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 AVG 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 1.04). 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 AVFs. It showed better AVF survival in patients undergoing flow monitoring. Therefore, 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
weeks after their creation. If there is doubt about their maturation, a postoperative ultrasound should be obtained to provide objective measurements. Anatomic problems should be corrected aggressively to achieve AVF maturation.

4

CVC CARRIAGE: FROM LOCAL TO SYSTEMIC EFFECTS

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About 80% of U.S. hemodialysis patients initiate HD with a catheter, and there are long delays in the transition to a permanent access. Catheter-related bacteremia (CRB) is the most common complication. The risk increases with duration of catheter use. In one observational study, CRB occurred in 35% of catheter-dependent patient at 3 months and 48% at 6 months. CRB often results in hospitalizations, as well as metastatic infections, such as endocarditis, septic arthritis, osteomyelitis, and epidural abscess. Due to the frequency and severity of CRB, there has been immense interest in understanding its presentation, treatment, and prophylaxis.

Treatment of CRB always entails empiric antibiotic therapy, which is modified once the pathogen and its sensitivities have been identified. Systemic antibiotics alone (without doing anything about the catheter) are inadequate therapy, as ~75% of the patients will have recurrent CRB once the antibiotics are discontinued. Immediate CVC removal takes care of the source of the infection, but is burdensome, as it requires placement of a non-tunneled CVC with subsequent placement of a new tunneled CVC. Guidewire CVC exchange is effective in patients whose fever resolves after initiation of systemic antibiotics. Finally, instillation of an antibiotic lock permits salvage of ~70% of CVC, while successfully treating the infection.

There has been a growing interest in prophylaxis of CRB. A number of randomized studies have shown dramatic reduction in CRB in patients whose CVC were instilled with an antibiotic or an antimicrobial (such as taurolidine, 30% citrate, or 70% ethanol). None of these agents are approved for use in the U.S. The use of prophylactic antibiotic locks has been recently shown to promote the emergence of antibiotic-resistant infections. Finally, application of mupirocin or polypyrrolidid antibiotic ointment at the catheter exit site also decreases CRB.

There is growing evidence that catheter use also impact non-infectious events by producing chronic inflammation. Thus, catheter use is associated with increased cardiovascular mortality and hospitalization, whereas switching to an AVF or AVG reduces these risks. In addition, getting rid of a CVC reduces inflammation, and improves erythropoietin-responsiveness, hypoalbuminemia, and nutritional status.

5

WORLD HEALTH ORGANIZATION CHECK LIST

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As part of an initiative to improve patient safety the World Health Organization (WHO) has developed a surgical checklist (CL) to ensure basic minimum safety standard. The Haute Autorité de Santé has made it mandatory for all operating rooms to implement an adapted version of the CL by January, 2010 (Accreditation program, V2010). A multicenter study published in the New England Journal of Medicine (Haynes, 2008) has shown significant reduction of the rate of complications, including death, during hospitalization within the first 30 days after the operation. Ideally, the checklist should be associated with Preoperative briefings that have the potential to reduce operating room (OR) delays through improved teamwork and communication. Use of the CL will require a change in culture for medical teams, and the benefits will be realized only if everyone is supportive of the change and implementation is robust. WHO recommend that the CL should not remain confined to the operating room (Lancet, 2008, 372). With attitudes starting to change and a safety culture slowly emerging, we now have the opportunity to really improve patient safety. The presentation explains what is a CL, how this CL works, and how it could be adapted to the context of angiaccess for hemodialysis.

6

SURGICAL APPROACH TO EARLY FAILURES

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Arteriovenous fistulas (AVFs) are the best method of vascular Access (VA) compared to synthetic grafts and catheters. Unfortunately a significant amount of AVFs (28-53 %) never mature to support dialysis. This figure has been reported to be even 60 % in DAC study (Dembier 2008).

Immediate failure on the day of surgery is generally regarded as a technical failure and may be due to low level of expertise, one of the most important risk factors for fistula failure (aOR:3.97). Early thrombosis sometimes seen at the time of surgery, and could be a result of kinking or twisting of the outflow vein at the swing point or a backwalled suture at the anastomosis (Shenoy 2009). In the absence of technical issues early thrombosis could be the result of undiagnosed underlying hypercoagulability, inadequate vessels, period of extreme hypotension, and constricting wound dressings, shirts and bad habit (i.e. lying on the fistula arm) of the patients.

Interventional attempts to diagnose and narrow early thrombosis may be complicated by the presence of recent surgery. Duplex Ultrasonography may help in diagnosing and choosing the best therapeutic option. Surgical thrombectomy and repair of the technical problems may be the best option. If it is impossible or fails, a decision should be made for that particular patient. A proximal new anastomosis or a new fistula elsewhere can be done.

In a randomised double-blind placebo controlled trial conducted with Clopidogrel for six weeks by Dialysis Access Consortium (DAC) fistula thrombosis occurred in 12.2 % with clopidogrel compared to 19.5 % with placebo (Ehrandze 2005). An AVF that fails early is the one that either never develops adequately to support dialysis, or fails within the first 3 months of its use. In general two variables are required for AVF maturation: a) Adequate blood flow to support dialysis and, b) Enough size to allow for successful repetitive cannulations (Asif 2006).

Combining venous diameter of 0.4 cm or greater and flow volume of 500 mL/min or greater increased fistula adequacy to 95 %. When neither criterion met adequacy was 33 % (Robbin 2002). Augmentation of flow and increments in size are early events and AVFs that are going to mature will do so in a couple of weeks. In most of the recent literature 1 month found to be adequate for autogenous fistula maturation before its use. Fistula First Breakthrough Initiative (FFBI) also recommends all fistulas be examined by 4 weeks (Shemesh 2007). If the fistula found adequate by physical examination and DUS by this time it can be used; if not, early identification and salvage attempts should be undertaken.

Main reasons for early failure are: failure to dilate of the vessels, accessory veins, deep location.

The great majority of immature or failed (thrombosed) fistulae can be salvaged using endovascular techniques. Beathard et al. (Beathard 2003) reported 98 % success rate of angioplasty and it was possible to initiate dialysis in 92 % of the cases. Turmel-Rodrigues et al. (2001) reported 100 % stenosis rate in immature forearm fistulas. The initial success rate was 97 %. Turmel-Rodrigues et al. (2009) also reported a technical success in 73/74 patients after angioplasty with either stenosis or an insufficient enlargement of radial artery. Surgery mostly is preferred in unsuccessful or complicated angioplasty cases. In immediate thrombosis, and in deep fistulas surgery usually is the first therapeutic option.

In a recent prospective, comparative study, the outcome and cost of surgery and PTA in the preemptive repair of JAS in lower forearm AVFs were compared (Tesoriere 2006). The authors concluded that their study confirmed a higher restenosis rate after PTA than surgery but with strict surveillance for restenosis, two procedures showed similar assisted primary patency and cost, suggesting that they should be considered equally valid, complimentary alternatives in the preemptive treatment of JAS in forearm AVFs.
Abstracts from Angio Access for Hemodialysis

7 COMPARISON OF NON-CONTRAST-ENHANCED MRA AND CE-MRA FOR EVALUATION OF UPPER EXTREMITY VASCULATURE PRIOR TO VASCULAR ACCESS CREATION

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Introduction: Pre-operative mapping of arterial and venous anatomy helps to prevent post-operative complications after vascular access creation. Unfortunately the current standard of reference for non-invasive vascular imaging – contrast-enhanced (CE) MRA – has been linked to nephrogenic systemic fibrosis (NSF) in patients with ESRD. The purpose of this work was to evaluate a novel non contrast-enhanced (NCE) MRA protocol for pre-operative assessment of upper extremity vasculature.

Methods: All MR acquisitions were performed on a 1.5T MR scanner (Gyroscan Intera, Philips Medical Systems) using multi-element phased-array surface coils. NCE and CE-MRA datasets were acquired in 10 healthy volunteers and 15 patients with CKD 4-5. To cover the entire upper extremity from the palmar arch to the heart three NCE acquisitions were performed. Next, the CE-MRA protocol consisted of a multiposition dynamic protocol with 2 injections of 10 mL 1:1 diluted macrocyclic contrast medium (Gadovist, Bayer Schering). Subsequently 11 arterial and 16 venous segments were analyzed with regards to image quality (IQ: 0=not visible; 1=suboptimal depiction; 2=visible and interpretable; 3=visible and interpretable with good image quality, and 4=visible and interpretable with excellent image quality) and vessel-to-background ratio.

Results: Significantly more arterial vessel segments were depicted using CE-MRA compared to NCE-bT1F (99% vs. 95%, p<0.001) with mean IQ of 3.74 vs. 2.63, (p<0.001) and mean vessel to background ratio of 6.53 vs. 4.14 (p<0.0001). On the other hand, 88% of the venous segments were portrayed using NCE-bT1F versus 77% using CE-MRA (p<0.001). Mean IQ and contrast ratio were 2.46 vs. 2.33 (p=0.140) and 5.28 vs. 3.90 (p<0.0001), respectively.

Conclusions: Arterial image quality and image contrast of CE-MRA remain superior to NCE-bT1F. However, NCE-bT1F yields images that are of diagnostic quality in the vast majority of subjects. Still, NCE-bT1F enabled better visualization of venous segments compared to CE-MRA. In conclusion, NCE-bT1F is an attractive alternative for CE-MRA in patients with ESRD who need to undergo imaging for determination of the optimal site for access creation.

8 FIRST VASCULAR ACCESS IN A FRENCH SURGICAL CENTER

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Materials and methods: This prospective study includes 542 consecutive patients (75 children < 16 years and 467 adults) referred for the creation of their first arteriovenous access for haemodialysis from January 2005 to December 2008. The mean age was 52 years (SD: 25, range: 1 to 92) and the mean weight was 65 Kg (SD: 23, range: 163 to 8). Among adult patients, 27% were diabetics, 80% had hypertension and 22% smoking. Mean adults BMI was 25. The majority of patients (75%) were not previously dialyzed at the time of access creation. Pre-operative vessel mapping was performed using ultrasound and venography in cases of previous central vein catheter. Prophylactic haemostasis and microsurgery were systematically used for fistula construction. Stenoses and thromboses were treated by surgery or interventional radiology. Autologous AVFs were created in all patients but one PTFE. Seventy-two per cent were distal AVFs (373 Radial Cephalic AVFs, 16 Ulnar Basilic AVFs) and 28% were proximal AVFs (60 Brachial Cephalic AVF, 92 Brachial Basilic AVF).

Results: Maturation rates and angioaccess on use at the beginning of dialysis according to age/co-morbidities of patients and AVFs will be reported. Initial failures included, overall primary patency rates were 67%, 51% and 32% at 6, 12 and 24 months, respectively (SD<0.3). Secondary patency rates were 84%, 73% and 53% at 6, 12 and 24 months, respectively (SD<0.3). (Fig.1).

Conclusion: Micorsurgical techniques allow to build a vast majority of radiocephalic fistulae, with relatively few immediate failures, excellent long-term patency rates and a very low incidence of ischaemic complications. Using these techniques, the need for prosthetic grafts as first vascular access is extremely rare, even in obese patients.

9 AN ALGORITHM FOR TREATMENT OF STEAL SYNDROME

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Clinical staging, distal artery pressure measurement, duplex ultrasound and angiography are the main criteria on which to select the best treatment for individual cases of AVF-related distal ischaemia. Ligation of the fistula is mandatory and urgent for high grade ischaemia, and a definitive CVC is necessary if the creation of a more distal AVF is not possible. Proximal artery stenoses are best treated with percutaneous transluminal angioplasty (PTA). Apart from these two situations, treatment should be adapted to the extent of the AVF flow for each patient.

The main treatment for proximal AVF-related ischaemia is DRIL if the flow through the fistula can be considered “normal” (400 to 800 ml/min); proximalization of the arterial inflow (PAI) may be an option. Low flow AVF (<400 ml/min) should be ligated. High flow AVF (above 800 ml/min) should be treated by flow reduction techniques to increase distal artery pressure: 1) Banding is rarely effective, 2) Revision using distal inflow (RUDI) techniques involving ligation of the proximal anastomosis and interposition of a graft.
between the distal radial artery and the elbow vein, or transposition of the radial artery (Bourquelet et al. J Vasc Surg 2009) avoid the risks of secondary stenosis of the venous anastomosis of grafts. A similar algorithm applies for distal AVF which are less frequently complicated by distal ischaemia. Low flow non-matured AVF must be ligated. Normal flow AVF should be treated by distal radial artery ligation. High flow AVF-related ischaemia (above 800 ml/min) is best treated by juxta-anastomosis proximal radial artery ligation (PRAL) which is an easy and effective technique for reduction of distal AVF (Bourquelet et al. Eur J Vasc Endovasc Surg in press).

10 CEPHALIC ARCH STENOSIS. CONSERVATIVE SURGERY OR CREATION OF A NEW VASCULAR ACCESS?

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Cephalic arch stenosis (CAS) is the major reason why brachial cephalic AVFs so frequently malfunction (up to 39%). The stenosis may be partly due to compression of the dilated vein as it passes through the clavicular fascia, just before its junction with the axillary vein. Turbulent high flow, frequently associated with elbow AVF, may reinforce the stenosis by inducing hyperplasia of the intima and valves in the upper part of the vein.

In view of the rather disappointing results of percutaneous angioplasty for CAS (early recurrence after PTA, risk of subclavian vein stenosis after stenting) surgery must be considered for certain patients. Re-routing the vein is a surgical option. The upper part of the cephalic vein is freed as proximally as possible to ensure adequate length. A second incision in the axilla exposes the axillary vein. The cephalic vein is then transposed through a subcutaneous tunnel and anastomosed end-to-side to the upper basilic &#8260; axillary vein. We have performed this technique successfully in a few cases. In 2005 Chen reported 9 patients with a median fistula age of 14 months. Primary patency rates after surgery were 70% at 6 months and 60% at 12 months, compared to the primary patency rates (42% at 6 months and 23% at 12 months) reported by Rajan in 2003 after percutaneous balloon angioplasty in 26 fistulas. Although stenosis may reappear at the site of re-anastomosis, this is far from frequent according to Chen. It is important to note that this transposition procedure may jeopardize the creation of a basilic vein fistula in the future.

Creation of a new vascular arteriovenous access in the opposite limb, if feasible, might be a better option when CAS is associated with very high flow AVF, or high grade aneurysmal degeneration of the vein, especially in younger patients.

In conclusion, besides percutaneous treatments, surgical re-routing and creation of a new access must be considered when treating CAS.

11 SUPERFICIALIZATION OF FOREARM VEINS: LIPECTOMY

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Background: Tunnelled transposition is the traditional technique for superficialization of the distal cephalic vein in obese patients. Lipectomy is a new technique (J Vasc Surg 2009) that removes subcutaneous fat without mobilizing of the vein.

Methods: This single-centre prospective study included 49 consecutive patients (17 men, 32 women) who underwent second-stage lipectomy after creation of a radial-cephalic vein fistula. Mean patient age was 54 years, 36% had diabetes, and mean body mass index was 31 ± 5.6 kg/m². Subcutaneous fatty tissues were removed after two transverse skin incisions under regional anaesthesia and preventive haemostasis. Cannulation was first allowed 1 month later, after clinical and colour duplex ultrasound evaluation. Technical success was defined as the ability to remove the fat and to palpate the patent vein immediately under the skin at the end of the operation. Clinical success was defined as the ability to perform at least three consecutive dialysis sessions with two needles. All patients were checked systematically every 6 months by the surgeon.

Results: Technical and clinical success rates were 96% (47 of 49) and 94% (46 of 49), respectively. Mean vein depth decreased from 8 ± 2 to 3 ± 1 mm according to duplex ultrasound imaging. The mean vein diameter increased from 6 ± 1 to 8 ± 2 mm. In one patient, vein tortuosity that was overlooked required conventional repeat tunnelling. One extensive haematoma resulted in loss of the fistula. One patient died before the fistula could be used. Primary patency rates were 71% ± 7% and 63% ± 8% at 1 and 3 years, respectively, and secondary patency rates were 98% ± 2% and 88% ± 7%. Delayed complications were treated by surgery (N = 7) or by endovascular procedures (N = 10).

Conclusion: Lipectomy is a safe, effective, and durable approach to make deep arterialized forearm cephalic veins accessible for routine cannulation for hemodialysis in obese patients who often have distal veins that have been preserved by their fat from previous attempts at cannulation for blood sampling or infusion.

12 TOPICAL ELASTASE INCREASES AVG OUTFLOW VEIN DIAMETER AND LUMEN AREA IN A SWINE MODEL

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Aims/Introduction: PRT-201 is a recombinant human pancreatic elastase under development as a treatment to improve AVF maturation and prolong AVG patency. The objectives of this study were to determine the effect of PRT-201 on AVG outflow vein diameter, blood flow, patency, venous neointimal hyperplasia, and wound healing.

Methods: Twenty-three 6 mm x 10 cm PTFE grafts were interposed between the femoral arteries and veins of 12 juvenile Yorkshire swine. The outflow vein was treated topically with either saline (n=6) or saline containing PRT-201 1.0 mg (n=4), 1.5 mg (n=5), 3.0 mg (n=5) or 4.5 mg (n=3) over 10 minutes. Digital photographic images and blood flow (Transonic) were obtained pre- and post-treatment. Twenty-one days later, angiography was performed to determine graft and vein patency and vein lumen diameter. The AVG was exposed and graft blood flow was measured. Finally, the animals were euthanized and the AVGs and veins were fixed with formalin.

