Massive Hemorrhage from Arterial Access during Intracranial Aneurysm Stent-Assisted Embolization: Endovascular Diagnosis and Therapy

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Abstract

Keywords

- ▶ inferior epigastric
- ▶ embolization
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Massive hemorrhage from arterial access in patients receiving anticoagulation and antiplatelet therapy is a rare but potentially devastating complication. The authors present a patient who developed a large retroperitoneal and anterior abdominal wall hemorrhage following an unintentional and unrecognized arterial injury during an endovascular procedure. Reversal of anticoagulation in patients who have undergone stent-assisted coil embolization of intracranial aneurysms is an undesirable approach due to the risk of thromboembolism; rather, transcatheter embolization of the bleeding source should be considered.

Objectives: Upon completion of this article, the reader will be able to discuss the role of transcatheter embolization for the treatment access hemorrhage without reversal of anticoagulation.

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Patients who receive stent-assisted coil embolization of intracranial aneurysms require full anticoagulation to prevent thrombosis of the stented arterial segment, which could result in serious complications including stroke and/or death.^{1,2} Thrombosis rates, even with the use of anticoagu-

lation, range from 3 to 16%; the addition of antiplatelet medications lowers the rate by approximately 5%. In cases of major hemorrhage resulting from vascular access injury, correction of the underlying coagulopathy has been the preferable strategy suggested in the literature.³ Management of access hemorrhage during intracranial aneurysm embolization presents a dilemma that does not have clear solutions given the desire to maintain anticoagulation. In this report, the authors describe a patient who experienced a major access site-associated hemorrhage from an injury to a tiny branch of the inferior epigastric artery (IEA) during stent-assisted coil embolization of a wide neck intracranial aneurysm. As in this case, anticoagulation and antiplatelet therapy can be continued, and the source of hemorrhage identified and controlled by endovascular means.

Case Report

A 56-year-old woman with a past medical history of surgical clipping of an anterior communication artery aneurysm presented for stent-assisted coil embolization of a left paraophthalmic internal carotid artery wide neck aneurysm. The

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Fig. 1 Common femoral angiogram and selective inferior epigastric angiogram. (a) Right common femoral artery angiogram at time of initial closure demonstrating contrast extravasation from IEA (arrow). (b) Selective IEA shows tiny inferior branch vessel enlargement and ectasia corresponding to site of previous bleeding. IEA, inferior epigastric artery.

patient was taking aspirin (325 mg/day) and clopidogrel (75 mg/day) for 7 days prior to the procedure.

The procedure was performed under general anesthesia. Right common femoral artery (CFA) access was obtained by an experienced neurointerventional attending using manual palpation and an 18-gauge needle (Cook, Bloomington, IN). Arterial access was achieved after the third pass with the needle. The access site was dilated over a guidewire to accept a 6-Fr introducer sheath, through which the following endovascular procedure was performed.

Intravenous infusion of heparin was administered throughout the procedure to maintain the activated partial thromboplastin time (aPTT) between 60 and 80 seconds. After a diagnostic cerebral angiogram, a 4.5-mm by 22-mm Enterprise stent (Cordis, Miami Lakes, FL) was positioned and deployed within the paraclinoid-supraclinoid segment of the left internal carotid artery and across the wide neck parophthalmic aneurysm. The aneurysm was embolized through the interstices of the stent using 2.5- and 2.0-mm DCS Orbit microcoils (Cordis). An arteriogram of the right groin was obtained in anticipation of closure device (**Fig. 1a**), after which the catheters and sheath were removed and hemostasis achieved using a Perclose Proglide device (Abbott, Redwood City, CA).

Approximately 90 minutes after the procedure, the patient's blood pressure dropped to 64/23 mm Hg (baseline: 115/49 mm Hg). On examination, the right groin access site appeared clean and dry without signs of a hematoma, but there was tightness and tenderness in the right lower abdomen. Laboratory tests showed a hemoglobin decrease from 11.1 mg/dL to 8.0 mg/dL (normal = 11.7–16.0 g/dL), and hematocrit from 32.9 to 22.9% (normal = 35.0–49.0%).

An emergent computerized tomography (CT) study of the abdomen and pelvis was obtained showing an extensive hematoma in the right hemipelvis, extending along the right anterior abdominal wall and right psoas muscle (**Fig. 2**). After further review of the right groin angiogram, a decision was made to continue anticoagulation, obtain a diagnostic angiogram, and perform transcatheter embolotherapy if ongoing bleeding was identified.

