changes suggest thrombosis. (3)

Once the patient was diagnosed, the next problem was treatment definition. The prospect of a second major surgery to replace the LVAD in a relatively unstable patient with gastrointestinal bleeding was difficult and risky, while the use of systemic fibrinolytics was impracticable in the context of a recent gastrointestinal bleeding.

In a multidisciplinary meeting, it was agreed to use a "local" treatment in the inner part of the device, using low doses of thrombolytic agents, accepting both the risks of bleeding and of possible complications related to advancing a catheter into the LVAD. It was also agreed to prepare the patient for a possible emergency device replacement.

After the administration of local tPA (1 mg), device hemodynamic parameters were normalized, with resolution of echocardiography and laboratory abnormalities.

The references published about the "local" use of thrombolytic therapy in patients with LVAD are limited. Delgado et al. report the infusion of tPA at a rate of 1 mg/min through a catheter advanced into the left ventricle in Jarvik 2000 bearers, while Tshirkov et al. describe the use of tPA inside the inflow cannula of a Berlin Heart device; both procedures successful and with no bleeding complications. (4, 5)

Furthermore, Kieman et al. report a thrombus inside a HeartWare LVAD successfully managed with intraventricular tPA, also with no further complications. (6)

Our presentation is in line with those previously reported, and poses the administration of local low dose fibrinolytic therapy as a viable alternative to complex device replacement in selected patients.

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Tibial Angioplasty with 2D Perfusion Imaging

Endovascular treatment for occlusive disease of the lower limbs has gained popularity in the treatment of patients with critical ischemia and lesions at the level of the tibial territory. (1, 2) New advances in technology, specific work material, more experience and new techniques, have turned tibial balloon angioplasty into a successful procedure in a selected group of patients. But the advent of this technique has entailed the need for angiosome-guided revascularization.

Angiosome is not a physiological but an anatomical concept, defined as the blood supply from a main, secondary or distributing artery to a specific tissue area. (3, 4)

Each angiosome includes skin, muscle, tendon, nerve and/or bone. Angiosome junction occurs in the deep muscles, providing anastomotic channels if the main artery and/or vein is blocked. (4)

The angiosome model for lower limb revascularization was incorporated since the first publication of Alexandrescu in 2008. (3, 5) This model accounts for blood supply to the skin and adjacent structures, allowing mapping of the three-dimensional vascular territories to plan incisions and flaps, and providing the basis for the interpretation of several physiological and pathological processes including delayed healing or flap necrosis. (4) It is used in various medical fields, including myocardial revascularization, selective visceral embolization, and flap, incision or amputation planning. Over the past decade, a small number of studies have analyzed the viability of angiosome-oriented revascularization strategy in critically ischemic legs with tissue lesions, showing higher benefits in treating wounds and in recovering ischemic limbs. (3, 6-8)

A second point is the possibility of verifying reperfusion of an ischemic territory/ulcer using 2D perfusion angiographic imaging. Specialized software is used not only to show but also to measure the contrast agent flowing in arteries or tissues. This technique shows the arrival rate or wash-out using a color scale. In this case, the perfusion image verified adequate angiographic and hemodynamic results, providing a direct source of perfusion to the lesion. The image is strictly correlated to the corresponding angiosome. The system consists of a Flat Panel Detector 20 (Philips Medical Systems, Netherlands) single-plane angiography in combination with a 3DRA workstation (Prototype, Philips Netherlands), responsible for per-

fusion reconstruction and density correlation versus time. We thus present our clinical experience on two-dimensional perfusion. This technology, based on measurement and comparison of contrast density versus time, allows the assessment of color differentiation at various arterial, parenchymal, and venous times in the same angiographic acquisition. Color differentiation is achieved with reconstruction algorithms by image pixel, parametrically assigning and codifying the angiography grayscale to a color scale for each pixel obtained. In this way, the software obtains qualitative data, by means of color differentiation of arterial vessels, as well as quantitative data. These data provide information about each area of interest targeted by the operator, allowing a comparison between pre- and post-treatment data. Time to peak (TTP), arrival time (AT), mean transit time (MTT) and wash-out (WO) are the most common times used, as each of them represents arterial time (AT + TTP), parenchymal time (TTP + MTT), and venous time (MTT + WO). Parametric color coding allows visual evaluation and quantification of blood circulation functionality under normal or pathological conditions; for example, MTT visualization of the contrast passage through the arterial circulation can recognize hypoperfused areas of circulation. These calculated rates can be combined with 3D reconstruction (volumetric) data, creating a dataset from which blood flow and volume of the perfused area are estimated.

The information is used as an angiographic perfusion study and may be an interesting tool to assess and differentiate complex blood restrictions in arteries or particular areas.

The case presented here corresponds to a patient with critical limb ischemia, with an ulcer in the anterior middle third of the left leg, with pain at rest and

Fig. 1. A. Wound on anterior left leg. **B.** Angiography showing occlusion of the anterior tibial artery. **C.** Perfusion image without perfusion even in collaterals of the anterior compartment of the leg.