Results: Similar responses for several vein measurements were noted among the PRT-201 dose groups and thus the PRT-201 groups were combined for analysis. PRT-201 resulted in an acute non-dose dependent increase in the outer vein diameter compared with saline (19±13% vs. 6±8%, p<0.05). At 21 days, PRT-201 was associated with greater vein patency (76% vs. 33%), graft blood flow, and vein lumen diameter. Histomorphometric outer vein and lumen diameter and area were greater with PRT-201 whereas neointima area, medial area, neointima thickness, and neointima/lumen ratio were similar. PRT-201 at all doses caused notable dissolution of the external elastic lamina that was limited to the application site. Other histopathological measures of vein tissue response were not affected by PRT-201. PRT-201 had no adverse effect on wound healing grossly or microscopically.

Conclusion: PRT-201 treatment of the AVG outflow vein immediately following placement was both safe and effective at increasing outer vein and vein lumen diameter and area in swine. An ongoing clinical trial is evaluating the effect of PRT-201 on AVG outflow vein diameter and blood flow in CKD patients undergoing AVG placement.

13 DEADLOCK IN HEMODIALYSIS ANGIOACCESS (DHDAA): REFLECTIONS ABOUT 15 OBSERVATIONS

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The authors reported observations of deadlock in hemodialysis angioaccess (DHDAA) of 15 patients (9 F & 6 M) with mean age at 59±18 years,
treated by hemodialysis for 127±86 months. Co-morbidity as diabetic mellitus and obesity were noted in 8 patients, arteriopathy and coronaryopathy in 12, calciphylaxis and chronic inflammatory in 4. Risk factors incriminated in DHDAAs were: unusually high incidence of central veins catheterism (CVC) (6±4 catheters per patient, all by jugular veins, while 5 to 16 times were occurred in 7p) including 4±3 non-tunnelled-catheters and only 3±3 permanent tunnelled catheters (PTC) (Canaud) per patient. Only 1 patient had known 2 subclavian catheters before DHDAAA situation. They received up to1±6 surgical procedures for angiaccess including fistula, PTPE, or shunt but only 3 patients received radio-cathelic in forearms as the first angiaccess while 12 did receive proximal fistula or PTPE. Femoral accesses including catheters, PTPE and saphen vein bypasses were attempted in 9 patients. Bilateral stenoses of superior cave system-central veins occurred in most of the patients (stenoses of internal jugular veins in 12p, subclavian veins in 10p, brachio-cephalic veins in 12 associated with femoro-ilac veins in 3p). Angioplasties and stenting could help 12 patients to obtain tunnelled catheters and/or fistulas. 8 patients received femoral PT catheters and 3 with PTFE or saphen bypass. Last angi-access comprised aggressive but still fragile solution such as PT catheters in 6 patients and 7 could receive proximal Fistula or PTPE AA after 1 – 2 central veins angioplasties with stenting. Peritoneal dialysis was contraindicated in all and transplantation was possible only in 1 patient. Hospitalisation was unusually high and unpredictable and stressful. 3 patients died 1 to 6 months after the last AA. In conclusion, the situation of DHDAA in our 15 patients seemed to be the result of numerous unsuccessful attempts of angiaccess and CVC. To help patients in DHDAAA, multi-disciplinary efforts and patience are needed.

14 IN-LOCO THROMBOLYSIS AS FIRST-LINE THERAPY FOR THROMBOSED ARTERIOVENOUS FISTULAE: A 6-YEAR RETROSPECTIVE STUDY

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Introduction: Maintaining a functional arterovenous fistula (AVF) is crucial for the hemodialysis patient. Despite a close monitoring of AVF, complications such acute thrombosis may occur. An early diagnosis is mandatory to initiate therapies among them the pharmacological thrombolysis occupies a prominent place, especially when endovascular or surgical treatments are not immediately available. We evaluated, over 6 years, the efficacy and the safety of a thrombolytic therapy promptly initiated in the dialysis unit which consists in direct infusion of urokinase (UK) into the thrombus.

Patients and methods: A monocentric retrospective study was conducted in our in-hospital hemodialysis centre from January 2004 to April 2010. Thirteen patients (5 women and 8 men; age range, 30-84 years; mean 69 years) with an acute thrombosis of AVF (10 autologous and 3 grafts AVF) immediately received infusions of UK and heparin as a first-line therapy according to a standardized protocol. The UK was administrated for 6 hours through small needles (2 to 4) located into the thrombus. Successful thrombolysis was defined when bruit and thrill returned and the patient was dialysed via AVF.

Results: Thrombosis occurred on average at 32 months (range, 5 – 120 months) after AVF creation, mainly due to stenosis. Pharmacological thrombolysis lead to the salvage of AVF for eight patients (62%) among them one patient re-ocluded his AVF within one month. For the remaining 5 patients unsuccessfully treated with UK, endovascular and/or surgical interventions failed to restore blood flow in 80%. Concerning adverse events, only one patient displayed an episode of bleeding without any clinical consequences. Following successful thrombolysis, angioplasty or surgery was performed when needed in order to correct the underlying causes.

Conclusion: Despite a limited number of cases in our series, our results provide that direct UK infusion into thrombus immediately performed in dialysis facilities is valuable as a first-line therapy to salvage thrombosed AVF. Dosage and infusion time adjustments are probably required to improve the efficacy of the protocol.

15 MICROSURGERY FOR DISTAL AND PROXIMAL ARTERIOVENOUS FISTULA IN ADULT: A 3-YEAR EXPERIENCE

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Introduction: early failure of autogenous A-V fistulae(AVF), defined as non-function of the AVF, occurs in high rates using conventional surgical techniques, and is mostly caused by early thrombus secondary to errors in surgical technique. Early failure rate incidence varies between 18% to 53%, except the results of K. Konner (2%). However microsurgery and preventive haemostasis have been reported to give excellent results in a paediatric and adult population (5-11%). Consequently in the last three years we performed all autogenous fistulae (distal, proximal forearm and elbow) using loupes and operative microscope magnification.

We report our results in adult.

Patients and methods: this study includes 129 adult patients (62 M and 67 F, mean age 65 ± 22 years, 32% diabetics). We created 83 radio-cephalic fistulae, 19 mid-arm fistulae, 24 elbow fistulae and 3 brachial-brachial fistulae. Under local anaesthesia the artery and vein exposure was performed using loupe magnification (x3.5). The incision of the artery and vein, performed with ophthalmic knife and completed with microsurgical scissors, and the anastomosis were carried out under operative microscope guidance (magnification up to x12) with 7-80 Core-tex sutures.

Results: thrombosis occurred within the immediate 24 h following surgery in 1 case of distal AVF (1.2 %) and 1 case of elbow AVF (2%). Early failure rate was 6% for distal AVFs, 5.2 % for proximal forearm AVFs and 12% for elbow AVFs. All brachial-brachial fistulae were subjected to vein transposition. Primary patency rates for distal AVFs were 79% at 1 year and 69% at 2 years; for proximal forearm AVFs were 84% at 1 year and 70% at 2 years and for elbow AVFs were 89% at 3 year and 78% at 2 years. Secondary patency rates for distal AVFs were 94% at 1 year and 91% at 2 years, for proximal forearm were 93% at 1 year and 84% at 2 years and for elbow AVFs were 95% at 1 year and 86% at 2 years. No complications occurred.

Conclusions: the “microsurgical” approach with operative microscope assistance allows the construction of native AVFs in a vast majority of patients with very low incidence of complications and immediate and late failure rates.

16 CVC: A CHRONIC INFLAMMATORY DISEASE?

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Inflammation is the physiological response to a variety of noxious stimuli such as tissue injury caused by infection or physical damage. It is a complex process that involves the participation of several cells and molecules, and may present different intensities and durations. Inflammation usually refers to a localised process. However, if the noxious stimulus is severe enough, distant systemic changes may also occur, and these changes are referred as “acute phase response”, which is accompanied by typical signs and symptoms. This acute phase response may include neuroendocrine, metabolic and haematopoietic changes, as well as changes in non-protein plasma constituents. The haematopoietic response includes leukocytosis and leukocyte activation, and anaemia secondary to erythrocyte damage and/or decreased erythropoiesis. Haemodialysis (HD) patient’s showed indicators of increase inflammatory response that is not well clarified. However, bacterial contamination of the dialysar, incompatibility with the dialysar membrane and infection of the vascular access are well documented causes of the inflammatory process in HD patients.

Recently, it was demonstrated that the inflammatory response associated with HD procedure and/or with renal insufficiency is enhanced in patients who required central venous catheter (CVC) as vascular access for HD. In fact, when we compare haematological and biochemical markers, between HD patients using CVC, with those using arterovenous fistula (AVF) for vascu-
lar access, the first group presented a statistically significant lower levels of haemoglobin associated with enhanced markers of inflammation, including increased leukocyte and neutrophil counts, higher levels of C-reactive protein, interleukin-6, elastase and lactoferrin, and low albumin serum levels. Additionally, HD patients using CVC, also showed changes in iron metabolism, namely, a decrease in transferrin saturation, and an increase in soluble transferrin receptors, prohepcidin and hepcidin serum levels. The increase in the levels of hepcidin, by decreasing iron mobilization for erythropoiesis, leads to the development/worsening of the inflammatory anaemia. This may explain the higher requirement of rhEPO doses to achieve the target haemoglobin levels in HD patients using CVC as vascular access for HD.

In conclusion, patients using CVC as vascular access for HD present indicators of an enhanced inflammatory process. Given that there are no current effective treatments for chronic inflammation (or its consequences) in HD patients, the focus must be on prevention, to avoid an enhancement in the inflammatory response and in the anaemia.

17 ENDOVASCULAR TREATMENT OF LONG (>5 CM) OBSTRUCTIONS OF ARTERIO-VENOUS FISTULAS OF THE FOREARM IN HAEMODIALYSIS PATIENTS

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Purpose: Occlusion of long tracts of arterio-venous fistulas of the forearm in haemodialysis patients is related to a worst outcome after percutaneous angioplasty than for short stenoses or obstructions. Aim of this work was to present our results in the endovascular treatment of long obstructions of arterio-venous fistulas.

Materials and methods: Over a 4-years period, endovascular treatment of 18 dysfunctional arterio-venous fistulas of the forearm in 18 patients was attempted. Mean length of obstruction was 7.4 cm. After fistulography, revascularization was performed with percutaneous angioplasty in two sessions, with balloon catheters of progressively increasing diameter (3 to 5 mm in the first, 6 to 7 mm in the second session, performed 20 days after). Immediate technical success (restoration of patency with successful following first dissection) and complication rate were recorded. Primary and secondary patency rates at 1 year were calculated.

Results: Success rate was 85%. In 20% of patients recurrence of obstruction occurred within 60 days after endovascular treatment. Primary and secondary patency rates at 1 year were 66.7% and 100%, respectively.

Conclusion: In our series, percutaneous treatment of long occlusions of arterio-venous fistulas was done in all patients with good immediate success rate. Being early recurrence frequent, we recommend close clinical and ultrasonographic monitoring after treatment. Our patency results at 1 year encourage every attempt for salvage of occluded fistulas. Clinical relevance: Long-term patency rates after angioplasty of long occlusions of arterio-venous fistulas of the forearm justify endovascular treatment before choosing the surgical approach.

19 CEASING RENAL REPLACEMENT THERAPY DUE TO LACK OF ACCESS IN A 2-YEAR OLD CHILD WITH MULTICYSTIC RENAL DYSPLASIA

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In 19 months old female infant suffering to polycystic kidney and liver dysplasia peritoneal dialysis (PD) was started because of symptoms of chronic renal insufficiency. The clinical course during the first four months of PD did not cause any problems and dialysis was found adequate. Through the subsequent months the treatment was complicated by the following: 1) at the age of 23 months - a surgical correction of the inguinal hernia, 2) at the age of 24 months – a surgical replacement of the PD catheter due to malposition (the tip of the catheter moved upwards toward right lobe of the liver), 3) at the age of 25 months – an exudate (dialysate) in patient's left pleural cavity required drainage, 4) at the age of 26 months – second surgical correction of PD catheter malposition, which slipped out from the Douglas cavity and reached the former location. The PD catheter was replaced to the left side. Inspection of the pleural cavity through thoracoscopy revealed no diaphragm damage, however, the residual dialysate was still present and pleural drainage was necessary again.

The patient has been switched from PD to hemodialysis (HD). 14 HD sessions were performed, with technical and clinical problems, as follow: the child was restless, low BP was observed, persistent exudate in the pleural cavity required pleurodesis of the left side with talcum powder. A severe sequela - massive pleural hemorrhage 6 days was noticed after this procedure. The patient was switched back to PD, but adequacy was poor. The serum urea and creatinine levels rose up significantly.

A LRD kidney transplantation from mother was performed in month 28, with subsequent favorable outcome.

The case described above shows the problems one may find when renal replacement therapy starts early, in a small child presenting with a fatal renal disease and weakness of abdominal wall in whom PD failed after 3 months and HD was not made possible because of technical problems and concomitant underdialysis. Fortunately for the patient, she benefited a lot and recovered from LRD kidney transplant.

18 CUTTING BALLOON AND CRYOPLASTY IN DIALYSIS FISTULAS

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Two continuing problems have not yet overcome in interventional radiology of failing fistulas and grafts. In the acute phase, technical failure of a procedure may occur due to residual stenosis mainly due to the rigidity of the underlying stenosis - rarely due to vascular collapse. In the follow-up phase, still frequent restenosis occurs mainly due to aggressive neointimal growth at the stenotic site. Unfortunately both phases are frequently mixed in the discussion. Failure of the procedure with residual stenosis is very likely to lead to insufficient flow and therefore rapid reintervention will be utilized. Cutting and high pressure balloons have been introduced to overcome in particular rigid stenoses with opening of the diameter. Technical success nicely shows that both devices work to fulfill their jobs. Unfortunately randomized trials however looked not on technical success in a difficult subgroup but on overall patency after primary use of cutting balloons vs. conventional balloons on a none selective group of patients undergoing percutaneous interventions. Not surprisingly, no advantage was seen in these trials comparing cutting balloons and normal balloons. This should not be mixed with the still convincing technical outcome with cutting balloons in rigid stenoses.

Cryoplasty however, has been introduced just in order to overcome the problem of neointimal growth only. Mainly it was used in peripheral arteries where it did not show a significant improvement compared to conventional balloons. Experience with cryoplasty in dialysis fistulas and grafts is scarce: a small pilot study published encouraging results while a recent larger series did not reveal major benefits.

To understand technical innovations in interventions, technical success and long-term patency should not be mixed - neither hope and facts.
surgeon. Unfortunately, most of time no clear question has been asked. But as we are aware of the problems, each time a complete investigation is made. Arteriovenous fistula (AVF) construction needs a standardized protocol of preoperative assessment in order to avoid failure through a better understanding and prediction of AVF maturation and function. CDUS is an objective and non-invasive method to assess morphological and functional characteristics of vessels. Preoperative skillful CDUS scanning may increase options for AVF by identifying veins that are not clinically assessable, assess patency and suitability of both arteries and veins that will be used for vascular access, and identify arterial and venous abnormalities that may be responsible for early AVF failure. Beside vessels assessment, B mode ultrasound provides information about texture of the soft tissue and depth of the vessels suggesting in some cases transposition in a more superficial position. Actually CDUS is the only investigation able to provide these three kinds of findings in the same time while remaining cost effective.

21 DUPLEX IMAGING AT 1 MONTH
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The aggressive institution of a “fistula first” policy has resulted in the increased incidence of early failure of arteriovenous fistulae (AVF) due to fistulae being placed in patients with clinical risk factors and small vessels. A preoperative method of assessment of characteristic criteria has been developed using Color Doppler Ultrasound (CDUS) to define arteries and veins suitable for creation of autogenous AVF, and this has shown the benefits of using well-sized radial arteries and cephalic veins for RCAFVs. Unfortunately this means that borderline patients for whom successful AVF maturation could have been achieved with secondary interventional radiology procedures are sometimes eliminated. The failure to mature comes before the ischemic risk and the silent central venous stenosis leading to edema after AVF creation throwing off balance. The favorable outcome of the more aggressive approach to the management of these patients by radiological or surgical re-intervention is a consequence of early CDUS evaluation. Duplex scanning is the only method available for flow measurement and detection of accesses at risk of dysfunction and thrombosis before the first cannulation. The arterial and venous vessels are the first to be studied, but soft tissue exploration provides original information not supplied by fistulography. CDUS at one month has become the keystone of evaluation of newly created AVF, providing objective measurements of flow, size and morphology and detecting hidden abnormalities, and thus indicating the best management. The Disease Outcome Quality Initiative (DOQI) guidelines provide some anatomical and functional parameters for an “adequate” AV fistula which can be easily recorded by CDUS. This is defined as an AVF that has a flow of greater than 600 ml/min, a diameter of greater than 0.6 cm and which is approximately 0.6 cm from the skin surface. The aim is to provide an indication of when, where and how to perform the first safe puncture, to distinguish between AVF suitable from those that must be revised. Elderly patients with co-morbid conditions are at increased risk of developing an access-induced ischemia. Steal situation and assessment of the arteries is documented by CDUS driving to different attitude. The main complications and dysfunctions of AVF can be detected early by CDUS providing strong arguments for revision transposition or even closure.

22 CO2-VENOGRAPHY - ESSENTIAL PREOPERATIVE EXAMINATION WHILE PLANNING THE FIRST VASCULAR ACCESS
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Planning the first vascular access procedure a shunt-plan is demanded for every dialysis patient, because his venous pool is limited and during his dialysis life various surgical procedures may become necessary. Different diagnostic methods can evaluate the existing venous pool: clinical examination, colour duplex scanning, MR-angiography, conventional phlebography with iohodinated contrast agent or with CO2-gas. The majority of our patients is old and has a poor venous outcome, so that the clinical examination doesn't give enough information about the superficial veins and there is no information about the basilic vein, the deep venous system of the upper arm or the central venous outflow. The coloured duplex scanning describes the venous status only in certain areas, but there is poor description about collaterals, we haven't a two dimensional image information (map) and the display of the central venous system is difficult. There are different advantages of the CO2-phlebography compared to the phlebography with iohodinated contrast agent:
- no toxic gas without any side effects, except for occasionally pain on the site of injection.
- no nephotoxicity with preservation of renal rest function
- no thireoidal or allergic reaction
- very low viscosity with quick mapping of all veins, collaterals and central venous outflow
- short duration of examination and very cheap.

