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Case Report

Aorto Femoral Bypass Graft in Chronic Limb Ischemia Patient

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ABSTRACT

A 44-year-old man was admitted to hospital to be performed re-thrombectomy after previously performed thrombectomy at the referring hospital but did not show clinical improvement. CT angiography results before re-thrombectomy showed a central thrombus measuring 1.1 cm in diameter, and an impression of 2.6 cm long at the branching of the right external Iliaca artery which caused total obstruction of the right illiaca external artery to the distal. Aortofemoral bypass graft surgery is a procedure utilized commonly for the treatment of aortoiliac occlusive disease. The treatment given to manage symptoms if medical management or minimally invasive therapy, such as balloon angioplasty and stenting, was unsuccessful or unsuitable for the patient. Aortofemoral bypass graft surgical procedure was performed on the patient. However, post procedure angiography showed no visible flow through the newly placed graft. A repair graft procedure was planned for the patient, but the patient refused to undergo further surgical procedures.

Introduction

Chronic leg ischemia is a disease of the peripheral arteries that results in reduced blood supply to the limbs. This is usually caused by atherosclerosis (rarely vasculitis) and will generally affect the lower limbs (however the upper and gluteal limbs can also be affected). About 15-20% of people over 70 have peripheral artery disease. The Framingham study shows an increase disease prevalence from 0.4 per 1000 males aged 35-45 years to 6 per 1000 males aged> 65 years. [1]

Surgical bypass surgery diverts blood flow around the diseased artery to increase blood flow distally. Bypass surgery is not therapy for aortoiliac occlusion disease. This is the treatment prescribed for symptomatic relief if medical management or minimally invasive therapy, such as balloon angioplasty and stenting, is unsuccessful or unsuitable for the patient. [2]

Case Presentation

A 44-year-old man was consulted to the cardiovascular department by his colleague thorax-cardiovascular surgery for arteriography after re-thrombectomy with a diagnosis chronic limb ischemia (CLI) of inferior limb dextra post thrombectomy right femoral artery post operation day (POD) -4 + post re-thrombectomy right femoral artery and right tibialis posterior artery POD-1. From the history, the patient was referred from the referral hospital for re-thrombectomy because the saturation of the right lower extremity did not

improve after having had one thrombectomy at the referring hospital. the patient is referred to Cardiothoracic Department at the referral hospital. Complaints of pain in the leg intermittent, appeared during activity, improved when resting was felt more than two weeks before the patient came to the referral hospital. Thrombectomy was done once at the referral hospital, then he was referred because the saturation did not improve and he got a cold right leg. When asked to the cardiovascular department for arteriography after another thrombectomy was performed at the referral hospital by the Cardiothoracic department, the patient still complained of thick on the right leg and a little pain, but the pain was less than before the thrombectomy. There are no complaints of tightness, chest pain, or pounding. Patients obtained a history of smoking 2 packs per day, no history of hypertension, diabetes mellitus, CVA, or previous heart disease.

Vital sign examination and other physical examinations were all found within normal limits, but on the touch of the right inferior limb, a normal perfusion was found. On examination of the sensation of pulse and saturation of the toes of the two feet, it is obtained as follows:

Table 1. Inferior Limb Arteries

Inferior Limb Arteries	Right	Left
Femoral Artery	-	++
Popliteal Artery	-	++
Anterior Tibialis Artery	-	++
Posterior Tibialis Artery	-	++
Dorsalis Pedis Artery	-	++

Table 2. SpO2 Inferior Limb

SpO2 Inferior Limb	Right	Left
Digiti I	Difficult to evaluate	94%
Digiti II	92%	94%
Digiti III	84%	99%
Digiti IV	85%	98%
Digiti V	90%	97%

Before re-thromboectomy saturation of digit I-V pedis Dextra around 77-85%

Laboratory examination, chest x-ray, and ECG were seen within normal limits, CT angiography results before re-thrombectomy showed a central thrombus measuring 1.1 cm throughout 2.6 cm branching of the right illiaca externa artery which causes total obstruction right illiaca externa artery to distal. There was no contrast filling in the right illiaca externa artery, right femoral artery, right poplitea artery, right posterior et anterior tibialis artery, right peroneus artery, right plantaris artery, right dorsalis pedis artery. Then performed retrograde and anterograde thrombectomy in right femoral artery, obtained a soft thrombus size 15 cm. Retrograde thrombectomy in the posterior tibialis artery, 3 cm thrombus was obtained.

