Long-term Tesio Catheter Access for Hemodialysis Can Deliver High Dialysis Adequacy with Low Complication Rates

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ABSTRACT

Purpose: The use of central venous catheters for long-term hemodialysis has been associated with increased mortality and high prevalence of infection and venous stenosis. However, because central venous catheters still constitute a significant proportion of vascular access in prevalent populations, even in the Fistula-First era, the authors examined the long-term patient outcomes and performance of this vascular access type to inform current clinical practice.

Materials and Methods: The authors conducted a retrospective cohort study of 433 patients on maintenance hemodialysis in a dialysis program from January 1999 through April 2008 all using twin-catheter Tesio Caths (TCs) (MedCOMP, Harleysville, Pennsylvania). Written and electronic records were examined with respect to laboratory indices as well as mortality, access-related infection, need for thrombolytic infusion, access revision and dialysis adequacy.

Results: A total of 759 TCs were inserted with 552,035 catheter days follow-up. Thirty-six percent of insertions were in patients incident to dialysis (< 90 days). Mean single-pool Kt/V was 1.6 ± 0.3. Cumulative cohort survival rates were 85%, 72%, and 48% at 1, 2, and 5 years, respectively. No patients died as a result of lack of vascular access. Cumulative assisted primary access site patencies were 76%, 62%, and 42% at 1, 2, and 5 years, respectively. The prevalence of symptomatic central venous stenosis was 5%. Catheter-related bacteremia occurred at a rate of 0.34 per 1,000 catheter days.

Conclusions: Appropriate use of TCs with protocolized care can deliver effective long-term hemodialysis with good adequacy and rates of access-related infection approaching those seen with arteriovenous grafts.

ABBREVIATIONS

AVF = arteriovenous fistulae, AVG = arteriovenous graft, CI = confidence interval, CRB = catheter-related bacteremia, CVC = central venous catheter, HR = hazard ratio, MRSA = methicillin-resistant *Staphylococcus aureus*, spKt/V = single-pool Kt/V, TC = Tesio Cath

Effective hemodialysis is dependent on maintaining durable and safe vascular access capable of sustaining flow delivering high-adequacy treatment with a low incidence of complications. All such vascular access is prone to dysfunction through vessel thrombosis and stenosis as well as acting as a portal for infection. Arteriovenous fistulae (AVF) have the best longevity and lowest rates of access-related infection but are dependent on adequate, adaptable vasculature for formation and maturation (1). Arteriovenous grafts (AVGs) can be used where the patient's native vasculature is inadequate for AVF formation with a shorter time-to-use period but are prone to frequent stenosis and thrombosis requiring endovascular intervention. Infection of prosthetic AVGs may require removal and surgery. Central venous catheters (CVCs) are relatively easily placed and removed and, in contrast to AVFs and AVGs, can be placed without surgery and used immediately. They are, however, prone to thrombosis and are associated with the highest rates of access-related infection and venous stenosis (2) As such they have been seen as a double-edged sword (3) Despite international guidelines advocating use

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of AVFs as the primary access type (4,5), there is considerable variation in implementation (6). Female sex, the presence of ischemic heart disease and peripheral vascular disease, obesity, and white race have all been cited as predisposing to CVC use (7–9) A pragmatic approach to CVCs has been described in patients awaiting live-donor kidney transplantation or with unsuitable vascular anatomy for AVFs and in patients unwilling to have either AVF or AVG formation (10,11) Until the complications associated with CVCs are reduced to a level comparable with other forms of vascular access it is difficult to recommend their enduring use in long-term hemodialysis patients. To this effect, we examined the complications and outcomes of CVC use in a large cohort at our center over an extended period (over 9 years).

MATERIALS AND METHODS

Our center provides specialist renal care for a population of 2.1 million people in a large urban center. It acts as the admission unit for a hemodialysis program of 1,260 patients delivered by eight satellite units and one hospital unit and with a high prevalence of CVC use. We retrospectively studied outcomes of a cohort of 433 patients receiving a Tesio Cath (TC) (Bio-Flex Tesio Catheter, MedCOMP Inc, Harleysville, Pennsylvania) for vascular access as previously described from January 1, 1999 to April 1, 2008. The study was approved by the Institutional Review Board at our institution, which waived the requirement for informed consent.