Advantage of CO2-phlebography compared to MR-angiography:
- shorter time of examination
- cheaper
- no contrast agent reaction (e.g. gadolinium induced nephrogen fibrosis)
- no second pass effect with masking arteries and veins.

Before starting hemodialysis treatment we send every patient to CO2-phlebography. It is a simple method for a complete two-dimensional mapping of the superficial veins, the deep venous system of the upper arm and the central venous outflow. It is easy to perform, to document, save and interpret. The pictures value many years. We have with these images an impressive tool to explain further procedures concerning the vascular access to the patient. It is a good documentation of the remodelling of the shunt vein comparing to future CO2-phlebographies of the same area. Therefore this method is for us the first choice while planning vascular access surgery.

23 DISTAL BANDING OF THE SHUNT VEIN - A SIMPLE OPTION TO TREAT STEAL SYNDROME
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After creating an av-fistula more than 75% of the patients present an asymptomatic retrograde flow in the artery distal of the av-anastomosis. No treatment is necessary. Only if symptoms like permanent pain or tissue damage occur treatment is essential to save the hand. This so called steal syndrome is caused by reduction of perfusion pressure in the supplying artery and consequently reduced blood flow.

The flow volume is related to the 4th potentiation of the vessel diameter. The higher the diameter of the artery at the level of the av-anastomosis, the less the reduction of the perfusion pressure and vice versa. Same for the vein: the bigger the vessel diameter, the bigger the perfusion reduction. Steal is exclusively determined by the relationship between arterial output capacity and venous drainage capacity. Therefore steal syndrome can only be treated by increasing the output capacity or reducing the drainage capacity or a combination of both.

If there is no neplanostomotic arterial stenosis, the proximalisation of the arterial leak is the only technique to increase the output capacity. The drainage capacity can only be limited by calibre reduction of the draining vein, possibly in combination with the stenotic length (autologous resistance loop). The reduction of calibre can be achieved with different methods:
- banding with suture
- banding with PTFE cuff
- banding with interposition of tapered PTFE

But these techniques are unprecise and don't allow further correction easily. We prefer – as follows - a very simple method of shunt vein banding, performed in local anesthesia. Without cutting the vessel, we knot a non-absorbable filament over a 2.5 up to 4 mm dilator. This technique allows an exact reduction of diameter in 0.5 mm steps. Intraoperatively we measure
blood flow by ultrasound, which allows to control the successful procedure immediately. Results were presented.

24 MATURATION FAILURE: A SURGEON-PERSPECTIVE

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Objectives: To communicate our experience in the maturation failure at a center with exclusive dedication in the construction of vascular accesses.

Materials and methods: Between January 2008 and December 2009, we performed 663 primary native arteriovenous fistulae at the Vascular Access Center of ASODI. Among these, 23 (3.5%) cases presented maturation failure, of which 14 (60.9%) were women and 16 (69.6%) diabetics, with a mean age of 58 years (ranging 12 to 85). Venous mapping with preoperative Doppler ultrasound was performed (by the same surgeon) to all patients to define the access site and flebography was considered if there was suspicion of central venous injury. We defined as a failure of maturation a clinically inadequate venous dilatation, a vein diameter less than 4 mm by ultrasound after 4 weeks or if there was low-flow during the first sessions of dialysis. All patients underwent early detection in the basis of clinical and ecographic control and were treated surgically.

Results: Among our 23 cases of maturation failure 15 (65.2%) were radiocephalic arteriovenous fistulae, 5 (21.7%) antecubital brachiocephalic, 2 (8.7%) basilic transpositions and 1 (4.3%) ulnar basilic fistula. The diagnosis of maturation failure was made in a mean time of 7 weeks (ranging 1 to 30). According to the clinical and ultrasound findings the etiology of the maturation failure was: proximal vein stenosis in 9 (39.1%) cases, yusta-anastomotic stenosis in 7 (30.4%) cases, arterial atherosclerotic disease in 4 (17.4%) cases and anastomosis failure in 3 (13%) cases. Treatment consisted in 19 (82.6%) surgical repairs and 4 (17.4%) new accesses with PTFE. Among the repairs 15 (78.9%) were proximal reanastomosis, 3 (15.8%) angioplasties using a patch and 1 (5.3%) resection with end to end anastomosis. Maturation was achieved in all surgical repairs in a mean time of 5 weeks and their primary patency rates were 100%, 94% and 84% after 3, 6 and 12 months respectively.

Conclusions: Early detection and active surgical treatment of the maturation failure of vascular accesses clinically and Doppler ultrasound based, performed by the same surgeon, has excellent results and allows rescue in a reasonable period of time, of an important number of accesses before starting punctures.

25 CVCs: LEGAL ISSUES

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In dialysis patients, both central venous catheter (CVC) insertion and CVC use during the dialysis procedure pose important legal issues, because of potentially severe, even fatal, complications.

A first issue is the decision of the kind of vascular access that should be proposed to patients: an AV fistula, a graft or a CVC, either non-tunnelled or tunnelled. Non-tunnelled catheters are more easily complicated by infections, but they can be more easily inserted when urgent dialysis needs to be started. Leaving for a prolonged time a temporary, non-tunnelled CVC increases the risk of complications and it could arise a liability issue. Even when choosing a tunnelled CVC, a recent paper (JASN 2009; 4: 456) suggested that to adequately inform patients, nephrologists are ethically obligated to systematically explain the harms of tunnelled cuffed catheters. The authors propose that if CVCs must be used to initiate dialysis, nephrologists should present them only as “temporary” measures and “unsuitable for long-term use”. Thus, not only is their long-term use ethically problematic, but it potentially exposes nephrologists to legal liability.

Another critical issue is the preparation of a complete, informative consent form, which should be ideally explained and signed by the doctor performing the procedure or surgical intervention. However, another physician of the vascular access or dialysis team could also explain the procedure and obtain the informed consent.

The CVC insertion procedure has many aspects of legal interest, starting from the choice of CVC (non-tunnelled vs. tunnelled), the use of ECG monitoring, the use of ultrasound guidance for cannulation, the use of fluoroscopy for checking the position of the metal guide-wire as well as the CVC tip before the end of the procedure. Use of insertion devices and techniques that can prevent accidents amenable of legal liability should be encouraged. Complications of CVC use are mainly thrombosis and infection. These are expected, and legal issues might relate to inappropriate catheter care, rather than for the event “per se”. Indeed, it might be difficult to establish liability with a catheter related infection or thrombosis in the individual case. In conclusion, we can not avoid using CVCs, but reducing them at the minimum and adopting safe approaches to their insertion and use will reduce legal liability.

26 TREATMENT OF PARTIALLY THROMBOSED ANEURYSMS AND RESIDUAL THROMBI IN HAEMODIALYSIS VASCULAR ACCESSES USING STENT GRAFTS

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Objectives: To communicate our experience with the implantation of stents in aneurysmal haemodialysis vascular accesses with wall-adorhering thrombus or isolated residual thrombus.

Patients and Methods: There were 35 haemodialysis accesses in 33 patients in which we inserted 39 covered stents (3 Passager, 12 Wallgraft, 1 Viabahn and 23 Fluency) and 1 non-covered stent (Wallstent). The accesses were: 9 radial fistulas, 23 brachial fistulas, and 3 PTFE grafts. Stent indications were: aneurysmal dilatation with residual wall-adorhering thrombus (n=30), and wall irregularities with residual wall-adorhering thrombus (n=5).

Results: The clinical success rate was 97.1 %. In five cases, two stents were implanted in the same session. Manual catheter thrombo-aspiration was performed in 26 cases (74.3 %). In 31 accesses a PTA was done after thrombo-aspiration. The mean follow-up time was 18 months (range: 0-61 months). The primary patency rate was 66 ± 8 % at 6 months, 43 ± 8 % at 12 months and 20 ± 7 % at 24 months. The secondary patency rate was 77 ± 7 % at 6 months, 60 ± 8 % at 12 months and 34 ± 8 % at 24 months. Nineteen stents (54.3 %) were patent at the end of the follow-up. To date, sixteen vascular accesses (45.7 %) are still being punctiong in the stents during haemodialysis sessions without problems.

Conclusion: Metallic stents are useful for treating lesions in partially haemodialysis accesses thrombosed aneurysms in selected cases.
27
GOOD PRACTICE RULES FOR RADIOPROTECTION IN THE OPERATING ROOM
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Recommendation on C-arm use in a virtually controlled area:
- signs and visuals
- rules to observe to deliver the lowest dose (ALARA concept)
- individual and collective radioprotection systems and devices
- obligatory controls/dosimetry and quality
- collaboration with PCR and radiation national supervisor
- professional practices report

28
HOW I DECLOT AVFS AND GRAFTS
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Vascular access thrombotic occlusions are a frequent problem in patients with end stage renal disease (ESRD) requiring hemodialysis. Rapid recognition and treatment of access-related complications are essential to preserve long-term access function. A good knowledge of minimally invasive percutaneous recanalization techniques is of paramount importance for the interventional radiologist. Herein, interventional treatment possibilities for thrombosed arteriovenous (AV) access grafts and fistulae are presented.

AV Fistula Thrombosis

The duration, location and extent of AV fistula thrombosis as well as the type of access are important determinants of treatment outcome. Fistula thrombosis should be treated within 48 hours whenever possible. Timely declotting allows immediate use without need for central venous access. Although comparative studies are lacking, the available literature strongly suggests that thrombosed autogenous AV fistulas should preferably be treated by interventional radiology. The only exception may be forearm AV fistulas that have thrombosed due to anastomotic stenosis. It is likely that in such cases, creation of a new proximal anastomosis will provide good results although no surgical series has demonstrated this thus far.

Interventional thrombolysis can be performed mechanically or pharmaco-mechanically. A short-segment thrombosis can be simply treated with balloon angioplasty alone; however, an extensive thrombosis requires the combination of mechanical devices and/or thrombolytic agents with consecutive balloon angioplasty.

Poulin et al. combined a local low dose infusion of urokinase with PTA and thromboaspiration to achieve a 12-month overall patency in 14 native fistulas of approximately 90%. Zaleski et al. reported on patients with complete thrombosis of their Brescia-Cimino fistulas, which were treated by angioplasty and urokinase infusion. Procedural success was 82% with primary, primary assisted, and secondary patency rates at 12 months of 71, 93, and 100%, respectively.

Twenty of 24 patients (83%) with occluded Brescia-Cimino fistulas were successfully recanalized by Overbosch et al. using the Hydrolyser catheter. Median assisted patency was 34 weeks and was significantly shorter in fistulas than in PTFE grafts.

Turmel-Rodrigues et al. described an 81% initial success rate using thromboaspiration and PTA in 16 patients. An 81% secondary patency at 1 year was reported.

Liang et al. reported a success rate of 93 % and a primary patency rate at one year of 70%. We have experienced technical success rates of almost 90% in 81 native fistula procedures with a combination of PTA and mechanical thrombectomy devices. The primary and overall fistula patency was 27 and 51% at 1 year, respectively, pinpointing the efficacy of percutaneous thrombosis treatment strategies.

These results show that initial percutaneous interventions in occluded native arteriovenous fistulas are very effective in the early treatment of the recently occluded dialysis access with good success rates and satisfactory primary and long-term patency rates comparable to those of surgical thrombectomy. However when percutaneous thrombectomy is feasible, surgical revision should be reserved for failures of percutaneous techniques. The choice of the appropriate percutaneous approach will depend on the size and location of the thrombus detected by angiography, while the choice of device depends on the experience of the centre with the respective modality.

Graft Thrombosis

As with AV fistula occlusion, graft thrombosis should be treated without delay and within 48 hours, at least before the next dialysis session. A compact “arterial plug” is invariably seen. Mature thrombi older than five days are often fixed to the vessel wall beyond the venous anastomosis, rendering surgical extraction more difficult. In grafts, this is less of a problem for the interventional radiologist.

PTFE graft thrombosis can be approached using a wide array of percutaneous techniques including combinations of thromboaspiration, thrombolytic agents such as tissue plasminogen activator (tPA), mechanical thrombectomy and mechanical thrombectomy devices. Turmel-Rodrigues et al. found higher patency rates after radiological intervention, with a 6 month primary patency rate of 32 % in thrombosed grafts. The results of the treatment of thrombosis and associated stenosis in synthetic grafts have been summarized by Aruny et al. Clinical success rates for thrombolysis or mechanical thrombectomy range from 75 to 94% with primary patencies of 18-39% at 6 months. Reported 6- and 12-month secondary patencies for thrombolysis range from 62 to 80% and 57 to 69%, respectively.

Trerotola et al. demonstrated a 95% technical success with a 3-month primary patency of 39% using the Arrow-Trerotola percutaneous thrombolytic device. Comparing different mechanical devices for percutaneous thrombolysis, Smits et al. concluded, that “the treatment of the underlying stenoses was the only predictive value for graft patency”. Each centre should therefore choose the technique according to their expertise. Whichever technique is used, it is important to perform thrombolysis early, to avoid access abandonment and temporary catheter placement.

29
CENTRAL VEIN OBSTRUCTION: TO STENT OR NOT TO STENT?
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Stenosis of the upper central veins can lead to central venous hypertension, which may be the cause of vascular access malfunction or even access loss. Such complications occur in 11–50 % of hemodialysis patients. The most significant clinical symptom of central venous stenosis is swelling of the access arm. Central venous stenoses have to be treated, when they are severe and disabling such in impairing upper extremity swelling, weariome pain or if they lead to inadequate haemodialysis.

Percutaneous intervention by PTA with or without stent deployment has been advocated to prolong vascular access patencies. It is now an undisputed fact, that angioplasty should be applied as the primary treatment modality in central veins. Stent deployment is necessary in primary PTA failures such as elastic recoil or insufficient PTA. An appropriate endoprosthesis for central veins should be flexible enough to be used in curved and tortuous vessels. Vanishing of collateral veins is a good indicator of successful angioplasty after sufficient reconstruction of the venous lumen. With respect to a conservative attitude, stent placement should be considered in cases of early (3 to 6 months) re-obstruction.

It is still in debate whether primary stenting generally decreases the likelihood of recurrence in central venous obstructions, but it may prolong patency intervals and allows for easy repetitive interventions. Nevertheless routine placement of a stent for central stenoses to prevent restenosis is not generally recommended in view of the published results after primary or secondary stenting compared to primary PTA.
30 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 transvenous 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.

31 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.

32 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 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.

33 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 connection or disconnection) should be done in an aseptic way.

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 VC 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
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 (AVFs). 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 cuffed 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 bacteremia (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 SHUNTE: 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 TS 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 RADIOCEPHALIC 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 anesthesia 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%, 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 HAEMODIALYSIS ARTERIOVENOUS FISTULA IN A NON-DEDICATED CENTER

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Nephrology, Fundacion Hospital Alcorcon, Madrid - Spain

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
exclusive dedicated surgeons.

Results: Since 1998, 2413 surgical interventions were performed for creating and repairing arteriovenous fistula in 1229 patients, including elective and emergency surgery (74.8% and 25.2% respectively). Outpatient procedures were performed in 82% of cases (89% in elective and 60% in emergency surgery). There were unexpected admissions due to surgical complications in 6% of patients. There was no postoperative mortality. The rate of admissions were 0.09 episodes and 0.2 days per patient/year.

Conclusion: Outpatient surgery is possible in a high percentage of patients to create or to repair an arteriovenous fistula, including emergency surgery. Vascular access surgery can be included in ordinary activity of a surgical unit. Outpatient vascular access surgery decrease unnecessary hospital admission, reduces costs and nosocomial complications.

38 PREVALENCE OF HEPATITIS B AND C IN IRANIAN HEMODIALYSIS CENTERS FROM 1978 TO 2010: A SYSTEMIC REVIEW ARTICLE

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Introduction: Hepatitis C virus (HCV) and HBV (HBV) infection in dialysis patients represent a significant health problem for dialysis units, both in term of containing the spread of infection, and following the clinical progression of infected patients. Dialysis patients are at particularly high risk of acquiring HCV and HBV infection because of nosocomial spread. As a routine, all hemodialysis patients in Iran have blood samples taken biannually for assessment of serum HBS Ag, HBS Ab, and HCV Ab and statistical analysis of prevalence and incidence.

The prevalence/incidence of End Stage Renal Disease (ESRD) in Iran has increased in the last 20 years. The prevalence of HBV infection has been estimated to be 1% in 1980 rising to 3% in 1990 to 6% in 2000. The prevalence of positive HBS Ag and HCV Ab decreased from 3.8% and 14.4% in 1999 to 2.6% and 4.5% in 2006, respectively.

Patient and methods: Most of national and international papers, dissertations, congresses reports, Iranian medical university projects, research centers, reports of Deputy for Health affairs (published or unpublished) were reviewed.

Selection Criteria for Studies: Descriptive/analytical cross-sectional studies/ surveys from April 1995 to March 2010 for international studies and February 1978 to March 2010 of Iranian studies that have sufficiently declared objectives, proper sampling method with similar and valid measurement instruments for all study subjects and proper analysis methods regarding sampling design and demographic adjustments.

Results: Presence of positive HBs Ag, Anti HBV Ab, or HCV RNA in blood samples of study samples.

