Percutaneous Isolated Limb Perfusion with Thrombolytic Agents for Limb Salvage

John F. Eidt, MD, Little Rock, AR; Venkat Kalapatapu, MD, Little Rock, AR; Mohammad Moursi, MD, Little Rock, AR; Ahsan Ali, MD, Little Rock, AR

Catheter-based thrombolysis is a valuable treatment option in selected patients with acute arterial occlusion, particularly when a multiside hole catheter can be embedded directly in the thrombus. Intra-arterial thrombolysis may however be contraindicated or impossible in some patients with arterial occlusion. In some cases, such as patients with recent surgery or intracranial pathology, thrombolysis may be contraindicated owing to the risk of remote hemorrhage. Despite attempts to restrict the activity of the thrombolytic agent to the offending thrombus with so-called "fibrin selective" agents, catheter-directed thrombolysis with currently available commercial agents invariably results in a systemic lytic state with the attendant risk of bleeding. In other cases of severe outflow obstruction of the distal tibioperoneal and pedal arteries, a catheter cannot be effectively advanced into the obstruction. In these types of cases, in which catheter-directed thrombolysis is not an option, we have utilized a technique of percutaneous isolated limb perfusion to deliver high-dose thrombolytic agents directly into the limb without the risk of a systemic thrombolytic state.

Method

This procedure must be performed with either regional or general anesthesia. A femoral and sciatic nerve block or spinal or epidural anesthetic may be used. Alternatively, general anesthesia may be chosen based on surgeon, patient and anesthesiologist preference.

The entire leg and groin are prepped and draped. An antegrade 5F sheath is placed in the ipsilateral common femoral artery. Ultrasound guidance is used to avoid puncture of the superficial or deep femoral arteries. A 5F straight flush catheter is advanced to the level of the popliteal artery at the joint line. This catheter will be used for intra-arterial infusion of thrombolytic agents. Next, a 5F sheath is placed in the adjacent common femoral vein in a retrograde manner and a 5F straight-flush catheter is advanced to the level of the popliteal vein. Care is taken to avoid injury to the deep vein valves by first gently traversing the thigh with a floppy glidewire (Terumo).

Intravenous heparin is administered at a dose of 100 units/kg and the ACT is maintained at > 300 seconds. After the leg is completely exsanguinated with a latex rubber bandage (Esmarch), a pneumatic tourniquet on the thigh is inflated to 300 mm Hg. The venous catheter is connected to a drainage bag and allowed to drain any residual venous blood by gravity. Normally there is very little venous outflow until the arterial infusion is started. The arterial catheter is irrigated with 500 cc normal saline and the venous effluent is monitored until it is the color of blush wine. This inflow-outflow technique ensures that the infused thrombolytic agent can be completely retrieved through the venous catheter, and it eliminates any stagnant blood. We have used a pressure bag in some cases to increase the rate of arterial infusion but we are cautious to avoid supraphysiologic pressures that might induce capillary leak and edema.

A variety of thrombolytic agents can be infused. Most commonly, we have used Urokinase (Abbott Laboratories) 1 million units and infused this into the arterial catheter over 5 minutes. The venous outflow catheter is clamped and the Urokinase is allowed to dwell in the leg for 45 minutes. We have also used tPA 1 to 20 mg or ReoPro (abciximab) 10 to 20 mg. We are currently undertaking a dose-ranging study with tPA to determine the optimum dosing regimen. After 45 minutes, the thrombolytic agent is flushed from the extremity by infusing an additional bolus of normal saline 500 mL into the arterial catheter and allowing the venous catheter to drain spontaneously. The tourniquet is released and the leg is allowed to reperfuse. The technique can be repeated with a different agent as needed.

Results

During the past 2 years, we have used this technique to treat 2 upper extremities and 8 lower extremities in 10 patients. Rest pain was the most common presenting symptom though ulcers were present in 1 patient. There were 7 male and 3 female patients with a mean age of 52.1 ± 13 years (mean ± SD). Mean follow-up was 9.1± 5.8 months (mean ± SD).

Technical success, defined as the ability to place the catheters in the arterial and venous systems and effectively establish an ingress-egress system, was 100%. Nine of 10 patients experienced improvement in their symptoms. In one of these patients, an appropriate distal target vessel was identified that was not present on preoperative angiography and a successful bypass was performed. One patient did not have relief of symptoms and underwent a below knee amputation after 4 months. Physiologic evidence of reperfusion was evidenced by a modest increase in the mean ankle brachial index (0.15 to 0.5). Following thrombolytic infusion, the arteriogram demonstrated a significant change in only 2 of 8 patients despite relief of symptoms in all but one patient. It is our hypothesis that thrombolysis is effective in opening small vessels that are not easily identified on routine intraoperative angiography. There were no hemorrhagic complications and there were no clinical signs of systemic coagulopathy. Systemic fibrinogen levels were not reduced. There were no deaths.

Conclusion

Isolated limb perfusion is a relatively simple technique that can be used to avoid the risk of systemic thrombolysis while delivering a high concentration of lytic agent into an extremity. The technique has been used effectively in a small group of highly-selected patients. The optimum agent, dose, and duration of therapy are uncertain.[1–3]

References

1. Comerota A, White J, Ghrosh J. Intraoperative intra-arterial thrombolytic therapy for salvage of limbs in patients with distal arterial thrombosis. Surg Gynecol Obstet 1989;169:283.
2. Creech O, Krementz E, Ryan R, et al. Chemotherapy of cancer: regional perfusion utilizing an extracorporeal circuit. Ann Surg 1958;148:616.
3. Quinones-Baldrich W, Colburn M, Gelabert H, et al. Isolated limb thrombolysis with extracorporeal pump and urokinase. J Surg Res 1994;57:344–51.

NOTES