

## Abstracts from the 2016 Vascular Access for Hemodialysis Symposium May 12-14, 2016 | Chicago, USA

### ORAL PRESENTATIONS

#### 1.1.1.1

##### USE OF A HANDHELD ULTRASOUND DEVICE TO SUBSTANTIATE LANDMARK ASSESSMENT OF ARTERIOVENOUS FISTULA MATURATION

*Pryor LA, Butler KG, Larkin JW, Deich D, Maddux D, Usvyat LA, Hymes JL, Maddux FW*

Fresenius Medical Care North America, USA

**Objectives:** Difficult cannulation and possible infiltration of new arteriovenous fistulae (AVF) often lead to prolonged catheter exposure and its associated risks and complications. We evaluated a handheld ultrasound device, Sonic Window (SW) (Analogic Corp, Peabody, MA, USA), for its use in substantiating landmark assessment in maturing AVFs and AV grafts (AVGs) being prepared for cannulation.

**Methods:** At 4 clinics from 09/08/2015 to 11/18/2015, all patients with new AVFs/AVGs that were deemed ready for cannulation by landmark assessment at 4 weeks after placement were referred to a trained super user for SW evaluation. Trained clinicians used the SW handheld ultrasound device to capture cannulation characteristics of AVF/AVG including vessel depth, vessel diameter, and recommended needle gauge. SW readings either substantiated or disproved that the AVFs were ready for cannulation, by the criteria of being at least 6 mm in depth, 6 mm in diameter, could accommodate at least a 17 gauge needle and had discernable edges.

**Results:** A total of 15 patients with new AVFs were deemed ready for cannulation by landmark assessment and were referred to the super user for SW evaluation. Of these, 11 of 15 (73%) were found by SW assessment to meet criteria for cannulation and 4 (27%) did not. Of the 11 that met criteria for cannulation, in the 30 days that followed, 4 AVFs were functional, 2 were awaiting surgical approval to use, 2 refused cannulation, 2 clotted, and 1 patient changed modality. Of the 4 that did not meet criteria for cannulation, in the 30 days that followed, 2 were referred for interventional procedures, 1 clotted, and 1 was awaiting surgical intervention.

**Conclusions:** SW appears useful in substantiating landmark assessment of AVF maturation. Once substantiated, cannulation areas and needle gauge can be identified and used for needle placement to reduce the risk of infiltration and potential AVF damage or loss. Additional studies of SW are warranted.

#### 1.1.1.2

##### EARLY USE OF INTERMITTENT PNEUMATIC COMPRESSION ASSISTS IN FISTULA MATURATION

*Singh TM<sup>1</sup>, Mitra A<sup>2</sup>, Arkans E<sup>3</sup>, Desai S<sup>4</sup>*

<sup>1</sup>El Camino Hospital, USA

<sup>2</sup>Auburn University, Auburn, USA

<sup>3</sup>ACI Medical, USA

<sup>4</sup>MS Ramaiah Medical College, Bangalore, India

**Objectives:** Delays in AV fistula (AVF) maturation cause dialysis delays and increased costs. Increased distention pressure and wall shear stress intermittently may have important roles in AVF maturation based on previous experimental research. Early use of non-invasive devices may help assist clinical AVF maturation and dilation.

**Methods:** One week after AVF creation, a novel, intermittent pneumatic compression device [Fist Assist (FA)] was applied 15 cm proximal to the AVF in order to apply cyclic compression (50 mm Hg). Twelve AVF patients were enrolled in an IRB approved study to test vein maturation at baseline and with the FA. FA was applied during dialysis 3 times per week for trial (n = 7) patients for a maximum of 6 weeks postoperatively. Controls (n = 5) had

no FA. Vein size was measured and recorded at n = 0, 30 and 90 days by duplex measurement. Clinical results (percentage increase) were recorded and tested for significance.

**Results:** No patients experienced thrombosis or adverse effects. Patient compliance and satisfaction was high. No significant immediate early vein maturation was seen after 30 days in either group. After 3 months, the mean percentage increase in vein diameter in the FA treatment group (159.5%) was significantly larger (p = 0.05) than controls (76.7%) in the first 5 mm segment of the fistula. Comparing 3 month average percent increase: The mean for the treatment group (123.2%) seems to be statistically greater than the control group (66.2%); p = 0.03. All fistulae treated with FA are still functional with no reported thrombosis or extravasations.

**Conclusions:** Early application of an intermittent pneumatic compression device may assist in AVF maturation and success. Novel, non-invasive devices like Fist Assist may have clinical utility to create functional fistulae development and decrease costs as they may assist in maturation.

#### 1.1.1.3

##### EFFECT OF EARLY NEEDLING ON SURVIVAL OF ARTERIOVENOUS FISTULAE

*Wilmink T, Powers S, Allen C, Baharani J*

Departments of Vascular Surgery and Renal Medicine, Heart of England Foundation Trust, Birmingham, UK

**Objectives:** To study the effect of time to needling on arterio-venous fistula (AVF) survival.

**Methods:** Analysis of two prospective databases of access operations and dialysis sessions from 2002 till 31/12/2014. Follow up till 1/7/2015. Time to needling defined as time from operation-date to first needling date. AVF survival defined till date AVF abandoned. Functional dialysis use defined as six consecutive cannulations of the AVF with 2 needles.

**Results:** 1633 AVF's were created: 957 (57%) radio-cephalic AVF, 502 (31%) brachio-cephalic AVF, 164 (10%) brachio-basilic AVF, and 10 other AVF. Some 1150 AVF (70%) were needled of which 1127 AVF (98%) reached functional dialysis. These were analysed. Needling-time varied from 1 day to 5 years. Thirty-one AVF (3%) were needled within 2 weeks and 372 (33%) AVF were needled after 16 weeks. Early needling, before 2 weeks, was not associated with worse AVF survival (logrank test p = 0.95) compared to needling between 4 and 16 weeks. Late needling, after 16 weeks, was associated with improved survival (logrank test p = 0.0002). Six consecutive successful cannulations from the start was associated with significantly improved AVF survival (logrank test p = 0.0002). Type AVF, diabetes, pre-dialysis state at operation, and six successful cannulations from the start were independent predictors for AVF survival.

**Conclusions:** Needling after 16 weeks or ensuring six successful AVF cannulations from the start are strong predictors of better AVF survival. AVF can be needled early if required and suitable.

#### 1.1.1.4

##### OUTCOME OF AV FISTULAS – A SINGLE CENTRE EXPERIENCE

*Matoussevitch V, Scholten N, Geissler F, Brunkwall JS*

University of Cologne, Cologne, Germany

**Objectives:** Despite the "Fistula First" initiative there is a high spread of grafts and catheters in patients on HD. The reason is based likely on disappointing results of AV Fistula (AVF) studies with a failure rates of up to 60%. We would like to present our encouraging single center experience with utilization of AVF in ESRD patients.

**Methods:** During the time period from 01.01.2013 to 31.12.2014 there were 150 patients at our institution who became a primary AVF. The median age

was 63 years (6-89). There were 35% of patients with diabetes mellitus and 77% of patients suffered from hypertension.

**Results:** During the two years 150 Patients were provided with 152 AVF. 39 radio-cephalic fistulas, 78 Gracz type fistulas, 24 brachio-basilic or brachio-cephalic fistulas as well as 11 AV grafts were constructed. The primary one-year fistula patency rate was 77%. Four fistulas/grafts were abandoned: two due to an occlusion, an AVF due to successful renal transplantation and one due to switch to peritoneal dialysis. There was no difference in performance of radio-cephalic vs Gracz type fistula. The fistula outcome was not dependent on the co-morbidities like diabetics.

**Conclusions:** The meticulous patient selection pre-operatively, in order to identify the best individual access for the given patient, leads to high patency and maturation rates. Furthermore this kind of patient selection reduces the impact of co-morbidities on outcome of AVF and consequently reduces the number of catheter/grafts used for HD.

#### 1.1.1.5

### BENEFITS OF ULTRASOUND-GUIDED CANNULATION ON AV FISTULAS AND GRAFTS

*Chua JN*

St. Georges University Hospitals, London, UK

**Objectives:** The use of real-time ultrasound guidance for vessel visualization and localization, needle guidance, and verification of ultimate needle location is already widely recommended by various international guidelines and medical governing bodies. It is now widely observed and practiced by medical and nursing practitioners. Regular implementation of these guidelines is a positive sign that the greater medical community is recognizing the benefits and importance of visual guidance when performing invasive procedures. Ultrasound-guided cannulation wherever applicable and possible is best practice to ensure safety and quality care. The purpose of this trial was to evaluate the benefits of ultrasound guidance on reduction of vascular catheter insertions, patient satisfaction, cost-effectiveness, nurse confidence and skill acquisition.

**Methods:** All haemodialysis patients with known history of cannulation difficulties and newly created or refashioned arterio-venous fistulae (AVF) or grafts (AVG) are enrolled to the ultrasound cannulation trial.

**Results:** Over 400 cannulation episodes were performed successfully on 56 patients in a span of 60 months. The success of ultrasound guided-cannulations meant that newly operated on patients (early cannulation of access including revision and rescues), no longer require temporary vascular access (e.g. temporary vascular catheters or cuffed-tunneled vascular access device) to bridge their haemodialysis treatments whilst waiting for the post-operative swelling to subside and the arterio-venous fistulae (AVF) or arterio-venous graft (AVG) to be easily palpable.

**Conclusions:** As a result of ultrasound guided cannulations, newly created AV fistulae and grafts are better looked-after with fewer episodes of missed cannulations and mis-directions. Nurse confidence and patient experience is enhanced. A local policy and competency document is now being developed to include real-time ultrasound guidance in cannulating known challenging access and newly created or re-fashioned arterio-venous fistulae and grafts.

#### 1.1.1.6

### RESULTS OF NONTRANSPOSED BRACHIOBASILIC AND BRACHIOBRACHIAL FISTULA CREATION: IMPLICATIONS FOR SINGLE-VERSUS TWO-STAGE PROCEDURE

*Ottinger M, Calero A, Gabbard W, Illig KA*

University of South Florida, Tampa, USA

**Objectives:** Transposed brachio-basilic AV fistulas have increasingly been performed in two stages, in theory to improve overall maturation rates. Published reports give conflicting results, perhaps in part as many reports of staged procedures eliminate those patients who "fail" the first stage (i.e., are lost to followup in addition to anatomic failure). We reviewed patients who underwent first stage fistula creation at our institution with specific attention to short-term outcome in an attempt to answer this question.

