

The use of local anesthesia to perform lower limb revascularization in the fragile patient with critical limb ischemia

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SUMMARY: The use of local anesthesia to perform lower limb revascularization in the fragile patient with critical limb ischemia.

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Patients with critical limb ischemia are usually compromised, frequently making administration of general or regional anesthesia pro-

blematic. We treated 3 fragile patients presenting contraindications to undertake traditional anesthetic techniques for lower limb revascularization, in whom local anesthesia with conscious sedation was used to complete the operation. An axillo-bifemoral, a unilateral axillo-femoral and a femoro-femoral bypass were performed. Procedure was uneventful in all three cases despite the coexistence of specific surgical challenges (distal anastomosis at the profunda in two cases, redo surgery and scarred groin in the third). Surgical revascularization under local anesthesia may be considered in selected high risk patients.

KEY WORDS: Limb salvage - Perioperative risk - Local anesthesia..

Introduction

Patients presenting with peripheral arterial disease have been well documented to be at an increased risk for cardiovascular morbidity and mortality with myocardial infarction and stroke accounting for the majority of deaths (1). More importantly, subjects in the most severe spectrum of this condition, namely critical limb ischemia (CLI) have been shown to be in an excessive risk for vascular death with a remarkably high mortality rate of 25% after only 1 year of follow-up (2). Notably, only 45% of these subjects will be alive and without amputation after the same time period. It is therefore expected that these patients are usually compromised and present a high operative

risk in case of an attempted revascularization procedure (2). On the other hand, endovascular techniques are frequently non-feasible due to various reasons, mainly unfavourable distribution of arterial lesions and/or severe renal impairment rendering the use of contrast agents unsafe. In this instance, surgical arterial reconstruction could be the only therapeutic option in order to achieve limb salvage, while in case the patient is judged too fragile to undergo complex revascularization procedures, primary amputation may be favored as a more rational and comforting approach.

General anesthesia (GA) confers a high risk for cardiovascular complications in patients with severe cardiac comorbidities, while subjects with pulmonary conditions can be very difficult to wean from post-operative ventilation. On the other hand, regional anesthesia (RA) may result in severe hypotension and shock in patients with systolic or diastolic heart dysfunction and a low ejection fraction, due to its vasodilatory effect which reduces peripheral resistance (3). Patient specific variables (i.e. unstable angina, severe arrhythmias or valvular disease, Chronic Obstructive Pulmonary Disease-COPD, oxygen depend-

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ence, sleep apnea, etc) as well as procedural factors (i.e. aortic or other major vascular surgery, prolonged procedures with large fluid shifts or blood loss) have been related with an increased risk for complications after general or regional anesthesia and are all very prevalent among patients undergoing revascularization procedures for CLI (3). We have treated 3 fragile patients presenting CLI due to aorto-iliac occlusion, performing an arterial bypass under local anesthesia (LA) and conscious sedation and we briefly describe these cases to indicate the feasibility of the method.

Brief description of cases

Case 1

A 75-year old male patient presented with ischemic rest pain in both lower limbs which started before 1 month. From the clinical examination, palpable pulses were absent in the femoral, popliteal and peripheral arteries while the Ankle Brachial Index (ABI) was 0.2 and 0.3 in the left and right lower limbs respectively. He was a heavy smoker (>100 pack/years) with a medical history of severe COPD. Spirometry indicated a FEV₁ <1lt. Moreover he was under Coumadin for a prosthetic aortic valve and he had a low ejection fraction of 30% as indicated by the preoperative cardiac ultrasound. CT angiography (CTA) indicated a small abdominal aortic aneurysm, 3cm of maximum diameter, occlusion of the common and external iliac arteries at the left and occlusion of the external iliac artery at the right side (Transatlantic Inter-Society Consensus Document-TASC D lesions). Common femoral arteries were patent but severely calcified. Superficial femoral arteries presented multi-level atherosclerotic lesions in both sides. The patient was classified as American Society of Anesthesiologists (ASA) 4. Mainly due to his severely impaired respiratory function he was deemed very high risk for GA and intubation, while the cardiac dysfunction and the need for anticoagulation would make him a high risk patient for administration of RA. Therefore, it was decided to proceed with an axillo-bifemoral bypass under LA. During the procedure conscious sedation with dexmedetomidine was administered. Lidocaine 1% was used during preparation of axillary and femoral arteries while Tumescent anesthesia was used to make the subcutaneous tunnel. An ePTFE ringed 7mm graft was inserted which was anastomosed to the axillary artery proximally and the deep femoral arteries distally. An endarterectomy of the femoral arteries

was necessary before distal anastomoses could be constructed. Total procedural time from skin incision to completion of the procedure was 105 min. In total the patient received 400mg of lidocaine. Postprocedurally, the ABI increased to 0.6 in both limbs and the patient reported significant clinical improvement with absence of rest pain and a walking capacity of about 200m. He was discharged at the 6th postoperative day.

