Lower extremity ischemia is an important source of morbidity with femoral venoarterial extracorporeal membrane oxygenation support. We describe our experience with the use of a side-arm graft sewn to the femoral artery that facilitates adequate extracorporeal membrane oxygenation flow while preventing lower extremity ischemia.

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Address correspondence to Dr Alten, University of Alabama at Birmingham, 1600 7th Ave S, ACC 504, Birmingham, AL 35233; e-mail: jalten@peds.uab.edu.
for cardiopulmonary bypass (CPB) with a left FA cannula. A long intraoperative course was complicated by severe bleeding. After weaning from CPB, he experienced low cardiac output and rapidly progressive lactic acidosis, requiring VA-ECMO support by a side-arm graft attached to the left FA and a 25F FV cannula. Severe postoperative bleeding precluded the initial use of heparin; the cannulation site was packed with sponges, and the skin temporarily closed with a bovine pericardial patch. He experienced no further bleeding complications and maintained normal LE perfusion. Weaning from ECMO was successful day three.

Comment

The femoral vessels are frequently cannulated for VA-ECMO because they offer relatively easy access to the central circulation and are associated with decreased bleeding and neurologic complications. Because the arterial cannula may approach the diameter of the FA, distal leg perfusion can become compromised. The incidence of LE ischemia ranges from 10% to 50% in patients with FA cannulation [1, 2].

The procedure in this report was adapted from the axillary artery CPB cannulation technique used by our cardiovascular surgeons. The success of this technique in rescuing our first patient from LE ischemia led us to explore it as our primary method of FA ECMO cannulation. We believe that ischemia related to cannula obstruction could be eliminated with this side-arm graft technique. All 3 patients demonstrated excellent LE perfusion (warm and pink), with easily palpable pulses once contractility returned. Historically, our patients whose FAs were directly cannulated had a temperature difference between the feet and rarely had palpable LE pulses.

Other techniques are reported to decrease the risk of distal leg ischemia seen in femoral VA-ECMO; most involve variations of DPCs that can be percutaneously or surgically placed distal to the ECMO cannulation site [3–6]. Investigators have still reported ischemia and tissue damage with their use, side effects of their placement, or both [1]. Our side-arm graft technique avoids intraluminal cannulas entirely, which should nearly eliminate the occurrence of LE ischemia in addition to allowing antegrade and retrograde blood flow. All 3 patients had normal retrograde (upper body) oxygen delivery as measured by cNIRS monitoring and measurements of radial arterial and superior vena cava venous saturation.

The anastomosis of prosthetic vascular grafts to the FA has previously been described for CPB [7] and ECMO support [8]. Although they did not describe it in detail, Doll and colleagues [8] mentioned performing anastomosis of a 6-mm Hemashield prosthesis to the FA in a review of their vast ECMO experience. They observed decreased ischemia after the change from percutaneous cannulation, but it is not clear how many patients underwent cannulation in this manner and whether increased bleeding or other complications resulted.

One advantage of femoral cannulation is that the vessels are easily cannulated percutaneously, offering the potential for emergent access. Our technique requires cutdown exposure and arteriotomy of the FA, increasing cannulation time and bleeding risks in comparison with the percutaneous technique. The second patient highlighted this limitation, given that he had significant bleeding at the anastomosis site, requiring reexploration. The potential for increased risk of bleeding and infection (foreign material) makes it necessary to delineate patient populations that may benefit most from this cannulation technique. Patients with smaller vessels likely to be occluded by arterial cannulas [4] (children, thin adults, peripheral artery disease [2]), patients in whom ischemia develops after percutaneous cannulation, or patients who undergo cannulation in the operating room with vessels already exposed for CPB (similar to our third patient) all may be attractive candidates for this approach.

In conclusion, our variation of a side-arm graft to establish FA access is effective in reversing or preventing distal LE ischemia, or both, associated with femoral VA-ECMO. Prospective studies are necessary to determine whether this technique has a sufficiently favorable side effect profile compared with percutaneous cannulation to warrant its prophylactic use in all patients.

References