**Methods:** A prospectively maintained database was reviewed to identify all patients at our institution who underwent the first stage (nontransposed fistula creation) of planned two-stage brachio-basilic (BrBas) and brachio-brachial (BrBr) fistula creation. Success in this context was defined as patients

who eventually underwent second stage fistula creation, leaving the operating room with a patent, transposed fistula.

**Results:** From October 2012 to November 2015, 61 patients underwent first-stage procedures as above. Of the 39 patients undergoing brachio-basilic fistula creation, 30 (77%) successfully underwent stage II transposition. 4 were lost to followup and one died (13%), 3 occluded before stage II (8%), and one was found to be unusable at exploration (3%). In comparison, of the 22 patients undergoing brachio-brachial fistula creation, 19 (86%) successfully underwent stage II transposition. 1 was lost to followup (5%) and 2 occluded prior to the second stage (9%). Overall, 80% of patients progressed to stage II, 10% were lost to followup, and approximately 10% failed.

**Conclusions:** Patency rates for the first stage of planned staged brachio-basilic and brachio-brachial fistula creation are equivalent. Only 80% of such patients end up undergoing successful stage II creation, however, lower than published maturation rates for single-stage brachio-basilic transposed fistulas. Even if all those lost to followup are assumed to undergo successful stage II transposition elsewhere, success rates, at 90%, leave little margin for failure at the second stage.

#### 1.1.1.7

### PROXIMAL ULNAR ARTERY ARTERIOVENOUS FISTULAS, INDICATIONS AND OUTCOMES

*Jennings W*

University of Oklahoma, College of Medicine, Tulsa, USA

**Objectives:** Confirming the integrity of both the radial and ulnar arteries is an integral component of physical examination prior to arteriovenous fistula (AVF) construction. Allen's test supplemented with doppler flow evaluation of the palmar arch(s) is a reliable clinical method used to evaluate hand perfusion by both vessels. Occasional patients are discovered where the radial artery supplies most or all arterial flow to the hand while the ulnar artery is occluded or inadequate. A radiocephalic or proximal radial artery AVF should be avoided in these individuals. A proximal ulnar artery (PUA) AVF is ideal for these uncommon patients, avoiding the higher risk of steal syndrome associated with brachial artery access and maintaining adequate hand perfusion through the dominant radial artery. This study reviews a series of patients where the PUA served as inflow for a series AVFs.

**Materials and methods:** All new patients referred for vascular access during a ten year period were evaluated through a retrospectively compiled database. All patients with a PUA-AVF were identified and included in this analysis. In addition to physical examination each patient underwent surgeon performed ultrasound vessel mapping and follow-up ultrasound examinations for maturation. During the initial evaluation all patients had an Allen's test performed with the addition of doppler flow evaluation of the palmar arch(s). Individuals discovered to have a dominant radial artery and incomplete or inadequate ulnar artery flow into the hand underwent a PUA-AVF construction.

**Results:** PUA-AVFs were established in 33 patients during a ten year period. Ages were 14-86 years (mean 62 yrs). 22 (67%) patients were women and 24 (73%) were diabetic. 11 (33%) individuals had previous access operations and 13 (39%) were obese. Direct AVFs were created in 23 patients and 8 individuals required a transposition. Primary and cumulative patency rates were 77% and 93% at 12 months and 71% and 83% at 24 months. No patients developed steal syndrome. Follow-up was 2-62 months (mean 14).

**Conclusions:** In patients where the radial artery is the only or dominant arterial supply into the palmar arch, a proximal ulnar artery AVF is a safe and effective method of constructing a moderate flow autogenous access.

#### 1.1.1.8

### BASILIC ELEVATION TRANSPOSITION FOR SUPERFICIALIZATION OF BASILIC ARTERIOVENOUS FISTULA VEINS

*Wang S*

Arizona Kidney Disease and Hypertension Center, USA

**Objectives:** Transposed basilic vein fistula is one of the common arteriovenous fistula types utilized for hemodialysis therapy. Typically, the transposition is accomplished by tunneling the vein through a subcutaneous tunnel (basilic tunnel transposition, BTT). However, BTT is frequently associated with stenosis of the proximal segment of transposition. A simpler approach is basilic elevation (BE) where the basilic vein is elevated to beneath the incision.

A drawback of elevation only is that the fistula is cannulated through the incision scar that may be less desirable for long-term fistula use. To minimize these issues, an alternative approach is basilic elevation transposition (BET) in which the vein is elevated and positioned in a subcutaneous pocket anterior to the incision. This report is to analyze the clinical outcomes of BET versus BTT performed by the author.

**Methods:** From February 2009 to October 2015, 96 patients underwent second-stage basilic transposition for superficialization of basilic fistula veins. Their relevant clinical data were retrospectively reviewed or prospectively collected, and further analyzed statistically.

**Results:** Of the 96 patients: 52% were males and 64% were diabetic; the average age was  $61 \pm 16$ ; 27 had BTT and 69 had BET; the average follow-up was  $25.4 \pm 19.1$  (range 1-79) months. The primary patency, primary-assisted patency and secondary patency rates were 27%, 91% and 100% for the BTT group and 45%, 98%, 100% for the BET group at one year respectively; and 21%, 80%, 94% for the BTT group and 36%, 98%, 98% for the BET group at two years respectively. Interestingly, the average required endovascular interventions within the fistula conduit for the first two years post surgery were significantly reduced for the BET group as compared with the BTT group ( $0.7 \pm 1.0$  versus  $1.5 \pm 1.3$ /patient/year,  $p = 0.002$ ).

**Conclusions:** BET is a reliable approach for superficialization of basilic fistula veins, which yields a high cumulative fistula survival rate under the assistance of endovascular interventions. Compared with BTT, BET is associated with reduced need for endovascular interventions to maintain the functionality of basilic vein fistulas. Further data and research are needed to confirm the advantages that BET may offer.

#### 1.1.2.1

##### MANAGING INFECTIOUS COMPLICATIONS OF VASCULAR ACCESS: ETIOLOGY, RISK FACTORS AND INTERVENTION

*Schild FA*

Florida International University Herbert Wertheim College of Medicine, Miami, USA

**Objectives:** Infection in vascular access surgery is second only to access thrombosis. Our objective is to delineate and demonstrate the best strategies for preventing and managing this far too common and dangerous complication.

**Methods:** A retrospective review was performed to analyze the root causes of infection in 1,574 patients on chronic hemodialysis, with a literature review to provide further insight. We demonstrate that causes of infection fall into 5 categories: 1. Operative infection, developing within 30 days of surgery 2. Post-operative infection, developing more than 30 days post-surgery in routine hemodialysis patients 3. Post-thrombectomy infection, developing following procedures performed in a radiology suite 4. Infection developing in grafts previously thrombosed for an extended period of time 5. Infection developing in patients with previously removed infected grafts, where a graft stump was used to repair the artery.

**Results:** Post-operative infection accounted for 6% of all AV-access infections. 50% came from the dialysis center. 5% were attributed to interventional procedures. 22% were spontaneous infections in non-functioning grafts, previously thrombosed for up to two years in some patients. 17% came from a remaining graft stump, previously excised for infection. Of the many organisms cultured, the most common were staph aureus and MRSA.

**Conclusions:** Infection is a terrible complication of vascular access surgery, possibly leading to death. In an effort to decrease infection rates we recommend the following: 1. Sterile technique is indicated in every aspect of vascular access including chronic hemodialysis 2. Meticulous operating procedures be used in all radiological interventions 3. Improved standards in training of dialysis center technicians 4. Prompt inspection of the access site is warranted in infection of unknown etiology in patients with non-functioning grafts. There is high concern for latent infection within a thrombosed graft or by graft seeding from a distant site 5. In removal of an infected graft we recommend repair of the artery using a vein patch, rather than leaving a portion of graft to repair the vessel, to reduce future incidence of infection 6. Patients with risk factors such as diabetes or HIV should be managed more aggressively, due to higher infection rates. Diagnosis of infection is generally based on clinical findings, which include local signs of inflammation or purulence. This should always prompt intravenous antibiotic administration and immediate removal of the graft. However, on the occasion of a localized infection one might choose to bypass the infected portion of the graft. After

the bypass, the infected portion should be selectively excised and the patient treated with the appropriate antibiotics. Even in the absence of local signs of infection, the graft should always be suspected as a potential source. New graft technology may tend to lower the incidence of infection.

#### 1.1.2.2

##### PACLITAXEL-COATED BALLOON ANGIOPLASTY FOR THE TREATMENT OF SYMPTOMATIC CENTRAL VENOUS STENOSIS IN DIALYSIS ACCESS. RESULTS FROM A PROSPECTIVE RANDOMIZED CONTROLLED TRIAL

*Kitrou PM, Papadimatos PN, Spiliopoulos S, Christeas Ni, Katsanos K, Karnabatidis D*

Patras University Hospital, Patras, Greece

**Objectives:** To report the results from a prospective single-center randomized trial comparing paclitaxel-coated balloon (PCB) versus plain balloon angioplasty (PBA) for the treatment of symptomatic central venous stenosis in dialysis access.

**Methods:** Within 20 months, 40 dialysis patients with symptomatic central venous stenosis were randomized (1:1) to undergo either dilation with a PCB (group PCB,  $n = 20$ ) or plain balloon (group PBA,  $n = 20$ ) of their central venous stenosis. Both de novo and restenotic [15/20; (75%) group PCB and 12/20; (60%) group PBA] lesions were treated. Primary endpoints were technical success and lesion primary patency (LPP). Secondary endpoints included complication rates and circuit primary patency. Individual subgroup longitudinal analysis was performed to compare outcomes of PCB versus previous treatment in the same patients.

**Results:** Until today, 6-month follow up is available in 14/20 (70%) cases in group PCB and in 18/20 (90%) cases in group PBA. According to Kaplan Meier analysis, LPP is 60% for group PCB and 45% for group PBA [ $p = 0.094$ ; HR: 0.48 (95% CI: 0.201-1.13)]. Longitudinal analysis between treatments show a statistically significant difference in favor of PCB treatment compared to previous PBA [9/15 (60%) vs. 4/12 (33.3%);  $p = 0.001$  HR: 4.39 (95% CI: 1.79-10.78)].

**Conclusions:** Interim results of this prospective randomized trial show a strong trend to improved patency for PCB in the treatment of symptomatic central venous stenosis. Final results will be announced.

