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 GPIIb 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
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 microwire catheter 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.2 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 A 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) score2 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 extravasation on DSA during the infusion, and migration of the thrombus was considered as a complication 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
complication, distal migration of the thrombus and recanalization of the aneurysm were considered complications of the abciximab infusion.

**Statistical Analysis**

Abciximab dose was considered a quantitative variable. Qualitative variables considered were the following: “complete recanalization” (complete vs. partial or no recanalization), “partial recanalization” (partial and complete recanalization vs. non-recanalization), “complications” (present or absent), “rebleeding” after abciximab infusion (present or absent), “aneurysm sac recanalization” [yes or no], significant “infarction in the MRI post procedure” (present or absent) and “good clinical outcome” (mRS <2).

Qualitative variables, including “complete recanalization,” “partial recanalization,” “presence of complications,” “rebleeding,” “recanalization of the aneurysm,” presence of significant “infarction in the MRI post procedure,” and “good clinical outcome” were compared among groups regarding their age (>65 years old), sex (male or female), location of the aneurysm treated (anterior vs. posterior circulation), presence of SAH at time of treatment and IV coadministration of another antiplatelet or fibrinolytic drug, such as heparin or abciximab, using the Fisher exact test. To compare the qualitative variables “partial recanalization” and “complete recanalization” with “significant infarction in the MRI” and with “good clinical outcome,” a Fisher exact test was performed.

A dose of IA abciximab (quantitative variable) was also compared with the following qualitative variables: “complete recanalization,” “partial recanalization,” “presence of any complication,” “rebleeding,” “aneurysm sac recanalization,” “infarction in the MRI,” and “good clinical outcome.” Testing comparison, in this case, was done using Kruskal-Wallis test. A two-tailed P < 0.05 was considered significant, and all tests were calculated using SPSS version 22.

**RESULTS**

The incidence of thrombotic complications in our series was 7.9% (19 of 240 cases). Five patients did not receive IA abciximab and were not included in further analysis. Of these, 3 patients had small thrombotic formations that did not limit the distal flow and did not have clinical implications for the patients, and in 2 patients the thrombosis occurred in the presence of a ruptured aneurysm before any coil was deployed. Finally, the analysis included 14 patients using IA infusion of abciximab. Three patients were men, and 11 patients were women. The age range was 48–76 years, with an average of 56.5. Seven patients had SAH, 7 patients had an unruptured aneurysm. The summary of the results is shown in Table 1.

Thirteen (93%) patients had at least partial recanalization, and 28.5% experienced complete recanalization of the parent vessel with restoration of normal flow. Eight (57%) patients had a complication from the infusion. No complication derived from the use of abciximab was directly associated with death or severe disability (mRS of 5 or 6). Regarding complications, 3 patients had aneurysm recanalization, 4 patients had distal migration of the thrombus, and 1 patient had a hemorrhagic complication. No additional bleeding was seen in the patients with ruptured aneurysms.

In the postoperative MRJ examinations, 6 patients did not have significant infarct related to the vessel initially occluded. In 8 patients, DWI lesions were found related to the artery that was occluded. The MRA demonstrated recanalization of the target vessel in all cases. The aneurysm was completely occluded (Raymond Roy occlusion class 1) in 3 cases; in 7 there was some filling of the neck (Raymond Roy occlusion class 2) and in 4 there was at least some partial filling of the aneurysm dome (Raymond Roy occlusion class 3).

One patient died on the fourth postoperative day because of complications derived from the SAH, 5 patients had complete recovery (mRS = 0), 6 had slight or moderate disability (mRS = 2 or 3), and 1 patient had severe disability (mRS = 5).

Qualitative variables, including age greater than 65 years, sex, SAH presentation, and coadjuvant administration of IV drug, did not demonstrate statistical significant association with recanalization (partial or complete), complication rates, infarction in postprocedural MRI or clinical status at follow-up. Three patients were treated with abciximab after developing thromboembolic complications during treatment of an aneurysm in posterior circulation. The location in the posterior circulation was significantly related to the lower rate of infarction seen in the MRI after the procedure (0% vs. 91%; P = 0.011).

All the patients with a thrombotic complication in the posterior circulation recovered completely (mRS = 0; 100% mRS <2), whereas only 3 of the 11 patients with thromboembolic complication occurring in the anterior circulation had an mRS less than 2 at follow up. However, this relation lacks statistical signification (P = 0.095). Location of the aneurysm did not show significant association with vessel recanalization or complications (P = 0.9 and P = 0.76, respectively).

