

# Diagnosis and treatment of a patient with type IV endoleak as a late complication after endovascular aneurysm repair

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Videosurgery Miniinv 2014; 9 (4): 667–670

DOI: 10.5114/wiitm.2014.47264

## Abstract

*Type IV endoleak is a very rare complication observed after implantation of aortobiiliac stent grafts. The difficult diagnosis of type IV endoleak leads to the application of many imaging methods in the diagnostic process. We present a case report of a patient who underwent implantation of an aortobiiliac stent graft in 2004. After surgery, the size of the aneurysm sac was monitored continually in the subsequent imaging studies. Progression of the aneurysm sac volume was detected in 2009. In a short period of time, the diameter of the aneurysm increased from 100 to 140 mm. Angio-computed tomography and angiography did not reveal the location of the endoleak. The attempt at localization and endovascular closure of the source of the endoleak failed. It was decided to treat the patient surgically. Intraoperatively, the source of the endoleak was visualized, and the endoleak was closed with surgical sutures.*

**Key words:** abdominal aortic aneurysm, type IV endoleak, aortobiiliac stent graft.

## Introduction

Novel, advanced procedures have been introduced to the treatment of abdominal aortic aneurysms (AAA), but they are still associated with life-threatening complications [1]. The most common cause of complications after the endovascular aneurysm repair (EVAR) procedure is ineffective cutting off of the circulation in the aneurysm sac, during the surgery or in a later stage, which leads to leaks (called endoleaks).

In patients who underwent implantation of an aortobiiliac stent graft, because of an abdominal aortic aneurysm, type IV endoleaks were extremely rare [2, 3]. Espinosa *et al.* reported the prevalence of this type of endoleak as 0.3% [4]. Forbes *et al.* reported the conservative treatment as sufficient, in the case of type IV endoleak. Furthermore, in longer follow-up observation, type IV endoleak was not the cause of the aneurysm re-supply in open surgery

[5]. The occurrence of this complication is often not taken into account, and the lack of proper control of the patients after surgery can lead to rupture of the aneurysm [4].

The purpose of this case report is to emphasize the importance of ongoing (long-term) follow-up of the patient after endovascular stent graft implantation, and difficulties in the diagnosis of type IV endoleak.

## Case report

The patient, aged 69, was treated and followed up in the Department and Clinic of General and Vascular Surgery in Poznan because of AAA. The patient has a history of numerous additional diseases (unstable angina, myocardial infarction, chronic renal failure, hypertension). In 2004, the patient underwent implantation of an aortobiiliac stent graft, because of a constantly growing AAA (body diameter

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– 28 mm, prosthesis length – 140 mm, legs diameter – 14 mm). Preoperatively, the diameter of the aneurysm sac was 65 mm, left iliac artery diameter was 21 mm, and right iliac artery diameter was 17 mm. The postoperative period proceeded without any complications. Periodic physical examinations and imaging investigations were performed (X-ray of the abdomen, Doppler ultrasound of the abdominal aorta and iliac arteries) in the Vascular Surgery Clinic in accordance with a generally accepted schedule (every 3 months). Three angio-CT control investigations, performed at 6, 12 and 18 months after surgery, did



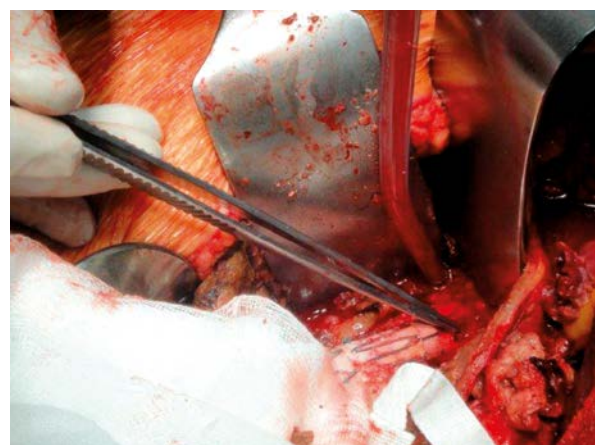
**Photo 1.** CT angiography performed on 10.10.2011. Size of the aneurysm sac in the largest dimension is about 14 cm



**Photo 2.** The image from digital subtraction angiography (DSA) performed on 28.11.2011. The investigation did not indicate the source of endoleak from the aneurysm sac

not reveal signs of aneurysm sac expansion or the presence of other complications. Only the control angio-computed tomography (CT) in 2009 revealed enlargement of the aneurysm sac – diameter 10 cm. In subsequent follow-up examinations, performed every 6 months for a period of 2 years, there was an increase of the diameter of the aneurysm sac from 10 cm to 14 cm (Photo 1). The last imaging study was performed 2 months before the surgery. Migration of the implanted stent graft was not observed, and the body and legs were unobstructed. Performed tests did not indicate the source of endoleak. After admission to the hospital in November 2011, angiography was performed (Photo 2). The attempt to localize the source of the endoleak failed. It was decided to treat the patient by open surgery.

