

Outcome of Central Venous Catheters and New Catheter Locking Solutions

PM ter Wee, M.D.

*Department of Nephrology, Vrije Universiteit Medical Center,
Amsterdam, Netherlands*

Central venous catheters are still frequently needed as vascular access for hemodialysis. These catheters are used at initiation of hemodialysis, in case of failure of the patient's arteriovenous fistula or loop graft and as permanent vascular access in a minority of patients. Recent data from the Dialysis Outcomes and Practice Patterns Study (DOPPS) reveal that in Europe 15-50% of patients and in the US 60% of patients start hemodialysis with a catheter mostly because of late referral which does not allow sufficient time to create a sufficient hemodialysis fistula or loop graft.

Such widespread application of central venous catheters exposes patients to the risk of catheter-related problems including insufficient dialysis efficacy due to catheter clotting and recirculation as well as catheter-related infections. Because of these complications about 50% of all temporary catheters has to be removed preliminary and/or replaced. In addition, these complications result in additional consumption of resources including nursing and nephrologists' time.

In recent times several measures have been taken to reduce catheter-related problems. These include the use of tunneled cuffed catheters, changes in preference of vascular access site and changes in catheter design. These improvements have resulted in a decline in catheter-related problems. In addition recent advantages in reducing infectious complications have been obtained by using alternative catheter locking solutions like citrate. In *in vitro* tests we have performed dose-response studies on the antimicrobial effect of different trisodium citrate concentrations and established that trisodium citrate had antimicrobial effects in contrast to heparin.

Subsequently, a double-blind randomized controlled study was performed comparing trisodium citrate 375 as catheter locking with heparin. A total of 291 patients were included in the study of whom 98 patients received a tunneled cuffed catheter and 193 an untunneled catheter. The study was prematurely stopped because of a difference in catheter-related bacteremia ($p < 0.01$). In the heparin group, 46% of catheters had to be removed preliminary because of a complication compared to 28% in the TSC group ($p = 0.005$). Catheter-related bacteremia rates were 1.1 per 1,000 catheter days for TSC versus 4.1 in the heparin group ($p < 0.001$). For tunneled cuffed catheters the risk reduction for bacteremia was 80% ($p < 0.001$) and for untunneled catheters 67% ($p = 0.05$). Fewer patients died from catheter-related bacteremia in the TSC group (0 vs 5; $p = 0.028$). There were no differences in catheter flow problems and thrombosis ($p = 0.75$). No serious adverse events were encountered. Major bleeding episodes were significantly lower in the TSC group ($p = 0.010$). Other locking solutions have also shown to be superior to heparin as catheter locking solutions.

In conclusion can be stated that the number of catheter-related complications can be reduced compared to earlier days because of improvements in used catheters, the choice of vascular access site and use of newer catheter locking solutions.