

Abstracts from Angio Access for Hemodialysis

ANGIO ACCESS FOR HEMODIALYSIS

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1 CURRENT PERSPECTIVE OF AN AMERICAN NEPHROLOGIST ABOUT VASCULAR ACCESS

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The DOPPS Study revealed huge differences in vascular access use between the U.S. and Europe. Ten years ago, AVF were used in only 25% of American hemodialysis patients, as compared with 80% in Europe. Although patient characteristics, such as age, sex, race, and cardiovascular disease affect the frequency of AVF use, differences among countries, regions, and individual units persist even after adjustment for these variables. The mortality of U.S. hemodialysis patients is about 35% higher in the U.S. than in Europe. Remarkably, when one adjusts for vascular access practice, there is no longer a survival difference. This observation is consistent with previous reports demonstrating a dramatic difference in mortality when catheter-dependent patients are converted to an AVF. Taken together, these observations highlight the importance of practice patterns on achieving optimal AVF use. The KDOQI guidelines (1997) and Fistula First initiative (2002) have encouraged American nephrologists to increase AVF use. These efforts have been extremely successful. Thus, from 2000 to 2008, AVF use in the U.S. has increased from 24 to 52%, with a corresponding decrease in AVG use from 58 to 22%. However, American nephrologists have encountered several significant challenges. First, a high proportion (40-60%) of AVF fail to mature despite routine preoperative vascular mapping. This has led to appreciation of the need to assess immature AVFs in a timely fashion, and intervene surgically or radiologically to convert them to mature AVFs. Second, there has been intense interest in understanding the pathogenesis of AVF non-maturation and identifying pharmacologic interventions to improve fistula maturation. Thus, for example, the DAC fistula trial found that clopidogrel reduced early AVF thrombosis, but did not prevent fistula non-maturation. Third, an unfortunate byproduct of aggressive efforts to achieve AVFs in most patients has led to an increase in catheter use from 17 to 26%, with a corresponding huge increase in catheter-related bacteremia. As a result, an ongoing debate in the American medical community is questioning whether some high-risk patients would be better served by receiving an AVG (rather than an AVF), so as to avoid prolonged catheter-dependence.

2 ACCESS MONITORING

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Most AVG fail due to irreversible thrombosis, superimposed on an underlying stenosis. This observation suggests that early detection of hemodynamically significant (>50%) stenosis, followed by preemptive angioplasty, prevents AVG thrombosis. Several noninvasive methods have been developed to monitor for AVG stenosis. Clinical monitoring consists of information routinely collected during dialysis. It includes physical examination (absent thrill, discontinuous bruit, or edema distal to AVG); Problems noted during HD (difficult cannulation, aspiration of clots, inability to achieve target dialysis blood flow, or prolonged bleeding from needle sites); or an unexplained decrease in dialysis dose (Kt/V). Surveillance methods include access flow monitoring (abnormal value is flow <600 ml/min or decreased >25% from baseline);

measurement of static dialysis venous pressure (abnormal value is a ratio of intra-graft to systemic blood pressure >0.6); or duplex ultrasound (abnormal value is a peak systolic velocity ratio >2 across the stenotic lesion). Several observational studies have measured the frequency of AVG thrombosis before and after implementing a program to monitor for graft stenosis. These studies have all shown a 40 to 80% reduction in AVG thrombosis after starting the program.

Six randomized clinical trials (RCT) have compared AVG thrombosis and survival in patients undergoing stenosis surveillance, as compared with a control group. In each study, the frequency of angioplasty was higher in the surveillance group. However, none of the studies observed a difference in graft thrombosis between the two randomized arms, and only one study found an improvement in graft survival. A 2008 meta-analysis of the RCTs found no decrease in the risk of thrombosis (relative risk of 0.94; 95% CI, 0.77 to 1.16; 446 participants) or access loss (RR of 1.08; 95% CI, 0.83 to 1.40) with surveillance compared with controls without the use of such techniques. Deployment of stent-grafts may improve the outcomes. However, a recent RCT showed no difference in AVG thrombosis between stent grafts and balloon angioplasty.

Only one RCT has evaluated surveillance and preemptive PTA in AVF's. It showed better AVF survival in patients undergoing flow monitoring. However, there is uncertainty about whether surgical revision is superior to angioplasty.

3 NONMATURING FISTULAS

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The biggest hurdle to increasing AVF use in U.S. hemodialysis patients is the high proportion of fistulas that fail to mature adequately to be used for dialysis. AVF non-maturation has increased in the past 20 years, and its frequency has ranged from 20 to 50% in several large observational studies. AVF non-maturation was observed in ~60% of patients in the DAC Study. Although preoperative ultrasound increases AVF placement, it has not decreased AVF non-maturation in most studies. AVF maturation can be assessed by clinical examination performed by the nephrologist or dialysis nurse. Clinically useful tests suggestive of underlying stenosis include failure of the fistula to collapse when the arm is elevated and lack of pulse augmentation when the outflow vein is occluded transiently. Experienced individuals can assess AVF maturation fairly accurately. In one study, dialysis nurses successfully predicted AVF usability for dialysis in 80% of patients.