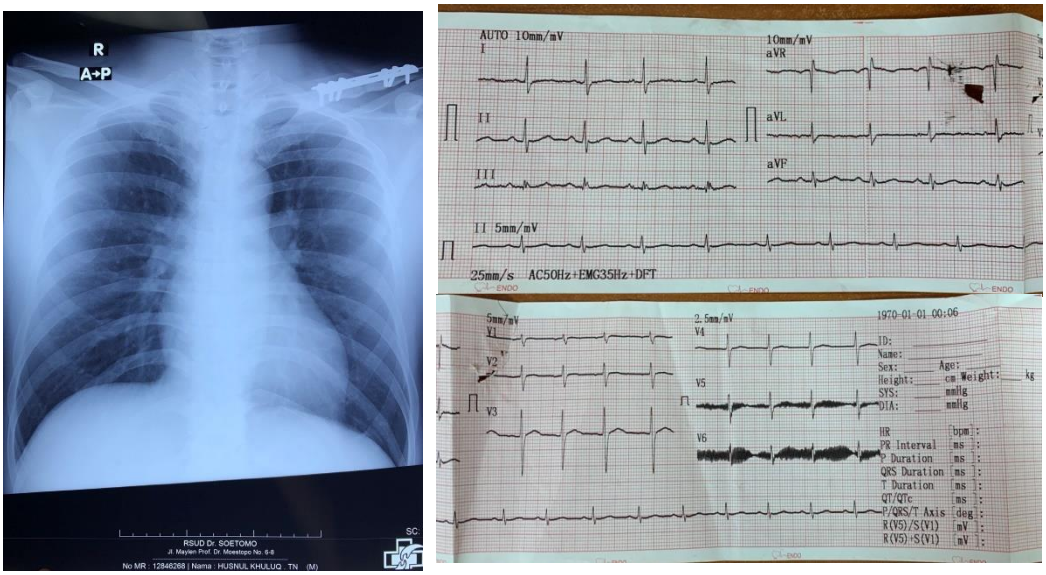

Figure 1. X-ray and ECG results of the patient

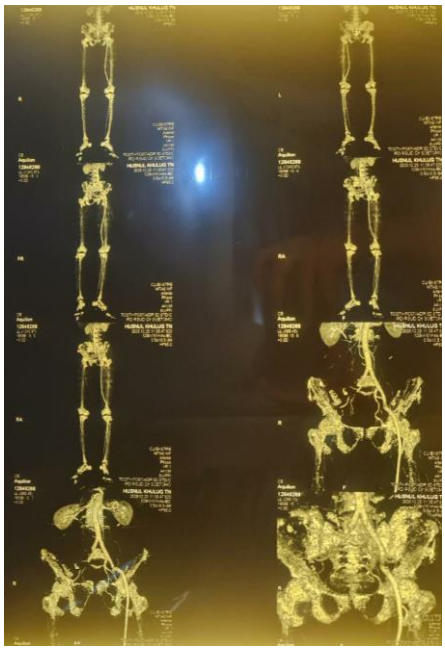

Figure 2. CT Angiography

Patient then admitted for an arteriographic evaluation of post-thrombectomy, the results of the arteriography were concluded as total occlusion Peripheral Artery Disease (PAD) in proximal of right iliaca communis artery (thrombus) with minimal flow to the right inferior extremity artery. Arteriography results were obtained as follows:

Lower Extremity Arteries Dextra	Lower Extremity Arteries Sinistra
- Total occlusion in proximal of right iliaca communis artery (thrombus) - Minimal flow to the right inferior extremity artery	- Left iliaca communis artery normal - Left iliaca external artery normal - Iliaca internal artery normal - Femoral communis artery normal - Superficial femoralis artery normal - Poplitea artery normal - Anterior tibialis artery normal - Posterior tibialis artery normal

Then the cardiothoracic surgeon decided to perform aorto femoral bypass because a thrombus was obtained from right iliaca communis artery to superficial femoral artery, then interpositioned with a synthetic graft of 8 mm from right iliaca artery to superficial femoral artery (SFA). After surgery, re-performed arteriography for evaluation of the graft, but there was no visible flow in the graft. The arteriography was summarized as follows: total occlusion in the right iliaca communis artery; collateral flow from right inferior mesenteric artery to the right iliaca internal artery. Patient was planned to do bypass graft repair, but the patient refused to do the procedure again and then patient was discharged.