#### 1.1.2.3

##### PREVENTION OF INFECTION IN AV FISTULA BUTTONHOLE ACCESS JULY 2009 TO DEC 2015

*Mott SV*

Conslution, USA

**Background:** For end-stage renal disease (ESRD) patients undergoing hemodialysis, infection of the arterio-venous access is the leading cause of access loss and the second leading cause of death in patients undergoing dialysis (Centers for Disease Control, 2011). Management of the arterio-venous access involves not only preparation of the site prior to cannulation, but evaluation and use of appropriate cannulation techniques. Selection of cannulation sites and determining the correct instruments to use are important aspects to consider.

**Objectives:** To demonstrate that use of an exfoliating pad in combination with antimicrobial soap is an effective and safe method of cleaning and maintaining infection free buttonhole sites.

**Methods:** An exfoliating pad with 1-2 drops of antimicrobial soap and water were used by the patient and/or staff preparing to cannulate buttonhole sites. Moderate pressure was utilized and the sites were scrubbed in a circular motion 9-12 times to remove dead skin, oil, and debrided the site of scab formation at the buttonhole site. The sites were then patted dry with clean paper towels and site disinfected with betadine immediately prior to cannulation. After betadine had dried, the cannulation needle sterile buttonhole pickers provided by the manufacturer were utilized to open the tunnel track and cannulate the access.

**Results:** This practice was started in June 2009 until December of 2012 with only two patients and has proceeded with 24 patients over 42 months. To date there have been 27,000 cannulation with no observed or reported buttonhole site infections and the tunnel tracks have maintained their integrity.

**Conclusions:** Infection control has been an ongoing problem since the implementation of buttonhole site cannulation and many dialysis centers have discontinued their use due to this issue. This project demonstrates that it is

possible to maintain buttonhole sites and prevent infection with appropriate preparation of the site with the use of a scrubber and antibiotic soap.

#### 1.1.2.4

##### OUR EXPERIENCE WITH THE SNUFFBOX ARTERIOVENOUS FISTULA USING SIDE-TO-SIDE ANASTOMOSIS WITHOUT LIGATION OF THE DISTAL VEIN

*Nakamura T*

Rakuwakai Otowa Memorial Hospital, Kyoto, Japan

**Introduction and objectives:** Arterio-venous fistula (AVF) in the snuffbox region is one of the current techniques used for creating a vascular access in patients undergoing dialysis. The Japanese Society for Dialysis Therapy recommends AVF in snuffbox at first time for the patient with end-stage renal disease as possible. We had several patients that had a lack of proximal forearm cephalic vein or low cardiac function. So we considered that it was a good choice for these patients, using the snuffbox arteriovenous fistula using side-to-side anastomosis without ligation of the distal vein.

**Material and methods:** From January 2014 to October 2015, a total of 211 AVF in the snuffbox were performed suffering from chronic renal failure, among them we performed 15 cases (6 males, 9 females, average age 74.5 +/- 11.3 years, 7 Diabetes Mellitus, 4 Nephrosclerosis, 1 OMI, 1 DCM) using side-to-side anastomosis without ligation of the distal vein in snuffbox AVF. Our indication for AVF in the snuffbox region using side-to-side anastomosis without ligation of the distal vein is forearm cephalic vein interrupted in the middle forearm, the presence of good dorsal vein network, especially low cardiac function.

**Surgical technique:** The surgery was performed with local anesthesia using 10 mL of 1% lidocaine. A three cm long incision was made in the snuffbox region of the hand. At first, the vein and artery were located and dissected. A 4-5 mm incision was made on the vein and artery. The incision was anastomosed according to running side-to-side method with Prolene 7-0 BV 175-6 surgical suture made by Ethicon Company. The presence of a thrill on the fistula was looked for after anastomosis.

**Results:** The short-term efficiency of the fistulas was excellent. Complication of bleeding, hematoma formation, venous hypertension, edema, and infection did not occur. Flow volume was 168–370 ml/min. Kt/V was 0.85–1.63 (average 1.3 +/- 0.3).

**Conclusions:** AVF in the snuffbox region using side-to-side anastomosis without ligation of the distal vein high is good efficiency and no complications, This method is a good option for AVF in the snuffbox with adequate indication.

#### 1.1.2.5

##### USE OF VWING VASCULAR NEEDLE GUIDE TO OVERCOME CHALLENGING AND UNSAFE CANNULATION IN CEPHALIC VEIN FISTULAS: A REVIEW OF 29 CONSECUTIVE PATIENTS

*Gardner E<sup>1</sup>, Young N<sup>2</sup>*

<sup>1</sup>Baptist Memorial Hospital, Collierville, USA

<sup>2</sup>Vital Access, Salt Lake City, USA

**Objectives:** As obesity rates in the dialysis population continue to rise, the ability to create a fistula that meets the Kidney Disease Outcomes Quality Initiative (KDOQI) guidelines for fistula depth becomes more difficult without invasive surgical intervention. Greater than 60% of the US dialysis population is considered overweight or obese, with 35% being obese. The VWING Vascular Needle Guide can be used to provide safe and effective cannulation to fistulas that do not meet the KDOQI guidelines of being less than 6 mm deep and having a discernable margin. The objective of this study is to review the results of using the VWING Vascular Needle Guide as part of a successful fistula cannulation program.

**Methods:** Twenty nine patients with cephalic vein fistulas were implanted with VWING Vascular Needle Guides between January 2015 and July 2015 at a single vascular access practice. VWINGs were placed if the fistula was considered too deep to cannulate safely (6 mm or greater in depth) or if the dialysis unit staff were unable to cannulate the fistula. Additionally, the depth of the VWING locations was less than 13 mm deep. Fifty five VWING devices were implanted into twenty nine patients in hopes of providing safe and reliable access to a fistula that was previously challenging or impossible to cannulate. Fistula patency and VWING use rates were reviewed by interviewing

the twenty six dialysis centers where the patients received treatment at an average follow up of 256 days.

**Results:** One hundred percent of the patients implanted with VWING Vascular Needle Guides were achieving safe and reliable access through the implantable needle guides at an average follow up of 256 days. At 9 months, the primary assisted patency was 100%. The device usage was 98%.

**Conclusions:** Through use of VWING Vascular Needle Guide, fistulas that may have previously been difficult or impossible to cannulate, or would have suffered from early fistula failure due to unsafe cannulation, can achieve reliable and safe needle access while avoiding an invasive elevation or transposition procedure.

#### 1.1.2.6

##### DECLINING POPULARITY OF THE RADIO CEPHALIC ARTERIOVENOUS FISTULA!

*Cusso M, Brambilla R, De Figueiredo F, Brick M, Mistry H, Rashid H, Valenti D, Gambhir R*

King's College Hospital, London, UK

**Objectives:** To look at the outcomes of Radio cephalic Arteriovenous fistula (RC AVF) and assess what percentage get used for dialysis.

**Methods:** All Radio cephalic AVF created at a tertiary vascular unit from 01 Jan 2014 to 31 Dec 2014 were included in the study and outcomes analysed as on 31 Dec 2015. The primary outcome assessed was patency and use of AVF for haemodialysis (HD).

**Results:** Of 306 fistulas created in 2014, 43 RC AVF (14%) were created. Male to female ratio was 7:1 and the average age was 61 years. 37 patients were on HD prior to RC AVF procedure and 6 patients were low creatinine clearance patients. 9/43 (21%) AVFs failed within 30 days, 15 (35%) failed at a later stage and needed a proximal AVF. 6 patients died before they could dialyse. 8 had to have angioplasties. Only 13/43 (30%) were available for use for dialysis at the end of study period.

**Conclusions:** This study shows that about 2/3<sup>rd</sup> of the RCAVF failed, and only 1/3<sup>rd</sup> were actually successfully used for HD at 1 year. It may therefore be worthwhile creating a proximal AVF in the mid-forearm or in the antecubital fossa as the first AVF rather than have a failed RC AVF at wrist.

#### 1.1.2.7

##### IMPROVING PRACTICAL TECHNIQUE IN STENT CANNULATION (ULTRASOUND GUIDED CANNULATION INTO STENTS) IN HAEMODIALYSIS

*Jian L, Salizo A*

Robina Hospital Queensland Health, Gold Coast, Australia

**Objectives:** Cannulation into stent grafts in an arteriovenous fistula (AVF) is not recommended by current guidelines because of the potential to damage stents during the cannulation process. However, an increasing number of stent grafts are being utilized to salvage problematic AVFs, and some of these are positioned in locations where cannulation into the stent is unavoidable - a procedure for which there are no established guidelines, and only limited published research. This paper reports cases where ultrasound-guided cannulation was used to minimize the complications encountered when cannulating into stents, thus prolonging the lifespan of the AVF.

**Methods:** Three patients with failed native AVFs had stent grafts inserted to salvage their vascular access. The limited usable segments of AVF available, combined with the length of the stent-grafts, meant that cannulation into (or through) the stents was unavoidable. The lack of experience and guidelines with this process initially led to complications, including stent separation from the intima wall and pseudoaneurysm formation (due to cannulation). These were overcome by implementing appropriate clinical measures, in particular ultrasound-assisted needle placement.

**Results:** Using normal cannulation technique, two patients experienced stent separation due to the needle tip being placed between the stent and the intima wall during the course of dialysis. All patients suffered pseudoaneurysm formation and haematoma after needle removal. Using ultrasound-guided cannulation to confirm the needle tip position, and prolonging holding off time after needle removal, was found to effectively control these complications. One patient's AVF is still functional after four years of cannulation. One died of unrelated complications, and one transferred to another facility after 5 months.

**Conclusions:** Ultrasound-guided cannulation performed by dialysis nurses with specialized training has prevented further complications and prolonged the lifespan of the AVF in this small sample of patients. As the number is very limited, further research into this technique is recommended.

### 1.1.2.8

#### PRESSURE FLUCTUATIONS COULD CAUSE THE THRILL IN ARTERIOVENOUS FISTULAS - AN *IN VITRO* STUDY

*Krueger U, Scholz H*

Queen Elisabeth Hospital, Berlin, Germany

**Objectives:** The high blood flow rate within an arteriovenous fistula (AVF) causes flow disturbances, which could elicit perivascular vibrations (PV). A palpable thrill is often recommended as proof for a sufficient AVF. Yet, the specific factors which cause the PV have not been unambiguously determined. This study was performed to investigate the pressure fluctuations within an *in vitro* AVF.