All patients were assessed clinically for AVF formation by a consultant nephrologist and referred for further assessment by a consultant surgeon as appropriate. The indication for TC placement in incident patients was a lack of suitable vessels for successful AVF creation, immediate requirement for enduring vascular access for hemodialysis in patients unable to wait for AVF maturation, or patient choice. In prevalent patients the indication was inadequate or failed access via an existing AVF, AVG, or CVC or patient choice.

Central venous mapping by conventional venography was only performed for patients with clinical signs suggestive of central venous stenosis or with a history of multiple uncuffed or cuffed CVC insertions. Temporary venous access for hemodialysis using an uncuffed venous catheter was obtained via the femoral vein only and was in place for not more than a few days.

TC Insertions

Before TC insertion, both incident and prevalent hemodialysis patients were screened for methicillin-resistant *Staphylococcus aureus* (MRSA) carriage with nasal and axillary swabs according to local protocol. Those with MRSA carriage received 2% mupirocin ointment nasally (Bactroban Nasal Ointment, GlaxoSmithKline UK, Uxbridge, United Kingdom) four times daily. All other patients were treated with 0.1% chlorhexidine and 0.5% neomycin cream nasally (Naseptin Nasal Cream, Alliance Pharmaceuticals, Chippenham, United Kingdom) four times daily. These were started before TC insertion and were continued for 1 week after insertion.

Preprocedural single doses of antibiotics were given on the day of TC insertion in all cases. In the period from 1999–2005, our local protocol used clarithromycin, 250 mg orally (vancomycin, 500 mg intravenously, if the patient was MRSA positive on screening), and ciprofloxacin, 250 mg orally. From 2005–2008 all patients received 500 mg of vancomycin intravenously and 250 mg of ciprofloxacin orally.

All TCs (12-F Bio-Flex Tesio Catheter) were inserted by experienced surgeons or interventional radiologists under sterile conditions in operating theatres or in the interventional suite of the radiology department. Catheter placement was via the internal jugular vein in all cases, with an insertion point between the sternal and clavicular heads of the sternocleidomastoid muscle. Ultrasound and x-ray fluoroscopy were used in all cases to guide correct placement. All TCs were inserted percutaneously with no deep dissection to the vein using a two–guide wire technique. The tip of the "venous" catheter was placed about 3 cm caudal to the right atrial margin visible on x-ray. The tip of the "arterial" catheter was placed 3 cm cephalic to the tip of the "venous" catheter. The cuffs were individually tunnelled from the point of the percutaneous puncture to lie within the tunnel 3 cm from the exit site and maintaining a separation of at least 1 cm between the venous and arterial catheters. A postprocedural erect chest x-ray was performed to exclude pneumothorax and assess TC tip position.

Catheter and central venograms were not routinely performed in cases of TC replacement. Catheter venograms were performed as clinically indicated at the discretion of the interventional radiologist, and mechanical fibrin sheath disruption using a guide wire was performed if required. Surgical teams did not perform venography in any instance.

TC Care

TCs were locked according to the dead space of each catheter with heparin, 5,000 U/mL (Monoparin sodium heparin, 5000 IU/mL, CP Pharmaceuticals, Wrexham, United Kingdom) between dialysis sessions. A volume of 46.7% sodium citrate (DuraLock C, MedCOMP) was used as a catheter lock in postoperative patients, patients with a bleeding diathesis, and in those with heparin allergy or sensitivity. Antibiotic catheter locks were not used. The exit site was cleaned at each dialysis session with sterile normal saline followed by 4% chlorhexidine gluconate solution (Hibiscrub, Molnlycke Healthcare, Manchester, United Kingdom) and allowed to air dry before the application of a bio-occlusive dressing. Patients did not receive prophylactic antimicrobial therapy to the exit site. Routine systemic antiplatelet or oral anticoagulant agents were not used to improve blood flow rates.

Quarterly screening of all patients for nasal and exit site carriage of MRSA was adopted as routine practice at our center in 2007. All patients returning to their satellite