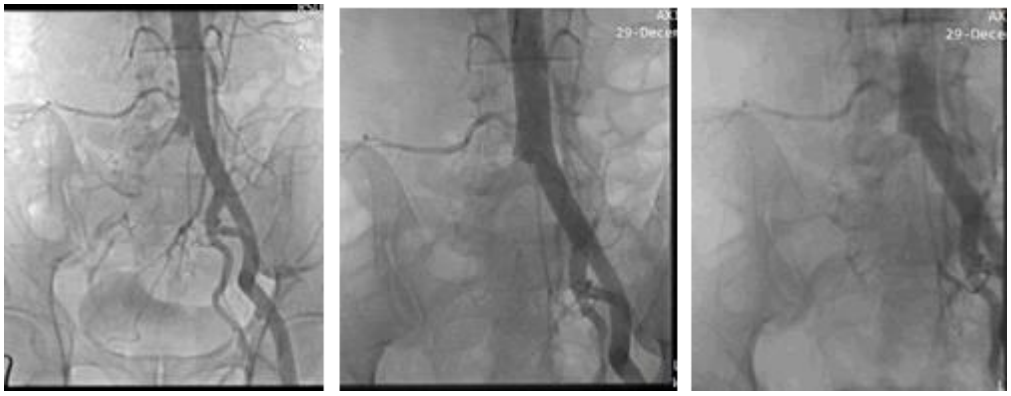

Figure 3. First arteriography post re-thrombectomy (a), second arteriography post aorto-femoro bypass graft (b), collateral flow from right inferior mesenteric artery to the right iliaca internal artery (c)

Discussion

Chronic limb ischemia (CLI) is generally defined as pain at rest or loss of tissue (ulcers or gangrene) caused by an ischemic process which can be determined based on the hemodynamic value of ankle or toe pressure, or can be based on measurements of low transcutaneous oxygen levels (TcO2). Where the criteria for low pressure at the ankle range from less than 40 - 70mmHg, the toe pressure is less than 30-50 mmHg, TcO2 is less than 20 - 40 mmHg. The pressure criteria for the ankle, toes, and TcO2 may differ in each guideline. For the purpose of clinical improvement, pain or injury that does not improve with conventional wound care or painkillers, more advanced technologies such as angiography and revascularization can be used in order to determine the condition of the arteries that could be an underlying condition for the condition [3]. The prognosis of CLI is determined based on the morbidity and mortality underlying functional impairment of the limbs. Cardiovascular events such as myocardial infarction and stroke occur in

30-50% of patient subjects with PAD overall within 5 years, whereas patients with CLI face this risk during the one year period. The procedure for amputation at or above the ankle, occurs in 30-50% of cases of CLI. [4]

The clinical presentation of CLI depends on the degree of ischemia, presence of infection, and concurrent neuropathy. Pain due to ischemia is usually more severe when the patient is in a supine position and requires narcotic drugs as painkillers. The pain can wake patients from sleep and make them unable to walk. Infection can increase pain even without severe ischemia. Neuropathy can cause tissue injury or mask pain due to the ulcer process. Current guidelines recommend measuring the ankle brachial index (ABI). The calcification process that causes obstruction in the blood vessels of the extremities can be predicted based on the pressure on the toes. TcO2 or skin perfusion pressure can be used as an indicator of wound healing. ABI examination is the initial examination that needs to be done in diagnosing PAD in the inferior limb. [3,4,5]