The mean prevalence of anti HCV Ab, HBS Ag and HBS Ab in different studies in Iran from February 1978 to March 2010 is 17.6±14.9, 5.01±3.4 and 62.5±10.04 respectively.

Conclusions: In comparison with similar studies, the prevalence of HCV infection in Iran is low. This might be a result of having prevention programs for high risk groups and strict blood screening programs. More studies could be helpful to find the best methods for the implementation of preventive and control measures with regards the genotype distribution in Iran.

39 ROUTINE LOCK SOLUTIONS: WHICH EFFICACY FOR WHICH PATIENTS?

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The prevention of catheter-related bacteraemia (CRB) in hemodialysis (HD) patients remains a challenge because of high morbidity and mortality associated to CRB. A number of strategies has been tried for the prevention of CRB. Interdialytic locking of the lumen catheter with one or more highly concentrated antimicrobial agents has recently showed to prevent biofilm formation and thus is used for the prophylaxis of CRB. Several but not all randomized controlled trials (RCT) including tunnelled cuffed as well as non tunnelled HD catheters have showed a significant reduction in the incidence of CRB with antimicrobial lock solutions (ALS) as compared with heparin alone. Two recent meta-analyses showed that the use of ALS reduces by about two thirds the risk of CRB in HD patients. However there was a lack of significant effect of ALS in some included RCT with low CRB incidence in their control groups. Moreover, the incidence of CRB obtained with ALS is similar to reported in observational trials with low incidence of CRB, with presumably stricter hygienic measures. No included study reported CRB due to bacteria resistant to the antibiotic included in the ALS neither serious adverse event. However the follow up was 6-40 months in most trials, which does not allow to exclude the onset of adverse events or bacterial resistance with longer use of ALS. Therefore the first logical step of a preventative strategy should be the intensification of the education of all dialysis unit staff members on adequate catheter care. The use of additional prevention methods like ALS should be reserved to patients at high risk of infection (i.e. diabetics, carriers of femoral catheters or cases of recurrent CRB) or subjects in whom a CRB would lead to dramatic consequences (i.e. patients with artificial heart valves, pacemakers, vascular grafts, . . .). Concerning use of antibiotic locks in the treatment of CRB, RCT are scarce. However, current guidelines recommend the combination of systemic antibiotic therapy and an antibiotic lock when catheter salvage is attempted. Nevertheless the success rate of catheter salvage in case of S. aureus is low, even with antibiotic locks, and therefore should be reserved to problematic cases.

40 THE USE OF LIPOSUCTION TO ENABLE CANNULATION OF AUTOGENOUS AV FISTULAS IN PATIENTS WITH OBESITY

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Aims/Introduction: Many obese patients have veins of adequate size but they are too deep to cannulate successfully. The traditional approach to this situation has been to dissect out the vein and surgically transpose it to a superficial subcutaneous position. This procedure is challenging and prone to technical failure. It also is time consuming and requires sizable incisions which are prone to wound complications and limit patient and surgeon acceptance of the procedure.

In this clinical trial we used suction lipectomy ("liposuction") to reduce the layer of subcutaneous fat overlying selected arteriovenous fistulas in order to allow them to be successfully cannulated for dialysis.

Methods: This was an investigator-initiated, IRB-approved protocol. Entry was restricted to subjects with arteriovenous fistulas having a depth of 6 mm or greater because of a thick layer of overlying adipose tissue. To be included in the liposuction study patients needed to have a previously created radiocephalic or brachiocephalic fistula. Inclusion criteria included depth greater than 6 mm and flow greater than 400 ml/minute as measured by duplex methodology. Patients with nontransposed Brachiocephalic fistulas were excluded because these fistulas are subfasial and closely related to the medial cutaneous nerve.

A plastic surgeon collaborated in the study. The procedures were done with local tumescent anesthesia and conscious sedation. We utilized a combination of ultrasound-assisted liposuction and suction lipectomy superficial to the arteriovenous fistula. Duplex ultrasound imaging was used during the procedure to monitor its progress and to identify vascular structures to protect.

Results: Thus far 10 out of a planned 20 patients have had the study procedure. 80% have been able to be cannulated within 2 weeks. One patient required repeat liposuction. There has been one episode of skin flap necrosis that has delayed healing.

Conclusions: Preliminary results suggest that suction lipoplasty may be a simple, low risk and beneficial procedure that can make excessively deep AV fistulas much easier to cannulate.
41 NECKLACE GRAFT: ARE WE READY TO USE IT?

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Introduction: Vascular access has become a major problem in dialysis, with few patients with no other possibilities than complex grafts. Our surgeon performed 12 necklace grafts (from axillary artery to contralateral axillary vein) from 2006 up to now in such situations. We wondered how nurses and patients felt about this atypical access.

Methods: We made a survey with questionnaires for nurses and patients in 3 haemodialysis centers (44 nurses and 6 patients, all actually using necklace as vascular access).

Results: 87 % of nurses had more than 6 months experience with necklace grafts. 70 % had initial difficulties using it, and only 16 % felt enough trained. With time, 80 % experienced significant improvement (33 % had no more difficulties, all of them having more than 12 months experience). 60 % of the nurses who had to manage with the necklace every week had no more difficulties, whereas none of those who used this access less than once a month achieved this goal. Necklace grafts were considered as a bit more difficult to use than native fistulas for 59 %. Only 20 % of the nurses found that the graft changed their contact with patients (the main reproach was an unwanted proximity). Compared to native fistulas, 46 % experienced more stress with necklace, considering it as "the ultimate access". Patients had an average of 3 accesses before necklace (range: 1-9), the last one was always a catheter. 2/6 patients had initially major difficulties to accept the graft, but all patients are now totally adapted to it. 50 % have a different perception of themselves and the feeling that their family look at them in a different way since the graft. 5 of the 6 patients are totally satisfied with their graft. Average primary patency is 374 days (range: 1-1241). 4 patients had thrombosis (one was definitive), 2 patients deceased with a functional access. 1 patient deceased after the surgery (he had a sickle cell anemia).

Conclusion: After a necessary time for adaptation (both from nurses and patients), necklace graft seems to be globally well accepted and tolerated, with pretty good results. But we have to remember that it's not easy surgery, and to clearly define its indication.

42 HEMODYNAMICS AND PREVENTION OF ISCHAEMIA

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Creation of a proximal access always reduces the perfusion pressure of the distal vascular bed, however compensatory mechanisms including dilatation of adequate arterial collaterals and decreased peripheral resistance are able to maintain tolerable distal perfusion. Hand ischemia due to access related steal can range from minor complaints and pain during haemodialysis to tissue necrosis and amputation when those compensatory mechanisms are insufficient.

Regarding flow patterns in a proximal arteriovenous fistula, in all conditions blood flow direction in the proximal artery is always toward the hand and the flow in the vein always toward the heart. Similarly, the flow in the arterial collaterals is always toward the hand, the direction however of flow of the artery distal to the anastomosis may be either antegrade, retrograde or bidirectional depending of the pressure gradients of the proximal artery, the arterial collaterals, the proximal vein and the peripheral resistance. Wheatstone bridge is an electrical analogue. A large anastomosis always results in reduced peripheral perfusion and decrease of the pressure distally. However adequate arterial collaterals may compensate and maintain peripheral perfusion.

Three main mechanisms of significant ischaemia due to steal have been described by Wixon and Mills (2000): a) Steal caused by discordant vascular resistance and a poor collateral network. b) Steal caused by an inflow arterial lesion and c) Steal during haemodialysis caused by hypovolemia and a resultant diminished proximal arterial pressure unable to compensate the perfusion via the arterial collateral. An additional mechanism is a high flow access (Suding et al 2007). Severe steal develops immediately following synthetic bridge grafting and patients should be closely monitored, surveillance is not indicated beyond one month. In contrast, steal following proximal autogenous fistulae may be either of immediate or of 'late' onset necessitating life-long surveillance. (Lazarides et al 2003).

Predicting patients who will suffer ischemia remains difficult although the risk of steal is expected to be greater in diabetics, those with vasculitis, elderly or patients with multiple previous distal access procedures. Several measurements however may be helpful preoperatively to forecast an increased risk. Photoplethysmography and finger pressures or digital-brachial indices can identify those patients at greater risk of steal.

43 WHY, WHEN AND HOW TO TREAT ANEURYSMS

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Access related aneurysms represent a challenge for the surgeon but are under-reported in the literature. Access related aneurysms can complicate all access types and comprise false aneurysms caused by the repeated punctures (mostly in prosthetic grafts), true aneurysms caused by degeneration and subsequent dilatation of the native vein wall and anastomotic aneurysms. Aneurysm formation complicates 2% to 10% of arteriovenous grafts and recently Woo et al (J Vasc Surg 2010) reported an incidence as high as 30% in autogenous arteriovenous fistulae.

Indications for repair of false aneurysms include: 1) size exceeding twice the diameter of the graft; 2) rapid expansion; 3) involvement of the overlying skin; 4) signs of infection and 5) significant shortness of the remaining cannulation area. Indications for repair of true aneurysms are 1) involvement of the anastomosis; 2) concomitant stenosis; 3) diffuse aneurysmal autologous fistulae involving most of the cannulation area; 4) cosmetic reasons (relative indication) and 5) presence of thrombus lining the aneurysmal wall (an additional relative indication).

The repair of access related aneurysms may be surgical or endovascular. Surgical repair includes excision of the aneurysm and either primary repair with end to end anastomosis or new graft interposition. In case of tandem aneurysms the staged repair allows the remained access segment to be cannulated while the repaired segment matures, avoiding the use of central venous catheters. The post-intervention 12-month primary patency for such redo surgery on aneurysms was reported by Georgiadis et al (J Vasc Surg 2008) being 57%.

Partial aneurysmectomy and reduction of the luminal diameter, is another option for the treatment of complicated diffusely aneurysmal autologous fistulae. With this novel procedure Woo et al (J Vasc Surg 2010) reported acceptable midterm results regarding patency and complication rates, while offering an all-autologous angioplasty.

Endovascular pseudoeurysm repairs have been increased over the past decade. Currently available commercial stent-grafts can endure repeated punctures extending the use of the initial graft, and in a recent series a 90% 12-month patency of such revisions was reported (Shemesh et al, EVC 2010).

Aneurysm associated infections represent a special problem necessitating partial, subtotal or total graft removal depending on the extend of infection.

44 THE REASONS WHY AN ABSOLUTE PRIORITY SHOULD BE GIVEN TO DISTAL NATIVE FISTULAS

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Year 1966. Remember. Brescia, Cimino and coll published the legendary paper "chronic hemodialysis using venipuncture and a surgically created
arteriovenous fistula”. It was a side to side wrist radio-cephalic arteriovenous fistula (AVF). Since this date, the AVF demonstrated their superiority over prosthetic grafts and central venous catheters: fewer procedures of access salvage, better long-term primary access patency rate, better dose of dialysis delivered, fewer infection episodes, much less prone to early recurring episodes of acute thrombosis difficult to solve.

The choice of creation of upper arm or forearm vascular access is still a matter of debate in patients whose venous or arterial vessels seem unsuitable for forearm fistula. However, the wrist AVF (radio-cephalic and ulnar-basilic fistulae) remains the access of first choice because of the following advantages: 1) preservation of upper arm veins to permit the maximum number of possibilities for future access placement 2) simplicity to create whereas brachio basilic AVF requires a superficialisation 6 to 8 weeks later after the anastomosis creation, delaying use of the access or prolonging catheter dependence. The higher primary failure (non-maturation) of forearm fistulae could discourage surgeons or nephrologists, but endovascular treatments by skilled interventional radiologists permit access salvage and maturation in the most of the cases. The two major advantages of wrist AVF are low risk of hand ischemia and low risk of hyperflow, specifically in diabetics and patients with peripheral arterial obstructive disease. In case of steal syndrome, it is more simple to realize a DRAI, than a DRIIL or a RUDI intervention for brachiocephalic or arterial obstructive disease. In patients with steal syndrome, it is more simple to realize a DRAI, than a DRIIL or a RUDI intervention for brachiocephalic or arterial obstructive disease.

Lessons from the past …

LIMITATIONS OF DUPLEX ULTRASOUND EXAMINATIONS

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Beside pre-operative physical examination, Duplex ultrasound may select suitable vessels and reduce arteriovenous fistula (AVF) failures. Although most problems that are encountered are venous, both the artery and vein are important and specially directed evaluation must be completed. Several mapping criteria have been proposed including internal diameter of the artery and vein, arterial wall morphology, arterial blood flow, hyperaemic response, venous distensibility and venous blood flow. Proposed internal diameter of the artery was in range 1.5 to 2.5 mm and venous diameter 1.6 to 2 mm. Until today no consensus has been reached on reliable threshold value on vessel size. Reported cut-off values for studied parameters are inconsistent which might be explained by differences between research groups in measurement protocols and differences in the parameters measured. One might speculate that this inconsistency may be due to the use of different diagnostic modalities and measurement techniques. Differences probably are result of different ultrasound machine with different software and different conditions during measurements. Vessel diameter is one factor influencing the success of fistula creation to be used in conjunction with others for individualized decision-making for fistula creation. Because of poor reproducibility of venous diameter measurement and especially at low venous congestion pressure, measurement reproducibility of venous distensibility as a single parameter is inadequate. Arterial lesions could be located in the subclavian artery, axillary artery and even in the radial artery. It is recommended that radiologic evaluation comprise assessment of the complete arterial inflow not just that in immediate proximity to the anastomosis. The better predict vascular access outcome a combination of arterial, venous and cardiac parameters should be used instead of single parameter. While ultrasound provides an accurate assessment of peripheral vasculature, it does not provide direct visualization of the central veins. A weakness which could potentially result in development swelling associated with central vein stenosis after AVF placement. Vascular mapping is a way of evaluating of the arteries and veins for fistula creation. For optimal results combination of physical examination, ultrasound assessment and angiography are available.

ANEURYSMAL DEGENERATION OF THE DONOR ARTERY IN VASCULAR ACCESS: POTENTIAL RISKS AND TECHNICAL OPTIONS

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Introduction: While arterial dilatation of the donor artery is common after arteriovenous fistula (AVF), aneurysmal degeneration (AD) seems to be rare; we report 3 cases.


Patient #2 - A 34-year-old lady had a right ulnar artery to basilic vein fistula in 1997. Four years later, she had proximal ligation of the ulnar artery due to AD (24 mm) and high-flow (2.4 l/min). The ulnar aneurysm thrombosed 4 years later: no embolic event was noted. Patient #3 - In 1991, a 37-year-old man required a left radial artery to cephalic AVF at the wrist. Ligation of the proximal radial artery was performed in 2000 because of high-flow (2 l/min). Diagnosis of AD of the brachial artery in 2003 was confirmed by angiogram in 2005. The runoff was a normal ulnar artery initiating above the elbow, without evidence of ischemia. Angiogram evidenced an aneurysm of the brachial artery, thrombosed at the elbow, without distal emboli.

Conclusion: The rarity of AD after vascular access surgery may be due to limited life-expectancy of patients. As shown in Table I, diagnosis of AD occurs years after closure of the AVF, the major risk is distal emboli, and the risk of rupture seems low (one contained rupture diagnosed intraoperatively). Patients presenting with arteriomegaly should be carefully followed by an...
nual evaluation. Indications for surgery are distal emboli, or the presence of diseased forearm arteries. Vein bypass, when possible, should be preferred to prosthetic bypass, after excision of the diseased segment.

**TABLE I - AD AFTER VASCULAR ACCESS IN THE LITERATURE**

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**TABLE I - ESTIMATED ESRD PATIENTS ON RRT AND ITS TREATMENT MODALITIES 2001 - 2008, PATIENTS IN THOUSANDS (Sources: Moeller, NDT 2002; Grassmann, NDT 2005, Fresenius Medical Care 2009 modified)**

**49 VALUE AND LIMITS OF PREOPERATIVE IMAGING**

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**Introduction:** Before creation of an artery-venous fistula (AVF), careful selection of suitable vessels is necessary. The AVF should be created as distal as possible and as proximal as necessary to provide sufficient flow and patency and to avoid early failure and long-term complications. Due to the growing number of elderly, diabetic, and obese patients starting hemodialysis, preoperative imaging becomes more and more important in the planning of vascular access.

**Colour-Coded Duplex-Ultrasound:** Preoperative vessel assessment with ultrasonography has been shown to enhance the success rates of AVF creation. When performed carefully it brings important information on morphology and function of arm arteries and veins. From the available literature a minimal inner diameter of the anastomosed vessels (radial artery and cephalic vein) of 1.6 to 2.0 mm is advisable for the creation of successful radio-cephalic AVF. Critical minimal diameters of cubital and/or upper arm vessels for the creation of successful elbow/upper arm fistula creation have not yet been defined.

The predictive value of the radial artery peak systolic velocity and resistance index (RI), calculated from preoperative ultrasonographic parameters, is uncertain. However, Malovrh showed a significant correlation between radial artery RI, diameter, and flow during preoperative hyperemia testing and the outcome of AVF creation. The cephalic vein diameter increase after application of a proximal tourniquet also is an important predictor of success. Medial arterial and veins cannot be visualised completely. Therefore, when patient history or ultrasound indicate the possible existence of a central arterial or venous obstruction, additional radiological examination is necessary. Radiological Evaluation: In patients with a history of central vein cannulation, preoperative evaluation of mediaslinal veins should be considered. Conventional iodine arterio-venography and contrast-enhanced CT may cause permanent deterioration in renal function in patients with severe renal damage. Gadolinium-enhanced MR is associated with a low but significant risk of nephrogenic systemic fibrosis. CO2 arterio-venography or time-of-flight MRA can be less harmful alternatives, however, with lower resolution of image details, and especially CO2 angiography is not exhaustively available.