Complete recanalization of the parent vessel was associated with good clinical outcome (100% vs. 27%, P = 0.05), but there was not a significant association with infarction on MRI (P = 0.67). On the other hand, partial recanalization did not show significant association with clinical outcome nor infarction on the MRI (P = 0.57 and P = 0.71, respectively). Higher doses of IA abciximab were associated with higher rates of aneurysmal recanalization (P = 0.038), but did not show better recanalization rates, partial (P = 0.42) or complete (P = 0.36).

**DISCUSSION**

To date, reports of the use of abciximab has been restricted to small case series6–11 and have suggested a low risk of complication. Our larger case series found an unexpected higher complication rate and a lower rate of procedural success than has been previously reported.

Previous experience with the use of IA abciximab infusion is summarized in Table 2. Successful recanalization rates in the literature range between 80% and 100%. A potential question is the definition of successful recanalization, which is often subjective without clear thresholds. Satisfactory improvement of flow in our series occurred in 13 of 14 patients, although complete recanalization with restoration of normal flow was
**Table 1. Patients with Thrombotic Complications During Coiling of Cerebral Aneurysm, Treated with Intra-arterial Abciximab**

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Sex</th>
<th>IA Abciximab (mg)</th>
<th>Aneurysm</th>
<th>Coadjuvant IV Infusion</th>
<th>Recanalization</th>
<th>Complication</th>
<th>MRI</th>
<th>MRI - (RROC)</th>
<th>mRS at Follow-Up</th>
</tr>
</thead>
<tbody>
<tr>
<td>53</td>
<td>Female</td>
<td>10</td>
<td>(e) Acom, 10 mm</td>
<td>None</td>
<td>Complete</td>
<td>Rupture and bleeding</td>
<td>Left MCA and watershed stroke foci. Rebleeding</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>61</td>
<td>Female</td>
<td>7</td>
<td>(R) Acom, 12 mm</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>Left ACA infarct</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>70</td>
<td>Female</td>
<td>10</td>
<td>(R) Acom, 11 mm</td>
<td>None</td>
<td>Complete</td>
<td>None</td>
<td>No significative infarct</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>61</td>
<td>Female</td>
<td>5</td>
<td>(e) Basilar, 14 mm</td>
<td>None</td>
<td>Partial</td>
<td>Recanalization of aneurysm</td>
<td>No infarct</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>51</td>
<td>Male</td>
<td>7</td>
<td>(e) Acom, 9 mm</td>
<td>None</td>
<td>Complete</td>
<td>Distal thrombus</td>
<td>No significative infarct</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>50</td>
<td>Female</td>
<td>17</td>
<td>(e) Basilar, 7 mm</td>
<td>None</td>
<td>Complete</td>
<td>None</td>
<td>No infarct</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>60</td>
<td>Female</td>
<td>9</td>
<td>(e) Basilar, 6 mm</td>
<td>IV abciximab</td>
<td>Partial</td>
<td>None</td>
<td>No infarct</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>49</td>
<td>Male</td>
<td>9</td>
<td>(R) MCA, 7 mm</td>
<td>IV abciximab</td>
<td>Partial</td>
<td>Distal thrombus</td>
<td>Multiple infarcts and petechial transformation</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>47</td>
<td>Female</td>
<td>10</td>
<td>(e) MCA, 8 mm</td>
<td>None</td>
<td>Partial</td>
<td>None</td>
<td>Multiple right small infarcts</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>55</td>
<td>Female</td>
<td>8</td>
<td>(R) Acom, 5 mm</td>
<td>IV abciximab/heparin</td>
<td>Partial</td>
<td>Distal thrombus</td>
<td>Infarct left ACA territory</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>50</td>
<td>Female</td>
<td>10</td>
<td>(R) Acom, 6 mm</td>
<td>None</td>
<td>Partial</td>
<td>Distal thrombus</td>
<td>Infarct Left Parietal, progression of the SAH</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>76</td>
<td>Male</td>
<td>6</td>
<td>(R) Acom, 8 mm</td>
<td>None</td>
<td>Partial</td>
<td>Recanalization of aneurysm</td>
<td>Left frontal and left parietal infarct</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>48</td>
<td>Female</td>
<td>8</td>
<td>(R) MCA, 10 mm</td>
<td>Heparin</td>
<td>Partial</td>
<td>None</td>
<td>No infarct</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>61</td>
<td>Female</td>
<td>8</td>
<td>(R) Acom, 7 mm</td>
<td>None</td>
<td>Partial</td>
<td>Recanalization of aneurysm</td>
<td>Caudate nucleus infarct</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

