A ruptured aneurysm after stent graft puncture during computed tomography-guided thrombin injection

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Type II endoleaks occur in 5% to 10% of patients who are treated by endovascular aneurysm repair. A persistent type II endoleak combined with documented aneurysm expansion is generally considered an indication for intervention. Thrombin injection directly into the aneurysm sac is described as a safe and efficient treatment option. We present a patient with a ruptured aneurysm caused by a puncture of the stent graft during computed tomography-guided thrombin injection. This case highlights a possible harmful complication of thrombin injection and emphasizes the need for caution while performing such a procedure. (J Vasc Surg 2010;52:1045-7.)

The most common cause for persistent or renewed pressurization of an aneurysm sac after endovascular aneurysm repair (EVAR) is the early or late occurrence of an endoleak. An endoleak is considered evidence of incomplete exclusion of the aneurysm sac from the circulation, and it is therefore believed that endoleaks may eventually lead to aneurysm rupture.

Endoleaks are divided into several subtypes, with type II endoleaks being the most frequent.[1] A type II endoleak is caused by retrograde flow from a lumbar artery, the inferior mesenteric artery, an accessory renal artery, or a hypogastric artery into the aneurysm sac. Type II endoleaks occur in about 5% to 10% of patients who are treated by EVAR.[2,3] An aggressive approach was adopted in the early days of EVAR, and all type II endoleaks were treated in fear of aneurysm rupture.[4]

Most large series assessing type II endoleaks have demonstrated a relationship between persistent type II endoleaks and aneurysm sac expansion, reinterventions, and even rupture. A correlation between aneurysm-related death and type II endoleaks, however, has not been shown.[5,6] It was because of this relatively benign character of type II endoleaks, combined with reintervention-related complications, that a more conservative policy was adopted.[7,8] Nowadays, although some authors plead for an even more conservative policy, documented aneurysm expansion is generally regarded an indication for reintervention.[4,5,7,8]

Several therapeutic options are available to treat type II endoleaks. Owing to its minimally invasive nature and high rate of technical success, transarterial coil embolization is considered the therapy of choice.[1,6] Transarterial embolization can be technically challenging, however. Thrombin injections directly into the aneurysm sac are described as a safe and efficient alternative with a high success rate and fewer complications in several case series.[9-12] Some therefore even favor direct translumbar embolization over transarterial embolization for the treatment of type II endoleaks.[9]

We present a patient with an aneurysm rupture caused by puncture of the endograft during thrombin injection to highlight this potential complication and to emphasize the need for caution while performing such a procedure.

CASE REPORT

Two years ago, an 89-year-old man was referred to our clinic with an 8.4-cm asymptomatic abdominal aortic aneurysm (AAA). The patient underwent an uneventful EVAR by placement of a Talent bifurcated stent graft (Medtronic, Santa Rosa, Calif). Postoperative computed tomographic angiography (CTA) showed successful exclusion of the aneurysm sac, which was confirmed on a duplex ultrasound (DU) imaging 6 months after EVAR. The measured maximal aneurysm sac diameter at this time was 7.8 cm (Fig 1, *A*). However, follow-up CTAs at 12 and 24 months showed gradual expansion of the aneurysm sac up to 11 cm (Fig 1, *B*). Although no endoleaks were identified on DU imaging and CTA, a magnetic resonance angiogram (MRA) with a blood-pool contrast agent showed a type II endoleak originating from a lumbar artery.

The decision was made to treat this endoleak by a CT-guided puncture of the aneurysm sac with injection of thrombin. With the patient supine, CT guidance was used to pass a 21-gauge needle from an anterior transabdominal approach into the aneurysm sac.

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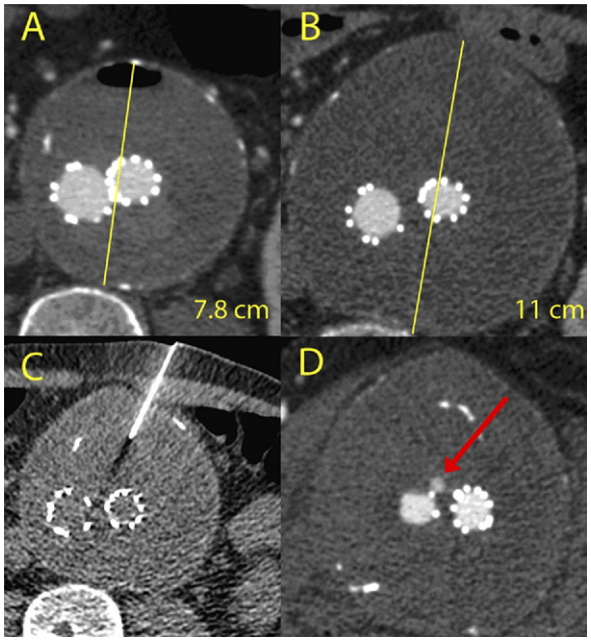

Fig 1. A, Computed tomography (CT) imaging on the second postoperative day shows aneurysm reduction from 8.4 to 7.8 cm, with no evident endoleak. **B,** At 2 years, the aneurysm had grown to 11 cm, but there was no evident endoleak. **C,** CT imaging of the second thrombin injection shows the needle clearly positioned outside the stent graft. **D,** CT imaging 2 weeks after the second thrombin injection shows aneurysm rupture and extravasation of contrast *(arrow)* due to a type III endoleak.