**50 PERIPHERAL VASCULAR ACCESS FOR HEMODIALYSIS: CORRELATION BETWEEN MDCT ANGIOGRAPHY, DSA AND DUPLEX**

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**Aims/Introduction:** The objective of our study was to assess the diagnostic value of 64-slice MDCT angiography in the evaluation of tailed peripheral vascular access (PVA) in comparison with conventional digital subtraction angiography (D SA) and doppler ultrasound study.
Patients and methods: MDCT angiography, DSA and US was performed in 26 dysfunctional hemodialysis fistulas and grafts in 23 consecutive patients. Images obtained with MDCT, DSA and US were interpreted by two MDCT radiologists and two interventional radiologists, respectively, who were blinded to information from each other and other studies. For MDCT, contrast was administered (1ml/Kg at 5ml/s) via a peripheral vein in the contralateral arm. Axial MIP, coronal MIP, and VRT images were obtained and reconstructed.

Sensitivity, specificity, positive and negative predictive values of contrast-enhanced MDCT in detection of vascular anomalies were determined (stenosis, occlusion, aneurysms and others).

Results: Sensitivity, specificity, positive and negative predictive values of MDCT for detection of significant stenoses or occlusions was 96%, 98%, 96% and 99% respectively.

Conclusion: 64-slice MDCT is a rapid, minimally invasive and an accurate technique for diagnosing vascular access site stenosis or occlusions but it is more expensive than standard doppler examinations.

However due to inability to perform CT-guided vascular access site intervention at present it has limited clinical value. Hence, it should be considered only if we suspect either a central arterial lesion or presence of a non-diagnostic or nonvisualised segment on DSA.


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Background: In 2003, the US Federal Health agency (CMS) funded the Fistula First Coalition which includes the CMS, Renal Network programs, dialysis providers, primary care physicians, nephrologists, surgeons, interventional radiologists/nephrologists, professional societies, quality improvement organizations, and patient advocacy groups. The initiative lead to a broad national partnership to ensure that more hemodialysis patients had the opportunity to receive an arteriovenous fistula (AVF). The initial goal of the Initiative was to attain a rate of AVF use in 40 percent of prevalent patients. This goal was reached in 2005. The 2009 Fistula First Breakthrough Initiative (FFBI) goal for prevalent AVF use was raised to 66%. There has been concern that attempts to reach maturity AVF did not affect mean time delay before AVF use. Hence, it should be considered only if we suspect either a central arterial lesion or presence of a non-diagnostic or nonvisualised segment on DSA.

Results:

<table>
<thead>
<tr>
<th></th>
<th>AVF in use</th>
<th>Avf placed (in use and maturing)</th>
<th>Graft</th>
<th>Total CVC</th>
</tr>
</thead>
<tbody>
<tr>
<td>July 2003</td>
<td>32.2%</td>
<td>38.4%</td>
<td>40%</td>
<td>26.9%</td>
</tr>
<tr>
<td>February 2010</td>
<td>54.8%</td>
<td>62.7%</td>
<td>20.6%</td>
<td>24.4%</td>
</tr>
</tbody>
</table>

Conclusion: both AVF in use and in place increased dramatically during the study period, while graft use decreased by half. The rate of maturing AVF (difference between AVF in place and in use) slightly increased during the study period (6.2 vs. 7.9). However, it’s possible that many of these maturing AVF might eventually mature with/revisions. The small increase in immature AVF did not affect patient outcome quality since total CVC actually dropped during this period. Nevertheless, current CVC use remains unacceptable high, which is partly due to high incident CVC use and persistent CVC use without AVF beyond the first 90 days of dialysis. Future FF policy should be aimed at reducing total CVC to 10% and at raising AVF target beyond 66%.

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Aims: The surgical creation of a-v fistulas is largely based upon tradition rather than scientific founded knowledge of theoretical ideal configurations. Whereas the dimensions of the available vessels cannot be modified, some physical parameters of the anastomosis can, e.g. the anastomotic length. Using Computational Fluid Dynamics (CFD) we investigated, in an idealized a-v fistula model, if a varied anastomotic length would exert some systematic influence on important fluid dynamic parameters such as time average wall shear stress (TAWSS) and oscillatory shear index (OSI).

Material and methods: Using computer aided design software, a three dimensional side-to-side a-v fistula model was created by fusing a 4 mm (artery) and a 6 mm (vein) curved tube through an elliptical anastomosis. By varying the length of the anastomosis from 5 to 15 mm with increments of 2.5 mm, five models were created with identical shapes except for the anastomotic length. The models were imported into the finite element software “COMSOL Multiphysics 3.4”. Flows in the models were simulated solving the Navier-Stokes equation and applying realistic volume flows in the tubes. The chosen volume flows were obtained from Phase Contrast MRI scans of a real side-to-side a-v fistula with dimensions similar to the models.

Results: The oscillatory shear index was calculated for each model revealing pronounced high OSI in the distal vein segment of the fistulas, and with minimal difference between the five anastomotic lengths. In the proximal vein oscillatory shear stress was almost absent. High levels of TAWSS (>5 Pa) were present in the proximal artery of all models. Levels of TAWSS below 1.5 Pa was not found.

Discussion: The clinically important proximal vein stenosis frequently seen in a-v fistulas could not simply be explained by localized high levels of OSI or low TAWSS in any of the fistula models. The much higher level of OSI in the distal vein segment, which in practice often appears well dimensioned, may lead to discus if OSI has any major importance in the development of vein stenosis in a-v fistulas.

52 A 17-YEAR-OLD CENTRAL VENOUS CATHETER FOR HEMODIALYSIS

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We reported a case of a 17-year-old central venous catheter (CVC) for haemodialysis.

Mrs B. born on Nov 1947, started chronic haemodialysis on May 1979. A native forearm arteriovenous fistula was created on April 1979. From 1979 to 1991 she developed severe high output heart failure which remained uncontrolled despite several surgical interventions for access flow reduction. In 1992 a cardiac catheterization confirmed a post capillary pulmonary hypertension (PH) and a systolic pulmonary artery pressure of 75 mmHg. On October 1992, a Hickman’s catheter was placed through the right internal jugular vein with the tip well-positioned into the right atrium and vascular access was ligated. The PH progressively reversed and no more episodes of right cardiac failure occurred. Only a few complications of the CVC were observed. On Mars 2002 an episode of CVC related Ralsitonia Picketti infection was successfully treated by systemic and intracatheter antibiotics. On December 2003 a perforation of the clamping zone was repaired by replacement of the CVC external
VALUE AND LIMITS OF ARTERIOVENOUS ACCESS MONITORING

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The risk for peripheral vascular access (VA) for HD is to develop a hemo-
dynamically active stenosis leading to reduction of access flow (Qa) and
thrombosis. The aim of VA monitoring is to reliably identify VA at high-risk
for thrombosis and define the optimal time for preemptive correction of the
causal lesion. The ideal tool would be easy to use, non invasive, have a high
sensitivity and a low false – positive rate. VA monitoring includes physical
examination, changes in dynamic arterial and venous pressures, static venous
pressure, online Qa monitoring, recirculation, Qs stress test. Physical exami-
nation and Qa monitoring remain the preferred tests. Physical examination is
time consuming, physician dependant and difficult to standardize. Measure-
ment of Qa has dramatically improved the surveillance of VA. Observational
studies had confirmed the cost-effectiveness of the method with reduction of
the thrombosis rate and reduction of VA costs despite the increase of the
angioplasties rate both in grafts and native AVF. Nevertheless randomized
prospective trials failed to confirm these observations in grafts, and monthly
flow monitoring did not seem more accurate than physical examination in
prevention of thrombosis. Randomized prospective trials bring some evid-
cence in favor of benefit of flow surveillance in addition to clinical monitor-
in native AVF. The difficulty to confirm the effectiveness of Qa monitoring in
AVF could be explain by the small number of randomized studies, weak
statistical power, inaccurate predictors, no distinction between distal and
proximal AVF, too long delay between indication and intervention. However,
in our experience, a stringent policy of identification of distal AVF at high-risk
for thrombosis, based on monthly Qa surveillance in addition with physical
examination, using an absolute Qa threshold value of 400-450 ml/min with
corrective intervention performed within a week resulted in a thrombosis rate
lower than 0,002/patient year.

LESSONS LEARNT FROM CULTURE OF CVC CONTENT

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Catheter (CVC) related infections are frequent and life-threatening com-
lications. To prevent them, early detection of CVC colonization was un-
tertaken from 1986 to 2010. CVC studied were definitive or permanent
CVC for haemodialysis, either dual catheters (Canaud’s catheters) or Per-
mach. Connections and disconnections during haemodialysis sessions
were performed by nurses with strict application of rules of hygiene. The
protocol of detection was based on monthly culture of the CVC content
(i.e. heparin and the 1st cc of blood) of each branch of the dialysis cath-
eter before starting a dialysis session; if the culture was positive, cultures
of the catheter contents were repeated before the next two sessions; if the
three consecutive cultures were positive CVC colonization was confirmed
and treatment was initiated. Treatment was commenced immediately if
there are systemic signs. Treatment was based on association of systemic
antibiotic treatment, antibiotic lock-solution and fibrinolytic treatment of
CVC. The results were: intra luminal colonization: 0,69 p 1000 CVC
days, bacteremia 0,21 p 1000 CVC days. The actuarial survival was 66%
at 36 months. The probability to be infection-free was 90%. A first posi-
tive culture was confirmed in the majority of the cases; pathogens were
mainly staphylococcus species. Treatment was effective. No death, no en-
docarditis occurred; only one epiduritis was observed. Some catheters
remains chronically colonized with relapses after 1 to 6 months after end
of treatment, needing repeated treatments and lock solution with higher
concentration of antibiotics. 3 CVC only were replaced for infectious rea-
sons. Identification of colonized CVC by routine culture of CVC content
followed by appropriate treatment allows to obtain a low CVC-related
bacteremia rate and prevents distant infectious localizations. Bacteremia
rate lower than 0,3 per 1000 CVC days can be achieved, contributing to
prolong the CVC lifespan which commonly reach several years.

RELATIONSHIP BETWEEN CARDIAC OUTPUT AND DISTAL AVF WITH
BLOOD FLOW LOWER THAN 2/L/MIN

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Background: A vascular access blood flow (Qa) higher than 2 l/min is consid-
ered as predictive for high-output cardiac failure. Deleterious cardiac conse-
quences of Qa < 2 l/min had not yet been documented.

Aim of the study: An observational study was carried out to estimate the re-
lationship between cardiac output (CO) and Qa measured by the ultrasound
dilution method (Transonic Haemodialysis Monitor HDQ2). CO, Qa, cardiac
index, central blood volume were measured during the first 90 min of a dialy-
sis session in 19 chronic haemodialysis patients with a distal AVF with Qa< 2
l/min. Cardiac situation was assessed by means of echocardiography. A score
of severity (from 0 to 4) was built for left ventricular diastolic diameter, ejec-
tion fraction and parietal thickness which resulted in a total score of cardiac
abnormalities (TSCA).

Results: No relation was observed between CO and Qa. CO was inversely
correlated with age (p=0.045). Qa was inversely correlated with the TSCA
(p=0.016). 3 groups of patients were identified according CO and ratio Qa/
CO distributions. The group 1 had CO > 4l/min and Qa/CO < 20% and was
considered as “normal” (n=9, Mean age 75 +/- 10 years), the group 2 had a
CO > 4l/min and Qa/CO > 20% and could be considered as “hyperkinetic”
(n=5, Mean age 65 +/- 12 years) and the group 3 with a CO < 4l/min and Qa/
CO > 20% was considered as “cardiac insufficient” (n=7, Mean age 87 +/- 5
years). The cardiac index was lower in 2l/min/m2 in the group 3; the Qa
was higher in the group 2 than in the other groups. No difference concerning
the central blood volume between the 3 groups was observed.

Conclusion: Measurement of CO and Qa by ultrasound dilution method
could allow identifying inadequate relationship between heart and AVF, and
contributing to diagnosis of either low or high-output cardiac failure. This
is the initial step before to consider specific strategy.

TECHNICAL SURGICAL REFINEMENTS ALLOWING TO MAXIMIZE SU-
CESSFUL DISTAL ANASTOMOSIS

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The main shortcoming of distal AVF is the high early failure rate, as largely re-
ported for this vascular access. Data from literature shows how thrombosis in
the anastomotic area and juxta-anastomotic vein stenosis are two of the main
causes of the immediate failure. These complication are those directly related
to the surgical procedure, whereas artery or mid /proximal vein stenosis may
reflect a pitfall in preoperative vessels evaluation.

The main challenge in performing a patent arteriovenous fistula with a distal
radial artery and cephalic vein, is represented by the small size of vessels.
The size by itself not representing an absolute limiting factor for a vascular
surgical procedure. A precise and less traumatic as possible handling and suturing of such a small
and fragile vascular structure is the key point for an haemodynamically cor-
rect anastomosis, that would lead to a mature fistula.

Two techniques are proposed for such a purpose: microsurgery and preven-
tive haemostasis.
Abstracts from Angio Access for Hemodialysis

The use of microsurgery for AV fistula offers many advantages: precise handling of vessels, suture positioning, and sharp intima-to-intima vessel–wall apposition. The extreme precision allowed by the use of microsurgery favours the respect of vessel anatomy, and thereby the functional role played by the endothelial cell layer in fistula maturation. Preventive haemostasis ameliorates the operative field visualization. Vascular clamps are therefore unnecessary, thus further reducing traumatism to the vascular wall, and the radial artery is less likely to be dissected. The brachial plexus block, needed for the use of an inflatable tourniquet, has a further advantage of inducing vasodilatation. We still lack prospective RCT, but the results reported up to date in literature favour the use of these techniques to maximize a successful distal anastomosis. We should not ignore, by a translational meaning, how cardiovascular and plastic-reconstructive surgeons - facing vessels of the same size – successfully moved to microsurgical techniques long time ago. A spread in their use would produce a large amount of data that could help us in definitely clarify their contribution in reducing the early failure rate.

58 MICROSURGERY FOR RADIO-CEPHALIC DIRECT WRIST ACCESS IN THE ELDERLY

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Introduction and aims: Guidelines recommend the radio-cephalic direct wrist access (RCAVF) as the first-choice for dialysis. Concern has been raised, however, that this is not appropriate for all age groups. A recent meta-analysis showed an increased risk of failure of RCAVs in pt > 65 years suggesting the brachio-cephalic elbow access (BCAVFs) as first choice in elderly pts when planning access surgery. Microsurgery however is demonstrating outstanding results on vascular access surgery, allowing high prevalence of functional distal access with acceptable risk of early failure. We evaluated the results of microsurgery in RC-AVF creation in patients >70 years.

Materials and methods: We reviewed the incident pts referred for vascular access creation from Nov 2004 to Nov 2008. We observed the prevalent causes of RCAFV, early failure rate, 1year primary and secondary patency of 83 pts>70y.

Patients data are as follow: Number 83pts; age (mean +/- DS) 77.7 +/-5; hypertension 90.3%; diabetes 30.1%; obesity 21.6%; vascular disease 72.2%. Regarding renal function: 57% of pts were in conservative treatment (mean creatinine clearance of 10 +/- 2.4 ml/min), while 43% were in dialysis due to chronic renal failure (CRF) at the time of the study performed. Overall mortality rate at 1-year was 14.4%. Conclusions: In this series microsurgery allowed the creation of RCAFV in the elderly with acceptable risk of early failure and good long term patency. Further study would help to better define this very promising results.

60 SURGICAL TREATMENT OF ANEURYSMS AND FALSE ANEURYSMS

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Aneurysms are common complications of AVFs. The frequency ranges between 0 and 6%. Aneurysm formation is favored by stenosis; or, as a consequence of weakened venous walls from repeated cannulations, and often from a combination of both. Observations and results are based on a 10-year study (2000 to 2010) involving 2213 patients (1254 women and 919 men), of which 28 percent were diabetics. This study also represents a total of 2854 surgical interventions, more than the number of patients because some patients required several surgeries, and 86 aneurysms (3.8%) operated. Study results indicate that aneurysms represent the third highest cause of complications after stenosis and thrombosis. The majority of aneurysms require no surgical treatment. Treatment is needed in thrombosed aneurysms in order to rescue vascular access, as well as for ruptured aneurysms, infected aneurysms, painful aneurysms and false aneurysms. The type of surgical intervention required will depend of the location of the aneurysm, the condition of the skin as well as the condition of the fistula. Aneurysm location: radio cephalic AVF – 39, cubital basilic - 4, brachio cephalic - 13, brachio basilic - 8, arm straight bypass - 2. Four different types of surgical procedures were used: Resection with AVF ligation (27 patients operated); Resection with AVF ligation, and partial resection and reconstruction of blood vessel over the fistula (7 patients operated). Partial resection and reconstruction of blood vessel over the fistula (7 patients operated). Of the 17 operated patients, the track was lost of 5. Seven years later, 2 AVFs are still functional. Resection of aneurysm and creation of a new arteriovenous anastomosis (18 patients operated). Of the 18 patients, the track was lost of 12; follow up was possible for 26.
Nine years later, 5 AVFs are still functional. False aneurysms (16 patients operated) are often caused by transfusing punctures of the vein, resulting from inappropriate compression or needle withdrawal; or, as a result of puncturing of the artery. False aneurysm may be venous or arterial. Both require urgent surgical intervention.

61 THE BUTTONHOLE TECHNIQUE - SUMMARY OF AN EXPERIENCE IN MOROCCO

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The Buttonhole technique (BH) is a method of puncturing AVF where the same point of puncture and alignment are used in consecutive dialysis sessions. It was described by Z. Twardowski and H. Kubara in 1977. BH consists of creating a tunnel measuring a few millimeters between the skin surface and wall of the AVF. This tunnel will enable cannulation the AVF repeatedly at the exact same location, same angle and depth. Some myths regarding the BH include: The BH is used only in auto-dialysis, the BH may only be use with new AVF, cannulation in the same location can cause aneuryms and hemostasis takes more time. All above are false.

