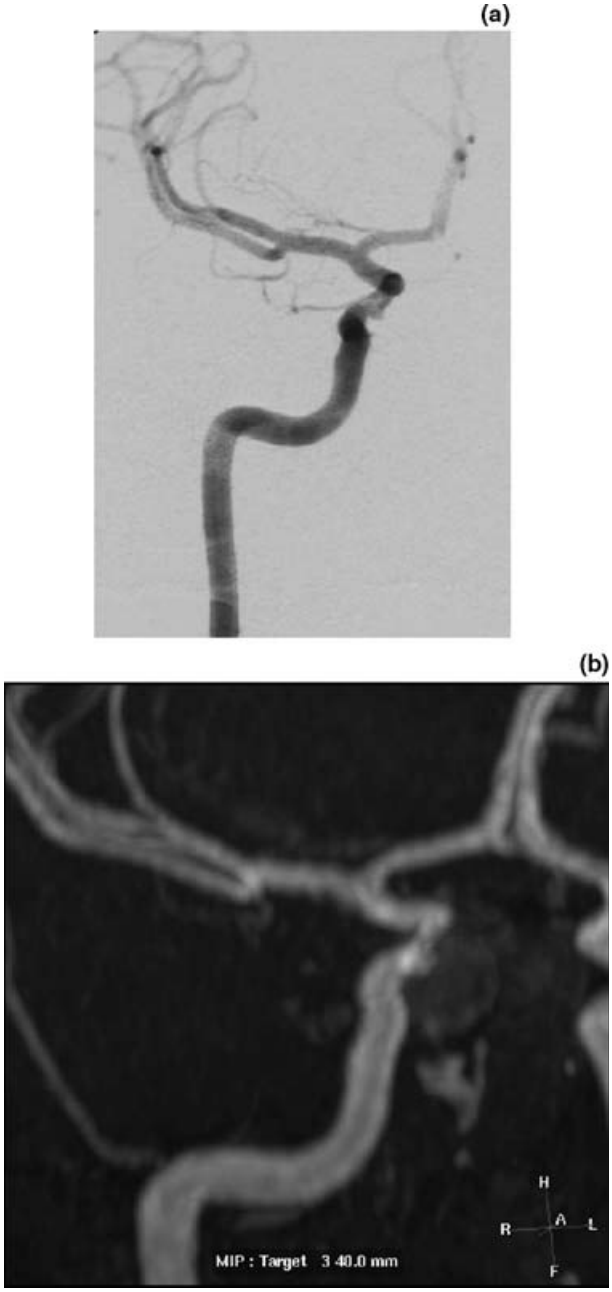

FIG. 1
Vessel wall irregularities following traumatic injury of the right internal carotid artery proximal to the origin of the ophthalmic artery. (a) Digital subtraction angiography; (b) three-dimensional time-of-flight magnetic resonance angiography.

FIG. 2
Traumatic internal carotid artery aneurysm in the previously injured vascular area. (a) Three-dimensional time-of-flight magnetic resonance angiography; (b) digital subtraction angiography.

proximal to the origin of the ophthalmic artery, which was confirmed by intra-arterial digital subtraction angiography (Figure 2b). T2-weighted images showed the small microinfarctions in the right hemisphere to be unchanged.

On day 27, the traumatic ICA aneurysm was treated with Guiglielmi detachable coils. The patient recovered without additional neurological deficits (Figure 3a).

Following coil implantation, a third 3D time-of-flight magnetic resonance angiography (MRA), taken on day 28 (Figure 3b) showed normal vascular flow in the ICA, a satisfactory luminal diameter, and successful reduction of flow through the pseudoaneurysm sac. Again, minor vessel wall irregularities were seen above and below the site of the treated pseudoaneurysm.

The patient was discharged on day 44 with a residual loss of visual acuity in the right eye.

A follow-up 3D time-of-flight MRA, taken 10 months after embolisation, showed near-regular vascular morphology of the internal carotid artery (ICA) (Figure 3c).

Discussion

Surgery-induced damage of intracranial arteries can cause acute haemorrhage with lethal potential, requiring emergency treatment.

The development of an ICA pseudoaneurysm following transsphenoidal and rhinolaryngological surgery is a rare complication.[2–4] The percentage of transsphenoidal

https://doi.org/10.1017/S0022215107006780 Published online by Cambridge University Press