**Methods:** An AVF model was constructed from tubes and a y-connector. Immediately behind the y-connector, a truncated finger of a latex glove (balloon) was inserted to simulate a sudden change of the diameter and a strongly compliant vein. The non-pulsatile perfusion was performed with distilled water using a centrifugal Bio-Pump (BioMedicus, USA). A micro-semiconductor pressure transducer (IBW78, TU Dresden, Germany) with a cutoff frequency of 4 kHz was inserted into the balloon for local pressure measurements. The frequency analysis was carried out by the LabVIEW software (National Instruments, USA). To validate the experimental setup, the sound of PV recorded in patients by means of an electronic stethoscope (Littmann 3200, 3 M, USA) were compared to the sound audibled within the AVF model.

**Results:** The spectral analysis of the sound signals recorded in patients and the model revealed a similar frequency distribution. On the balloon surface, PV were already palpable at laminar flow rates. The local pressure curve recorded in the model showed small fluctuating components superimposed to the mean pressure. The frequency analysis of the pressure fluctuations revealed the highest magnitudes up to 75 Hz at Re 1500 and up to 300 Hz at Re 4000.

**Conclusions:** The jump in diameter between the y-connector and the balloon causes a turbulent jet leading to local pressure fluctuations at laminar flow rates, which could be responsible for PV.

### 1.1.3.1

#### IDENTIFYING PATTERNS OF VASCULAR ACCESS EXPERTS CARE UTILIZED IN A TIMELY CATHETER REMOVAL PROJECT

*Inglese M<sup>1</sup>, Butler KG<sup>1</sup>, Maddux D<sup>1</sup>, Latif W<sup>2</sup>, Horowitz I<sup>2</sup>, Bodin S<sup>1</sup>, Milfort M<sup>1</sup>, Maddux FW<sup>1</sup>*

<sup>1</sup>Fresenius Medical Care North America, USA

<sup>2</sup>Fresenius Vascular Care, USA

**Objectives:** Central venous catheter (CVC) rates have been relatively unchanged for several years among both incident and prevalent in-center hemodialysis (HD) patients. A Timely Catheter Removal Project explored the internal and external processes needed to decrease catheter rates and exposure days in HD patients through collaboration with Vascular Access Experts (VAE), such as surgeons and endovascular specialists. The objective of this investigation was to identify the types of procedures, patient services, and facility services provided by VAE partners.

**Methods:** We surveyed VAEs at 8 participating clinics using a 15 question survey. Each question could be answered "yes" (1 point), or "no" (0 points); the maximum score for each VAE was 15. Survey results were divided into 3 main segments: patient services (4 questions about timeliness and coordination of care for patients), facility/nephrology services (5 questions about timeliness and communication with the HD clinic), and procedures provided (vein mapping, arteriovenous fistula/graft (AVF/AVG) creation, peritoneal dialysis (PD) catheter insertion, CVC removal, AVF/AVG evaluation and intervention). The responses to surveys were verified and compiled by clinic and on an aggregate basis.

**Results:** In the eight clinics surveyed, there were 26 different VAE partners (range per clinic = 3 to 8 VAEs). The scores for procedures and services offered by each VAE broadly ranged from 5 to 15. Score ranges for VAE patient services, facility/nephrology services, and procedures provided were 0 to 4, 0 to 5, and 2 to 6, respectively for a total best score of 15. This score has

created process metric assessment for comparison of VAE partners for these clinics. Of note, HD clinics did not consistently have key contact information for their VAEs, and some reported different information for the same VAE partners, identifying logistical gaps and ineffective communication.

**Conclusions:** We identified that the process metrics based on procedures and services provided varied among VAE partners. Such process metrics may help HD clinics evaluate and compare VAE partners in the context of clinic workflow, services, and procedures. In addition, HD clinics should be encouraged to maintain accurate identification and contact information about VAE partners.

### 1.1.3.2

#### VASCULAR ACCESS TIME BASED PROCESS METRICS AS A NOVEL IDENTIFIER IN THE DIALYSIS ACCESS CARE CONTINUUM

*Latif W<sup>1</sup>, Horowitz I<sup>1</sup>, Maddux D<sup>2</sup>, Butler KG<sup>2</sup>, Usvyat LA<sup>2</sup>, Inglese M<sup>2</sup>, Curi MA<sup>3</sup>, Maddux FW<sup>2</sup>*

<sup>1</sup>Fresenius Vascular Care, USA

<sup>2</sup>Fresenius Medical Care North America, USA

<sup>3</sup>Rutgers New Jersey Medical School, Newark, USA

**Objectives:** The transition from an incident HD catheter to a more permanent vascular access is a complicated process and the clinical pathway has never been outlined and measured in its component parts. We investigated if a care coordination program could help increase fistula rates as well as remove catheters in a timely fashion relative to corporate averages. Further, we utilized novel time based process metrics to assist in identification of the rate limiting steps in the care pathway.

**Methods:** Patients were referred to our vascular center for vein mapping in preparation for placement of a de novo AV fistula/graft, or for surgical evaluation of a dysfunctional AV access. Eighty nine patients were enrolled and completed the care coordination program. Process metrics were measured for the following: 1) days from surgical consultation to surgery, 2) days from surgery to catheter removal, 3) days from initiation of balloon assisted maturation (BAM) to catheter removal, and 4) total catheter exposure time. Clinical outcomes of fistula and graft creation and interventional success rates were also tracked.

**Results:** Overall, 77/89 (87%) patients who completed the care coordination program had functioning fistulae. Grafts were present and functioning in 12/89 (13%) patients. The median time from surgical consultation to surgery was 29 days. The median time from maturation initiation to catheter removal was 35 days. In fistulae patients, 33/77 (43%) required BAM with an average of 1.63 interventions per patient. The median time from surgery to catheter removal was 73 days and total catheter exposure time was 108 days. Relative to the corporate average of 60%, the absolute rate of successful fistulae creation was improved by 27% (p<0.05). Relative to the corporate average of 148 days, the absolute total catheter exposure time was reduced by 40 days.

**Conclusions:** Care coordination with time based process metrics has helped identify the steps in the clinical pathway to promptly remove catheters while achieving superior clinical outcomes.

### 1.1.3.3

#### ASSOCIATIONS BETWEEN COORDINATED VASCULAR CARE VISITS AND DECREASED RATES OF HOSPITALIZATIONS AND MORTALITY IN HEMODIALYSIS PATIENTS

*Han H<sup>1</sup>, Chaudhuri S<sup>1</sup>, Usvyat LA<sup>1</sup>, Koh E<sup>2</sup>, Latif W<sup>2</sup>, Miller G<sup>2</sup>, Sor M<sup>2</sup>, Maddux FW<sup>1</sup>*

<sup>1</sup>Fresenius Medical Care North America, USA

<sup>2</sup>Fresenius Vascular Care, USA

**Objectives:** Coordinated vascular access care between Fresenius Medical Care North America (FMCNA) and Fresenius Vascular Care (FVC) integrates vascular access management for enrolled FMCNA hemodialysis (HD) patients. We investigated if hospitalization and mortality rates differ in FMCNA HD patients receiving dialysis access management from FVC compared to matched controls.

**Methods:** We analyzed data from 1,300 FMCNA HD patients in the FVC program that had at least one visit to a FVC clinic from January 2014 to April 2014. Patients not in the FVC program were identified for controls by nearest neighbor 1:1 matching on the logit of the propensity score for age, dialysis vintage, body mass index, and baseline lab values. Exact matching was

performed based on FVC visit month and year, state, gender, race and access type. Six month hospitalization and mortality rates from the date of the FVC visit or matched date were compared between study groups.

**Results:** In total, 2,600 FMCNA HD patients (1,300 FVC & control) were studied. Compared to control patients, FVC patients exhibited a 22% lower 6 month mortality rate after one or more FVC visit (10.95 per patient year (ppy) FVC vs 14.47 ppy control;  $p = 0.059$ ). Albeit the 6 month hospitalization rate was lower in FVC patients compared to control, there were no significant differences identified (1.50 ppy FVC vs 1.59 ppy control;  $p = 0.33$ ).

**Conclusions:** This study suggests that coordinated vascular access care visits are associated with lower mortality rates in FMCNA HD patients compared to matched controls. Ongoing analysis is warranted to determine long term mortality and hospitalization outcomes associated with the FVC program.

#### 1.1.3.4 STRATEGIES FOR IMPROVING PAEDIATRIC VASCULAR ACCESS

*Gogalniceanu P<sup>1</sup>, Shroff R<sup>2</sup>, Calder F<sup>1</sup>*

<sup>1</sup>Guy's Hospital, London, UK

<sup>2</sup>Great Ormond Street Hospital, London, UK

**Objectives:** Most children have haemodialysis via a central venous catheter. Arteriovenous fistula (AVF) formation for long-term haemodialysis is often viewed as a challenge. Nevertheless, AVF use may be associated with fewer infections, hospitalizations and improved longevity. The study aims to review the strategy and outcomes of a dedicated vascular access clinic over a two-year period.

**Methods:** An integrated, multi-disciplinary clinic was set up to provide paediatric vascular access services for London. The clinic consists of a vascular access/transplant surgeon, a paediatric nephrologist and ultrasound angiologist. All children are assessed by clinical and ultrasound examination.

**Results:** In a 2-year period 23 patients (56% male, 44% female) were seen in the integrated clinic. 12 new AVFs were formed and 11 existing AVFs were followed-up. These consisted of 12 brachiocephalic, 9 brachio-basilic and 2 radiocephalic vein AVFs. For new AVF formation the median age was 9.4 (3-17) years with a median weight of 26.9 (14-67) kg respectively. Maturation scans 6-weeks after AVF formation showed a median flow of 1277 (432-2880) ml/min. The primary maturation rate of new AVFs was 82% (9/11). Two cases required angioplasty to achieve maturation-assisted primary maturation 100%. Successful needling was achieved in all patients. Median time to initial needling was 8 weeks post AVF formation. For the 11 children with existing AVFs a median flow rates of 1781 (800-2971) ml/min at a median 153 weeks after AVF formation was seen. Of the 22 AVFs being used successfully for dialysis, a median kt/V of 1.97 (1.8-2.9) and urea reduction ratio of 80.7 (79.3-86)% was achieved.

**Conclusions:** A one-stop vascular access clinic incorporating ultrasound assessment is key to forming functional fistulae in children. However, successful dialysis requires a multidisciplinary approach incorporating play specialists, dialysis nurses and parents.

#### 1.1.3.5 TUNNELED HEMODIALYSIS CATHETERS USED AS A VASCULAR ACCESS IN ELDERLY PATIENTS ON HEMODIALYSIS

*Gerasimovska V, Gerasimovska-Kitanovska B*

University Clinic of Nephrology, Medical Faculty, Skopje, The former Yugoslav Republic of Macedonia

**Introduction:** The growing population of elderly and advanced age appears as an exclusive factor negatively influencing dialysis practice. This retrospective study evaluated tunneled catheter outcomes in an elderly patient population (>65 years) and compared them with those in a younger control group.