The following are cited as barriers to the BH: Patients with a lot of sub-cutaneous fat, with mobile veins, presence of scar tissue on the arterialized vein, the staffing patterns within the hemodialysis units. Those limitations are valid for all puncture techniques.

Complications: Oozing from the needle sites during dialysis and the “trampoline” effect.

Benefits of BH: Preservation of a high quality vein for a future surgical intervention, less time required for needle insertion, lower rate of failed cannulations, important reduction in the frequency of hematoma, lengthened AVF life.

The BH is just another method of inserting needles into an AV fistula. It should not cause a decrease in blood flow rates, in machine pressures or a decrease in adequacy.

For 12 years we have cannulated all our new patients or new AVF using this technique. After the first five years, we compared two equivalent groups: The first group with the traditional cannulation and the second using the BH. There were no significant differences in regards to rates of infection, bleeding, or time needed for hemostasis follows each session. This study showed that the BH group experienced lesser pain and no aneurysm. Five years later we re-evaluated the remaining BH dialysis patients. Compression times remained the same, no aneuryms and only 5 infections developed at the sites of cannulations.

The BH presents numerous advantages compared to the traditional cannulation and merits being attempted in each hemodialysis center. The authors of this paper are convinced that after a trial period it will be preferred and adopted not only by the staff but also by the patients.

62 DILATATION OF RADIAL ARTERIES IN IMMATURE DISTAL AVF

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The main disadvantage of distal accesses is their high risk of maturation failure. Forearm artery arteriosclerosis may explain up to 30% of such failures. Surgical treatment in such cases is unsatisfactory and may lead to the loss of the forearm fistula except when it is possible to redo the arteriovenous anastomosis a few centimeters higher up at the forearm. For this, only a short segment of the radial artery close to the anastomosis should be affected, which is actually not frequent. Percutaneous Transluminal Angioplasty (PTA) should be performed when a radioccephalic fistula fails to develop because of radial arteriosclerosis. Even very long lesions of the radial artery are amenable to this technique because the high flow due to the access decreases the risk of early thrombosis and favors arterial remodeling. PTA is very effective, leading, in most patients, to normal development of the fistula by increasing its flow. In a recently published series, 91% of accesses could be used for hemodialysis without difficulty; the primary patency access rates after PTA were 83% (range, 60%-93%) at 1 year and 74% (range, 47%-89%) at 2 years, and the secondary access patency rates were 86% (range, 64%-95%) at 1 and 3 years. The main risk associated with PTA is arterial rupture. In nearly all cases where rupture occurred they were mild and easily controlled by prolonged low-pressure inflation of the balloon. Their main risk is evolution to a false aneurysm.

Conclusion: when a distal access fails to mature because of forearm artery lesions, PTA will salvage the fistula without risk of distal ischemia and/or of cardiac failure and without jeopardizing further proximal access creation. The efficacy of PTA clearly influences the surgical strategy and is a major argument in favor of attempting to create distal accesses in patients with mild distal artery arteriosclerosis. Creation of forearm accesses should be avoided only in cases of extremely severe distal artery lesions.

63a ANGIOGRAPHY FOR DISTAL ISCHEMIA AND ROLE OF ANGIOPLASTY IN FOREARM ARTERIES

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Three associated mechanisms can explain the occurrence of distal ischemia in patients with an angioaccess for hemodialysis. These are venous pressure that is too high, arterial lesions and steal. Angiography is often necessary to evaluate these mechanisms accurately and to select the best treatment. It should visualize arteries from the subclavian artery to the palmar arches and the veins from the inflow to the venae cavae. It should first rule out arterial lesions whose effects on hand supply need to be evaluated according to their location and the hemodynamics which are highly modified by the access.

In patients with a radioccephalic fistula, the radial artery feeds the access and the ulnar artery supplies the hand. Dilatation of the radial artery increases the flow in the access (but not the steal) and very slightly improves hand supply. In contrast, dilatation of the ulnar artery does not increase the flow in the access but improves hand supply and may cure ischemia. Ulnar artery angioplasty should be performed when feasible. In other cases, treatments available for distal ischemia are access closure or distal radial artery ligation in order to stop the steal.

When a distal access fails to mature or when its flow is too low, arterial lesions should be sought by angiogram, and angioplasty of such lesions should be performed when identified to restore satisfactory function of the access. Even very long lesions of small forearm arteries are amenable to such treatment, which provides satisfactory results in the long term, the high flow due to the access decreasing the risk of thrombosis and favoring remodeling after dilatation. Angioplasty often prevents the occurrence of distal ischemia by salvaging the access and avoiding the creation of a proximal access. The latter are frequently complicated by ischemia in patients with arteriosclerosis of the forearm arteries.

In contrast, dilatation of a forearm artery is at high risk and has no effect on hand supply in patients with a brachial access. Conclusion: forearm artery dilatation can cure distal ischemia in a few patients but it prevents many cases of distal ischemia by salvaging low flow distal accesses and avoiding creation of proximal access in patients with arteriosclerosis.

63b STENOSIS OF THE FINAL ARCH OF THE CEPHALIC VEIN, TREATMENT BY PERCUTANEOUS TRANSLUMINAL ANGIOPLASTY

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The main complication of brachiocephalic accesses is the occurrence of a
stenosis of the cephalic arch. Such a lesion increases the pressure in the access, causing many complications such as aneurysmal development of the access, complications at the puncture site (bleeding, false aneurysm, spot of necrosis) and may lead to an acute thrombosis of the fistula. Therefore a stenosis of the cephalic arch should be treated and the first choice treatment is percutaneous transluminal angioplasty (PTA). However PTA is contraindicated when the flow in the access is too high because it increases the flow in the fistula and in case of distal ischemia because it major the steal. In other cases, the dilatation should be performed as in any other site on an access. It carries a slightly higher risk of ruptures which are usually easily treated by low-pressure prolonged balloon inflation; in case of failure, the implantation of a stent will stop the bleeding and will restore a satisfactory patency of the access. A stent can also be placed in case of recoil of the stenosis after deflation of a balloon of a sufficient size. Following PTA, an early recurrence of the stenoses and restenoses seems frequent; in such cases (span inferior to 4 months in our institute) the implantation of a stent may increase the interval between the restenoses; covered stents seem to have give slightly better results than bare stents, for the former restenosis are more frequent on the edge of the stent and for the latter into the stent. Whatever the indication of stenting of the cephalic arch is, an endoprothesis should never protrude into the subclavian. A protruding stent will lead to a stenosis of the subclavian contraindicating any further creation of brachiocephalic fistula or arteriovenous graft at this limb. In case of early recurrent restenoses a surgical transposition of the access can be considered; it requires a cephalic vein of good quality without other stenosis and normally patent central veins.

Conclusion: In this observation, several factors had been contributing to the AVF's thrombosis. But in spite of the management of post exchange hypercoagulability, it is also necessary to always look for a stenosis according to the adage: "no thrombosis without stenosis".
5% of cases: 3 local hematoma and 1 ischemic cerebral stroke. There were no infectious complication and no systemic bleeding complication. Post-in situ thrombolysis angioplasties were performed in 53% of cases. During the study for the 31 patients included they had 2.4 ± 2.6 VA angioplasties per patient (PP), 0.3 ± 0.4 catheters for HD PP and 2.3 ± 2.4 in situ thrombolysis procedures PP. At the end of the study 18 of 31 patients had a still functioning VA. 8 patients have died of unrelated causes.

Conclusion: In situ thrombolysis provides a useful means of preservation of VA. In our centre in situ thrombolysis is used as the therapy of first choice in dialysis patients without active bleeding or high bleeding risk. This technique usually allows to perform the dialysis session while waiting for endovascular procedure.

66 CVC: RELATIONSHIP BETWEEN INFECTION AND THROMBOSIS
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Introduction: Central venous catheters (CVCs) remain undesirable tools for dialysis-access due to their inherent complications of Infection and thrombosis causing catheter - dysfunction and limited CVC - lifespan. The catheter surface represents the real battlefield between the microorganisms and the body's defence mechanisms. Corroborative data suggest that there is a close relationship between the infectious and thrombotic complications of CVCs.

Methods: Intraluminal bacterial contamination and subsequent colonization of CVCs involves the formation of fibrin sheath and the biofilm. The proteins present in the ‘slime’ (e.g. fibrin, fibrinogen, fibronectin) act as adhesins that promote platelet adhesion, aggregation and induce cascade of thrombogenesis besides providing a protected environment for bacterial multiplication eventually leading to catheter-related bloodstream infection (CRBSI). Likewise, preexisting fibrin sheath or platelet thromb may provide nidus for the bacterial adherence, colonization and subsequent development of CRBSI.

Results: Recent studies suggest that the prevention of biofilm formation through intraluminal catheter-restricted filling of antimicrobial / anticoagulant solutions (e.g. gentamicin/ cefotaxime in combination with heparin/ citrate) could significantly reduce the incidence of catheter - thrombosis and CRBSI with an ensuing increase in the lifespan of CVCs.

Conclusion: The placement of intraluminal ‘lock’ solutions could generate a microenvironment hostile to invading microorganisms with consequent down regulation of the bacterial biofilm formation, platelet adhesion and consequent coagulation activation.

67 THE BRACHIAL VEIN-BRACHIAL ARTERY AV-FISTULA
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Introduction: Autogenous AV fistulas (AVF) have been proved to be more durable, have less complications, and be less expensive to take care of than AV grafts (AVG). A limiting factor in terms of having a high prevalence rate are the complications that have been utilized. The simplest and most direct means of treating the ischemic steal is the ligation of the outflow of the fistula (drawback is elimination of the fistula outflow). Clinically it can manifest with either mild symptoms (coolness, paraesthesia and absence of distal pulses), or severe symptoms (rest pain, severe paresthesia, paralysis, cyanosis and gangrene) immediately after construction of the AV access or later after its inception.

Diagnosis is based on clinical manifestations, aided by the vascular laboratory and angiography.

Treatment: Mild cases can be observed closely; most of them will reverse in a few weeks. If the ischemic manifestations are severe and threaten the viability of the limb, urgent surgical treatment is required. Several techniques have been utilized. The simplest and most direct means of treating the ischemic steal is the ligation of the outflow of the fistula (drawback is elimination of the fistula outflow). Another widely used technique is “banding”. It consists of producing a stenosis in the outflow portion of the AV fistula/ AV graft, close to the anastomosis. Rational is to increase fistula resistance and eliminate steal. Problem with this technique is the high rate of post-procedure thrombosis of the access. Elongation of the access is another technique with similar rational and problems. In 1988 we reported a technique that consists of ligation of the artery just distal to the take-off of the AV fistula or AV graft and an arterial bypass to the artery distal to the ligation. This technique has received the name “DRIL” (Distal Revascularization Interval Ligation). Results have been excellent, with immediate reversal of the ischemic condition while maintaining function of the access. Several large series reports have confirmed our results. Recently, a technique that uses elongation of the access and transfer of the anastomosis to the axillary artery (proximalization) has been reported to give good results.

Corroboration by other groups is still missing.

Conclusion: In our view, at this time, DRIL is the procedure of choice for the correction of AV fistula/ AV graft induced ischemic steal.

68 CLINICAL PROBLEMS AND INDICATIONS FOR TREATMENT OF STEAL SYNDROME
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Severe ischemic steal secondary to a hemodialysis arterio-venous access occurs in approximately 1% to 4% of cases. The pathophysiological basis of this condition is a marked decrease or reversal of flow in the arterial segment distal to the AV fistula or AV graft induced by the low resistance of the fistula outflow. Clinically it can manifest with either mild symptoms (coolness, paraesthesia and absence of distal pulses), or severe symptoms (rest pain, severe paresthesia, paralysis, cyanosis and gangrene) immediately after construction of the AV access or later after its inception.

Diagnosis is based on clinical manifestations, aided by the vascular laboratory and angiography. Treatment: Mild cases can be observed closely; most of them will reverse in a few weeks. If the ischemic manifestations are severe and threaten the viability of the limb, urgent surgical treatment is required. Several techniques have been utilized. The simplest and most direct means of treating the ischemic steal is the ligation of the outflow of the fistula (drawback is elimination of the fistula outflow). Another widely used technique is “banding”. It consists of producing a stenosis in the outflow portion of the AV fistula/ AV graft, close to the anastomosis. Rational is to increase fistula resistance and eliminate steal. Problem with this technique is the high rate of post-procedure thrombosis of the access. Elongation of the access is another technique with similar rational and problems. In 1988 we reported a technique that consists of ligation of the artery just distal to the take-off of the AV fistula or AV graft and an arterial bypass to the artery distal to the ligation. This technique has received the name “DRIL” (Distal Revascularization Interval Ligation). Results have been excellent, with immediate reversal of the ischemic condition while maintaining function of the access. Several large series reports have confirmed our results. Recently, a technique that uses elongation of the access and transfer of the anastomosis to the axillary artery (proximalization) has been reported to give good results.

Corroboration by other groups is still missing.

Conclusion: In our view, at this time, DRIL is the procedure of choice for the correction of AV fistula/ AV graft induced ischemic steal.

69 STAPHYLOCOCCUS CARRIAGE: CONSEQUENCES AND PREVENTION
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End-stage renal disease (ESRD) patients on maintenance haemodialysis are at a greater risk for bacterial infection, particularly with Staphylococcus aureus (S. aureus). The annual incidence of S. aureus bacteraemia in this patient population ranges from 6 to 27%. The incidence of invasive methicillin-resistant Staphylococcus aureus (MRSA) infections is 100 times greater among haemodialysis
patients compared to the general population. By comparison with infections by other organisms, S. aureus bacteraemia, particularly MRSA blood-stream infection, carries a greater risk for morbidity and mortality and imposes considerable costs on the health care system. Despite catheter access being the primary risk for blood stream infection, patients with specific characteristics are at higher risk, and nasal colonization with S. aureus generally precedes invasive infection.

Nasal carriage rates of S. aureus and MRSA in haemodialysis patients are high, but colonization with MRSA was found to be associated with a 4-fold increased risk of infection. Acknowledged risk factors for nasal carriage of MRSA are high age (>75 years), diabetes mellitus, the immunocompromised state, preceding hospitalisation and repeated administration of antibiotics.

Given the considerable morbidity and mortality increase associated with methicillin resistance of S. aureus infections, there is a need for effective strategies to prevent and eradicate MRSA carriage/infection. Confronted with the question “MRSA: total war or tolerance?” we implemented a comprehensive infection control practice in our out-patient dialysis centre. Routine screening for MRSA carriage was performed in all patients entering the dialysis centre, with the purpose of early detection of patients at risk for infection. Mupirocin ointment was given to all patients with nasal colonization (long-term success rate 95%). Patients with wounds were closely monitored for bacterial infections. Central to the infection control practice to prevent transmission of MRSA was forceful standardized hand hygiene combined with the stringent use of gloves, gowns and facial masks for care of patients with catheter access. Colonized or infected patients were treated in a separate ward (isolation ward).

Invasive infections. Central to the infection control practice to prevent transmission of MRSA was forceful standardized hand hygiene combined with the stringent use of gloves, gowns and facial masks for care of patients with catheter access. Colonized or infected patients were treated in a separate ward (isolation ward).

The role of longitudinal MRSA screening and eradication therapy with mupirocin was forceful standardized hand hygiene combined with the stringent use of gloves, gowns and facial masks for care of patients with catheter access. Colonized or infected patients were treated in a separate ward (isolation ward).

In the context of options to prevent transmission of MRSA, successful strategies have been reported. These include hand washing compliance, the use of alcohol-based hand rubs, and the implementation of relevant infection control protocols. Nevertheless, the overall effectiveness of these strategies remains a matter of concern. Therefore, we assess the impact of infection control measures on the incidence of MRSA bloodstream infections in a 3-year follow-up period at our centre.

Introduction: Improvements in haemodialysis access survival have led to an increase in the prevalence of ESRD patients outlasting their fistula or graft. This has led to an increase in repeat procedures per patient in order to create additional access sites. In some patients, exhaustion of traditional vascular access has prompted the surgeon to become more resourceful, creating fistulas and grafts that are rather ‘exotic.’

Methods: A PubMed literature search was performed for unusual case reports or series of arteriovenous fistulas and grafts placed in ESRD patients for the purpose of hemodialysis access. Seven published reports were chosen for presentation based on teaching point value.

Results: Of the novel approaches, we report the formation of one or more of axillary-internal jugular, ipsilateral axillary-axillary, “necklace” configuration axillary-axillary, femoro-femoral, axillo-iliac, veno-venous axillo-iliac, SFA-right atrial, and axillo-renal approaches that have been successfully anaesthesised. Reported patencies varied, but all cases demonstrated promising outcomes.