The left CFA was accessed using ultrasound guidance and a 21-gauge micropuncture needle (Cook). A single-wall arteriotomy was performed. The access site was dilated to accept a 5-Fr introducer sheath, through which a Cobra 2 catheter (Angiodynamics, Queensbury, NY) was positioned in the contralateral right external iliac artery for diagnostic angiogram.

Contrast extravasation was noted inferior to the right IEA (**Fig. 1b**) corresponding directly to the small area noted on the earlier CFA angiogram (**Fig. 1a**). No defect or evidence of bleeding was noted from the Perclose arteriotomy site.

A superselective angiogram documented active bleeding from a small branch artery originating from the proximal right IEA (**Fig. 1b**). A 0.018-inch microwire could be guided into the branch vessel but the 2.3-Fr Prowler Plus microcatheter (Cordis) could not be advanced due to the small vessel diameter. Therefore, embolization was performed of the proximal IEA across the origin of the branch vessel using 2-mm by 3-mm Vortex microcoils (Boston Scientific, Natick, MA). Postembolization arteriograms of the right IEA (**Fig. 3**) and external iliac artery were obtained demonstrating no further evidence of bleeding. The patient remained neurologically intact and was discharged home on postprocedure day 2.

Fig. 2 Noncontrast CT of the abdomen and pelvis. Extensive hematoma (H) in the right hemipelvis, extending along the right anterior abdominal wall and right psoas muscle.

Discussion

Reported femoral access site complications for diagnostic and interventional procedures are 1.8 and 4%, respectively.⁴

Fig. 3 Postembolization angiogram. Inferior epigastric artery occluded by microcoils across the origin of the small branch vessel.

Physiologic risk factors include age, large body surface area, hypertension, female gender, and degree of anticoagulation.⁵ Anatomic risk factors include the location and size of vascular access, vascular anatomy, vessel calcification, and use of a sheath.^{6,7}

IEA injury is rare but most commonly iatrogenic, and found in patients with an underlying coagulopathy.³ The artery can be unintentionally punctured during vascular access, especially when a retrograde femoral puncture is high or whenever anterograde femoral arterial access is performed. In the case described here, the arteriotomy was in the upper third of the right CFA, below the level of the inguinal ligament (►Fig. 1a). This patient, however, had a high origin of the right IEA and a small branch artery coursed into the area of the arteriotomy site. The need to keep this patient fully anticoagulated undoubtedly resulted in persistent life-threatening hemorrhage from this tiny branch vessel that was documented on both arteriograms (►Figs. 1a, b). In addition, anatomic variants of the IEA that are susceptible to hemorrhage should be kept in mind during the angiographic evaluation for sources of bleeding. Specifically, the corona mortis artery is an anastomotic branch from the IEA to the obturator artery through the obturator canal that occurs in 29% of angiograms, and has been shown to hemorrhage in trauma and orthopedic repairs.⁸

In anticoagulated patients with access site hemorrhage, it is crucial that diagnosis and management be prompt and aggressive. Once hemorrhage is suspected and measures have been taken to ensure hemodynamic stability, CT of the abdomen, pelvis, and/or thigh can be obtained to confirm and localize the hematoma.^{3,9} When the hematoma extends into the retroperitoneal or intra-abdominal space, CT can identify and estimate the extent of blood loss; absence of hematoma on CT should lead the physician to seek alternative

cause for the hypotension. Contrast-enhanced CT may identify the branch artery supplying the active bleed and assist in directing endovascular or surgical intervention.³

Once active hemorrhage is suspected, diagnostic angiography and, when appropriate, transcatheter embolization of the injured branch artery is the best therapeutic option, especially when discontinuation of anticoagulation or antiplatelet therapy is ill advised. Sobkin et al reported a retrospective study of 20 IEA injuries related to paracentesis, trauma, or drain placement, which showed that coil embolization stopped bleeding with an overall 90% success rate.³ In this series, 76% of patients had an underlying coagulopathy exacerbating an otherwise potentially small bleeding site; there were no documentation of attempts to reverse the coagulopathy prior to the embolization. In addition, Wick et al described a retrospective report of 52 patients undergoing IEA embolization with a primary success rate of 90% and no complications from the embolization procedure.¹⁰ When the injured vessel involves the common femoral or external iliac artery, temporary placement of an occlusion balloon catheter can control the bleeding, allowing time for surgical intervention. In the correct clinical and anatomic circumstance, deployment of a covered stent graft is an additional endovascular option, especially when the injury involves the external iliac artery.