**Material and methods:** We looked at the outcome of a group of 170 patients (pts) receiving chronic hemodialysis (HD) treatment via 256 tunneled-cuffed catheters (femoral, jugular and subclavia) divided in two groups: elderly  $\geq 65$  yrs ( $n = 59$ ), and non-elderly <65 years ( $n = 197$ ). Demographic data, medical comorbidities (diabetes), and catheter-specific data regarding in-dwelling time, function and complications were recorded. Criteria for catheter removal were (1) elective removal, (2) catheter malfunction (blood flow <300 ml/min) and (3) catheter-related bloodstream infection CRBSI.

**Results and discussion:** Fifty nine tunneled catheters were placed in group of 41 elderly patients (18 men and 23 women; mean age 76.5 years). The

mean number of catheters per patient was  $1.75 \pm 1.28$ . Duration of catheter (median) was 310 catheter days. One hundred and ninety seven catheters were identified in the nonelderly group -129 patients (59 men and 70 women, mean age 50,9 years). Duration of catheter (median) was 316 days. There was statistically significant difference in sex and diabetes between the two groups. We found statistically significant difference between groups for number of catheters per patient ( $\geq 65$  yrs  $1.75 \pm 1.28$ , <65 yrs  $2.27 \pm 2.08$ ;  $P = 0,02$ ), and number of previous failed AVF ( $\geq 65$  yrs  $2.51 \pm 1.1$  (1-5) and <65 yrs.  $3.3 \pm 1.6$  (1-6),  $P = 0, 024$ ).

**Conclusions:** Tunneled catheter outcomes in pts aged 65 years and older undergoing hemodialysis do not vary significantly compared with those in younger cohort.

#### 1.1.3.6 A NOVEL CLASSIFICATION SYSTEM FOR AUTOGENOUS ARTERIOVENOUS FISTULA ANEURYSMS IN RENAL ACCESS PATIENTS

*Valenti D, Gambhir R, Slim H, Rashid H, Mistry H*

King's College London, London, UK

**Introduction:** Arteriovenous fistulae (AVFs) constructed for hemodialysis access are prone to aneurysmal degeneration. This can lead to life-threatening sequelae such as aneurysmal rupture. The literature includes various guidelines on the management of certain aspects of access-related aneurysm formation; however, no classification system exists to guide reporting or prognostication. We aimed to create a universally acceptable classification for these aneurysms and establish guidance about their management.

**Methods:** We clinically examined, duplex scanned, and photographed all of the autologous arteriovenous fistulae in our local renal failure population in January 2010 in order to categorize morphology. We then followed up the cohort for 2 years prospectively to assess outcomes, primarily of rupture or surgical intervention for bleeding.

**Results:** A total of 344 patients were included (292 currently needing their fistula and 52 with low creatinine clearance awaiting dialysis). In all, 43.5% of dialyzed patients had aneurysmal fistulae. We propose a classification system as follows: type 1a: dilated along the length of the vein; type 1b: post-anastomotic aneurysm; type 2a: classic "camel hump"; type 2b: combination of type 2a and 1b; type 3: complex; and type 4: pseudoaneurysm. Six fistulae needed emergency surgery for bleeding in the 2-year follow-up period and 5 of these were type 2 aneurysms. The remaining one was in the nonaneurysmal group, although it had become aneurysmal by the time it bled.

**Conclusions:** Type 1 aneurysms are much commoner in patients who have not yet needed their fistula and have a relatively innocuous course although type 1a aneurysms should be monitored for high flow and physiological consequences thereof. Type 2 aneurysms are associated with needling of AVFs. They are at significant risk of rupture and need to be monitored carefully or treated prophylactically.

#### 1.1.3.7 INDICATIONS AND OUTCOMES OF NONHEMODIALYSIS ARTERIOVENOUS FISTULAS IN PEDIATRIC PATIENTS

*Carsten CG, Cull DL, Keahy G*

University of South Carolina School of Medicine Greenville, Greenville Health System, Greenville, USA

**Objectives:** Medical conditions requiring permanent, lifelong venous access are uncommon but frequently begin early in life. They are usually treated with catheter based therapies however catheters are associated with infectious, thrombotic and mechanical complications. An alternative is to utilize surgically created autogenous arteriovenous fistulas as a means of providing permanent venous access. The purpose of this study is to describe the indications for placement and outcomes of arteriovenous fistulas placed for permanent venous access in children less than 19 years old.

**Methods:** A retrospective review of our arteriovenous database was performed for the time period 10/2009-5/2015 to identify all patients <19 years of age who received arteriovenous access creation for non-hemodialysis use. Indications, age, ethnicity, gender, location of access, number of secondary interventions, number of access failures and length of follow-up were examined. All patients received preoperative vein mapping. Surgery was performed using a pneumatic tourniquet for vascular occlusion. Anastomoses were interrupted monofilament. An operative microscope was used in all cases.

**Results:** Fourteen patients received 17 fistula creations. Mean patient age was 9.8 years (4-18). Follow up ranged from 3 months to 5 years. There were 10 males, 8 Caucasian, 4 African American, and 2 Hispanic patients. Indications for vascular access placement included hemophilia (n = 5), sickle cell disease (n = 3), cystic fibrosis (n = 1) and chronic illness requiring frequent IV infusion or pheresis (n = 5). Sixteen fistulas were placed in the upper extremity, one in the thigh. Three patients required placement of a second fistula. All patients achieved a usable access. Nine secondary interventions were performed to achieve or maintain functional fistula patency. There were no infections and no cases of significant steal.

**Conclusions:** In selected pediatric patients requiring lifelong venous access, the surgically created arteriovenous fistula is an attractive alternative to catheter based access. Our results suggest that all pediatric patients requiring permanent vascular access should be considered for arteriovenous fistula creation.

### 1.1.3.8 ARE CREATION OF PRE-DIALYSIS ARTERIOVENOUS FISTULA IN ELDERLY PATIENTS A REASONABLE CHOICE?

*Gerasimovska V, Gerasimovska KB, Sikole A*

University Clinic of Nephrology, Medical Faculty, Skopje, The former Yugoslav Republic of Macedonia

**Introduction:** Starting renal replacement therapy with an arteriovenous fistula (AVF) increases patient survival following dialysis initiation. AVF creation should occur at least six months prior to anticipated hemodialysis (HD) initiation to allow for AVF maturation. The growing population of elderly and inclusion them into dialysis requires satisfactory and safe vascular access. Advanced age appears as an exclusive factor negatively influencing dialysis practice. Therefore, early creation of an AVF is strongly recommended.

**Material and methods:** Our study included 196 incident and prevalent patients (pts) in the advanced chronic kidney disease (CKD) at the University Clinic of Nephrology, Skopje, R. Macedonia. All predialysis AVF were created between January 2012 and December 2014. The inclusion criteria were: non dialysis pts over 18 years old, with stage 5 CKD, not secondary to a failed kidney transplant. The patients (n = 196, male 105 and female 91) were divided in two groups: A gr <65 years of age (n = 108) versus B gr >65 years of age (n = 88), and three subgroups according to main causes for renal failure – diabetic pts (Ad = 27, Bd = 37), hypertensive pts (Ah = 27, Bh = 39) and others- (APKD, Glomerulonephritis, Nephrolithiasis etc - Ao = 52, Bo = 13). All the pts were followed up for estimated Glomerular Filtration Rate (eGFR), BUN level, creatinin, hemoglobin, hematocrit and albumin level at the moment of creation of predialysis AVF and later at start of hemodialysis (HD). Statistical methods used were ANOVA comparison of numeric variables between groups.

**Results and discussion:** Mean glomerular filtration rate (eGFR) at creation in Ad group was higher (16,52 ± 4,5 ml/min vs. 12,1 ± 3,1 ml/min, p = 0,0001) at patients vs Bd group. We found statistically significant difference in eGFR at starting HD only in elderly patients with diabetes: Ad -13.6 ± 6.6 ml/min vs Bd -9.5 ± 3.5 ml/min (p = 0.0023\*). Ninety-eight percent of AVF were localized on the forearm: 92% in the distal and 8% in the proximal part. In B group only 9 pts underwent second AVF and 3 pts had a third AVF creation (more frequently in females). During the study period, in Bgr 75% (n = 66) of pts a mature fistula was used as their first dialysis access, 11% (n = 10) were still without dialysis and 14% (n = 12) started HD with central venous catheters (nonmaturing AVF before need for HD or AVF thrombosis). Duration time of AVF until puncture: A -Age <65 yrs 127 ± 288 days; B Age > =65 yrs 175 ± 203 days (p = 0.18). Statistically significant difference was found between subgroups for duration of AVF until puncture (days) for pts with HTA, and from the group of diabetic pts, and HTA for total serum albumin.

**Conclusions:** The age becomes less important barrier in modern medicine era. Elderly patients should not be denied creation of AVF as a rule. However, more than 80% of pts begin HD with a catheter rather than a AVF, either because they do not have a permanent vascular access, or their permanent access is not ready for use. The outcome of AVF benefits more from acknowledging individual vascular conditions than age of the patients. Our study proved that forearm fistula is feasible in elderly patients and may successfully serve for hemodialysis.

### 1.1.3.9 STRUCTURE AND REIMBURSEMENT FOR DIALYSIS ACCESS SURGERY IN THE US- OPPORTUNITIES FOR IMPROVEMENT AND CHANGE

*Gelbfish GA<sup>1</sup>, Vin Y<sup>2</sup>*

<sup>1</sup>Advanced Vascular Care, New York, USA

<sup>2</sup>Beth Israel Deaconess Medical Center, Boston, USA

**Objectives:** There has been a significant effort to improve dialysis access outcomes in recent years. Meeting quality benchmarks for dialysis access will have financial implications under the Centers for Medicare and Medicaid (CMS) ESRD Quality Incentive Program (QIP). Surgical expertise is vital to successfully achieving these goals. We explore current practice patterns of access creation in the US as well as possible barriers to surgical specialization in dialysis access.

**Methods:** Review of Medicare Claims Public Use Files (PUFs) for 2012 that are available to the public.

**Results:** The majority (62%) of US access surgeons create less than 30 dialysis accesses a year. 51% are Vascular Surgeons, 38% are General and Transplant surgeons. 96.5% of cases are performed in the hospital setting, 3% in Ambulatory Surgical Centers and 0.5% in an office based setting, which is explained by the reimbursement structure and rate for access creation in each setting. Reimbursement for access creation is lower when compared to percutaneous procedures in every setting.

