NEW METHOD OF FORCED IMPLANTATION OF PERMANENT CATHETERS FOR HEMODIALYSIS INTO CRITICALLY STENOSED OR OCCLUDED CENTRAL VEINS

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The aim of the study was to report a novel technique of forced implantation of catheters for hemodialysis into critically stenosed or occluded central veins, without preceding angioplasty or stenting.

Material and methods. Sixteen patients with central venous occlusive disease, requiring urgent hemodialysis underwent this procedure. Catheterization of stenosis – occlusion was initially performed with soft guidewire, subsequently exchanged to stiff guidewire. Forced insertion of dilators, peel-off sheath throughout the stenosis or occlusion and finally implantation of the catheter completed the procedure. Our technique does not require pre-procedural angioplasty or stent deployment.

Results. In all patients postoperative hemodialysis was managed with satisfactory adequacy. No early or late complications related to the procedure occurred. We did not observe any clinically significant aggravation of symptoms of central vein stenosis or occlusion. Complications, not-related to the procedure included one, late skin entry site infection and one, late catheter thrombosis. These were managed without the necessity of catheter exchange.

Conclusions. Our technique of forced implantation of catheters for hemodialysis into critically stenosed or occluded central veins without previous balloon predilatation or stenting is simple and diminishes the total cost of the procedure. Provides quick vascular access for hemodialysis in life threatening situations.

Key words: vascular access for hemodialysis, permanent catheters for hemodialysis, central venous occlusive disease

Association of central vein occlusive disease (CVOD) with previous placement of central venous catheters (CVC) has been well recognized since 1980s (1, 2). Incidence of central vein stenosis (CVS) in hemodialysed patients reaches 50% (2) and is reported to be more common after implantation of catheters into subclavian veins than into internal jugular veins (3).

Management options of CVOD include endovascular interventions such as angioplasty alone or with stent and directional atherecstomy (4, 5). When endovascular treatment fails, some surgical repairs can be considered. These include patch angioplasty of the axillosubclavian stenosis, veno-venous bypasses of the CVS and right atrial by-pass grafting (6, 7, 8).

K/DOQi recommends percutaneous transluminal angioplasty (PTA) alone or with stent as the preferred option of treatment of CVS (4). Initial results after PTA are very good but the long-term patency is not satisfactory. Primary 6 months patency ranges from 25% (9) to 42-60% (10, 11). Close surveillance and repetitive interventions extend overall patency. In hemodialysed patients with pacemaker lead-induced CVS, the secondary patency rates after angioplasty were 95%, 86%, and 73% at 6, 12, and 24 months, respectively, but patients required on average, 2.1 procedures/year (12). In another study, post-intervention assisted
patency for CVS angioplasty was 100% at 12 months, but required 1,8 re-interventions per index procedure (13).

Stents are indicated according to DOQI guidelines for stenoses that do not respond to PTA and recur quickly, within 3 months. One retrospective study of CVS endovascular treatment did not show any significant difference between primary and secondary patency between the stent and angioplasty only groups, in the 12 month follow up (14). Brachytherapy, drug eluting balloons, stents and covered stents are now investigated in purpose to improve the long term results (15, 16, 17). Unfortunately initial results are not as revolutionary as expected. In case of covered stents: primary patency, assisted primary patency, and secondary patency were 56%, 86%, and 100% at 12 months, respectively (16). In a study with longer follow up, primary assisted stent-graft patency rates were 100%, 100%, 80%, and 75% at 3, 6, 12, and 24 months, respectively (17).

There is a group of patients with arteriovenous access failure who undergo multiple implantations of short-term or long-term catheters in different localizations (including internal jugular veins, subclavian veins and femoral veins bilaterally), what usually causes CVOD, before they are referred to vascular surgeon for creation of a new access for hemodialysis. Unfortunately some of these patients are admitted to the hospital with already failed this one and only catheter access. This situation requires emergency implantation of new catheter with very limited options regarding possible sites for straightforward canullation.

**MATERIAL AND METHODS**

The technique was applied in 16 patients with CVOD within the period of last 12 months. Nine women and 7 men aged 66 years in average, with average body mass index of 35.2, were hemodialysed due to end-stage renal failure for more than 14 years.

All but two, were recently hemodialized via permanent catheters placed in femoral veins. Two patients were hemodialized via subclavian vein catheter. Patients were admitted as an emergency, due to significant malfunction or occlusion of catheter, preventing the execution of hemodialysis.