Anticoagulation and antiplatelet therapy are required to decrease the rate of thromboembolic complications from intracranial stent-assisted coil embolization^{1,2}; however, their use increases the rate of associated hemorrhagic complications.² In the case presented here, having such a large and clinically significant hemorrhage develop from injury to such a small branch vessel is testament to the risk associated with anticoagulation therapy. Any decision, however, to decrease, discontinue, or reverse anticoagulation must be weighed against the risk of a thromboembolic event occurring at the site of stent and coil placement. The authors' prior experience with a similar situation ended with disastrous complications when anticoagulation was discontinued to allow surgical control of a groin hemorrhage following vascular access; as a result, the stented segment of the internal carotid artery thrombosed and the patient suffered a fatal stroke.

The optimal choice of embolic agent in coagulopathic patients remains controversial. Because many embolic agents depend on an intact clotting cascade to achieve durable occlusion, a variety of agents have been used alone or in combination, including Gelfoam, particles, coils, and glue. In Sobkin et al's study, in their series of 20 patients with IEA embolization, 79% had underlying coagulopathy, and all had coil embolization with or without Gelfoam per operator preference and experience with high clinical success. Johnson et al¹¹ showed in lambs that there were no measureable

effects on the occlusion rates in coil-embolized arteries despite anticoagulation. In the present case, coils were chosen given the small vessel size, risk of nontarget embolization to the leg, and visibility of the coils for precise placement. Despite the high clinical success, we recommend close follow-up given the potential risk for recanalization or incomplete occlusion in coagulopathic patients.

In conclusion, in the case of access site hemorrhage following stent-assisted coil embolization of an intracranial aneurysm, anticoagulation and antiplatelet therapy should be continued and emergent angiography with embolotherapy performed. Whenever embolization is not the appropriate treatment for the injured vessel, alternative endovascular measures (i.e., covered stent graft, temporary balloon occlusion catheter) may be employed.

References

- 1 Yamada NK, Cross DT III, Pilgram TK, Moran CJ, Derdeyn CP, Dacey RG Jr. Effect of antiplatelet therapy on thromboembolic complications of elective coil embolization of cerebral aneurysms. *AJNR Am J Neuroradiol* 2007;28(9):1778–1782
- 2 Layton KF, Cloft HJ, Gray LA, Lewis DA, Kallmes DF. Balloon-assisted coiling of intracranial aneurysms: evaluation of local thrombus formation and symptomatic thromboembolic complications. *AJNR Am J Neuroradiol* 2007;28(6):1172–1175
- 3 Sobkin PR, Bloom AI, Wilson MW, et al. Massive abdominal wall hemorrhage from injury to the inferior epigastric artery: a retrospective review. *J Vasc Interv Radiol* 2008;19(3):327–332
- 4 Chandrasekar B, Doucet S, Bilodeau L, et al. Complications of cardiac catheterization in the current era: a single-center experience. *Catheter Cardiovasc Interv* 2001;52(3):289–295
- 5 Waksman R, King SB III, Douglas JS, et al. Predictors of groin complications after balloon and new-device coronary intervention. *Am J Cardiol* 1995;75(14):886–889
- 6 Muller DW, Shamir KJ, Ellis SG, Topol EJ. Peripheral vascular complications after conventional and complex percutaneous coronary interventional procedures. *Am J Cardiol* 1992;69(1):63–68
- 7 Ellis SG, Bhatt D, Kapadia S, Lee D, Yen M, Whitlow PL. Correlates and outcomes of retroperitoneal hemorrhage complicating percutaneous coronary intervention. *Catheter Cardiovasc Interv* 2006;67(4):541–545
- 8 Karakurt L, Karaca I, Yilmaz E, Burma O, Serin E. Corona mortis: incidence and location. *Arch Orthop Trauma Surg* 2002;122(3):163–164
- 9 Illescas FF, Baker ME, McCann R, Cohan RH, Silverman PM, Dunnick NR. CT evaluation of retroperitoneal hemorrhage associated with femoral arteriography. *AJR Am J Roentgenol* 1986;146(6):1289–1292
- 10 Wick MC, Klocker J, Grundtman C, Jaschke W, Chemelli AP. Transcatheter embolization for the management of acute active inferior epigastric artery hemorrhages. *J Endovasc Ther* 2013;20(4):561–567
- 11 Johnson WH Jr, Peterson RK, Howland DF, Lock JE. Systemic heparinization does not prevent clot formation in coil embolization. *Cathet Cardiovasc Diagn* 1990;20(4):267–270