The main goal of CLI management is to preserve limb function. Revascularization is the main strategy for limb salvage, but in some conditions, this procedure does not produce very good results. For example, in a patient with cognitive impairment, delays in diagnosis on an outpatient basis, and severe comorbidities can be markers of a poor prognosis despite revascularization procedures. When a revascularization procedure is considered to be performed, imaging of the arteries is necessary as an identification process and can determine the means or procedure of revascularization. Duplex ultrasound, and noninvasive angiography with computerized tomography (CTA) and magnetic resonance (MRA), can be useful in demonstrating peripheral arterial vascular obstruction. The duplex ultrasound does not require contrast but requires special training and has disadvantages in providing imaging images of a more distinctive artery (eg A. tibialis). [6,7]

CTA requires iodinated contrast and can cause complications of nephropathy in patients with impaired renal function. Severe arterial calcification can create artifacts limiting CTA to diagnose distal arterial obstruction. MRA is a magnetic examination in which this procedure can be performed without the aid of contrast. The MRA procedure has less diagnostic value than CTA imaging because it cannot assess the calcification process in the arteries. Imaging modalities with CTA and MRA also have drawbacks in diagnosing abnormalities in the lower tibial region. However, CTA and MRA can help localize target lesions and determine the modality of the revascularization procedure. The following are recommendations for the use of imaging with DUS, CTA and MRA in patients with PAD of the inferior limb (table 3). [3,8]

The limitation of non-invasive imaging of the distal artery makes it an invasive procedure that is angiography is often used for pre-procedures such as amputation. Invasive angiography using iodinated contrast provides images with the highest spatial resolution. Diagnostic procedures can be performed using a small amount of contrast (30 mL) for both legs using both conventional and digital subtraction angiography (DSA) procedures. [7]

In various centers, endovascular revascularization is the most preferred treatment for CLI cases, due to the lower morbidity and mortality compared to surgical procedures. The optimal treatment strategy (endovascular revascularization versus open surgery) depends on anatomical factors, comorbidities, and patient preferences coupled with operator experience and skills. Although claudication can be relieved by revascularization of the inflow (aorto-iliac and femoral), CLI is a

multilevel disease in which not only the inflow requires revascularization but also the outflow area (tibia) [3,7]. Aorto-iliac disease can be performed endovascular procedure through access to the common femoral artery ipsilaterally or contralaterally, or through the brachial and radial arteries. Retrograde approaches via the popliteal artery are less common, but can help traverse the occlusion of the superficial femoral artery where the antegrade cannot pass. Retrograde approach through a poplitea, which requires access of the femoral artery contralateral or antegrade, then the patient is positioned face down on the operating table and uses ultrasound-assisted imaging to prick a needle to access the popliteal artery at or just above the knee joint. A 4-5 French sheath is used as an access wire which can be snared from above after passing retrograde occlusion. [9]

Various systems can be used to traverse occlusion in arteries, among others by using wires and balloons with diameters of 0.035 ″, 0.025 ″, 0.018 ″, and 0.014 ″. The occurrence of recoil or dissection can occur in lesions with a severe degree of calcification which can occur in the practice of stenting in the illiac area. Balloon expandable stent has the ability to expand stronger and more evenly so that it is often used on lesions in the osteal area, while self-expanding stents can be used in areas with long lesions. A covered stent is a type of stent that can be used to treat life-threatening iliac artery perforations during endovascular procedures. None of the three types of stents can guarantee that a restenosis process will not occur at the place where the stent has been installed. [10]

Abnormalities in the common femoral artery often coincide with both the superficial femoral artery (SFA) and the deep femoral artery. Endovascular procedures give good results in these areas. Use of both the SFA and the deep part should be avoided because the mobility of the hip joint such as repeated flexion can cause stent fractures, and can cause occlusion of the deep arteries which can provide collateral if there is occlusion in the SFA area. Endovascular management of both branches can be done with balloon angioplasty alone, but this can be complicated if there are lesions with severe calcification. Endarterectomy surgical procedure with patch angioplasty provides better results compared to endovascular procedures alone. A hybrid approach by combining both surgical and endovascular procedures can be used in lesions located in the illiac and in the area of the common femoral artery. However, this procedure still requires further study to assess its success. [11]

Drug-coated balloon yields better results than balloon angioplasty in patients with lesions in the SFA area with symptoms of claudication. Drug-coated balloons can also be used as a method of dilation prior to stenting. [12,13]