Venography showed critical stenosis (12 patients) or occlusion (4 patients) of left brachio-cephalic vein in 10 cases and right brachio-cephalic vein in 6 cases. Color Doppler ultrasonography showed thrombosis or critical stenosis and fibrosis of internal jugular vein on contralateral side. Ipsilateral to CVS / occlusion internal jugular vein was confirmed to be patent in every patient.

In all patients the Hemo-Flow®, long-term hemodialysis catheter (Medical Components Inc.) was implanted.

Internal jugular vein, ipsilateral to stenosed or occluded brachio-cephalic vein was accessed with a 21-gauge needle, under ultrasound guidance. Previous venography determined the site of CVS (fig. 1). Catheterization of critically stenosed / occluded brachiocephalic vein with the guidewire provided with the Hemo-Flow® catheter kit was technically impossible in all patients, due to inability to cross the lesion. Instead, standard angled, soft, 0.035” Canalizer™ guidewire (Angiotech®) was used. In one case 4F, 0.038”, Bern Impress™ catheter (Merit Medical Systems Inc.) was necessary to facilitate catheterization of occlusion. Successful passage of the guidewire to right atrium was achieved in all cases. Standard CanalizerTM guidewire was then exchanged via Bern Impress™ catheter to stiff – soft tipped, hybrid, 0.035”, GlidewireAdvantage™ guidewire (Terumo Corporation). Two dilators and then peel-away introducer were inserted forcefully over the guidewire into internal jugular vein and further through CVS / occlusion (fig. 2). GlidewireAdvantage™

![Fig. 1. Phlebography showing central veins stenosis](image)
guidewire was then removed. After subcutaneous tunnelization, permanent Hemo-Flow® catheter was inserted into the peel-off sheath, which was subsequently removed.

In 4 cases, due to the kinking of peel-off sheath in the place of stenosis, advancing of Hemo-Flow® catheter was impossible. Passage was managed by introduction of stiff GlidevireAdvantage™ guidewire into the venous lumen of Hemo-Flow® catheter, down to the right atrium or superior vena cava and forced advancement of Hemo-Flow® HD catheter over the guidewire, with simultaneous gradual removal of peel-away sheath. Procedure ended with Canalizer™ guidewire guided, correct positioning of the tip of Hemo-Flow® HD catheter in superior vena cava (fig. 3).

RESULTS

Immediately after procedure, patients were hemodialysed with implanted catheters. No complications related to the procedure occurred within the period of last 12 months of observation. One, late, local infection of skin at the catheter entry site and one, late thrombosis of the catheter were successfully managed without exchange of catheter. Till now, all implanted catheters are in use with satisfactory adequacy of hemodialysis. We did not observe any aggravation of clinical symptoms of CVS.

DISCUSSION

Our paper presents simple, quick and cost effective method of implantation of permanent catheters in hemodialysed patients with CVOD and exhausted and failed vascular access. This method can be applied as the emergency – life saving procedure.

The main advantages of our method are quick and simple access to central veins and no need for preimplantation balloon angioplasty / stenting of the stenosis or occlusion. These shorten the duration of procedure and reduce the overall cost of hospitalization. Rationale for catheter implantation without preceding angioplasty was based on the literature reports stating, that percutaneous angioplasty of CVS led to accelerated neo-intimal hyperplasia and higher cellular proliferation than the primary lesion (18). Moreover, angioplasty of asymptomatic CVS greater than 50% was associated with more rapid stenosis progression as compared with a non-treatment approach (19). Finally, intravascular ultrasound study showed immediate recoil after angioplasty in >50% of lesions (20). These findings are in concordance with clinical observations, that maintaining long patency after angioplasty or stenting requires frequent and repetitive interventions (12, 13, 16, 17).

Our method is somehow reintroduction of historical technique developed in 60ties of the last century by Charles Dotter, named "The
permanent catheter placed in central veins and vascular PTFE graft anastomosed with brachial artery, seems to provide a vital option for these specific group of patients and our method can simplify the entire procedure of implantation (22).

CONCLUSIONS

Our method seems to be a valuable option to provide acutely permanent catheter access for hemodialysis in patients with CVOD. The procedure is quick and provides immediate access for hemodialysis in live threatening situations; does not require preprocedural angioplasty or stenting of central veins and thus is time and cost–effective. Additionally, gives time for planning of further endovascular interventions and planned creation of native, prosthetic vascular access for hemodialysis or hybrid procedures.

REFERENCES


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