Postoperative ultrasound is very useful in assessing AVF maturation. One study evaluated AVF diameter and blood flow in predicting clinical success. If the diameter > 4 mm and flow >500 ml/min, 95% of AVF were used for HD. If diameter <4 mm and flow <500 ml/min, only 33% were successful. Postoperative US can also identify anatomic abnormalities, which if corrected surgically or radiologically, may convert an immature AVF to a mature one. Specifically, peri-anastomotic stenosis can be treated by angioplasty or surgical revision; accessory veins can be ligated; and excessively deep fistulas can be superficialized. A recent study examined the impact of aggressive salvage procedures on fistula maturation. Among sonographically immature AVF not undergoing a salvage procedure, only 31% (8/26) were used successfully for dialysis. In contrast, among sonographically immature AVF undergoing 1 or more interventions, 78% (25/32) were successful. Similarly, other studies have shown that aggressive interventions can promote maturation of many immature AVFs.

In summary, all new AVF should be assessed clinically for maturity at 4-6

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PLACEMENT OF CVCs THROUGH STENOTIC OR OCCLUDED CENTRAL VEINS

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Objective: A method for hemodialysis catheter placement in patients with central thoracic venous stenosis or occlusion is described and initial results are analyzed.

Materials and methods: Twelve patients with a mean age of 63.2 years (42-80 years) with central venous stenosis or occlusion and who required a hemodialysis catheter were reviewed. All lesions were confirmed by helical CT or phlebography. Five patients had stenosis while seven patients were diagnosed with an occlusion of thoracic central veins. All patients were asymptomatic without sign of superior vena cava syndrome. After percutaneous trans-stenotic catheterization or guide wire based recanalization in occlusions, a balloon dilatation was performed and a stent was placed, when necessary, prior to the catheter placement.

Results: Technical success was 92%. Three patients had angioplasty alone and nine patients had angioplasty with stent placement. Dialysis catheters were successfully inserted through all recanalized access. No immediate complication occurred, neither did any patient developed a superior vena cava syndrome after the procedure. The mean follow-up was 21.8 months (8-48). Three patients developed a catheter dysfunction with fibrin sheath formation (at 7, 11 and 12 months after catheter placement, respectively). Two were successfully managed by percutaneous endovascular approach and one catheter was removed.

Conclusions: For patients with central venous stenosis or occlusion and those that need a hemodialysis catheter, catheter insertion can be reliably achieved immediately after endovascular recanalization with acceptable technical and long-term success rates. This technique should be considered as an alternative procedure to place a new hemodialysis catheter through a patent vein.

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ACCESS FLOW AND FINGER PRESSURES IN FOREARM AND UPPER ARM AVF

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The dialysis population is changing towards elderly patients with multiple comorbidities. This implies a shift to the use of more upper arm accesses, because of lack of sufficient quality vessels for the creation of functional forearm radiocephalic arteriovenous fistulae (AVF). Upper arm AVF are associated with high volumeflows, which may result in steal syndrome, distal ischemia and cardiac failure.

To determine the clinical and hemodynamic outcome of fore- and upper arm accesses, all patients receiving a first AVF during a 3 years period were followed by regular duplex scans at 1, 6, 12, 26 and 52 weeks. Access flow and finger pressures were measured and complications and interventions recorded.

A total of 91 accesses were placed. Upper arm AVF were created in 50%, forearm AVF in 38% and graft AVF in 12% of patients. Nonmaturation occurred in 20% of the forearm AVF and 9% in the upper arm AVF. Mean flow in forearm AVF at 6 weeks was 1124 ml/min, compared to 1910 ml/min in upper arm AVF ($p < 0.001$). Mean flow in forearm AVF at 6 months was 1591 ml/min, compared to 1904 ml/min in upper arm AVF ($p > 0.05$). Ischemia developed in 1 patient (3%) with a forearm AVF and 5 patients (11%) with upper arm AVF. Mean finger pressures after 6 weeks are 95 mmHg in forearm fistula and 74 mmHg in upper arm fistula ($P = 0.014$). After 6 months the finger pressures 100 mmHg and 71 mmHg ($P = 0.013$) respectively.

Conclusion. Upper arm AVF generates high volume flows which cause higher risk on ischemia and low finger bloodpressures as compared to forearm AVF.

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WHY DO NEPHROLOGISTS SEEM TO LIKE CVCs SO MUCH?

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Do nephrologists actually like CVCs? Most of them do not. Strategies aiming at reducing CVCs use should analyse the reasons of their success.