IA, intra-arterial; IV, intravenous; MRI, magnetic resonance imaging; RROC, Raymond Roy occlusion class; mRS, modified Rankin Score; (e), elective/unruptured; (R), ruptured/SAH; NR, not reported; SAH, subarachnoid hemorrhage; ACom, anterior communicating artery; ACA, anterior cerebral artery; MCA, middle cerebral artery.
<table>
<thead>
<tr>
<th>Investigation Work</th>
<th>Use</th>
<th>N</th>
<th>Rate of Success in Terms of Recanalization</th>
<th>Dose of Infusion</th>
<th>Complication</th>
</tr>
</thead>
</table>
| Park et al., 2008\(^1\) | — | n = 32 (R 16; nr 16) | 100%  
53% Complete  
47% Partial | 5—15 mg | 1% hemorrhage |
| Song et al., 2004\(^4\) | — | n = 7 (R 4; nr 3) | 86%  
57% Complete  
28% Partial | 5 mg | 0.14% hemorrhage (1 SAH) |
| Fiorella et al., 2004\(^6\) | Coiling and AVM cases, IV and tPA was also administered | n = 3 (R 3) | 100% Complete | 3.5—10 mg | 0% hemorrhage, 40% cortical infarcts |
| Mounayer et al., 2003\(^12\) | — | n = 13 (R 4; nr 9) | 100%  
92% Complete  
8% Partial | 4—10 mg | 0% hemorrhage, 8% distal embolization (stroke) |
| Kwon et al., 2002\(^1\) | Urokinase also administered | n = 2 (R 1; nr 1) | 100% | 4—5 mg | 0% |
| Aggour et al., 2010\(^14\) | IA, followed by a IV infusion for 12 hours, 6 patients tPA | n = 23 (R 11; nr 12) | 73.9% of at least partial recanalization  
56.6% complete recanalization | 5 mg/min maximum; 0.25 mg/kg | 0% hemorrhagic complications |
| Jones et al., 2008\(^13\) | IA, followed by IV infusion for 12 hours | n = 15 (R 12; nr 3) | TICI 0 (13.3%)  
TICI 1—2 (46%)  
TICI 3 (40%) | 0.25 mg/kg | 0% intracranial bleeding, 6% digestive bleeding |
| Walsh et al., 2011\(^16\) | Study included patients treated with IA and IV; IA during coiling = 4. | n = 4 (R 2; nr 2) | NR (75% distal migration of thrombus) | NR | 25% intracranial hemorrhage, 75% distal migration of thrombus |

R, ruptured; nr, not ruptured; SAH, subarachnoid hemorrhage; IV, intravenous; tPA, tissue plasminogen activator; IA, intra-arterial; NR, not reported; AVM, arteriovenous malformation; TICI, thrombolysis in cerebral infarction.
seen in only 4 cases. Moreover, we found the correlation between DSA, MRI findings, and neurologic impairment to be imperfect, leading to uncertainty about the real value of the flow improvement demonstrated after the IA abciximab infusion on DSA. In fact, up to 25% of patients in our series with complete recanalization and 77.7% of those with partial recanalization still demonstrated significant infarcts in the territory of the initially occluded vessel. Only when the recanalization of the parent vessel was complete was there a significant correlation with better neurologic outcomes. This result might be a little discouraging, considering our current study, in which complete recanalization was achieved in only 28.5% of cases. This rate does not differ significantly with most recent investigations.13-16,17

At this point, it is interesting to remark that we found a close relation with the location of the aneurysm treated in the posterior circulation and better clinical outcomes and a lower rate of infarction. This association has never been reported in neuro-endovascular cases treated with IA abciximab. Previous studies have suggested that recanalization response after tPA infusion is worse in patients with posterior circulation strokes.15 This finding has been explained by the difference in the clot composition, as the rate of cardioembolic strokes is higher in the middle cerebral artery.15 We hypothesize that our differences in clinical and radiologic outcomes between anterior and posterior circulation are due more to hemodynamic factors, as the etiology of the clot is the same in both posterior and anterior circulation.

More than 50% of the cases suffered complications, including hemorrhage, distal migration of the thrombus with obstruction of other important branches and recanalization of the aneurysm.

