Introduction

Thromboembolic stroke is the most common severe complication following coil embolization of intracerebral aneurysms, with a 5% incidence of permanent deficits. Despite heparin anticoagulation, rescue therapy with the platelet glycoprotein IIb/IIIa receptor antagonist abciximab may be required. However, we describe a failure of abciximab rescue therapy and discuss the importance of monitoring the variable individual response to abciximab.

Case Reports: Two patients underwent stent-assisted cerebral aneurysm coil embolization complicated by thromboembolic stroke. In one patient, abciximab rescue therapy failed and was associated with a poor neurological outcome. Thromboelastography (TEG® model 5000; Haemoscope, Skokie, IL) and platelet aggregometry suggested inadequate platelet inhibition, although other tests of platelet function suggested adequate inhibition.

Conclusion: We describe a failure of regular-dose abciximab rescue therapy for thromboembolic stroke complicating stent-assisted cerebral aneurysm coil embolization. The use of TEG to individualize abciximab dosing in this setting may improve patient outcome, as it tracks a pattern of coagulation consistent with the clinical picture.

Key Words: Platelet aggregation inhibitors; embolization; therapeutic; intracranial aneurysm; thromboelastography; intracranial embolism; thrombosis.
Developing clot in whole blood with specific patterns developing in the presence of hypercoagulability, anticoagulant therapy, antiplatelet therapy, and various coagulopathic states, even during high-dose heparin anticoagulation using a heparinase reagent to digest the heparin (16–18).

Case reports

Patient 1

A 79-year-old woman with a past medical history of diabetes and peripheral vascular disease presented for coil embolization with possible stent assistance, under general anesthesia, for ablation of an unruptured left carotid ophthalmic aneurysm. She received aspirin, but was allergic to clopidogrel, and was heparinized to obtain an activated clotting time (ACT) of more than 250 seconds. A 5-× 7-mm wide neck aneurysm was ablated with GDC coils and a 4.5- × 20-mm stent (Boston Scientific Neurovascular, Fremont, CA). Although post-embolization angiography failed to demonstrate any arterial thrombus or occlusion, she subsequently emerged from anesthesia with aphasia and dense right-sided hemiplegia, suggestive of cerebral thromboembolism. Immediate brain computed tomography (CT) imaging did not demonstrate any old or new intracranial infarction or hemorrhage. Based on the clinical diagnosis of acute cerebral thromboembolism, an initial bolus of 0.25 mg/kg abciximab was administered and this was followed by an infusion of 0.125 mcg/kg/minute for 12 hours. A normal pre-procedure TEG developed into a hypercoagulable pattern post-procedure (see Figure 1) and then demonstrated an adequate response to abciximab as defined by a reduction in the maximum amplitude (MA) of more than 33% (15). The patient made a rapid and complete clinical recovery within 1 to 2 hours.

Patient 2

An 85-year-old woman suffering from a giant cavernous carotid aneurysm underwent coil embolization with Hydrocoils® (MicroVention, Aliso Viejo, CA) with stent assistance under general endotracheal anesthesia. She had no other medical problems and received clopidogrel and aspirin for 7 days prior to the procedure and 7500 U (100 U/kg) of heparin during the procedure. Following successful ablation of the aneurysm, angiography demonstrated no evidence of arterial thrombosis. However, on emergence from anesthesia, she was aphasic and hemiplegic on the right. An immediate CT scan ruled out intracranial hemorrhage and did not show any evidence of infarction. Based on the clinical diagnosis of cerebral thromboembolism, an initial bolus of 0.25 mg/kg abciximab followed by an infusion of 0.125 mcg/kg/minute for 12 hours was administered, as for patient 1. Unfortunately, unlike previous patients we have managed with this complication, patient 2 showed no immediate signs of improvement. The following day, diffusion-weighted magnetic resonance imaging demonstrated acute cortical infarctions in the left superior frontal lobe posteriorly, even though the anterior cerebral arteries all appeared patent with magnetic resonance angiography. This patient suffered neurological deficits that gradually improved over 1 month, at which time she had four-fifths right-arm strength and mild word-finding difficulty.

As with the previous patient, TEG showed the development of a hypercoagulable pattern post-procedure TEG (Figure 2), but there was no change in this hypercoagulable pattern following abciximab, indicating a possible treatment failure. Given this unexpected response, the TEG was repeated and additional platelet function assays (PFA-100® [Dade-Behring], and turbidometric platelet-rich plasma aggregometry) were ordered. The PFA-100 showed markedly prolonged closure times with both adenosine diphosphate (ADP)–collagen and epinephrine–collagen reagents, consistent with platelet inhibition, so abciximab therapy was continued at the recommended dose. However, platelet aggregometry reported the following day was mostly normal other than 43% aggregation in response to 5 μM ADP agonist. This sensitive test was consistent with only mild platelet inhibition, so the TEG pattern was more representative of the overall coagulation profile and clinical picture.

Discussion

We described two failures of anticoagulation during stent-assisted coil embolization and one failure of rescue therapy with abciximab for thromboembolic stroke complicating this procedure. Resistance to the effects of both aspirin and clopidogrel is well recognized (10), but we demonstrated resistance to abciximab when using a weight-based dosing formula, in addition to illustrating the difficulties of monitoring antiplatelet therapy.