**Conclusions:** In our outcome-oriented environment, dedicated access surgeons remain rare. Barriers to specialization may include difficulty in centralizing access care to higher volume centers of excellence, lack of appropriate training and financial constraints.

### 1.1.4.1 COMPARISON OF OUTCOMES OF HERO GRAFTS AND TRANSPOSED FEMORAL VEIN FISTULAS

*Ladenheim E, Lulic D, Lum C, Agrawal S*

LDAC Vascular Centers, USA

**Introduction:** For patients with bilateral upper extremity central venous stenosis, AV access solutions can include the Hemodialysis Reliable Outflow (HeRO) device as well as an autogenous AV fistula in the lower limb. We report on a single surgeon experience with 40 HeRO grafts and 18 transpositions of the femoral vein.

**Methods:** This is a retrospective analysis of 40 patients who underwent placement of an upper extremity HeRO device and 18 patients undergoing superficial femoral artery to transposed femoral vein AVF from 2009-to 2015 by a single surgeon at one center. Operative details, Intraoperative flows and flows on the first week postoperative visit were recorded. Data was collected on primary and secondary patency and intervention rates. Complications were summarized by cross tabulation and compared between the HeRO and SFA-tFV groups.

**Results:** The one year cumulative primary patency of the HeRO grafts was 30% and for the SFA-tFV fistulas was 79%, the difference was statistically significant by Log Rank testing (p = .0001). The one year cumulative secondary patency was 71% for the HeRO grafts and 93% for the SFA-tFV fistulas, also a statistically significant difference (p = .03). The HeRO graft patients required an average of 2.1 interventions per year to maintain patency. The thigh fistulas required an average of 0.4 interventions per year to maintain patency. 37 out of 58 patients experienced a complication. There were significant differences between the groups in patterns of complications. 37% of the tFV patients had a hematoma or seroma compared with 5% of the HeRO graft patients and 17% of the tFV patients experienced delayed wound healing compared with 2.5% of the HeRO graft patients. (p<.05). None of the tFV patients had distal ischemia.

**Conclusions:** HeRO graft had lower primary and secondary patency compared with the transposed femoral vein fistula and HeRO grafts required 5-fold more frequent interventions to maintain secondary patency. However, the patients with Femoral Vein transposition had significantly more problems with healing of the surgical site. The tFV AVF has become our access of choice for patients with bilateral central venous stenosis.

## 1.1.4.2

**FIRST 100 EARLY CANNULATION GRAFT FOR REDUCE THE CENTRAL VENOUS CATHETER: RESULTS OF SINGLE CENTER 4 YEARS EXPERIENCE***Tozzi M, Franchin M, Bossi M, Ferraro S, Piffaretti G*

University of Insubria, Varese, Italy

**Objectives:** This study evaluated 4 years (from 2011 to 2015) of prosthetic vascular access (pVA) management in patients without native options for vascular access. Our experience is based on Acuseal graft (Acuseal® W. L Gore - Flagstaff; AZ - USA).

**Methods:** The present paper is a single center experience with retrospective analysis. We considered patients requiring vascular access with malfunctioning CVC (temporary or tunnelled cvc) that received pVA for early cannulation. One-hundred patients (mean age 60 ± 12 years; 64 male) were treated: 45 with CVC, 30 with a malfunctioning aVA, 25 without any vascular access requiring HD urgent.

**Results:** Graft implantation was technically successful in all cases and early cannulation within 24 hours was performed in all cases. Primary patency was 60.3% and secondary 85.3% at 46 months. In our operating protocol the CVCT or CVC are removed 12/24 h before the operating in case of malfunctioning or recent bacteremia (N°36-80%) and 2.4 days of mean, after the surgery, in other cases (N° 9-20%). We removed all the CVC (N°45) without temporary solution.

**Conclusions:** In our experience, the use of acuseal graft for early cannulation has allowed us to reduce the number and the permanence of cvc; in fact the early cannulation of the graft reduce the permanence in days of cvc (range 1-4 mean 2.4 days) respect to standard ePTFE and it allows the removal of all infected or malfunctioning cvc before surgery.

This practice in our center allows to reduce the percentage of cvc from 22.6% (2011) to 12.9% (2014). The use of this practice will lead to a reduction in the time of bacteremia and central venous stenosis.

## 1.1.4.3

**HISTOLOGICAL EVALUATION OF PROSTHETIC VASCULAR ACCESS: EARLY CANNULATION VS STANDARD EPTFE***Tozzi M, Franchin M, Angrisano A, Tadiello M, Gattuso A, Castelli P*

University of Insubria, Varese, Italy

**Objectives:** The biological integration of the prosthesis for vascular access can have dramatically different effects: on one hand it ensures the sealing during the cannulation as in the case of the standard ePTFE, secondly it generates intimal hyperplasia. For this reason, studying the different events, such as the cellular infiltrate and the matrix integration of the prosthesis may be valuable to explain the different clinical outcomes of prosthetic vascular access. The purpose of our study is the one to evaluate histologically the Accuseal (Gore) vs ePTFE standard in different times of the inside stay.

**Methods:** The aim is to evaluate morphofunctional and immunophenotypic characteristics of 12 implants Accuseal comparing them with those of 12 prosthetic ePTFE grafts in the patient for different times and harvested after kidney transplant. For each graft will be analyzed, with histochemical and immunohistochemical techniques, 3 different portions: arterial and venous anastomosis and the cannulation segment. After, each sample will be processed and embedded in paraffin. It is planned to prepare at least 30 sections for each sample, with a thickness of 5 microns, that will be used for at least 14 different stainings, both histochemical (eg, EE, Picrosirius, Alcian blue, etc) that immunohistochemical (CD3, CD34, CD68, CD 163, MMP2, Cd66b, TGF beta, vimentin, etc.). Each staining will be performed on at least 2 different slides and with appropriate controls.

**Results:** The PTFE, in both conformations, is quickly integrated, and the extracellular matrix pervades the entire wall (Picrosirius red, alcian blue). Also the cell population and 'abundant throughout the thickness of the wall of EPTFE. Recognize macrophages (CD68), lymphocytes (CD34), fibroblasts (CD13) and smooth muscle cells. But in Acuseal graft the cells is restricted to adventitial layer.

**Conclusions:** The fundamental difference in this preliminary evaluation is the lower presence of cellular infiltrate and matrix in Acuseal. This characteristic could be explained by the barrier that the intermediate layer of silicon opposed to cell migration, What happens in segments cannulated through the needle holes and spreads into the lumen forming characteristic growths. If this feature can affect the patency of the prosthesis in a positive or negative will be our goal.

## 1.1.4.4

**IN SEARCH OF AN OPTIMAL SCREENING PROGRAM FOR DETECTING STENOSIS AND PREDICTING INCIPIENT THROMBOSIS IN ARTERIOVENOUS GRAFTS***Tessitore N<sup>1</sup>, Bedogna V<sup>2</sup>, Pessolano G<sup>1</sup>, Lipari G<sup>2</sup>, Mansueto G<sup>3</sup>, Lupo A<sup>4</sup>, Poli A<sup>5</sup>*<sup>1</sup>Emodialisi Borgo Roma, Italy<sup>2</sup>Department of Vascular Surgery, Italy<sup>3</sup>Radiology Institute, Italy<sup>4</sup>Division of Nephrology, Italy<sup>5</sup>Department of Public Health, Italy

**Objectives:** Guidelines recommend that grafts should be screened for >50% stenosis (St) by surveillance (access blood flow [Qa], static venous pressure ratio [VAPR] or Duplex Ultrasound [D]) stating that there is insufficient evidence to prefer one technique from the other because no study has compared vis-à-vis all of the tools. To identify an optimal screening program, we compared the diagnostic performance for angiographically-proven St (StA) and predicting incipient thrombosis (within 3 mo) of Qa by ultrasound dilution (QaU) using the HD03 device, VAPR (according to Frinak et al) & D using the Logiq 7 device (to detect >50% St [StD] and to measure Qa [QaD]) in the same population of 57 upperarm grafts (46 with straight & 11 with loop configuration).

**Methods:** Diagnostic performance was evaluated by the area under the ROC curve (AUC) & differences between AUCs by the DeLong test.

**Results:** All tools showed a similar good performance for StA, with a AUC 0.87 [95% CI 0.74-0.99] for StD (78% sensitivity [SE] & 4% false positives [FP]), 0.84 [95% CI 0.78-0.98] for QaU (best threshold Qa <1300 ml/min: 78% SE & 13% FP), 0.79 [95% CI 0.65-0.93] for VAPR (best threshold VAPR >0.9: 61% SE & 9% FP), & 0.70 [95% CI: 0.52-0.87] for QaD (best threshold Qa <1000 ml/min: 60% SE & 29% FP). QaU was the best screening tool for predicting thrombosis: AUC: 0.83 [95% CI 0.73-0.93] with best thresholds between Qa <1000 ml/min (60% SE & 16% FP) & Qa <1200 ml/min (80% SE & 24% FP). Its AUC was significantly higher (p<0.05) than that of StA (0.67 [95% CI 0.55-0.77] with 70% SE & 35% FP) & VAPR (0.58 [95% CI 0.42-0.74]: best threshold VAPR <0.6 with 30% SE & 21% FP). At logistic regression analysis QaU & VAPR were the only significant & independent predictors of thrombosis, with a 35% [95% CI 12-57] lower risk for each 100 ml/min above a Qa 400 ml/min (p = 0.005) & a 5% [95% CI 1-9] lower risk for each 0.1 above a VAPR of 0.4 (p = 0.04), respectively.

**Conclusions:** Our comparative study suggests that in graft an effective screening program should be based on QaU & VAPR measurements for their good ability for detecting StA (in a way analogous to D) and predicting incipient thrombosis. It also suggests that – in order to contain the risk of thrombosis-stenosis should be electively repaired when Qa drops below 1000-1200 ml/min and/or VAPR below 0.6.

## 1.1.4.5

**TWO-STAGE BRACHIOBASILIC ARTERIOVENOUS FISTULA – IS IT REALLY WORTH THE EFFORT?***Brambilla R, Cusso M, Brick M, Fatima DF, Rashid H, Mistry H, Valenti D, Gambhir R*

King's College Hospital, London, UK

**Objectives:** To look at the outcomes of two stage Brachio-basilic arteriovenous fistula (AVF) and assess what percentage get actually used for dialysis.