To our knowledge, this study is the first to assess the post-coiling state of the aneurysm after IA abciximab infusion on the basis of MRA findings. Aneurysm recanalization was seen in 3 of our patients (Figure 1), and it is closely related to the dose of IA abciximab administered; however, increasing doses did not mean higher recanalization rates or better clinical outcomes. Despite the fact that none of these recanalized aneurysms rebled after IA abciximab infusion, we believe that abciximab should be used with caution in patients with ruptured aneurysms, and with due consideration of other factors such as packing density19 and platelet count.17

Two studies report cases of hemorrhagic complications in patients with ruptured aneurysms. These authors considered the presence of a ruptured aneurysm to be a relative contraindication to the use of abciximab. We only observed one hemorrhagic complication, and it occurred in a patient with a ruptured aneurysm. Gentric20 reported an incidence of hemorrhagic complications of 9.5%, but only one quarter of them were clinically relevant.

Apart from the setting of ruptured aneurysm, other factors believed to be associated with hemorrhagic complication include concurrent IV administration of urokinase, or another anti-fibrinolytic,4 and thrombocytopenia.17 We could not demonstrate this relationship, but the power of our study might be limited by the small number of the sample. Early in our experience, IV heparin was administered for 24 hours after IA infusion of abciximab in 2 patients. There was no hemorrhagic complication and no aneurysm recanalization. Similarly, 2 of our patients received concurrent IV injection of abciximab, with no new hemorrhage. Our current practice is to avoid the IV injection of abciximab and the use of other fibrinolytics. IA infusion of other GPIIb/IIIa inhibitors, such as eptifibatide and
Figure 2. A 61-year-old female patient with a ruptured anterior communicating aneurysm. (A) Cerebral angiogram, anteroposterior (AP) left internal carotid artery (ICA) injection. After deployment of first 3 coils, a thrombus formation besides the coil mass (arrow) produces complete occlusion of left A2, seen as a lack of distal flow in the ipsilateral anterior cerebral artery (arrowheads). (B) Cerebral angiogram, AP left ICA after 8 mg of IA abciximab achieved partial recanalization with improvement of filling in distal A2 (arrowheads). There was persistent flow delay and permanent “snow dot” (arrow) adjacent to the coil mass, protruding into the parent vessel. (C and D) Twenty-four–hour postprocedure magnetic resonance imaging and angiography. (C) Axial T1 gadolinium. Recanalization of part of the neck, measuring 6 mm in maximum diameter (arrow). (D) Axial diffusion. Ipsilateral left caudate nucleus infarct (asterisk).
tirofiban, have been proposed as an alternative to abciximab for treating thromboembolic complications during neuroendovascular procedures. Although some studies have shown lower rates of rebleeding and thrombocytopenia, there is still not enough evidence to justify their use.

Distal migration of the thrombus is a complication not commonly addressed by other authors. Mounayer reported 1 patient with distal embolism causing a stroke in a series of 13 patients treated with IA abciximab. Walsh et al. observed that this complication was common in his series. The incidence of this complication was also high in our experience, as up to one quarter of our patients demonstrated obstruction of flow in a distal vessel, with 3 of the 4 cases developing significant infarct on MRI (Figure 2).

We believe that the use of IA abciximab should be considered on an individual basis. Factors to consider include the clinical condition, the presence of concomitant hemorrhage, which vessel is occluded, the potential for collateral circulation, and risk factors for bleeding, including doses of abciximab and treatment with other blood thinners. Although the current study has some potential limitations, including a small number of cases and the lack of a reliable comparison group, our results are not as encouraging as previously described. We demonstrate, on a scientific merit, the role of some risk factors in relation to the prognosis and complication rates of using IA abciximab for thromboembolic complications after aneurysm coiling.

**CONCLUSION**

In our experience, the use of IA abciximab for treatment of acute thrombotic complications during aneurysm coiling is moderately successful for restoration of blood flow in an occluded vessel. The complication rate using IA abciximab is higher than previously reported. Aside from the well-known risk of bleeding, there is also an increasing risk of stroke on post-procedural DVI, even when recanalization on MRA is achieved. Greater doses of IA abciximab are associated with higher rates of aneurysm recanalization, without demonstrating a clear improvement in outcome or reperfusion. Patients with thromboembolic complications in posterior circulation treated with abciximab have better radiologic and clinical outcomes than those occurring in the anterior circulation. The use of IA abciximab should be individualized and limited in patients with complication risk factors.

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**REFERENCES**


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