Conclusion: These unusual cases presented can serve as teaching points for even the most experienced vascular surgeon. When choosing where to place access in these often complicated patients, the surgeon must always weigh the morbidity of the procedure versus potential benefit. Close consideration to functional flow rates and ease of cannulation must always be considered. Despite exhaustion of traditional vascular access sites, such as the upper and lower extremities, a little ingenuity on the part of the surgeon can go a long way towards bridging their patients to transplant.
SURGICAL TECHNIQUES FOR TREATMENT OF STEAL SYNDROME

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The purpose of treatment of hand ischemia related to functioning angiaccess is to relieve ischemic symptoms, while preserving the vascular access. The choice of the more appropriate technique should be based upon the location of the arterio-venous fistula (AVF) and the underlying hemodynamic mechanisms of ischemia that include reversal of flow and/or distal arteriopathy with lack or absence of collaterals. Most patients do not have fistula high flow so that surgical techniques should focus on increasing blood pressure and flow to the hand rather than decreasing flow through the fistula. The results obtained with techniques aimed to reduce flow through the AVF have been disappointing and have abandoned by most authors. The various surgical techniques designed to treat ischemia and to preserve the access include (1) distal radial artery ligation below a end-to-side radiocephalic AVF to treat reversal of flow; (2) techniques aimed to improve blood flow the hand ie, DRIL (Distal Revascularization-Interval Ligation), PAI (Proximalization of the Arterial Inflow) or PAVA (Proximalization of Arterio-Venous Anastomosis). When severe ischemia occurs distal to a end-to-side radiocephalic fistula, ligation of the distal radial artery and the DRIL procedure can be used based upon the status of the ulnar and the digital arteries. In patients with patent ulnar and digital arteries, occlusion of the distal radial artery below the fistula by ligation or embolization is a easy and simple way of treating the ischemic steal syndrome related to reversal of flow. The DRIL technique should be performed at the wrist level in presence of severe digital arteriopathy.

At the elbow level, ischemia is mainly related to forearm and digital arteriopathy and techniques such as the DRIL and the PAVA or the PAI can be used to improve distal flow to the hand. The DRIL technique includes bypass with anastomoses above and immediately below the fistula, followed by ligation of the artery between the fistula and the distal bypass anastomosis. This technique increases distal arterial flow by establishing antegrade flow to the hand and by eliminating retrograde flow without degradation of the fistula parameters.

Data from our experience and from the literature, with an increasing numbers of publications, suggest that the DRIL is the most effective and durable treatment, compared to others techniques, with a success rate approaching 90% in terms of cure or relief of symptoms, bypass patency and maintenance of vascular access.

The PAVA or PAI techniques have been described only by few authors with a limited number of patients and are aimed to shift the anastomosis more proximally without arterial ligation. These techniques can be a valuable alternative for surgeons who are reluctant to ligature the brachial artery. However, flow model studies have shown that the greatest increase in distal flow was achieved by the DRIL, compared to the PAVA or PAI technique. Ligation of the AVF is an option in patients with severe arterial lesions and poor cardiac conditions or after kidney transplant.

FIBRIN SHEATH: HOW TO TREAT IT

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Introduction:
• Fibrin sheath histology/formation
• Time frame for formation
• What it causes
• Decreased catheter flow at dialysis
• Increased recirculation
• Catheter occlusion
• Central vein obstruction (especially with AICD/Pacemaker electrodes)
• ± Arm/leg swelling
• ± SVC syndrome

Patients and methods:
Diagnosis:
• Contrast angio through catheter or introducer sheath
• Echo (a catheter pullback) for suspected atrial thrombus

Treatment options:
• Catheter exchange
• Guide wire disruption
• Fibrin sheath stripping
• Balloon disruption
• Cutting balloon + balloon disruption
• Angioplasty of stenoses/occlusions

Techniques:
• 11 Fr or larger introducer sheath
• Place guide wire distally (IVC) to maintain access
• 14 or 16mm balloon for innominate veins, SVC
• F/U angio: Confirm straight line antegrade flow to the RA, no preferential filling of the azygos vein and no occlusion.
• If fibrin sheath is too constrictive and won’t disrupt, use 8mm cutting balloon to score the sheath, then follow with larger balloon.

Results:
• Variable, by technique and from patient to patient
• Sheath reforms very quickly
• Single versus split/dual catheters
• Anticoagulation

CENTRAL VENOUS CATHETER PLACEMENT: TECHNICAL CHALLENGES

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Introduction
History and evaluation
Prior Surgery:
• Cancer, cardiac, thoracic, trauma
Prior Central Vein access/devices:
• Type of access/device (non-tunneled/tunneled catheters, port, pacemaker, defibrillator)
• Location, how long
• Known difficulty cannulating central veins
• Known occlusions
• Prior catheter removal for sepsis
• Prior central vein stents
Prior AV access creation:
• Site, Longevity, Problems
• Reason for abandonment
Physical Exam:
• Scars from prior access, devices
• Chest wall collaterals, swollen arm, SVC syndrome
Labs, Imaging:
• Coagulation profile, CBC, electrolytes
• Prior studies [CT/MR/Angio, CXR (stents, devices)]
• Ultrasound (gray-scale, color Duplex imaging++)
Access site inventory:
• Available sites
• Thrombosed, unusable sites
Access strategy:
• Short term/long term access
• Pain management (sedation) +++
Abstracts from Angio Access for Hemodialysis

73 HOW TO AVOID HEMORRHAGIC COMPLICATIONS DURING COMBINED ANTITHROMBOTIC PROPHYLAXIS OF HEMODIALYSIS VASCULAR ACCESS

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Introduction/Aim: High bleeding tendency during combined (warfarin plus antiplatelet therapy) antithrombotic treatment remains the problem in chronic hemodialysis (HD) patients. The aim of this study was to determine the optimal dose of permanent anticoagulant prophylaxis (PAP) combined with intermittent antiplatelet therapy (APL).

Patients and methods: We investigated 127 pts on maintenance HD (mean time on dialysis 2.8 years). All pts had native arterio-venous fistula (AVF). We employed the rotational thromboelastography (ROTEM, Pentapharm) for evaluation of blood coagulation (“Y” – reaction time; normal range: 640 – 900 s) and fibrinolysis (normal range: 70 – 130%). APL (Vasonit - pentoxifylline, 300-600 mg) was started 4-6 hours after cessation of HD and was repeated only on the second day (300-600 mg). Pts treated with PAP (warfarin-Nycomed) were divided into three groups: Group 1 had INR below 1.5, Group 2 – between 1.5-2.0 and Group 3 – above 2.0.

Results: Table I presents data of our investigation. These data demonstrate that the main difference between Group 1 and Group 2 is more active fibrinolysis (p < 0.05), and hence only 3 minor vs 12 minor hemorrhagic events, respectively. The pts of Group 3 have marked hypocoagulability of blood and hyperfibrinolysis (correlation coefficient, r = 0.45, p < 0.3), and hence have had 21 minor and 3 major hemorrhagic events. No AVF thrombosis was encountered during the follow-up (24 ± 8 months) in all three groups.

In conclusion: Thromboelastography provides a new methodology to estimate adequacy of combined antithrombotic prophylaxis in HD pts with minimum risk of hemorrhagic complications. The optimal dose of warfarin is INR level below 1.3. Hyperfibrinolysis may be one of the main reasons of bleeding in HD pts.

<table>
<thead>
<tr>
<th>INR</th>
<th>TEG r (s)</th>
<th>fibrinolysis (%)</th>
<th>INR</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 1.5</td>
<td>674±134</td>
<td>66 ±30</td>
<td>1,25 ±0,11</td>
</tr>
<tr>
<td>1.5 – 2</td>
<td>703±127</td>
<td>114±25</td>
<td>p&lt;0.05</td>
</tr>
<tr>
<td>&gt; 2</td>
<td>1686±17,7</td>
<td>197±61</td>
<td>p&lt;0.05</td>
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74 EVOLUTION OF VASCULAR ACCESS FOR HEMODIALYSIS AFTER 10 YEARS

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Introduction: Hemodialysis is one of the main methods of extra-renal purification in our context given the lack of cadaveric kidney transplantation. The arteriovenous fistula (AVF) is the vascular access of choice for the realization of hemodialysis thanks of its longevity.

Aim: To evaluate the evolution of the AVF after 10 years of dialysis and to determine its various complications and their treatment.

Materials and methods: A retrospective study including all patients chronic hemodialysis for a minimum of 10 years. For these patients, we analyzed demographic, clinical and biological parameters and the characteristics of the AVF of each patient to describe the evolution of the AVF after 10 years of hemodialysis.

Results: We collected 39 patients with a more than 10 years duration of hemodialysis. Average age was 48 ± 13 years with a sex ratio = 0.56. The average length of hemodialysis was 15.5 ± 5.3 years. Two thirds of patients are dialyzed 12h/week, 3 sessions per week with a flow rate of the blood pump from 250 to 350 ml / min. The AVF is punctured by needles 16G in all patients. Twenty-one patients (53.8%) had one native AVF that is still functional. It is a left radial AVF in 92% of cases. Seven patients (17.9%) required the preparation of a 2nd AVF, often in the arm. Five patients (12.8%) have benefited from making a 3rd AVF, often at the contralateral arm. Five other patients have required the preparation of a 4th AVF. One patient benefited from making a 5th femoral AVF and popliteal AVF and peritoneal dialysis for 6 months because the exhaustion of all vascular sites. The 2nd AVF was performed for thrombosis of the 1st AVF in 13 cases: 5 thromboses occurred after 10 years of dialysis and 8 before 10 years of dialysis. These thromboses usually occurred on preexisting stenosis. Aneurysms of the AVF are more common after 10 years of dialysis: 3 cases of aneurysm occurred after 10 years of dialysis versus 1 case at 3 years of dialysis.

Conclusion: The AVF in chronic hemodialysis remains the generally functional after a long period of dialysis in our series.
ed fibrosis. A right external jugular venous single lumen Shaldon catheter was placed in January 2010. Finally, PD catheter was inserted in February 2010. These rescue vascular accesses using Shaldon catheters had permitted a one-year dialysis with correct 3-time weekly sessions.

76b

COMPUTATIONAL SIMULATION TO PREDICT MATURATION

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Despite the use of preoperative vessel assessment with ultrasonography to outline the strategy for access creation, still a high number of forearm arteriovenous fistulae (AVF) fails or do not mature. Prediction of blood flow enhancement after surgery may help to define whether fistulae will successfully mature and be functional for hemodialysis (HD) treatment. Therefore a patient-specific computational model is developed to calculate postoperative fistula flows.

Objectives: The European ARCH project develops image-based patient-specific computational modeling tools to simulate hemodynamic changes induced by AVF surgery and long-term vascular and cardiac adaptation. The modeling tools is designed and experimentally validated to predict AVF function for improvement of surgical planning and AVF management. Verification of model prediction of AVF maturation and patency is performed on the basis of prospective observational studies in HD patients. The basic tools and data produced in the context of the project will be made available under open-source licenses.

Methods: The model is preoperatively adapted to patient-specific conditions by determining patient vascular diameters, cardiac output, arterial distensibility, venous compliance, and brachial- and finger blood pressure using MRI, duplex ultrasonography and continuous waveform pressure measurements. Both forearm and upper arm AVF configurations are simulated to consider to be an surgical option with high success in terms of postoperative flow enhancement and maturation. The model will suggest the most distal AVF location which will be highly successful as a functional access.

Results: The postoperative fistula flow, measured by ultrasonography, correlated well to the simulated flow in a cohort of patients with newly created AVF in the forearm and upper arm. All patients with one week postoperative flows above 400 cc/min were successfully cannulated and dialysed within 3 months.

Conclusion: A patient-specific computational model may assist the surgeon in selecting the preferred AVF location with the best chance on flow enhancement and thus maturation.

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NAVIGATING OUR WAY THROUGH THE MAZE OF PUBLISHED EVIDENCE

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The 21st century has been dubbed “the era of evidence based medicine” and evidence basis is increasingly being used not only to guide practice but to determine health care policy and reimbursement. Modern health care practitioners must be aware of the various levels of evidence, often referred to as the “evidence pyramid”, topped by prospective randomized trials, as well as how systematic reviews evaluate multiple ideally randomized trials, eliminating those with significant flaws in design or execution, and top a second “evidence pyramid” that literally sits atop the first. Depending upon the depth and strength of the evidence, recommendations for practice are assigned numerical values, with level 1A being the highest level and 4 the lowest. Such recommendations form the basis of practice guidelines such as KDOQI. In an ideal evidence-based practice, systematic reviews or at least multiple randomized trials would be available to guide every decision we make. In actual practice, however, available evidence is often lacking or absent, and part of the “art of medicine” is the blending of available evidence and experience to treat our patients.

In the field of hemodialysis access, there is a growing body of evidence basis to help guide our practice. In fact, hemodialysis access should be well suited to evidence basis, given the large numbers of patients and relative uniformity of disease. Yet, as clearly shown by all three versions of the KDOQI as well as European, Asian and similar guidelines, the number of level 1 recommendations is very low, and the vast majority of our work is based on at best level 2 (and often 2C) recommendations. In this field in particular, the problem is compounded by the publication of research in three main groups of journals (surgery, radiology and nephrology), making it difficult for an interventionalist to stay abreast of developments. Further, and for unclear motives, there has been a trend for some authors to fail to cite existing literature from other journal groups, when even a simple PubMed search readily yields these citations. Finally, the sheer volume of emerging literature can be overwhelming to even the most dedicated evidence-based practitioner.

How then does a physician navigate this maze? There is no question that practice guideline documents such as KDOQI, with their multidisciplinary approach, are the best resource, and to the extent that high-level and current recommendations exist in those documents, they should be observed routine. Where recommendations do not exist, or practice guidelines are outdated, the next best source is the primary literature; with the ubiquitous PC and even iPhone, a quick PubMed search takes only a few seconds and may yield a recent (preferably randomized) trial to help guide care. In larger institutions, evidence-based practice teams are emerging and may be queried for guidance; even in smaller practices, a multidisciplinary regular conference (such as Access conference) can be used to blend published evidence and experience to develop local guidelines. The result is better care for our patients and while some may decry the loss of autonomy and relatively decreased emphasis on the “art of medicine”, evidence-based medicine is here to stay.


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CATHETER COATINGS

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As I postulated in 2000, the ideal dialysis catheter should be easy to insert and remove, inexpensive, durable, free of infection and thrombosis and ideally invisible to the body. As I also stated at that time, such a catheter did not exist, although many of the tenets of the ideal catheter had been met then as now: current catheters deliver high flows reliably, are relatively inexpensive, are user friendly and quite durable. However, with respect to infection and thrombosis, at least for tunneled dialysis catheters, little has changed in the past decade. While there is now a wide variety of catheter coatings available, not one has been shown to be effective for tunneled catheters in a randomized trial (see abstract concerning evidence basis). In fact, only a single randomized trial of catheter coatings in tunneled dialysis catheters, dating to 1998 and showing no benefit for a silver coating, has ever been published (1). This is at once remarkable and disheartening, since opportunities to do such trials abound. Unfortunately, manufacturers of coated catheters have been unwilling to fund such research, raising the very pertinent question of whether they might be concerned if their products would be shown ineffective in those trials. Indeed, if they truly believed in their products, one would think they would clamor to fund such evidence basis, so as to be able to use that evidence in marketing their products.

For tunneled dialysis catheters (TDC), antithrombotic as well as anti-infective coatings are presently offered. A relationship between infection and thrombosis is well established, relating to the formation of biofilm and subsequent bacterial attachment, thus it is reasonable to believe that either approach may be effective in reducing infection. However, these coatings do not last more than a short time (weeks at most), and TDC may be indwelling for months or longer. Thus, even if there is a short-term benefit (see non-tunneled catheters below) that benefit may not be durable. Another important consideration is the potential for harm (due to allergic reaction, development of resistant organisms) from these coatings, a lesson learned in the Silvergard trial (Trototola SO, Radiology 1998). The only way to adequately address these issues is via randomized trials. Of note, resistance has not emerged to date despite
widespread use of these coatings in short-term CVC, however it remains a frequently cited concern.

For nontunneled dialysis catheters (NTDC), the situation is only marginally better. While there are multiple RCTs, and now systematic reviews, showing that at least some coatings (rifampin-minocycline being the most well documented, silver sulfadiazine/chlorhexidine slightly less so, heparin, among others) are beneficial on nontunneled CVC, there is only one RCT of a NTDC with a coating (Chatzinikolaou I, Am J Med 2003). This study, using rifampin-minocycline coated NTDC, showed significant reduction in infection extending to nearly 5 weeks. Unfortunately, the study was aborted due to poor flow with the catheter, and to date, no replacement with this coating and better flow has been offered. Once again, this situation is curious since the widespread use of NTDC should allow performance of RCT quite readily, were industry to support such studies.

In summary, it is impossible to recommend any catheter coating for use in tunneled hemodialysis catheters at present. For non-tunneled catheters, were there a functional rifampin-minocycline coated device, a level 1 recommendation could be made. The United States Food and Drug Administration has recently taken a firmer stance on approval of TDC, which hopefully will compel manufacturers to improve the dismal evidentiary support for these coatings. Until then, it is incumbent upon the users of these devices to demand such evidence and not to simply adopt a device based on (very) weak evidence or worse, glossy product literature.

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IS THERE A PLACE FOR ENDOVASCULAR TECHNIQUES IN THE TREATMENT OF ANEURYSMS OF HEMODIALYSIS ACCESS?

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In order to discuss the role of the interventionalist in the treatment of access-related aneurysms one must first distinguish between the various types of aneurysmal change that may occur in hemodialysis access. Grafts may develop two types of pseudoaneurysms (narrow-neck and cannulation site lesion), and cannot develop true aneurysms by definition (an aneurysm involves all layers of the vessel wall). Fistulae may develop true aneurysms as well as at least one type of pseudoaneurysm (narrow neck); it is not clear if they can develop cannulation site lesions per se.

In the setting of high intra-access pressure due to outflow disease, both grafts and fistulae can develop the narrow neck pseudoaneurysm. These usually arise suddenly and always occur in accesses characterized by pulsatility, indicating outflow disease. Treatment of these lesions is centered on the outflow disease; PTA and rarely stent or stent-graft placement of the offending lesion will usually result in prompt resolution of the pseudoaneurysm. In general, treatment of the narrow neck pseudoaneurysm with stent-grafts is not indicated as it is a waste of resources and at least in fistulae theoretically increases the infection risk by introducing synthetic material. In addition, these lesions are usually in cannulation zones, and repeated puncture of a stent graft will result in breakdown of the device over time. Only if treatment of the outflow lesion is unsuccessful in eliminating the pseudoaneurysm should a stent-graft be considered, and this will be exceedingly rare.

