

Thrombolytic Therapy Saves Frostbitten Limbs

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WASHINGTON — Thrombolytic therapy has resulted in limb salvage among 18 patients with severe frostbite treated at one Minnesota hospital in the last few years.

Thrombolytic therapy has been available for management of frostbite for 10 years and has the potential to reduce amputations, but its use has not extended to the rural northern areas where most cases of frostbite occur.

Severe frostbite results in ischemia and blistering with subsequent demarcation and loss of tissue. Prostaglandins and other chemical mediators are released locally, resulting in intense spasm and blistering. Arterial thrombosis results from injury to endothelial cells that retract to expose subintimal collagen, subsequently triggering acute thrombosis after rewarming, according to Dr. George R. Edmonson of St. Paul (Minn.) Radiology.

Traditional treatment has simply been to rewarm the affected extremity, wait to see how much tissue recovers, then amputate the rest, but over the last couple of decades, investigators have been experimenting with intra-arterial infusion of various thrombolytic and vasodilating agents to dissolve clots and relieve arterial spasm in attempts to preserve more tissue.

At the annual meeting of the Society of Interventional Radiology, Dr. Edmonson described the process used at Regions Hospital, also in St. Paul. Patients are admitted to the burn unit, where the affected limb is assessed. Diagnostic arteriography is done to assess small vessel occlusion and loss of “distal tuft blush” at the tips of digits. Catheters are positioned for simultaneous infusion of treatment drugs into each affected limb.

Since the mid-1990s, Dr. Edmonson and his associates have been treating frostbite of the extremities with a variety of combined antithrombotic, antiplatelet, and vasodilating agents. Initially, they used urokinase along with heparin and papaverine, then switched to reteplase, and now have moved to using tenecteplase (TNK) because of its superior plasma stability and higher fibrin specificity compared with reteplase, he explained.

During three unusually mild Minnesota winters, six patients aged 18-65 years with severe frostbite who were at risk for amputation were treated for up to 72 hours with intra-arterial TNK infusions at 0.25 mg/hour per limb with coaxial papaverine at 30 mg/hour per limb and intravenous heparin at 500 mcg/hour.

Of the six patients, three who had 16 involved digits responded well and required no amputations. The other three (6 limbs, 30 digits) had incomplete angiographic responses. Of those, two (4 limbs, 20 involved digits) improved following TNK infusion but then developed infections and required partial amputations. One patient—who needed intubation for alcohol withdrawal—failed to respond and lost 8

fingers, but his thumbs were saved.

Those patients were compared with surviving patients (aged 14-77 years) of 12 treated with the same protocol using various doses of reteplase and papaverine over a 2-year period. Six of the patients recovered with no amputations, four had lost 31 digits at 45 days, and two had amputations but more distally than would have been anticipated without treatment. ■



Fingers with severe frostbite (left) can be saved from amputation with restored blood flow (right) after treatment with tenecteplase, papaverine, and heparin.

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