**Methods:** All two stage Brachio-basilic AVF created at a tertiary vascular unit from 01 Jan 2014 to 31 Dec 2014 were included in the study and outcomes analysed as on 31 Dec 2015. The primary outcome assessed was patency and use of AVF for haemodialysis (HD). Secondary outcomes assessed included early and late failures.

**Results:** A total of 39 two stage Brachio-basilic AVF were created in 2014. Male to female ratio was 1: 1.2 and the average age was 59 years. 29 patients were on HD prior to stage 1 procedure and 10 patients were low creatinine clearance patients. 10/39 AVFs failed within 30 days of stage 1 and two more failed before 2<sup>nd</sup> stage. Four of these had failed thrombectomies and another 4 had to have angioplasties before they went on to have the second stage procedure. 16 patients progressed to a second stage but only 13 (33%) were in use for dialysis at the end of study period. Three patients required angioplasty after the second stage to keep it patent. The

second stage was completed at a median time of 123 days (range 63-558 days) after the first stage. Eight patients had not progressed to a second stage and 5 died during the study period while three were transplanted after successful second stage. During the same period 70 AV grafts were created of which 61 (87%) remain in use, 6 failed and three were explanted due to infection.

**Conclusions:** This small study shows that about 1/3<sup>rd</sup> of the two stage Brachio-basilic AVF failed, 1/3<sup>rd</sup> did not have a second stage done or died. Only 1/3<sup>rd</sup> were actually successfully used for HD at 1 year. Therefore there is a need to relook at the utility of this procedure. Is it really worth the effort or are we better off placing an AV graft in the first instance?

#### 1.1.4.6 HYBRID VASCULAR GRAFTS FOR VASCULAR ACCESS SALVAGE AND CREATION IN PATIENTS WITH CHALLENGING ANATOMY

*Leeser DB<sup>1</sup>, Yi SY<sup>1</sup>, Rosenberry PM<sup>2</sup>*

<sup>1</sup>University of Maryland School of Medicine, Baltimore, USA

<sup>2</sup>University of Maryland at Shore Regional Health, USA

**Objectives:** Patients with end stage renal disease (ESRD) on chronic hemodialysis often require multiple interventions of their arteriovenous access. Those with disadvantaged anatomy have numerous revisions of pre-existing access sites on many different locations of their upper and lower extremities leading to significant morbidity. We report the use of Hybrid vascular graft (an expanded polytetrafluoroethylene vascular prostheses with a reinforced nitinol section) for salvage of existing grafts, access in morbidly obese patients, patients axillary veins too small for a standard surgical anastomosis, and access in patients with previous upper arm arteriovenous grafts.

**Methods:** A retrospective analysis was undertaken of 17 patients with 18 grafts placed, over a 3 year period who met criteria for Hybrid placement. Criteria included Body Mass Index (BMI) >45, previously stented outflow tract, small outflow vein caliber, and patients with previously failed upper arm grafts. Outcomes included, primary and secondary patency, cause of graft failure, along with complications of steal syndrome and infection.

**Results:** Of the 18 hybrid grafts placed, 47% had previously placed grafts in the upper arm between the brachial artery and the axillary vein; 29% were morbidly obese; 18% had veins too small for a standard anastomosis and one patient had contractures of the shoulder from a stroke that prevented operative positioning for a standard graft placement. The patency at 6 and 12 months respectively was 87% and 56%. The patency at 12 months for patients with prior upper arm access was 50%.

**Conclusions:** The use of the Hybrid vascular graft is an effective method to create a functional access in patients who are not good candidates for traditional surgical techniques. Despite the challenging aspects of this patient population, patency rates justify keeping the hybrid in the access armamentarium.

#### 1.1.4.7 PERCUTANEOUS ENDOVASCULAR TREATMENT OF STEAL SYNDROME SECONDARY TO AV GRAFT PLACEMENT

*Borzatta MA*

Okaloosa Heart and Vascular Center, USA

Steal syndrome secondary to arteriovenous access placement remains an infrequent but challenging problem to address. The incidence of steal syndrome in hemodialysis patients is about 3.5 to 5%, higher in Arteriovenous grafts especially if the arterial donor site is the brachial artery. The treatment of steal associated with arteriovenous grafts is certainly challenging, frequently resulting in the sacrifice of the access. In those patients requiring a reduction of the access flow to treat the steal created by an arteriovenous graft, the treatment has been primarily surgical and often has resulted in loss of the access. A totally percutaneous endovascular approach is described. Seven consecutive patients presenting with steal after the placement of an arteriovenous graft in the upper extremity were treated. After confirming with ultrasound flow measurements that the steal was secondary to a high flow access the patients underwent a contrast imaging study of the arteriovenous graft and placement of a balloon expandable covered stent which was deployed in an hour glass configuration in the arterial segment of the graft. This achieved a quantifiable flow reduction

resulting in the resolution of the symptoms secondary to the steal. All access remained functional with a secondary patency of at least 2 years and requiring an average of 2.5 interventions per year to maintain patency. This procedure allows to successfully treat the symptoms of steal while preserving the function of the access, and it allows to size the narrow portion of the stent to the degree of flow reduction needed to treat the symptoms and maintain patency.

#### 1.1.4.8 DIRECTION AND ANGLE-ASSISTED CANNULATION OF AV-FISTULA IN HEMODIALYSIS PATIENTS - A RANDOMIZED CONTROLLED STUDY

*Rønning MI<sup>1</sup>, Benshop P<sup>2</sup>, Hallan S<sup>1,3</sup>*

<sup>1</sup>St. Olavs Hospital HF, Trondheim, Norway

<sup>2</sup>Lillehammer Hospital, Lillehammer, Norway

<sup>3</sup>NTNU Norwegian University of Science and Technology, Trondheim, Norway

**Objectives:** Chronic kidney disease prevalence is 10.5% in Norway, ESRD incidence rate is 100 per million per year, and 72% of all patients on RRT have a kidney transplant. Those remaining on hemodialysis are therefore old and with a high comorbidity, and optimal cannulating of their arteriovenous fistulas (AVF) is challenging. Buttonhole technique (BHT) is often recommended, but finding the patients buttonhole- track can be difficult with many different nurses cannulating the patient. Our study tested if a simple marking on the skin of the direction and angle of cannulation could improve the probability of success and give cannulation with less fear and pain.

**Methods:** Norwegian HD-patients with established AVF and BHT using blunt needles were included in a randomized controlled trial (February to March 2012). Direction and angle of cannulation were marked on the skin in the intervention group, and success of cannulation at first attempt, level of success seen from nurse's and patient's opinion, fear – and pain-intensity, sign of infection were also recorded over a 8 week period in intervention versus control group.

**Results:** The intervention group (n = 43) had a higher mean age (69.5 vs 63.4 years, p = 0.04) and more difficult AVFs (40 vs 22%, p = 0.10) compared to the controls (n = 40) at inclusion, but no differences in sex, BMI, treatments per week, diabetes, hypertension, or other CVD. The proportion of successful cannulations with blunt needle improved significantly in the intervention group over the study period, but it was stable in the control group. Correspondingly, the level of fear and the level of pain improved in the intervention group (p = 0.21, p<0.05) but not in the control group (p = 0.47, p = 0.24). The rate of infection was low in both groups.

**Conclusions:** The study indicated that permanent skin marking of direction and angle of cannulation may improve the chance of successful cannulation with blunt needle. It also reduced the fear and pain in patients, but it is too early to make a clear recommendation.

#### 2.2.1.1 OUTCOMES OF 1644 CONSECUTIVE HEMODIALYSIS ACCESSES BY A SINGLE SURGEON

*Lucas III JF, McGlawn R, McGlawn K*

Greenwood Leflore Hospital, Greenwood, USA

**Objectives:** This study examined the outcomes of all accesses constructed by a single surgeon between January 1, 2011 and December 4, 2015.

**Methods:** All patients operated on for a new hemodialysis access were included. Patients were evaluated by ultrasound by the author for a suitable forearm cephalic vein. Arterial evaluation was by physical exam with the presence of easily palpable pulses in the target artery as the only criteria. If the forearm cephalic was not suitable or the radial pulses were not palpable, a formal venous ultrasound was performed in the vascular lab. If the patient was on dialysis, bilateral arm venograms were performed. All operations for primary fistulas were performed with intramuscular meperidine, oral diazepam and infiltration with 1% lidocaine and 0.25% bupivacaine. Grafts were placed using IV sedation and local, or with general anesthesia. All fistulas were created with interrupted anastomosis using nonpenetrating titanium clips. Patients with AVFs created under local were asked about hand symptoms in the operating room, and the fistulas were banded when necessary. Brachio-basilic and brachio-brachial fistulas were followed with U/S monthly until the vein was 6 mm in diameter and transposed under general anesthesia. Follow up was done twice a year and entered into the VQI database.

**Results:** 1644 consecutive accesses were created between January 1, 2011 and December 4, 2015. Follow up averaged 474 days. 1503 were AVFs (91%) and 141 were AVGs (9%). Radiocephalic fistulas represented 49% of all primary fistulas. Brachiocephalic fistulas were done in two stages 91% of the time and represented 35% of the fistulas. Brachiocephalic fistulas were 15% of the fistulas. One, two and three year primary patency was 55%, 42% and 36%. One, two and three year secondary patency was 85%, 77% and 71%. Age, race and gender had almost identical cumulative patency rates. There was a difference in patency when stratified by BMI, but the worst group still had a 65% cumulative patency at three years.

**Conclusions:** Using physical exam, U/S mapping, venograms and predominantly local anesthesia, it is possible to achieve high primary fistula rates in a large patient population. Age, race, sex and BMI are unimportant compared to the quality of the target artery and vein.

### 2.2.1.2

#### PACLITAXEL-COATED BALLOONS FOR THE TREATMENT OF DYSFUNCTIONAL DIALYSIS ACCESS. SIX-MONTH FOLLOW-UP RESULTS OF A SINGLE-CENTER RETROSPECTIVE ANALYSIS

*Kitrou PM, Papadimitos PM, Spiliopoulos S, Christeas N, Katsanos K, Karnabatidis D*

Patras University Hospital, Patras, Greece

**Objectives:** To evaluate the safety and effectiveness of Lutonix® paclitaxel-coated balloon (PCB) in the treatment of the dysfunctional dialysis access (DA).