Cannulation site lesions (CSL), which are common in grafts, are the result of repeated puncture of the same site (failure of needle rotation) of the graft. These lesions are pseudoaneurysms, as the graft material is generally gone and there is only skin and scar tissue overlying flowing blood. These lesions may limit puncture sites and more importantly may result in life-threatening bleeding, since with rupture there is no vascular contraction and bleeding will continue until the patient is hypotensive or dead. It is very tempting to treat these common lesions with stent-grafts, however this enthusiasm must be tempered with the poor results associated with stent-grafts in this application (based on very limited series), the location of these lesions in the cannulation zone (by definition) with concerns for long-term integrity of the device, and the availability of excellent surgical options in many patients. In particular with loop grafts, staged surgical replacement of the CSL with new segments of PTFE can allow continued access use, avoid catheter placement, and achieve very durable results. In my opinion, these considerations, IR management of CSl should be limited to emergent management of bleedings (since the surgical approach in this setting is often simply access ligation).

This is an excellent use of the available technology and usually results in access salvage; it can also be lifesaving. Once stabilized, careful consideration of elective surgical repair versus relying on the endovascular treatment can be made in a multidisciplinary fashion.

Least understood is the role of the interventionalist in aneurysms of fistulae. These are true aneurysms and may result from high flow alone, independent of any outflow disease. Indeed, the relationship of aneurysm formation to outflow disease is not established. We are often asked to treat outflow disease in aneurysmal fistulae, in order to depressurize them and theoretically reduce the risk of bleeding. However, there is no evidence basis to support this practice (thus representing an excellent opportunity for research, including a randomized trial). Likewise, exclusion of aneurysms with stent-grafts, while tempting to the interventionalist, is devoid of evidence basis and may eliminate one of the principal benefits of fistulae, namely the low infection rate, by the introduction of synthetic material. Because of the recognition that flows in excess of 2L/min increase the risk of high output heart failure, we have begun measuring flow in these aneurysmal fistulae and considering flow reduction surgery, coupled with aneurysmectomy if indicated, when flows exceed this threshold. In patients with lower flow, outflow lesions and aneurysms showing signs of skin thinning or bleeding, we continue to perform PTA (and rarely, stent or stent-graft placement if PTA fails) of outflow lesions, with the caveat that there is no evidence basis to support this practice at this time. For a variety of reasons, including some technical ones such as vessel diameter and lesion length, we only very rarely use stent-grafts to treat these aneurysms directly.

In summary, endovascular techniques have different roles in the management of aneurysmal disease of hemodialysis access depending upon the lesion. This is an area very short on evidence basis and an excellent opportunity for further research. Until such evidence is developed, interventionalists should avoid the temptation to use stent-grafts to treat these lesions except in highly selected situations. See: Vesely T. JVIR 2005, Rhodes ES, JVIR 2005.

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WHY THE INTERVENTIONAL RADIOLOGIST HATES ANEURYSMS

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Aneurysms are often connected to the upstream or downstream normal size vessel by stenoses or kinks which can be extremely challenging to pass. The guide wire rolls on itself in the aneurysmal sac and it may be extremely challenging or impossible to traverse the lesion.

However, the main problem with aneurysms is encountered in thrombosed fistula. Aneurysms usually grow slowly with time and local chronic low flow on contact with the aneurysmal wall frequently resulted in the creation of layers or thrombi of different ages, similar to those developing in aortic aneurysms.

These layers of old thrombi are usually so tough that they are impossible to lyse chemically or to break using currently available mechanical devices. During declotting maneuvers, fresh clots are relatively easily removed but these tougher older clots are often fragmented in still wall-adherent but instable pieces that can secondarily detach and embolize into the outflow. These embolic bullets can result in the reocclusion of the fistula if their diameter is bigger that the diameter of the outflow vein and they are in all cases non-desired pulmonary embolic events.

Faced to these tough threatening old thrombi, the interventional radiologist has only one therapeutic option: to trap them with a stent. However, stent placement to emprison such clots nested in aneurysms is possible only if there is a sufficient length of relatively normal diameter vessel to anchor stent extemities upstream and downstream from the aneurysm.

This challenge is nevertheless impossible to face when the whole vein developed aneurysmal degenerescence as we can see it mainly in brachial-cephalic fistulas, sometimes in radial-cephalic or ulnar-basilic fistulas.

At a time when the success rate of trained interventional radiologists is close 100% in the declotting of thrombosed mature fistulas, aneurysms are the major residual cause of failure, the reason why the IR hates aneurysms.

There is no consensus to date about the diameter of aneurysms in dialysis
fistulas that should mandate surgical correction. Aneurysmal degeneration of the arterialized vein is not a contraindication to percutaneous declotting of fistulas but indicates with no doubt a risk a failure or a risk of subsequent difficulties in cannulation if a stent has unfortunately to be placed in cannulation areas.

81 ENDOVASCULAR TREATMENT OF IMMATURE FISTULAS

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After surgical creation of the arteriovenous anastomosis, radial-cephalic, radial-basilic or brachial-cephalic fistulas should be usable for dialysis at 6 weeks. There is still some belief that a fistula insufficiently developed at 6 weeks could spontaneously become usable some months later, which is rarely true. Our experience indicates that there is always an underlying anatomical explanation to the nonmaturation of an autogenous fistula: a stenosis somewhere on the feeding artery or on the arterialized vein, an overall stenotic fibrotic or atherosclerotic disease of the vessel, the deep location of the vein. Deep location should be treated by superficialization of the vein, stenoses by surgical revision at the anastomosis or percutaneous dilation everywhere else. All stenoses, tight and short, moderate but long, respond very well to percutaneous dilation in immature but still patent fistulas. However, it is of paramount importance to diagnose them early (at 4 to 6 weeks of construction surgery) and to react urgently since, once thrombosed, these immature fistulas are most of the times impossible to reopen. The stage of systematic clinical evaluation and duplex imaging at 1 month is essential and the need for subsequent intervention should then be planned within the week. Once again, it is urgent to treat before a non-recoverable thrombosis occurs.

Percutaneous dilation of immature fistulas achieves a very high initial success rate in the hands of experience interventionists although the risk of early restenosis is high since primary patency rates at 1 year range between 30 and 40% in all published series. Restenosis can sometimes occur within 1 month and it is important to monitor the fistula closely after dilation as it was after surgical construction. It is not rare to be obliged to reilate a fistula 3 times during its first year of existence and then to reintervene much less often with time.

82 POSSIBLE DETERIMENTAL ROLE OF HIGH DIALYZER BLOOD FLOW ON BLOOD ACCESS

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According to the Dialysis Outcomes and Practice Patterns Study, in the United States the mean dialysis duration of 213 minutes is the lowest of the seven nations participating in the study and the prescribed blood flow rate of 401 mL/min is the highest. The requirement of high blood flow is the result of National Cooperative Dialysis Study, which falsely determined that shorter time of dialysis may be compensated with higher blood flow. The requirement of high blood flow increases demand on blood access. There are major differences in blood access use among Japan, Europe, and the United States. In addition, survival of AV fistulas is better in Japan and Europe than in the United States. Wrist fistulae, common in Japan and Europe, are uncommon in the United States, where upper arm fistulae providing higher blood flow are prevailing. It is my strong suspicion that the differences are related, at least in part, to the differences in required blood flow. For instance, primary arteriovenous wrist fistulae providing blood flows of 200 - 300 mL/min may be considered adequate in Japan and Europe, but are considered inadequate in the United States where the prescribed blood flow is over 400 mL/min. Such fistulae are abandoned and other blood accesses, including intravenous catheters, are created instead in the United States. Even fistulae providing blood flows of 350 mL/min are in jeopardy, because of repeated attempts to achieve higher blood flows, using tourniquets and other maneuvers. With these attempts, the intima of the fistula is damaged by suction of the inflow needle, and the survival of the fistula is shortened. Also, hypotensive episodes related to short dialyses suddenly reduce fistula blood flow and predispose to clotting. Finally, upper arm fistulae predispose to cephalic vein stenosis, steal syndrome and high output heart failure. Thus, the requirement of very high blood flow may be a contributing factor to poor blood access results in the United States.

83 THE HISTORY OF BUTTONHOLE TECHNIQUE

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It was a serendipitous discovery in Bytom, Poland. In 1972 I had a patient with very short segments suitable for cannulation. By necessity the fistula was cannulated into the same spots. After a few months the patient noted that cannulations were not painful. By the word of mouth other patients requested the same method and I agreed. Only one nurse was eligible to develop constant site. It took about 12 sticks. We used needles made in USA (sharper and more expensive), and in Poland (blunter but less expensive). Besides, we reused needles for the same patients, so they became even blunter with reuse. We ultimately decided to use blunter needles which tended to go through the established path not cutting the insertion tunnel wall. Sharper needles were only to establish the tunnel path. The needles became blunter with reuse so it was a smooth transition from sharp to blunt needles. After 5 years we published our observations in the Polish literature and after 7 years in Dialysis and Transplantation as constant site method of fistula cannulations. The name buttonhole method was given by Georg Krönung in 1984. The method was used by Dr. Scribner in his home hemodialysis patients.

Why the method was dormant for many years? In the 1980s and early 1990s high dialyzer blood flow and short dialysis was prevalent in the USA. Most patients had graft fistulas unsuitable for buttonhole. At that time, my attempts to introduce this method in Columbia, MO, were unsuccessful because blunt needles were not available and there were no nurses interested to champion the method. I started to work on the method in the USA in the late 1990. Medalist manufactured blunt needles and I found three nurses who wanted to cooperate with me. We presented our results on conferences, republished the updated results, and the method "has caught on like wildfire". Many centers use buttonhole method for home hemodialysis patients and for center hemodialysis patients.

84 INTRAVENOUS CATHETER DESIGN AND PROBLEMS

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In the late 1940s Gordon Murrey, a surgeon, and his colleagues developed veno-venous blood access for hemodialysis. The blood was taken from the right femoral vein and returned through the left femoral vein. In the late 1950s Achille Dogliotti, also a surgeon, developed a double lumen, staggered catheter inserted into the inferior vena cava. Staggered tip was invented to prevent blood recirculation during hemodialysis. Subclavian vein cannulation for hemodialysis was first described by Erben et al. in 1967. Nowadays intravenous catheters inserted into large veins are being used in those patients in whom any kind of arteriovenous fistula cannot be created or would fail if created. This is very common in the United States where very high dialyzer blood flows are used. The most successful alternate blood access is a soft dual-lumen catheter with a Dacron cuff limiting periluminal bacterial penetration to the transcutaneous tunnel. The best insertion site is the right external or internal jugular vein and the best tip
location is in the upper right atrium. The three major complications of intravenous catheters are bacteremia, exit/tunnel infection and thrombosis. Most of the catheters are made of silicone rubber or polyurethane. Silicone rubber is thermoset, whereas polyurethane is thermoplastic and softens at the body temperature. Catheter tip usually has drilled side holes at the inflow lumen that, according to my studies, have rough surface and are the site of clot formation. Dual lumen catheters with staggered lumens are frequently used with reversed lumens because of a clot in the inflow lumen. This is associated with a substantial recirculation. Multiple attempts are being made to eliminate complications of soft catheters. Not all attempts are successful, but some are. In the late 1990s it was shown that a flush lumen with a septum is associated with low recirculation in both directions. Based on this principle Palindrome catheters have been developed providing minimal recirculation with both flow directions (hence the name “palindrome”). This catheter has no drilled holes but laser cut slots.

85 BUTTONHOLE METHOD OF FISTULA CANNULATION

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There are two methods of needle insertion into arteriovenous fistula for hemodialysis: different site or rope-ladder method where needles are inserted into new spots for each dialysis and constant site or buttonhole method where needles are inserted into the exactly same locations during every dialysis session. The buttonhole method may be used for fistulas with short segments suitable for cannulation. This method has been shown to decrease complications like missed cannulations or hematoma formation and has been shown to be less painful than rope-ladder technique. Therefore in some centers it is a preferred method even in those patients who have sufficient fistula segment for rope-ladder cannulation. The buttonhole cannulation should be performed by a skilful dialysis staff with experience in this specific cannulation technique. A buttonhole track should be developed during 8 – 12 cannulations by a single cannulator using same angle and depth of sharp needle insertion. Only after the track is developed other persons should be eligible to cannulate the fistula using blunt needles inserted exactly through the established track. Before cannulation the site should be thoroughly disinfected, the sclab present in the buttonhole should be removed with a 19 gage sharp needle, the site disinfected again and then the needle introduced to the track. The dull bevel of the needle opens the vessel flap at the end of the tunnel using the same insertion angle and the same depth of penetration. In case of difficulties in needle insertion an experienced staff member who developed the buttonhole should try to cannulate using blunt needle. If the experienced staff is not available it is better to use sharp needle in another spot and thus prevent damage to the buttonhole. Both needles should be inserted antegrade. The same cannulator, very familiar with the fistula and buttonhole, is particularly beneficial for this technique; therefore self-cannulating patients either in center or at home frequently use this technique. Home hemodialysis patients having the same cannulating partner are also good candidates for this technique.

86 POST-PUNCTURE BLEEDING TIME OF ARTERIO-VENOUS FISTULAE IS SHORTENED BY THE USE OF ‘IRIS’ BANDAGE

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Aims: Since Cimino et al. first described arterio-venous fistula (AVF) in 1966, mechanical compression has been used as the main way to stop post-puncture bleeding (PPB), sometimes in association with haemostatic agents. Prolonged PPB may impair the quality of life of patients and disturb the timetable of dialysis units. Furthermore, sustained compression may damage skin and vascular walls. IRIS bandage is a microperforated adhesive bandage designed to be stuck directly on AVF puncture holes, without prolonged compression or haemostatics. Because it is transparent, its effectiveness is directly seen without removing it, which is convenient and safe. This study aimed to compare the duration of PPB with IRIS bandage vs duration of PPB with manual compression.

Materials and methods: When manual compression is used, PPB time cannot be precisely known because puncture holes are hidden. Therefore, manual compression and IRIS bandage were compared by analysis of the percentage of patients with persistent bleeding at 3 min. This cut-off time was beforehand determined in our population as the median PPB time with manual compression. The study included 64 patients dialysed three times a week on a native AVF (but one patient with a prosthetic graft). All patients gave written informed consent. At every session during 3 consecutive weeks, ‘Bleeding’ or ‘No-Bleeding’ at the cut-off point was recorded by the nurse in charge, for ‘arterial’ and venous puncture holes successively. Haemostasis was obtained by manual compression with a folded compress on weeks (w)1 and w3, and IRIS bandage on w2. Mac Nemar’s paired test was used for statistical analyses.

Results: For ‘arterial’ puncture holes, rates of persistent bleeding at 3 min were 53% (w1) and 56% (w3) when compression was used, vs 18% with IRIS (w2). For venous puncture holes, rates of persistent bleeding at 3 min were 44% (w1) and 45% (w3) when compression was used, vs 23% with IRIS (w2). For both ‘arterial’ and venous puncture holes, differences between IRIS and compression (w1 as well as w3) were statistically significant (p<0.05). Bleeding rates with compression were not statistically different between w1 and w3.

Conclusion: IRIS bandage significantly shortens post-puncture bleeding time of arterio-venous fistulae. Conflict of Interest Statement: none.

87 THE ULNAR-BASILIC FISTULA

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Introduction: Arteriovenous fistulas (AVFs) are the solution of choice among diverse types of vascular access. The forearm basilic vein is rarely used for creating autogenous vascular access. Its use presents a valuable option when autogenous wrist radial-cephalic direct access cannot be created due to the destruction of forearm veins. Results obtained with autogenous wrist ulnar-basilic direct access and autogenous wrist radial-basilic transposition are presented below.

Methods: In the decade 1993-2003, native fistulas utilizing the forearm basilic vein were performed in 27 patients (14 women, 13 men). The basilic vein was anastomosed to the ulnar artery or was transposed and anastomosed to the radial artery.

Results: AVF creation was successful in 22 patients (81.5%). The primary patency rate was 70.4% after 1 year, 61.6% after 2 years and 48.4% after 3 years.

Conclusions: AVFs utilizing the forearm basilic vein can be considered for primary or secondary vascular access because of the acceptable survival rate and low incidence of hand ischemia. Transposition of the basilic vein is a valuable option in the reconstruction of a thrombosed or stenosed radial-cephalic fistula.

88 WHAT’S NEW ABOUT PROSTHETIC GRAFTS IN PATIENTS ON HEMODIALYSIS?

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In the seventies polytetrafluoroethylene (PTFE) was introduced to create vascular accesses. A meta-analysis (Huber, J Vasc Surg, 2003) shows a primary patency of PTFE grafts of 58% (95% confidence interval (CI), 56%-61%) at 6 months and 33% (95% CI, 31%-36%) at 18 months, compared to 72% (95%
Killing Two Birds with One Stone: Subclavian Vein Bypass Graft to Relieve Venous Obstruction and Provide Hemodialysis Access

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A case of an end-stage-renal-failure patient with severe unilateral arm swelling secondary to subclavian vein occlusion in a fistula arm with an existing and functioning brachio-basilic transposition (BBT) arteriovenous fistula (AVF) is presented. After an unsuccessful attempt at angioplasty, patient had successful operative intervention with ipsilateral basilic vein to internal jugular vein bypass graft. We conclude that bypass to the internal jugular vein is a safe and effective method in the management of such cases, reducing the discomfort of symptomatic arm swelling, while salvaging the existing functioning vascular access, in patients with severe subclavian vein stenosis refractory to angioplasty.