Case 2

A 91-year old female patient was admitted to the emergency department because of rest pain with concomitant ischemic minor tissue loss of the 5th toe at the right side. Palpable pulses were absent at all levels in both lower limbs while the ABI was measured 0.3 at the left side and there was no detectable arterial flow at the right ankle. The patient had severe asthma under medication with bronchodilators, coronary artery disease and atrial fibrillation. She had been recently hospitalized and discharged 10 days prior to this admission for lower respiratory tract infection. At the time of presentation, she was not on anticoagulants but she was taking clopidogrel. The patient underwent a digital subtraction angiography which revealed infrarenal aortic, common and external iliac and common femoral arteries occlusion bilaterally (TASC D). Superficial femoral artery (SFA) was occluded at the right side while the profunda femoral artery (PFA) was patent through collateral network. The patient was categorized as ASA 4 and judged unfit for GA, while RA was contraindicated due to antiplatelet therapy with clopidogrel. In this case a right axillo-femoral bypass was performed to the right PFA with an ePTFE 8-5mm graft. Again lidocaine 1% and Tumescent anesthesia were used to prepare inflow/outflow arteries and perform the subcutaneous tunnel respectively. The use of sedation was not necessary and only analgesia with paracetamol and tramadol was administered. Total dose of lidocaine was 280mg while total procedural time was 80min. Postoperatively, an ABI 0.6 was recorded. Patient reported subsidence of rest pain while the toe ulcer progressively healed. The patient was discharged at the 9th postoperative day.

Case 3

A 69-year old patient was admitted to the cardiology department to undergo coronary angiography. He had undergone Coronary Artery Bypass Grafting (CABG) and Percutaneous Coronary Intervention

(PCI) in the past and had a defibrillator implanted 8 months ago. He had systolic and diastolic cardiac dysfunction with an ejection fraction of about 20% while he was also on coumadin. Moreover, he had a unilateral right aorto-femoral bypass which had been performed 8 years ago. During coronary angiography the patient reported sudden onset of left lower limb pain and numbness after multiple attempts to advance a wire via the left femoral artery. Clinical examination revealed a cold and pale limb without pulses while arterial flow was absent after examination with a hand-held Doppler. Immediately a CTA was performed which revealed a dissection at the level of the left CIA which caused thrombosis of the latter and the infrarenal aorta just proximal to the aortic bifurcation. The previous right aorto-femoral bypass was patent. INR at that time was 2.1. The patient was categorized as ASA 4. Subsequently, he underwent a femoro-femoral bypass from the right to the left common femoral artery with an ePTFE 7mm graft. Lidocaine 1% was used to prepare the femoral arteries and subcutaneous tunnel with a total dose of 260mg. Conscious sedation with dexmedetomidine was also used. Total procedural time was 60min and immediately post-operatively arterial inflow was restored and ABI was measured 0.75 at the left side. The patient was transferred to the cardiology intensive care unit where he remained for 24hours. He was discharged at the 8th postoperative day.

Discussion

Vascular reconstruction for CLI carries a significant risk for morbidity and mortality for both procedural (blood loss, fluid shifts, prolonged ischemic and procedural times, reperfusion injury) and patient-specific risk factors (compromised subjects with multiple cardiovascular and respiratory comorbidities) (3). These patients represent a great challenge regarding their anesthetic management. For example, the cardiodepressant effects of general anesthetics can severely compromise cardiac function. Furthermore, GA is to be avoided in patients with impaired cardiorespiratory reserve, due to possible difficulty to wean the patient postoperatively. The option of neuraxial anesthesia is not always feasible, as is the case in recent use of anticoagulants or clopidogrel, while in patients with severely impaired cardiac contractility and low ejection fraction, sympathetic denervation can cause significant hypotension. Moreover these techniques cannot ad-

