Innominate arteriovenous fistula following laser lead extraction –
endovascular treatment of potentially lethal complication

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Title: Innominate arteriovenous fistula following laser lead extraction – endovascular
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Short title: Endovascular treatment of IAF following laser lead extraction.

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The increased use of cardiovascular implantable electronic devices over recent years is associated with higher rate of distinctive complications and increasing number of lead extraction procedures as a result. As compared to surgical removal, less invasive transvenous lead extraction (TLE) is performed in most cases. However it can be complicated by several conditions, including the arteriovenous fistula (AVF), which although being rare, is a potentially lethal complication [1]. To date 5 cases of the innominate arteriovenous fistula (IAF) following laser lead extraction were reported, with overall 40% mortality rate [2,3,4]. Here, we report the effective endovascular treatment of the fistula with balloon-expandable peripheral stent graft.

The 75-year-old patient with a history of 3 myocardial infarctions, sick sinus syndrome, left ventricular ejection fraction 55% and pacemaker implantation 15 years earlier underwent a percutaneous laser extraction of the fractured atrial lead with simultaneous insertion of a new DDDR pacemaker (Etrinsa 6 DR-T, Biotronik) with two leads (right atrium, right ventricle). The procedure was complicated with a hemorrhagic shock, which occurred immediately after lead extraction. Decrease in blood pressure from 118/53 mmHg to 48/27 mmHg, heart rate of 141 bpm and an excessive sweating of the patient were noticed. The patient required both the intravenous infusion of norepinephrine (8 mcg/min) and blood transfusion (2 units of packed red blood cells). CT angiography was performed due to circulatory instability. The test showed the presence of IAF (Fig. 1 A,B,C). The patient was immediately subjected to endovascular treatment in the hybrid operating room. The patient was treated by successful implantation of a peripheral stent graft (BeGraft Peripheral 10x37mm, Bentley) to the affected innominate artery (Fig. 1 D,E,F) under general anesthesia. After 2 weeks the patient was discharged in a stable, good condition, left ventricular ejection fraction 55%, and remained unchanged during follow-up visits within next 1.5 years.
Lead dysfunction is the second (after infection) most frequent indication for lead extraction [5]. In TLE, non-powered telescoping as well as powered sheaths (including laser systems) are commonly used, however both can result in AVF formation [1,4]. From the previously reported 5 cases of the IAF following laser lead extraction, 2 resulted fatally without endovascular treatment attempt [2,3]. In 2014 Cronin et al. reported successful treatment of 2 patients with balloon-expandable stent graft implantation and spontaneous closure of the fistula in 1 patient. Although every patient with IAF was diagnosed during the TLE or post mortem, cases of AVF in different vascular locations were recognized even 586 days following the procedure. Complete fistula formation is not always simultaneous with vessel injury and may even last for weeks. Therefore, due to the growing number of patients after TLE, one should keep in mind that potentially lethal complications might become symptomatic days or even weeks after the procedure. Late signs of AVF include: continuous bruit with systolic accentuation over the anterior chest, upper extremity and facial swelling, dilated veins. The former is the most consistent with the diagnosis, and thus every physical examination of patients after TLE should comprise auscultation of the anterior chest area, as it may aid the proper diagnosis [4]. Because of the rare occurrence of the AV fistula during TLE, awareness of this potentially lethal complication is of utmost importance in terms of appropriate diagnosis and patient management.
References


Figure 1 Innominate arteriovenous fistula.

Panel A - Axial computed tomography angiography image depict the direct connection between innominate artery (asterisk) and innominate vein (star).
Panel B, C - 3D volume-rendering reconstruction of the innominate arteriovenous fistula – innominate artery (asterisk) and innominate vein (star), innominate arteriovenous fistula (arrow, Panel C).
Panel D - Arteriography showing innominate arteriovenous fistula and early innominate vein (star) filling.
Panel E - Introduction of the stent graft BeGraft Peripheral 10x37mm, Bentley (thick arrows) to innominate artery from right axillary artery access. Diagnostic Pigtail catheter (thin arrow) introduced from right common femoral artery access to enable intraoperative angiographic control.
Panel F - Control angiography after implantation of the stent graft to the innominate artery showing proper patency of both the stent and innominate artery. No signs of innominate vein filling in the arterial phase are visible, which confirms effective exclusion of the innominate arteriovenous fistula from the circulation.