# Intra-Arterial Use of Abciximab in Thromboembolic Complications Associated with Cerebral Aneurysm Coiling: The London Ontario Experience

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■ BACKGROUND: **Experience with intra-arterial infusion of abciximab for the treatment of endovascular thrombotic complications is limited to short case series. Our objective is to evaluate the safety and effectiveness of this drug for the treatment of thromboembolic complications during aneurysm coiling and to determine the risk factors.**

■ METHODS: **From an aneurysm coiling database, patients treated with intra-arterial abciximab after having thrombotic complications during the coiling procedure were selected for analysis. Complications after using abciximab were categorized as hemorrhage, distal migration of the thrombus, and aneurysm recanalization.**

■ RESULTS: **Fourteen coiling patients sustained a thromboembolic complication and were treated using intra-arterial infusion of abciximab and were subjected to further analysis. The age range was 48–76 years. Three patients were male. Seven patients had subarachnoid hemorrhage. Only complete recanalization was associated with clinical improvement, but this occurred in only 4 patients (28.5%). Partial or complete recanalization occurred in 13 patients (93%). Eight patients (57%) had complications derived from the infusion. Three patients had aneurysm recanalization, 3 patients had distal migration of the thrombus and 1 patient had a hemorrhagic complication. Eight patients demonstrated acute infarcts related to the occluded vessel, whereas 7 patients made a good functional recovery.**

■ CONCLUSION: **Successful recanalization of a vessel occluded by thrombus formation during aneurysm coiling using abciximab (Reopro) infusion is less than optimal. There are risks related to abciximab, including bleeding and aneurysm recanalization.**

## INTRODUCTION

Thromboembolic complications during endovascular aneurysm coiling range in frequency from 6.7% to 28%[1,2]; they are the most common cause of periprocedural morbidity associated with the endovascular treatment of cerebral aneurysms.[3] Acute management of this type of complication has risks, such as hemorrhage from an unsecured cerebral aneurysm or hemorrhage within a new infarct. Possible treatments include mechanical thrombectomy and the use of thrombolytic drugs, including urokinase,[4] tissue plasminogen activator (tPA),[5] and GPII/IIIb inhibitors.[6,7]

Abciximab is a GPII/IIIb inhibitor, reported to be effective in dissolving hyperacute thrombi when used intravenously.[7] Experience with intra-arterial (IA) abciximab is, however, limited to a few small case series, with potential selection bias. The previous literature has reported high rates of success, but better

**Key words**
- Abciximab
- Coiling
- Complications
- Endovascular
- Reopro
- Stroke
- Thromboembolic

**Abbreviations and Acronyms**
**CT**: Computed tomography
**DSA**: Digital substraction angiography
**DWI**: Diffusion-weighted image
**IA**: Intra-arterial
**IV**: Intravenous
**MRA**: Magnetic resonance angiogram
**MRI**: Magnetic resonance imaging
**mRS**: modified Rankin score
**SAH**: Subarachnoid hemorrhage
**TICI**: Thrombolysis in cerebral infarction
**tPA**: Tissue plasminogen activator

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delineation of complication rates, and related factors should be further reviewed. In this article, we review our experience with IA abciximab and try to clarify the benefits versus the risks.

## METHODS

### Study Population

From a prospectively maintained database of 240 coiled patients treated between January 2012 and January 2016, 14 patients were selected for analysis according to the following criteria: 1) patients with a brain saccular aneurysm treated with coil embolization; 2) use of IA abciximab after having a thrombotic complication during coiling procedure; 3) availability of digital subtraction angiography (DSA) before and after abciximab infusion; 4) availability of postprocedural computed tomography (CT) or magnetic resonance imaging (MRI) with diffusion-weighted imaging (DWI) scan.

Angiographic and endovascular procedures: diagnostic cerebral angiography of each aneurysm was discussed with a vascular neurosurgeon and a neurointerventional radiologist to decide the best therapeutic alternative (surgical clipping vs. endovascular coiling). Criteria favoring endovascular coiling were saccular ruptured aneurysm, presence of vasospasm, location within posterior location, dome-to-neck ratio greater than 1.5, age greater than 65 years, and calcification of the aneurysm neck visualized on the CT scan. A balloon-assisted coiling procedure was performed when the dome-to-neck ratio was less than 1.5, and the procedure was still favorable for endovascular coiling.