The anesthetic consultation prior to the operation classified the patient in the high-risk group (ASA III) with clinically significant possibility of perioperative and postoperative complications. During the operation, a significantly enlarged sac of the AAA was revealed. In order to achieve high preparation of the aneurysm neck, the left renal vein was ligated and cut. The neck of the aneurysm was dissected and a vascular prosthesis (diameter of prosthesis – 30 mm) was implanted. Both common iliac arteries were clamped. After opening the sac of the AAA, the thrombus was removed and the source of the endoleak was revealed on the front surface of the left arm of the stent graft (Photo 3). The source of the type IV endoleak was closed by vascular sutures.



**Photo 3.** Intraoperative examination revealed the source of the endoleak from the surface of the stent graft. The source of the type IV endoleak is shown by the tip of the tweezers touching the surface of the stent graft

The stent graft was protected using the wall of the aneurysm sac. The neck of the aneurysm was preserved by a previously implanted vascular prosthesis. The remaining part of the surgery proceeded in a conventional way. The Redon drain was left in the abdominal cavity.

The day after the operation, the patient complained about chest pain and breathing problems. The ECG found: heart rate 88/min, intermediate electrical axis of the heart, current Q waves in III and aVF, and elevation of QS and ST in V<sub>2</sub>-V<sub>3</sub> segments. The troponin I measurement was performed at a 6-hour interval, and these results were significantly elevated (I result – 1.92 ng/ml, II result – 3.30 ng/ml; standard result < 0.1 ng/ml). After cardiological consultation, it was decided to transfer the patient to the Department of Cardiology with the initial diagnosis of acute myocardial infarction in order to perform urgent coronarography.

The contrast examination of the coronary arteries revealed total occlusion of the left anterior descending artery (LAD) in the proximal length. In other coronary arteries, hemodynamic changes were not significant. During the same examination, LAD angioplasty with DES implantation was applied.

Two days after coronarography the patient was in a severe general condition without presence of diuresis or peristalsis. On the third day, diuresis and peristalsis were restored and the patient's condition improved. Over the next few days, previously elevated markers of myocardial damage decreased. After 14 days, the patient was discharged without any clinical problems or symptoms.

The patient remains under constant observation of the Department and Clinic of General and Vascular Surgery.

## Discussion

In the new generation of stent grafts, tight materials should be initially applied (Medtronic, Gore, Vanguard, Guidant, Cook), and such materials should not cause a type IV endoleak. In type IV endoleak, enlargement of the aneurysm sac was observed, often without apparent contrast extravasation in angio-CT. In the opinion of some clinicians, type IV endoleak should be classified as a type V endoleak. The mechanism of type V endoleak formation is unknown (the source of the endoleak is not visible in diagnostic tests) [6]. Rubin *et al.* concluded that type

V endoleak may be periodically occurring endoleak type I to IV [7]. Ren *et al.* reported that type IV endoleak occurred in 1 of 89 patients after the EVAR procedure, as a late complication [8]. However, many authors have undermined the occurrence of type IV endoleak if endoleak spontaneously disappears within 1–2 months after the EVAR procedure [9, 10]. Although type IV endoleak is a very rare complication after the EVAR procedure, patients with coagulation disorders have a generally increased detection rate of this complication [6, 11]. In the present case, laboratory tests did not demonstrate any abnormalities that could be a potential cause of type IV endoleak.

The results of imaging studies, clinical examination and the intraoperative image allowed a diagnosis of type IV endoleak, which typically was observed only after implantation of older generation stent grafts [6]. Barbieri *et al.* described the type IV endoleak as not clinically relevant, because it is characterized by spontaneous regression [12]. In this case, the type IV endoleak occurred as a complication almost 5 years after implantation of the stent graft. However, in previous papers this type of endoleak has not been described.

In some situations, angio-CT allows one to detect the presence of an endoleak, but does not allow one to unequivocally qualify the type of endoleak. In such cases, it is recommended to perform ultrasonography after administration of contrast (CEUS – contrast-enhanced ultrasound), which can determine with high probability the location of the endoleak source [13]. Ten Bosch *et al.* demonstrated greater efficacy of CEUS in comparison to angio-CT in the detection of endoleaks into the aneurysm sac after the EVAR procedure. However, so far the superiority of CEUS in detection of type IV endoleaks has not been demonstrated [14]. It should be emphasized that patients after EVAR require precise follow-up, because endoleaks are mainly asymptomatic. The possibility of endoleaks should be considered for any patient with unexplained symptoms [15].

## Conclusions

The analysis of this case report, and papers presented in the literature, indicates that in each patient after implantation of a stent graft because of AAA, clinicians should take into account the possibility of formation of several types of endoleaks, including rare ones, such as the type IV endoleak.

The type IV endoleak may appear even a long time after implantation of the stent graft, as a long-term complication. The type IV endoleak should not be ignored and should be constantly and carefully observed by periodic and regular check-ups. The type IV endoleak can lead to significant enlargement of the aneurysm sac, which may result in tragic consequences for the patient and a necessity for surgical treatment.

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**Received:** 29.09.2014, **accepted:** 1.10.2014.