Firstly, CVCs provide immediate vascular access. This is important, for many reasons; the late referral of CKD patients to nephrologists is well-known. In addition, despite timely referral, many patients (especially older ones) start hemodialysis (HD) with a CVC. Nephrologists are probably trying to avoid the futile creation of AV fistulas (AVF) in patients likely to die before dialysis. Secondly, patients are relatively unaware of the risks of CVCs in terms of morbidity (sepsis and derived complications) or mortality. They are more concerned about the potentially painful AVF punctures and aware of the time required to secure post-dialysis hemostasis of puncture sites (versus immediate (again) closure of the CVC ports). These apparent advantages of CVCs contribute to a communicable disease, with patients dialyzed next to a patient with a CVC, being at higher risk to refuse an AVF....

Thirdly, the decreasing experience of HD teams with AVF creates a vicious circle, both for HD staff regarding AVF puncture and surveillance, and surgeons whose training in the field of AVF is often limited. In addition, the poor maturation of AV fistulas with the current elderly population contributes to the delayed use of AVF, and thus to the use of CVCs.

Despite all these reasons, the % of CVC is strikingly different between countries and units, as shown by the DOPPS. Reducing the percentage of CVCs will only be successful if multi-targeted strategies address the various causes of the current success of CVCs. These should include incentives for the use of native AVFs, together with educational programs targeting all related caregivers, CKD as well as incident HD patients, in order to change as early as possible their opinion and more importantly their behaviour.

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RULES OF HYGIENE: ARE THEY THE KEY?

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The rate of catheter-related bloodstream infection (CRBSI) varies between HD units from < 1 to > 10 per 1000 catheter-days! Despite this striking variation, and the major impact of CRBSI in terms of morbidity and mortality, remarkably little research has been performed on the impact of hygienic precautions on the rates of CRBSI.

The main reason for this shortage of high evidence level data is probably the fact that CRBSI is relatively rare (although too frequent!): a (moderately high) CRBSI rate of 3/1000 catheter-days corresponds roughly to 1 CRBSI/140 HD sessions. Thus linking CRBSI rates with suboptimal, occasional hygienic precautions appears difficult. This may have diverted investigators from this area.

Hygienic precautions may contribute to a low CRBSI rates in several ways. Firstly, the jugular site should obviously be preferred to the femoral one, and tunnelled catheters to non-tunnelled ones. Secondly, CVC should be inserted under strict aseptic conditions. Thirdly, any manipulation of CVCs (like connection or disconnection) should be done in an aseptic way. Fourthly, the dressing of the exit site should be inspected at each session, and replaced if no more clean or intact. Finally, several studies have shown that an antibiotic ointment reduces the risk of exit site infection, at least until healing of the insertion wound.

Understanding the factors determining the variability of actual application of such basic hygienic precautions appears crucial. In addition, whether other practices such as wearing a mask (nurse and patient) at time of CVC manipulation, contributes to preventing CRBSI should be studied further.

Changing human behaviour (care givers are human beings!) requires putting the emphasis on some key aspects, critical for the success of the strategy. One such strategy is implementing a care bundle: putting the emphasis on a small number of key aspects, all necessary and critical for the success. This facilitates dissemination of the message to a multidisciplinary team. This has been

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successful in several campaigns in the ICU. It should further be emphasised that such a strategy has no chance of success if the leaders (nephrologists, head nurse) are not actually involved in the campaign.

Without reaching a high evidence level, some longitudinal studies fortunately suggest, in the HD context as well, that recognizing and sharing with all team members the importance of some basic hygienic precautions is a major step towards lower CRBSI rates.

34 NON-INFECTED CENTRAL VENOUS CATHETERS IN HAEMODIALYSIS PATIENTS ARE NOT ASSOCIATED WITH INFLAMMATION

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A recent study showed that the serum C-reactive protein (CRP) level of patients who underwent haemodialysis (HD) with non-infected central venous catheters (CVCs) was higher than that of those who underwent HD via native arteriovenous fistulas (AVF). In these patients, betadine solution was used for exit-site care (Goldstein, S.L. et al. (2009) *Kidney Int* 76 (10): 1063-1069). Our thought was to evaluate the changes in the serum CRP levels of HD patients who underwent dialysis via native AVF (AVF-1), then via temporary tunneled CVC for AVF dysfunction, and again via AVF (AVF-2). Eighteen tunneled jugular CVCs in 18 HD patients were included. Heparin lock and alcoholic-chlorhexidine solution was used for exit-site disinfection. The mean CRP values during the 3 periods were not different. A cross-sectional study in 225 HD in December 2008 showed that the median serum CRP levels of patients using AVF (89%) and CVC (11%) were 7 (IQR 3-20) mg/l and 10 (3-21) mg/l, respectively (ns). We have previously shown that the incidence of catheter-related bacteraemia (CRB) has decreased from 1.1 to 0.2/1000 catheter day during 1994-1997 and 2004-2007 when betadine was substituted with alcohol-chlorhexidine solution (Jean, G. et al. (2009) *Nephrol Ther* 5(4): 280-6).

