

Improved Angiographic Findings of Superficial Femoral Artery after Verapamil Injection into the Reperfusion Cannula of a Patient on Peripheral Venoarterial ECMO

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ABSTRACT

Limb ischemia is a complication that can occur in patients requiring percutaneously placed venoarterial extracorporeal membrane oxygenation (ECMO). One method used to prevent limb ischemia is the placement of an antegrade catheter into the superficial femoral artery. We describe a case in which the angiographic findings of the superficial femoral artery were improved by the injection of verapamil in a patient with limb ischemia.

INTRODUCTION

Adult patients who require cannulation for venoarterial extracorporeal membrane oxygenation (ECMO) in the setting of cardiogenic shock continue to be a challenging group to manage. The femoral artery and vein are the preferred vessels for cannulation. Unfortunately, due to the often minor difference between cannula diameter and diameter of the femoral artery, there is a high risk for lower extremity ischemia [Foley 2010; Bisdas 2011]. Many adults who survive ECMO are left with permanent sensory or motor deficits, tissue loss, and in severe cases amputation of the affected limb if left untreated. To help prevent limb ischemia, our institution percutaneously places an antegrade re-perfusion catheter in the superficial femoral artery (SFA). Typically, this is done at the time of cannulation, but can also be performed afterward if signs and symptoms of ischemia arise. We use a 5 or 7 French Super Arrow-Flex Sheath (Arrow International, Auckland, NZ) as our antegrade catheter. Once placed, the catheter is connected to the arterial ECMO cannula, thus creating a conduit and providing oxygen-rich blood distal to the mechanically obstructed femoral artery. This method has proven extremely effective at preventing limb ischemia [Maderahian 2006; Russo 2009]. Proper placement of the antegrade reperfusion catheter is confirmed by bedside angiography. This is done by injecting 10-20 cc of Omnipaque 300 (GE

Healthcare, Little Chalfont, UK) directly into the reperfusion catheter while simultaneously taking an x-ray of the thigh. Below, we describe a case in which the angiographic findings of the SFA were improved by the injection of verapamil.

PATIENT PROFILE

A 20-year-old female was admitted in cardiogenic shock status, following an uncomplicated spontaneous vaginal delivery (Gravida 1). Six hours post-delivery she experienced presyncopal symptoms while standing. Electrocardiogram showed sinus tachycardia to 140s. Transthoracic echocardiogram was performed to evaluate for postpartum cardiomyopathy. Echocardiogram revealed a mildly dilated left ventricle with an estimated ejection fraction of 35-40%, global hypokinesia, normal right ventricle, and no major valvular abnormalities.

After the resolution of her presyncopal episode, she started experiencing dyspnea for which a computed tomography (CT) scan with contrast and V/Q scan were performed, which were non-diagnostic. Over the next 48 hours the patient's condition continued to deteriorate, during which time she became severely hypotensive and hypoxic, ultimately leading to intubation and initiation of vasopressor support. Repeat echocardiogram at this time showed further reduction in left ventricular function, with ejection fraction estimated at 15-20%. Despite high doses of vasopressor support, the patient's mean arterial pressure remained less than 60 mmHg, with worsening lactic acidosis (lactic acid >11 mmol/L) and further progression of multisystem organ failure.

The patient was placed on venoarterial ECMO via percutaneous cannulation of the right femoral vein (21 French cannula) and right femoral artery (17 French cannula). A 7 French antegrade reperfusion cannula was then placed percutaneously into the right superficial femoral artery without complication. Placement of distal perfusion cannula was then confirmed with bedside angiography (Figure 1). After review of the angiography it was noted that the SFA was extremely narrowed. This was believed to be secondary to vasopressor use and/or vasospasm. Physical exam of the cannulated limb was consistent with limb ischemia as evident by absent pulses, colder temperature, and mottled discoloration. In hopes of improving circulation, 10 mg verapamil was injected into the SFA via the reperfusion catheter. Shortly thereafter, bedside

Received May 18, 2014 ; received in revised form August 27, 2014; accepted September 3, 2014.

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Figure 1. Placement of antegrade reperfusion catheter into SFA confirmed by bedside angiography.

angiography was performed showing improved diameter size of the SFA (Figure 2). During the perioperative period, the patient's pulses returned and limb ischemia started to resolve. The patient remained on venoarterial ECMO support for a total of 4 days and was then successfully decannulated, with subsequent discharge to a rehabilitation facility on hospital day 12. IRB approval was not obtained to report this case.

DISCUSSION

Limb ischemia is of great concern in patients requiring venoarterial ECMO due to negligible differences between cannula diameter and the diameter of the femoral artery. Placement of an antegrade reperfusion cannula into the SFA distal to the arterial ECMO cannula is a method our institution has adopted to help prevent lower limb ischemia. In this patient, the reperfusion cannula was found to be placed into a very narrow SFA. As seen on angiography, improvement in the diameter of the SFA was achieved with



Figure 2. Angiography of SFA status post-verapamil injection.

the injection of verapamil. This technique has been used only once. As reported in this case presentation, there was observed improvement in limb perfusion during the short-term perioperative period. Whether or not this improves perfusion and deters limb ischemia remains unclear and requires further research. It is unclear if this technique would be useful in patients with other forms of mechanical circulator support.

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