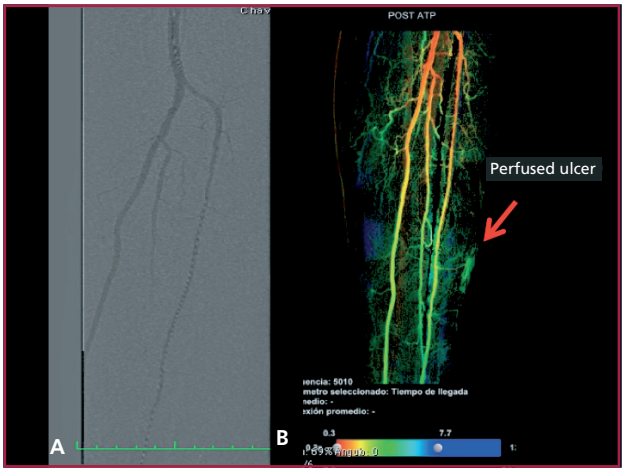

Fig. 2. Post-angioplasty result with complete recanalization of anterior tibial artery (**A**) and perfusion (**B**) of the anterior compartment (*arrow*). Marked perfusion territory in collateral of the anterior tibial artery with hyperperfusion of the lesion.

ankle-brachial index of 0.3. This is a diabetic patient with a 3-month history of trophic lesion of torpid evolution who underwent a selective 2D perfusion angiography of the limb.

Angiography showed complete occlusion of the anterior tibial artery at 5 cm from its origin, with recanalization into a distal tibial artery 3 cm above the frondiform ligament. A perfusion image revealed absence of direct or collateral circulation in the ulcerated area (Figure 1).

A tibial angioplasty with an Amphirion Deep 2/2.5 mm x 210 mm long tapered balloon (Medtronic-Invatec, Roncadelle, Italy) was performed, with correct angiographic outcome. The image also revealed not only the adequate patency of the tibial artery (TTP and TPM) but also the appearance of a collateral branch and a flush area matching the pretibial ulcer (Figure 2).

The patient was discharged the following day with an ankle-brachial index at rest of 0.86 and local wound treatment.

The success of the angiosome model to plan revascularizations intending to restore arterial flow suggests not only rechanneling arteries, but also consider those that directly supply the wound area, since the main flow to a certain area can be restored from arteries that do not belong to the original angiosome. However, in patients with chronic vascular inflammation and long-term diabetes, the compensatory capillary network is altered, indicating the need for a more specific, distal revascularization; thus, the probability of restoring an adequate blood supply to the affected territory will be greater. (3) The best healing outcomes for ischemic ulcers or limb salvage will depend on:

1. Direct angiosome revascularization;
2. Adequate wound treatment; and

3. Optimal clinical care, key to prognosis of patients with critical ischemia.

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Uterine Leiomyomatosis Extending into the Cardiac Chambers: Two Different Cases

Intravenous leiomyomatosis is a rare condition typically occurring in the fifth or sixth decade of life in women with a benign uterine fibroid tumor, with invasion of the venous system. (1) Cases of intracardiac extension account for 10%. (2) Surgical treatment is recommended due to risk of embolism from right cardiac chambers, and tricuspid valve obstruction associated with sudden death. (3) Only a few cases have been reported in the literature, and most of them include signs of heart failure in the clinical presentation. (1)

CASE REPORT 1

A 59-year-old patient without cardiovascular risk factors presented with edemas and ochre discoloration in the lower limbs (LL).

The echo-Doppler of the LL and abdominal ultrasound detected a uterine tumor and thrombosis in the inferior vena cava (IVC). Initially, gynecological surgery was not performed, and the patient was started on anticoagulation therapy with acenocoumarol. The patient progressed with edemas, abdominal distension, and progressive dyspnea, and a new abdominal ultrasound (US) revealed uterine tumor growth and IVC thrombosis. Our department of gynecology evaluated her and recommended surgical removal of the tumor. A total adnexo hysterectomy was performed, removing a 3-kg tumor. Pathological examination revealed uterine leiomyomatosis. The patient progressed with dyspnea and LL edema and transesophageal echocardiography confirmed a tumor in the right atrium, obstructing the right ventricular inflow tract. Thoracic and abdominal MRI angiography confirmed tumor expansion into the IVC and right cardiac chambers (Figure 1) and abdomen, and cardiac surgery was decided. Excision of the IVC and right atrial tumor was performed with a midsternal and abdominal right retroperitoneal approach (Figure 2). During the procedure, extracorporeal circulation time was 105 minutes, total circulatory arrest was 15 minutes, and hypothermia was 23 ºC. The patient is currently asymptomatic.

CASE REPORT 2

This case corresponds to an asymptomatic 51-year-old patient who, in a routine cardiovascular examination, was diagnosed a tumor involving the lower retroperitoneal space with IVC and right cardiac chamber invasion. Initially, a midsternal approach was the option to remove the tumor and perform etiological diagnosis. Surgery was performed under extracorporeal circulation, hypothermia (20 °C) and circulatory arrest. The result of the excision was a hard tumor, which was affecting the right chamber lumen from the IVC, but without any evidence of myocardial infiltration. Postoperative course was satisfactory, and the patient was scheduled for a second stage IVC and retroperitoneal exploration. Pathological examination confirmed the diagnosis of leiomyoma.

The patient was away for 18 months since the first procedure, and returned totally asymptomatic for outpatient consultation. A new CT scan with contrast showed the same retroperitoneal images, with extensive intravenous invasion into the right iliac vein, IVC, and again complete filling of the right atrium, right ventricle, and pulmonary artery. Knowing the anatomopathological report, complete leiomyoma and intravenous proliferation resection was proposed in a one-stage operation.

Gynecological, peripheral vascular and cardiovascular teams were involved in the procedure. A total adnexo hysterectomy and resection of multiple uterine myomas extending into the perirectal area and iliac vessels (Figure 3) were performed. One of the myoma branches penetrated the distal part of the right iliac vein, and from there, blocked almost all the vena cava lumen towards the right cardiac chambers and pulmonary artery. The next step consisted of resternotomy, cannulation of the ascending aorta, superior vena cava and left femoral vein (not involved), and resection of intracardiac leiomyoma via right atriotomy using ex-