Since this solution is more efficient than betadine in our hands, we hypothesized that the difference in the findings reported in the 2 studies may be attributed to the differences in the solution used. However, to confirm this hypothesis, a controlled study should be conducted in order to compare these 2 protocols.

35 LONG-TERM OUTCOMES WITH THE THOMAS SHUNT: A HISTORICAL REVIEW

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The femoro-femoral Thomas shunt (TS) is a permanent VA that was used in the 1970s and is currently not employed at most dialysis centers, except for a few centers in France and Spain. This evolution was due to the improvement in the devices used for achieving VA: central venous catheters (CVCs) and arteriovenous grafts (AVGs). TS has been criticized due to the associated risks of ischemia and infection; these risks increase with age and are more frequently observed in diabetics.

We report our experience of using TS as the last VA in patients and provide some relevant data found in the literature. We retrospectively studied 100 TSs implanted in 78 patients between 1970 and 2010. Prior to the implantation of TS, these patients had experienced VA failure with an average of 6.7 VA failures per patient. The mean age of these patients was 53 ± 11 years; 53% were women; and the mean dialysis period was 45 ± 67 months. The median survival period of TS was 62 months. Septicemia rate was 1/130 years of TS; cutaneous infection, 1/3 years of TS; and arterial surgery, 1/30 years of TS. In the 15-year period from 1998 to 2006, only 8 TSs were inserted due to the lack of availability. Our oldest patient had received TS more than 30 years back and is surviving without any complications. The annual TS-insertion rate declined from 5/year in the 1970s and 1980s to

only 0.3-0.5/year in the recent years.

Actually, TS is an exceptional alternative to other femoral access procedures (loop AVG and permanent femoral CVCs) when the superior vena cava is not usable. However, precise vascular evaluation is necessary to identify venous or arterial contraindications. The results of TS are also dependent on the experience and skill of the persons involved (surgeons, nephrologists, nurses, radiologists, and patients). In some single cases, the efficacy of TS for achieving long-term definitive vascular access is comparable with that of the PTFE graft if TS is performed by experienced professionals, but this procedure should not be performed by inexperienced teams, because of the potential complications.

36 SURGICAL TREATMENT OF JUXTA-ANASTOMOSIS STENOSIS IN RADIO-CEPHALIC FISTULA

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Introduction: The juxta-anastomosis stenosis is the most frequent kind of dysfunction in radiocephalic fistulas for haemodialysis. This adversity could cause low flow or thrombosis. The treatment of these lesions may be surgical or radiological.

Method: A prospective study was performed from 1998 to 2010. All dysfunctional radiocephalic fistulas (low flow or thrombosis) due to juxtaanastomotic stenosis were included (n= 96). The diagnosis of dysfunction was made with angiography in low flow cases and clinical evidence in cases of thrombosis. The repair was performed by a new proximal radiocephalic anastomosis. Technical and clinical successes and complications were evaluated. Patency following surgical intervention was estimated with the Kaplan-Meier method.

Results: In the study period were performed ninety six proximal anastomosis in ninety six patients. Sixty six patients were male and mean age was sixty seven years old. Programmed surgery was performed in 70,5% of cases and 29,5% were emergency procedures. Surgery was ambulatory in 92% of cases. Local anaesthesia was used in all cases. Technical success was achieved in 100%. There were no related complications. Mean primary patency at 1, 2, 3, 4 and 5 years was 89.4%, 75%, 70.4%, 65% y 56% respectively. Additional surgeries (n=16) in fourteen patients (twelve new proximal anastomosis and four PTFE interpositions) resulted in mean secondary patency at 1, 2, 3, 4, 5 years of 93.7%, 92.1%, 89.6% 87%, y 82.6% respectively. Mean secondary patency of initial dysfunctional radiocephalic fistula at 1, 2, 3, 4 and 5 years was 95%, 93.2%, 93.2%, 89.1% y 86.6% respectively.

Conclusion: In our experience the proximal radiocephalic anastomosis can significantly extend fistula functionality in patients who present juxta-anastomosis stenosis.

37 OUTPATIENT SURGERY FOR HEMODIALYSIS ARTERIOVENOUS FISTULA IN A NON-DEDICATED CENTER

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Introduction: The increase of prevalence in haemodialysis patients is a challenge for surgery units. Vascular access complications are the main cause of hospital admission in many dialysis units. Outpatient surgery could decrease waiting lists, related cost and complications associated with vascular access.

Material and methods: We performed a prospective study about vascular access surgery from 1998 to 2008. Outpatient surgery was included in the usual activity in a general surgery unit and was performed by not