Administration of IA abciximab was always considered after having a thromboembolic complication following an endovascular coiling procedure. When an intraprocedural vessel rupture happened or when the aneurysm ruptured previously to coil deployment, IA infusion of abciximab was avoided. Further conservative management was considered when the thrombus formation was not sufficient to produce a considerable delay on flow or to produce significant impairment in the patient after checking with a neurologic examination.

### IA Abciximab Infusion Procedure

In all patients, intravenous (IV) heparin was routinely given to maintain ACT between 200 and 300 seconds during the procedure; this was not reversed after the administration of abciximab. After a thromboembolic complication was confirmed by DSA, a microcatheter was navigated to the proximal end of the blood clot, and the IA abciximab infusion was started. The rate and dosage of IA infusion followed the recommendations of Fiorella et al.[6] The abciximab, diluted in saline to 0.2 mg/mL, was administered as a bolus of 2–5 mg over a period of 2 minutes. After each bolus was administered, control angiography was performed through the guiding catheter to assess the progress of thrombolysis. In cases of thrombus persistence or progression, further IA administration was performed until reaching a maximum dose of 0.25 mg/kg abciximab. Infusion was stopped if the patient was hemodynamically unstable or any complications occurred. When concurrent IV infusion was performed, the drug was diluted in 0.9% normal saline, and infusion was continued for 12 hours at a rate of 0.125 μg/kg/min. The total doses of IA abciximab and use of any other antifibrinolytic drugs were recorded. When coadjutant IV infusion of heparin was performed, unfractionated heparin was infused over a period of 12–24 hours to maintain partial thromboplastin time double of the baseline. Within the period of January 2012 to December 2013, there was not a strict protocol regarding the concomitant use of IV heparin or abciximab (patients 5,7,8,10 and 13). The decision was made by consensus between intensive care physician and endovascular surgeon. Overall, concomitant use of IV anticoagulants or antiplatelets was avoided in those patients with subarachnoid hemorrhage (SAH). Our current practice is to avoid the IV injection of abciximab and the use of other fibrinolytics as much as possible in all patients, given the higher risk of having hemorrhagic complications.[4] Our protocol does not include pretreatment with antiplatelets before intervention when endovascular coiling is planned.

### Radiological Assessment

Thromboembolic complication was confirmed on DSA. It was defined as anterograde flow disturbance, such as a complete occlusion or a delayed flow into the distal vessels, produced by gradual progression of a thrombus. Angiographic recanalization was classified according to thrombolysis in cerebral infarction (TICI) score[8] as follows: complete recanalization (TICI 3), partial recanalization (TICI 1 and 2), or no changes in distal flow (TICI 0). New hemorrhage or progression of a previous hemorrhagic event, distal thrombus migration and aneurysm recanalization were considered as complications of the infusion. Distal migration of the thrombus was considered as a flow delay or complete occlusion of a distal segment of the same parent artery after a complete or partial recanalization. The state of the aneurysm after abciximab infusion was also analyzed in the postprocedure DSA. An increase of contrast filling within the aneurysm in a comparison of angiography before abciximab infusion angiogram was considered to represent aneurysm recanalization.

All patients had post-coiling MRI and magnetic resonance angiography (MRA) as a routine follow-up. A new hyperintense lesion on DWI was considered an acute ischemic stroke. We differentiated between significant or nonsignificant stroke as follows: if the volume of diffusion restriction was greater than 10 mL; was responsible for new neurologic deficits post after coiling; and was related with the vessel previously occluded during the thrombotic complication. MRA was used to assess the post-coiling state of the aneurysm according to the Raymond Roy occlusion class.[9] Contrast extravasation on DSA during the infusion, and progression of a previous hemorrhage on the post-coiling MRI or CT were considered to be hemorrhagic complications.

### Clinical Follow-Up

The first physical examinations after coiling of all patients were recorded. All patients were assessed at 6 months after the procedure, according to the modified Rankin Scale (mRS).[10]

### Complications

Undesirable events that were directly related to the infusion procedure, including rupture of the aneurysm or hemorrhagic