

# Natural History and Management of Blunt Traumatic Pseudoaneurysms of the Internal Carotid Artery

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## Introduction

The natural history and management of traumatic ICA pseudoaneurysms is controversial.

## Methods

We retrospectively examined all head and neck CTA reports from trauma admissions using a keyword computerized search to find all trauamtic ICA pseudoaneurysm/Biffl 3 injuries over a 10 year period. Radigraphic and Clinical outcomes were then recorded. Statistical analysis was performed with either the Fisher’s exact test or student’s t-test when appropriate.

Additionally and uniquely, any patient with a confirmed ICA pseudoaneurysm received 3 days of transcranial Doppler (TCD) ultrasonography emboli monitoring of the ipsilateral middle cerebral artery (MCA).

## Results

Over the 10-year period, 43 traumatic pseudoaneurysms of the ICA were diagnosed in 39 patients. 22 (56%) were male with an average age of 41 years. 37(86%) pseudoaneurysms were located in the cervical ICA, 5 (12%) were in the cavernous ICA, and 1 involved both the cavernous and supraclinoid ICA segments.

## Results Continued

No cervical ICA pseudoaneurysm ruptured in the acute or delayed setting. Three of the 6 cavernous and/or supraclinoid pseudoaneurysm patients presented with ipsilateral carotid-cavernous fistulae (CCF) consistent with pseudoaneurysm rupture. All 3 also developed ipsilateral ischemic stroke requiring surgical treatment as described below.

In total, acute stroke was seen in 7 patients (16%); three were from hemodynamic failure and 4 were embolic. Overall mortality attributable to stroke in this subpopulation was 42% (n=3). Two of the 3 patients with infarctions associated with hemodynamic failure developed malignant ischemia requiring decompressive hemicraniectomy. Neither improved and both died after their families withdrew care. The third patient’s stroke was small and the patient was treated with antiplatelet agents alone with a good recovery. Of the 4 patients with embolic strokes, three underwent inpatient surgical treatment. All 3 underwent balloon test occlusion of the ipsilateral cervical ICA.

## Results continued

Two subsequently underwent endovascular parent-vessel sacrifice (PVS). Despite passing the original balloon test occlusion, one of the patients who underwent PVS later underwent EC-IC bypass for ongoing ischemic symptoms. Both PVS patients were mRS of 2 at follow-up. One patient underwent upfront EC-IC bypass after a failed balloon test occlusion, and recovered to an mRS of 3 at follow-up. The fourth patient with embolic stroke also had a complete contralateral ICA occlusion and contralateral strokes; due to poor neurological status, the family withdrew care and the patient died.

## TCD Data

Thirty-two of the thirty-nine patients (82%) received daily TCD with emboli monitoring; monitoring was not possible in the remainder due to technical constraints or poor temporal bone windows. An embolic rate of = 8 emboli per hour was predictive of embolic stroke (p=0.0076).

## Long Term outcome

Of the 33 survivors with 37 ICA pseudoaneurysms that did not undergo acute endovascular or surgical treatment, all were maintained on daily aspirin. 3 patients with 4 pseudoaneurysms (10.8%) were

## Long Term outcome continued

lost to follow-up and 1 patient died shortly after his admission from metastatic cancer. At longest CTA follow-up (range 1week-5years), 9 (28%) ICA pseudoaneurysms increased in size, 17 (53%) decreased or were stable in size, and 6 (19%) resolved. Neither initial size, morphology (saccular vs fusiform) nor location (cervical vs cavernous) predicted pseudoaneurysm progression, stability, or resolution.

Of the 9 that increased in size, 4 (44%) had mild enlargement (1 – 4.5 mm) and all four stabilized or decreased in size at subsequent follow-up (range, 3.5 months – 5 years) without surgical treatment. All patients were maintained on daily aspirin, and none developed clinical symptoms. The remaining 5 (56%) had an increase of = 5mm (range, 5 – 25mm) in maximal diameter within 1 year of injury and elective delayed endovascular treatment was selected in these cases. All were loaded on plavix/ASA and the cases went without complication. All aneurysms remained obliterated at longest radiographic follow-up (range, 4 months - 7 years) with no in-stent stenosis.

## Conclusions

The vast majority of traumatic ICA pseudoaneurysms can be treated conservatively with aspirin and close follow-up. Daily transcranial Doppler ultrasonography with emboli monitoring can identify patients at risk for embolic stroke. Acute endovascular treatment or surgical bypass should be considered in the setting of stroke or rupture. Delayed endovascular treatment is indicated only with progressive pseudoaneurysm enlargement or parent vessel stenosis.