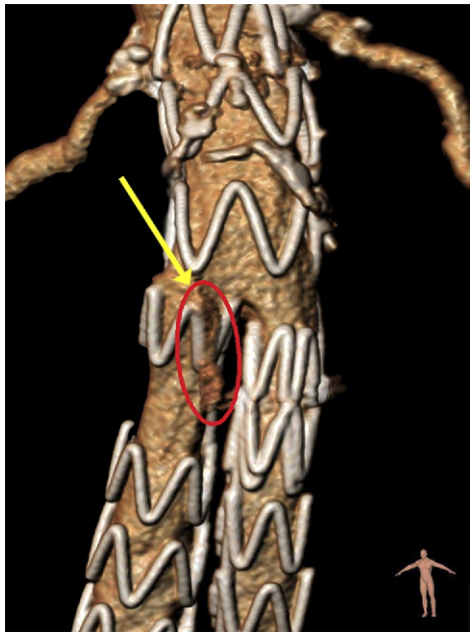

Fig 2. A three-dimensional volumetric reconstruction shows a type III endoleak originating in the main device of the stent graft. The *yellow arrow* indicates the puncture hole, and the *red circle* shows contrast extravasation.

Pressure in the aneurysm sac was 18 mm Hg, without pulsatility. Contrast was injected, which solely filled the aneurysm sac. Although we had expected to measure a higher intrasac pressure, we decided to aspirate the aneurysm sac and to proceed with the intrasac thrombin injection.

A total of 300 mL of blood was aspirated, which reduced the diameter of the AAA from 11 to 8 cm. Then, 2 mL of thrombin (500 IU/mL, thrombin component of Tissucol Duo 500; Immuno, Vienna, Austria) was slowly injected. Because a postprocedural CT scan showed an AAA diameter of 10 cm, we decided to obtain another CTA after 2 weeks and to repeat the procedure if the AAA size had returned to the pre-embolization diameter of 11 cm.

The control CTA again showed a sac diameter of 11 cm along with a type II endoleak. A second procedure, similar to the first, was performed. The needle position during this second procedure was confirmed by the aspiration of 20 mL blood (Fig 1, *C*). Because no more fluid could be aspirated, the aneurysm was thought to be partially thrombosed and only an additional 0.5 mL of thrombin was injected.

Unfortunately, a DU study 3 months later revealed an aneurysm diameter of 11 cm, together with a new endoleak of unknown origin. A new CTA was planned, but before this scan, the patient presented at the emergency department with progressive pain in the abdominal region. A CTA showed a ruptured aneurysm (Fig 1, *D*; Fig 2). During open surgical repair, a puncture was observed in the main device of the stent graft, which was over-sutured. The mural thrombus was partially extracted, and the aneurysm sac was reconstructed.

The patient's postoperative course was uneventful and he was discharged in good condition. A CTA 3 months later showed no abnormalities.

DISCUSSION

Failure to exclude an aortic aneurysm completely from the circulation remains the major weakness of EVAR. Indication and timing of secondary interventions are controversial and equivocal due to a lack of evidence. Some EVAR specialists advocate intervention if a type II endoleak persists >6 months, regardless of change in aneurysm sac size, whereas others are more conservative.[5,6,8] However, there is general consensus that expansion of the aneurysm necessitates intervention, although the risk of rupture due to a type II endoleak is very low.[3,5,8]

A multitude of therapeutic options are available for the treatment of type II endoleaks that range in their level of invasiveness. Transarterial embolization was introduced in 1997, and its minimally invasive character and high technical success rate convinced many physicians of its superiority.[13] However, initial medium-term and long-term results showed recurrent endoleaks in 60% to 91% of the patients. Apart from the high recurrence rate, its applicability is limited by the requisite to be able to catheterize the origin of the side branches at the level of the wall of the aneurysm sac.[9,14]

The high incidence of recurrent endoleaks in patients treated with transarterial embolization implies that embo-

lization of only the feeding inflow vessel is inadequate. Baum et al[9] suggested that endoleaks behave like arterial malformations in which occlusion of the feeding vessel will lead to recruitment of collaterals and, eventually, failure of therapy.[9] Hence, embolization of the entire aneurysm sac prevents abnormal communication among these aortic branches. A success rate of 92% reported for translumbar embolization vs a failure rate of 80% in transarterial embolization supports this hypothesis.[9] Moreover, a recent study by Stavropoulos et al[15] in which the endoleak cavity itself, and not just the feeding artery, was embolized with a transarterial technique gave similar results as the translumbar technique, with a 78.3% vs 72.6% clinical success.[15] The method chosen for the treatment of type II endoleaks depends on the level of expertise and the technical feasibility of each technique.

Since the introduction of CT-guided thrombin injection, good results have been obtained and few complications reported.[9,10,15] To the best of our knowledge, we are the first to report rupture of an aneurysm due to an iatrogenic type III endoleak from a puncture of the endograft during a CT-guided thrombin injection. Although CT provides excellent needle visualization, and direction and depth can be visualized, it remains a procedure that has to be thoughtfully planned and executed. The position of the needle can be difficult to control in relationship to a pulsatile moving stent graft because CT gives a static representation of a dynamic process.[16]

Needle entry under ultrasound visualization allows the operator to accurately position the needle while monitoring the thrombus formation and might prevent such incidents. Disadvantages of this procedure are poor visualization of the aorta due to air-filled bowel or obesity. Furthermore, an ultrasound-guided puncture is operator-dependent and has a relatively long learning curve.[10,11] A good alternative is therefore fluoroscopy combined with CTA. CT can verify needle positioning, and fluoroscopic guidance allows real-time embolization, thereby preventing misplacement of the needle or any embolic material.[17]

Nowadays, a more conservative approach is preferred in the management of type II endoleaks. If intervention is necessary, however, thrombin injection has proven to be an effective method of treatment of a type II endoleak.[9-12,15,17] This case clearly shows a potential negative adverse effect of this procedure.

CONCLUSIONS

Caution should be used during the planning and execution of a CT-guided thrombin injection. We therefore recommend meticulous needle verification with respect to the change in aneurysm volume due to aspiration.

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