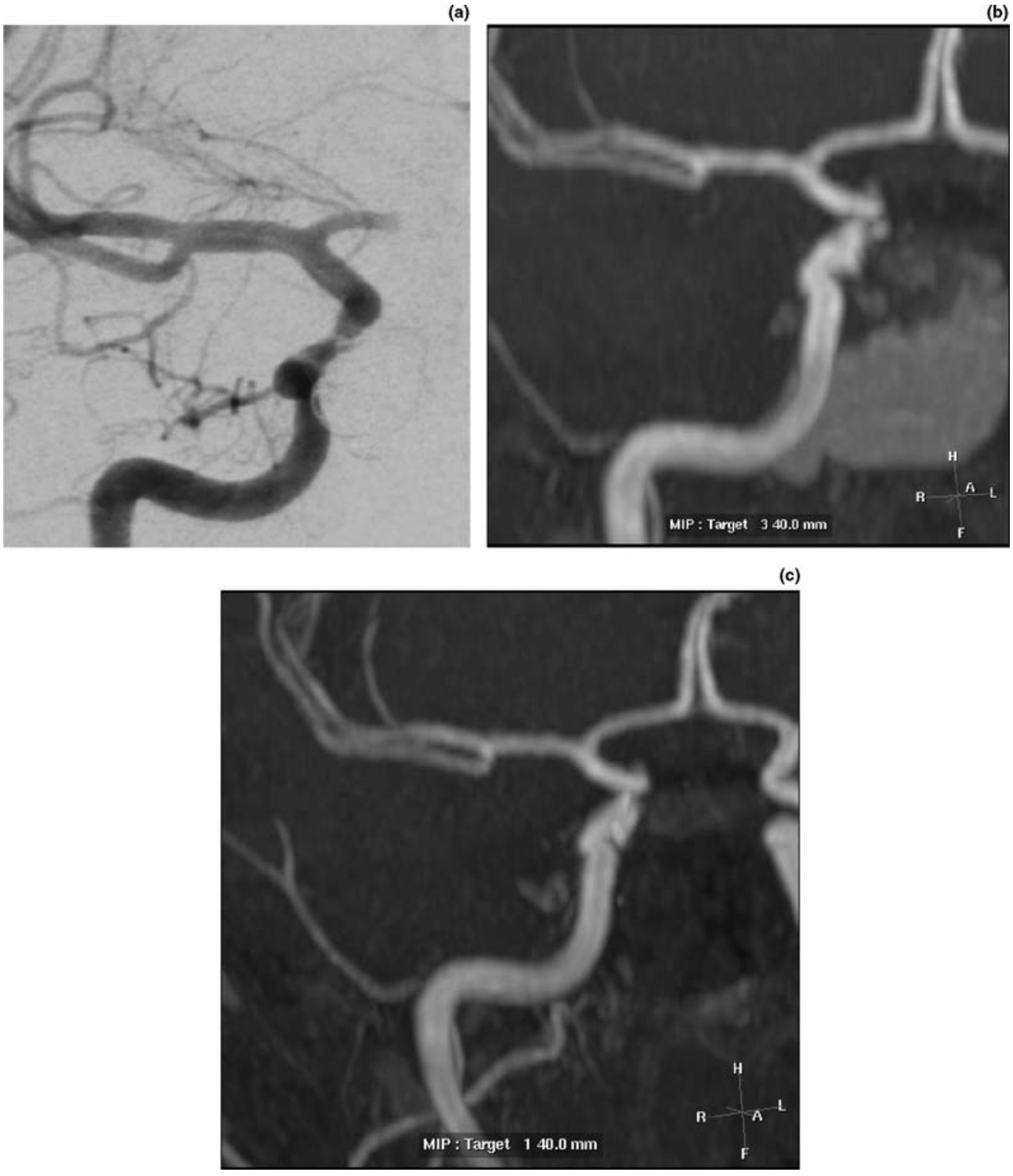

FIG. 3

Coil embolisation of the internal carotid artery (ICA) aneurysm in the injured vascular area. (a) Digital subtraction angiography; the aneurysm is completely occluded by the coils. (b) Three-dimensional (3D) time-of-flight magnetic resonance angiography (MRA) demonstrates normal flow in the ICA. (c) Ten months after embolisation, a follow-up 3D time-of-flight MRA shows regular conditions.

operations resulting in ICA damage varies from 0.4 to 1.4 per cent.[5,6]

In general, pseudoaneurysms carry an increased risk of rupture, with resultant subarachnoid or extradural haemorrhage combined with epistaxis as well as arterio-arterial embolism.[1,7] Detailed data are unavailable regarding the time course between trauma and pseudoaneurysm formation, and further complication such as vessel rupture.[8] Several case reports document pseudoaneurysm formation within days or weeks, causing intracranial or transnasal haemorrhage, following the initial surgery.[9] Therefore, early detection of pseudoaneurysm formation is mandatory in order to avoid these complications.

https://doi.org/10.1017/S0022215107006780 Published online by Cambridge University Press

In our experience, 3D time-of-flight magnetic resonance angiography (MRA) is a quick, non-invasive surveillance method, which is indicated weekly for the first month following internal carotid artery (ICA) perforation and monthly thereafter. This investigation can be performed within a few minutes (eight minutes in our patient). We no longer regard invasive angiographic methods as necessary.

- **Iatrogenic injury of intracranial arteries is one of the most severe complications of neuro- and otorhinolaryngological surgery**
- **Immediate control of bleeding by tamponade is usually followed by more definitive treatment, such as operative reconstruction of the damaged vessel**
- **This paper describes endoscopic endonasal surgery on a 36-year-old man, complicated by perforation of the right internal carotid artery**
- **This case illustrates the importance of routine follow-up angiography of the cerebral arteries after traumatic injury in order to exclude pseudoaneurysm formation**

Established surgical and endovascular methods exist for the treatment of pseudoaneurysms. Sufficient collateral arterial supply from the contralateral ICA must be confirmed if vessel occlusion is planned.[10–12] However, surgery is being progressively replaced by neuroradiological interventional procedures.[13,14] Pseudoaneurysm occlusion by coiling can preserve the damaged vessel, but carries the risk of coil compaction with further progressive pseudoaneurysm formation. Intra-arterial stent implantation may stabilise the injured vessel and avoid further or progressive pseudoaneurysm formation,[15,16] but complications due to delayed stenosis or occlusion cannot be excluded.

Conclusion

The presented case report illustrates the importance of routine follow-up angiography of the cerebral arteries after traumatic injury in order to exclude pseudoaneurysm formation as early as possible. Non-invasive MRA appears to be a suitable follow-up tool to exclude aneurysm formation. Our experience suggests that examinations are required weekly during the first month after damage, then monthly.

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Dr B Buerke takes responsibility for the integrity of the content of the paper.
Competing interests: None declared