*Aortofemoral Bypass Graft Surger***y**

Aortofemoral bypass surgery is a procedure commonly used to treat occlusive aortoiliac disease. The essential anatomy relevant to aortofemoral bypass includes the aorta which branches into the right and left common iliac arteries. The right and left common iliac arteries (CIA) then branch into the external iliac arteries (EIA) and the right and left internal iliac arteries (IIA). The external iliac artery then becomes the common femoral arteries (CFA). Aortoiliac occlusion disease can occur anywhere along these arteries and varies in degree. It is important to understand the anatomical relationships of these structures to disease processes, procedures, and where anastomosis may occur and where clamps need to be placed. The most common mode of visualizing these structures is with CT angiography, which can also be used to make 3D anatomical reconstructions. [14]

In the case of aortoiliac occlusion disease, the classic indications for surgical intervention are as follows: Severe atherosclerosis of the iliac artery or abdominal aorta causes symptoms, acute occlusion of the iliac artery or abdominal aorta, symptoms of severe claudication despite optimal medical therapy, gangrene of legs, non-healing ulceration, critical leg ischemia, which may present as pain at rest or as severe claudication. Prior to surgical intervention, smoking cessation, regular exercise, antiplatelet therapy, weight loss, treatment of underlying hyperlipidemia, hypertension, and diabetes were performed. The absolute contraindication for aortofemoral bypass is any patient who is too unfit for general anesthesia. Some patients who do not qualify for aortofemoral bypass are candidates for axillofemoral bypass. Relative contraindications or patients at high risk of complications from having aortofemoral bypass surgery include those with significant heart disease, a recent cerebrovascular accident, recent myocardial infarction, and certain types of previously performed abdominal surgery, retroperitoneal fibrosis, or horseshoe kidney. In addition, end-stage renal disease patients are a high-risk surgery group. [14]

Some of the things that cause the failure of the aortofemoral graft surgery are: Patients with acute occlusion of the graft, this may be due to technical problems, the most common cause is elevation of the intimal flap after local endarterectomy. The most common treatment in this patient is thrombectomy and securing the raised intimal flap. Patients may have recurrent symptoms without true thrombosis or graft occlusion; this is associated with neointimal hyperplasia of distal anastomosis and evidence of distal atherosclerosis. In these patients a local endarterectomy and a patch angioplasty can be performed. Graft thrombosis may occur in patients who have failed surgical operations more than 30 days after grafting. The most common treatment for the inflow procedure is thrombectomy, a profound aplasty can also be performed to increase the outflow. Although rare, false aneurysms, crooked grafts, and stenosis at the proximal to the proximal suture line can be determinants of surgical failure of aortofemoral graft surgery [15]. The importance of pre and postoperative angiography in determining the etiology of graft failure is emphasized. It is important to exclude problems with proximal anastomosis. Once the inflow is determined, angiography should ensure that an adequate outflow procedure has been performed. [15]

The only randomized control trial comparing open surgical treatment and endovascular procedures of CLI patients is the BASIL study where in the experiment, the two methods did not provide a difference in treatment by amputation and death within 5 years. The incidence of myocardial infarction, wound infection, and even pulmonary complications was higher in the open surgery group, but repeated revascularization procedures were higher in the endovascular therapy group. [16]

Conclusion

Patients with CLI are at risk for limb loss if revascularization is not performed and also have an increased cardiovascular event. Revascularization is necessary if the procedure can prevent limb loss and maintain ambulation and function, while medical therapy is focused on addressing the risk factors that contribute to atherosclerosis. Pre and postoperative angiography in determining the etiology of graft failure is necessary. It is important to exclude problems with proximal anastomosis. Once the inflow is determined, angiography must ensure that an adequate outflow procedure has been performed.

Endovascular recanalization from the original CTO may be a potential alternative to repeat bypass for

patients with limb ischemia after bypass graft failure and provides optimal results in terms of technical success, secondary vascular patency, and level of limb salvage despite complex lesions. Although a large amount of research is required, these therapeutic options should be considered before proceeding to amputation in patients without realistic re-surgical options.

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