Laura M. Criddle, RN, MS, CCNS, CNRN, replies:

As the author of the question suggests, there is little information in the literature to provide a simple answer to this complex issue. Since its widespread introduction in the 1990s, the number of indications for recombinant tPA has steadily increased. This drug was initially approved to promote coronary artery reperfusion after acute myocardial infarction. Subsequent approved and off-label “clot-busting” uses include acute pulmonary embolism, retinal vein occlusion, hepatic venous occlusive disease, and superior vena cava thrombus. Over the past few years, intravenous (IV) and intra-arterial tPA administration for acute thrombotic stroke has become common practice.1

One of the most important uses of tPA is declotting central venous access devices, particularly long-term or implanted catheters. Currently, tPA (alteplase, Cathflo Activase) is the only thrombolytic agent approved by the Food and Drug Administration for reestablishing patency in thrombosed central catheters.2

Declotting is done with 2 mg of tPA, diluted in 2 mL of sterile water for injection. After evacuating as much fluid as possible from the proximal end of the clotted line (using negative pressure generated with a 10-mL syringe), the drug is instilled and left in situ for half an hour. After 30 minutes, line patency is assessed. If the clot has not cleared, as second 2-mg dose is instilled and allowed to remain for 2 hours.

Studies documenting the efficacy of tPA for central catheter salvage report a 74% to 90% repatency rate.2 With such success using tPA to declot venous access devices, it was not long before tPA was considered for clearing occluded EVDs as well.

There are 2 potential uses for tPA in association with EVDs. One is routine intraventricular instillation to actively reduce the size of a clot; the other is to clear an obstructed catheter. The author of the question implies that nurses at his or her facility are asked to use tPA solely to restore patency to an occluded catheter, which is done for clotted central catheters. Although I found no published guidelines for this practice, obstructive hydrocephalus is the most dangerous complication of intraventricular hemorrhage. Because EVDs are inserted to prevent hydrocephalus, their continued patency is essential. Thus, prompt dissolution of catheter clots would presumably decrease morbidity and mortality. In examining the issue, there are several factors to be considered.

IV therapy nurses have been performing tPA thrombolysis of vascular access devices for several years—and have done so safely and effectively—but what about considerations unique to the brain? In patients with an already elevated intracranial pressure, is it safe to add fluid volume? This practice seems reminiscent of the cerebral compliance testing that was common in the past. However, as long...
as the catheter remains occluded, no additional volume actually enters the brain. When mixed in a standard 1:1 concentration, only a negligible volume is required to replace the fluid removed from the catheter proximal to the clot.

More importantly, can an anti-fibrinolytic agent be safely introduced into the brain of a patient who has already suffered an intracranial hemorrhage? Dosage would appear to be the chief consideration. If used in the same dose instilled in clotted central catheters, the potential for stimulating rebleeding appears to be minimal. Intravenous tPA doses used for reperfusion following acute myocardial infarction or stroke range from 50 to 100 mg. Intra-arterial tPA doses for stroke are typically 20 to 50 mg, but the dose for clearing a central catheter is a mere 2 to 4 mg.

Researchers have examined the effect of similar doses (2-5 mg) of tPA instilled directly into the brain’s ventricles, on a scheduled basis, to actively promote lysis of intraventricular clots. There have been no large, prospective, well-controlled trials of this practice but results of several small studies appear encouraging.

In one nonrandomized Canadian study, 21 postoperative patients with aneurysmal intraventricular hemorrhage received daily doses of 2 to 4 mg of tPA (alteplase, 2-4 mL) through their EVD systems. Dosage was individualized on the basis of the results of daily computed tomography scans. Catheters were clamped for 1 hour after instillation. Compared to controls, tPA patients had significantly lower intracranial pressure at 24 hours and the mean number of days to ventricular opening was reduced by almost 50%.

In this small series, patients in both the tPA and standard treatment groups had equivalent outcomes. Of particular interest from a nursing perspective was that 30% of patients who did not receive daily tPA required EVD replacement for catheter clots, whereas none of those in the tPA group needed catheter replacement. This finding supports the value of tPA as an EVD catheter management tool.

A third issue of particular importance to the use of tPA in EVDs is sterility. Although infections related to central catheter manipulation are a serious problem, intracranial infections are particularly devastating and contribute significantly to patient morbidity and mortality. This point is pertinent to the author of the question who asks whether EVD tPA instillation is a medical or nursing practice, because technique is extremely important for reducing catheter-related infections. What procedures do you currently follow when obtaining cerebrospinal fluid samples? Do you use masks, gloves, and gowns to draw a cerebrospinal fluid sample or to change an EVD bag? How do you prepare the sampling port? Do physicians or nurses perform the collection? The question really comes down to who can maintain the best EVD manipulation technique?

IV therapy teams have repeatedly documented lower rates of catheter site and bloodstream infections than are seen when staff members in general—whether nurses or physicians—insert catheters. It seems logical to conclude that the same would apply to EVD infections. Therefore, the question is really one of training, practice, and consistency.

Who, in your institution, can best meet these criteria? Critical care nurses are by and large a conscientious, trainable, and highly convenient group of care providers. Nevertheless, we are also a profession with high staff turnover, an abundance of inexperienced members, varied educational preparation, and multiple competing demands. In addition, we represent a large employee pool, and maintaining group competence in any uncommon and high-risk procedure is therefore difficult.

Summary

From a review of the minimal literature available on tPA declotting of EVDs it appears that (1) tPA can effectively restore central catheter patency but guidelines for its use as a declotting agent for EVDs have not been made widely available; (2) in standard catheter-declotting doses, EVD installation of tPA is safe; (3) nurses (IV therapists) have safely and successfully used tPA to declot venous catheters for many years; and (4) the incidence of catheter-related infections is closely related to experience with catheter insertion and manipulation.

Given this information, each institution will have to decide who can best perform the procedure. Will it be the neurosurgeons or fellows, who generally have years of intensive exposure to EVDs? Will it be a select group of nurses such as charge nurses, IV therapy nurses, or a clinical nurse specialist? Or will it be feasible to initially train and maintain the skill level of each staff nurse in the unit?

Rather than being a scope-of-practice question, the real issue is
one of individual provider familiarity, experience, and expertise. Institutions are advised to determine which professionals are best suited to the task, rather than which group is merely the most convenient.

References