equately anesthetize patients during various procedures, the axillo-femoral bypass included. In such occasions the use of LA with or without sedation has been previously reported in the literature but data are scarce as can be seen in Table 1. Specifically, we were able to identify only 5 published cases of axillo-femoral bypass and 9 cases of femoro-femoral bypass performed under LA (4-9). These previous reports indicate feasibility of this technique in selected cases. The patients presented in the current study seem to have required somewhat more complex procedures than those earlier reported. Patients from previous publications mainly had straightforward reconstructions while in our series 2 out of 3 patients had severe femoral artery calcification and required additional endarterectomy while the distal anastomoses were performed in the *profunda* rather than in the common femoral artery. The 3rd patient had a previous aorto-femoral bypass and therefore a previously operated scarred groin making the procedure technically more challenging. These factors did not seem to have prolonged procedural times (105min for Case 1 axillo-bifemoral, 80min for Case 2 axillo-femoral and 60min for Case 3 femoro-femoral bypass) which is an important variable when the operation is being performed under LA.

In 2 out of 3 cases, conscious sedation with dexmedetomidine had been used as an adjunct to LA in order to assist patient comfort and allow completion of the procedure without the need for intubation. This agent is usually indicated as a continuous infusion for short term sedation of intubated and mechanically ventilated patients in an ICU setting (7). Its off-label use as an adjunct to LA during vascular procedures has been only scarcely reported in the previous literature (7). Its anxiolytic, hypnotic and analgesic action in the absence of a significant respiratory depressant effect can be particularly useful in occasions like those presented here. Furthermore, its use may also have allowed us to limit dosage of lidocaine administered intraoperatively into its safe therapeutic range. Dexmedetomidine is reported to provide hemodynamic stability during anesthesia and reliable control of heart rate and blood pressure during surgical stimuli (10). On the other hand, α_2 – adrenoreceptor agonist can induce bradycardia and hypotension (10). In the described cases, the administration of half the recommended loading dose (0.5 instead of 1 mcg/kg/h in 10 min) and the incremental titration of the continuous infusion (0.8 -1.2 mcg/kg/h) provided hemodynamic stability to both patients.

TABLE 1 - THE STUDIES THAT REPORT THE USE OF LA TO PERFORM SURGICAL BYPASS IN PATIENTS WITH PERIPHERAL ARTERIAL DISEASE. THE REFERENCE NUMBER IS DISPLAYED IN THE FIRST COLUMN. AXILLO- AND FEMORO-FEMORAL BYPASSES LIKE THOSE PRESENTED IN THE CURRENT REPORT HAVE BEEN PRESENTED IN BOLD AND ARE VERY LIMITED. *FEM: FEMORAL, AX: AXILLARY, POP: POPLITEAL, TIB: TIBIAL.*

Journal/year of publication	Procedures	Peri-operative mortality	Duration (min)	Conversion to GA
Am J Surg 1997 (4)	Fem-Fem 7 Fem-Pop 21 Fem-Tib 16 Pop-Tib 13	n=2	NR	n=4
Br J Surg 1997 (5)	Ax-Fem 2 Fem-Fem 2 Fem-Pop 6 Fem-Tib 27 Pop-Tib 5 Jump graft 4	n=10	155 (60-420)	n=2
Cardiovasc Surg 1998 (9)	Fem-Pop 10	n=0	116 (85-114)	n=0
AANA 2005 (7)	Ax-Fem 1	n=0	101	n=0
Local Reg Anesth 2010 (6)	Ax-Fem 2	n=0	110,140	n=0
Cirugía Española 2012 (8)	Fem-Pop 1 Fem-Tib 7	n=0	96±15 min	n=0

Conclusion

Revascularization for CLI in fragile patients judged unfit to receive either general or regional anesthesia can be successfully and safely performed under local anesthesia with or without adjunctive conscious sedation in selected cases.

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Conflict of interest

The Authors declare that there is no conflict of interest.

Authors' contributions

Study conception: NK, AP, ET

Data collection: SL, GP

Literature search: KT,NK,GP

Writing of the manuscript: ET,KT,CI

Critical revision of the manuscript: all authors

Final approval of the manuscript: all authors

Overall responsibility: CI, AP

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