**Methods:** This is a retrospective analysis of 45 patients treated with the Lutonix® PCB due to dysfunctional DA. Adequate data were available in 39 patients (23 male; 59%), who underwent 61 interventions using 69 Lutonix® PCBs. In total, 20/39 (51.3%) patients treated had an arteriovenous fistula while 19/39 (48.7%) had an arteriovenous graft, with 35.9% of lesions (14/39) being de novo. Mean balloon diameter was 6.59 mm and length 73.41 mm. Primary outcome measure was 6-month lesion primary patency (LPP). Secondary outcome measures included circuit primary patency, minor and major complications, factors affecting LPP while in re-interventions (25/59; 64.1%), a longitudinal analysis of LPP results between PCB and previous treatment was performed.

**Results:** Six-month results will be available in March 2016. Interim results show 59.14% LPP with a median survival of 237 days based on Kaplan-Meier analysis. Six-month surveillance has been completed in 28/39 (71.79%) cases, while 20/39 of the lesions (51.3%) remain patent.

**Conclusions:** Interim results of this retrospective analysis indicate that the Lutonix® PCB could represent a valid solution for the treatment of dysfunctional DA. Final results will be announced.

### 2.2.1.3

#### ARTERIOVENOUS FISTULAE ARE NOT ALWAYS THE LOWEST COST CHOICE FOR DIALYSIS ACCESS

*Yuo T<sup>1</sup>, Wagner J<sup>1</sup>, Weisbord S<sup>1</sup>, Dillavou E<sup>2</sup>, Leers S<sup>1</sup>, Hager E<sup>1</sup>, Makaroun M<sup>1</sup>*

<sup>1</sup>University of Pittsburgh, Pittsburgh, USA

<sup>2</sup>Duke University, Durham, USA

**Objectives:** Maturation failure after arteriovenous fistula (AVF) creation leads to increased resource utilization and tunneled dialysis catheter (TDC) days. We compared Medicare expenditures associated with using AVF, arteriovenous graft (AVG), and TDC among different patient groups in order to identify cost disparities.

**Methods:** Using the US Renal Data System (USRDS) database, we identified incident HD patients in 2005 through 2008 who started HD with a TDC and survived at least one year with adequate billing records for analysis. We compared patient costs after AVF creation, AVG creation, and those who did not have record of AVF nor AVG, who were assumed to stay with TDC by default. We generated multivariate regression models to predict total one year costs, creating models for each patient group of interest.

**Results:** There were 444,233 patients who started HD 2005-2008, of whom 81% began HD with TDC. Of that total, 62,816 fulfilled the inclusion criteria and were available for cost analysis. In the first 3 months after HD initiation, 18,197 (29%) received AVF, 6,117 (10%) AVG, and 38,502 (61%) stayed with TDC. Average 1 year costs by access modality were: TDC \$46,109; AVF \$50,575; and AVG \$53,991 (P<.001). Multivariate regressions demonstrated

that patients who require assistance to transfer had cost savings with use of AVG over AVF, though this was non-significant. Among all AVF patients, 31% had at least one additional AVF creation, while 8% had two or more in the year following HD start. A single AVF maturation failure was associated with cost equivalence, while a second AVF failure increased cost (\$1,964, P = .016), as compared to initial treatment with AVG.

**Conclusions:** Among patients who start HD with a TDC, continued TDC use is associated with lowest 1-year cost, as compared to AVF and AVG. AVF creation generally has lower cost compared to AVG, except in debilitated patients or those with one or more failed AVF. Further investigation into developing patient-centered, cost-effective algorithms for hemodialysis access is warranted.

### 2.2.1.4

#### CEPHALIC ARCH RESTENOSIS AFTER PERCUTANEOUS INTERVENTION IN HEMODIALYSIS PATIENTS WITH UPPER ARM CEPHALIC VEIN AV FISTULAS

*Razdan RN<sup>1</sup>, Rosenblatt M<sup>2</sup>, Usvyat L<sup>3</sup>*

<sup>1</sup>White Plains Vein and Vascular, Connecticut Image Guided Surgery, Fresenius Vascular Care, USA

<sup>2</sup>Connecticut Image Guided Surgery, Fairfield, USA

<sup>3</sup>Fresenius Medical Care, USA

**Objectives:** To determine the rate of restenosis after various percutaneous treatments of cephalic arch stenoses in patients with brachial artery to cephalic vein AV fistulas used for hemodialysis.

**Methods:** A 4 year retrospective analysis of all patients with a brachial artery to cephalic vein AV fistula who presented with a cephalic arch stenosis was performed. 7,126 patients were treated in 44 outpatient facilities distributed across the US. After the first treatment patients were followed longitudinally to assess for recurrence. A total of 34,198 interventions were analyzed. The percent stenosis was documented before and after each intervention. The time interval and the change in severity of stenosis from post treatment to any subsequent treatment were measured to calculate an average rate of stenosis change per month. Patients were subsequently stratified by the type of intervention performed.

**Results:** Over-all, the time between interventions was 115 days. The average rate of stenosis change, independent of the type of stenosis and the method of treatment was 17.9% per month for all patients. Only 917 patients (12.8%) were able to successfully maintain fistula patency after 3 consecutive visits without the need for stent placement. This patient group originally showed a 21.7% monthly increase in percent stenosis which appeared to decrease after subsequent angioplasties to 15.6%. The remaining patients underwent stenting at some point in their fistula lifetime, with a total monthly average increase in stenosis of 19.1%.

**Conclusions:** Recurrent stenosis after percutaneous treatment of a cephalic arch stenosis in patients with a brachial artery to cephalic vein AV fistula is very common. After treatment the stenosis begins to reform at a rate of 17.9% per month independent of the type of treatment. Therefore, on average, all patients will have a 71.6% restenosis four months after treatment. Stent placement seems to improve the rate at which stenosis recurs but this effect appears to diminish over time likely reflecting in-stent restenosis and subsequent response to angioplasty. This large data set likely reflects an accurate depiction of the behavior of cephalic arch stenoses and therapeutic response as it includes interventions performed by physicians of various subspecialties in patients with a broad range of geographic and demographic differences.

### 2.2.1.5

#### PLACEMENT OF SECONDARY FISTULAS IN THE IPSILATERAL EXTREMITY WITHOUT LIGATION OF THE PRIMARY FAILING ACCESS

*Ladenheim E, Lum C*

LDAC Vascular Centers, USA

**Objectives:** When planning a secondary fistula sometimes the most suitable vessels are in the ipsilateral extremity. Traditionally, the failing primary graft (or fistula) is ligated and a bridging catheter is used until cannulation can proceed in the secondary fistula. We undertook this study to investigate the feasibility and safety of creating secondary fistulas in the ipsilateral extremity without ligating the primary access.

**Methods:** This was a retrospective case series involving multiple surgeons at a single center. We selected all patients between 2010-2015 with a failing graft or fistula undergoing placement of a secondary fistula in the same arm without ligation of the failing access. Primary endpoints were primary and secondary patency, whether a bridging catheter was used, and freedom from complications. Secondary endpoints were flow rates in the primary and secondary fistulas.

**Results:** 10 patients underwent creation of a secondary fistula without ligation of the primary failing access. 7 patients (70%) of the failing primary accesses were radiocephalic fistulas, two patients (20%) had brachial artery based accesses, and one patient (10%) had an upper arm loop graft. Bridging catheters were not required in 70% of the patients. One patient (10%) had early distal arterial hypoperfusion and required postop ligation of his fistula. One patient (10%) had late arterial insufficiency and required ligation of his radiocephalic fistula.

**Conclusions:** Routine ligation of the failing primary access is unnecessary when placing a secondary fistula in the ipsilateral extremity. Bridging catheters can often be avoided by ligating the failing fistula only in the event of symptomatic hypoperfusion.

### 2.2.1.6

#### TRAINING DIALYSIS TECHNICIANS - CAN WE DO BETTER?

*Schuman E, Knofler BJ*

Chemeketa Community College, Salem, USA

**Objectives:** Training dialysis technicians has been the Wild Wild West of Education. Prior to 2008 states determined how and IF they wanted to license technicians. National guidelines were then put forth by CMS prescribing a basic level of knowledge. Most technicians are trained by the large dialysis providers or career training institutions. Their instruction is mostly hands-on with a focus on passing one of many Certifying exams. Some community colleges provide structured, broad based education and are associated with a dialysis unit for hands-on training. There is little uniformity to the process of training these technicians that are a life and death conduit for HD patients and their access. Little data is available to compare programs or types of educational/training experiences. We look at these options and supply data on a community college based program.

**Methods:** This is a retrospective review of enrollees and graduates from a program that started in 2012. Curriculum was developed by experienced dialysis personnel and college educators. Prerequisites include a high school diploma or GED, acceptance to the college and completion of courses in writing, algebra and psychology. Follow up was done by program instructors.

**Results:** Students receive 154 hours of lecture and 220 hours of laboratory time during their 3 semesters in the program. Over a 4 year period 130 students enrolled in this program with 105 proceeding to clinicals. Currently, 27 are still in the program and 61 have graduated. Six have chosen to go to Nursing or Dietician school and 54 are licensed and practicing. Six are now preceptors in their respective units. Workplace evaluations cite these graduates for their reliability, capability and trouble shooting skills.

**Conclusions:** A recent article found that experienced technicians were more likely to recover from healthcare errors. Can this be taught in their basic education? Another study showed a difference between current and ideal elements of training. The precise skill set for technician trainees is not fully clear and may vary in different locales. There are many approaches to educating dialysis technicians. Further data should be obtained on this critical part of care delivery for dialysis patients.

### 2.2.1.7

#### USE OF THE UCLA/RAND APPROPRIATENESS METHOD TO DEVELOP A TOOL FOR STANDARDIZING AND OPTIMIZING VASCULAR ACCESS PROCEDURE SELECTION

*Cull DL<sup>1</sup>, Singapogu SS<sup>2</sup>, Singapogu J<sup>3</sup>, Woo K<sup>4</sup>*

<sup>1</sup>University of South Carolina School of Medicine - Greenville, USA

<sup>2</sup>George Mason University, Fairfax, USA

<sup>3</sup>Clemson University, Clemson, USA

<sup>4</sup>UCLA David Geffen School of Medicine, Los Angeles, USA

**Objectives:** Although the Dialysis Outcome Quality Initiative (K-DOQI) has dramatically increased arteriovenous fistula (AVF) prevalence, the benefits of that increase have been offset by increases in AVF non-maturation and

tunneled catheter use. Although better procedure selection would likely result in improved outcomes, neither K-DOQI nor others have provided patient-specific selection criteria for vascular access. The UCLA/RAND Appropriateness Method, a validated process for determining procedural appropriateness based on the literature and expert opinion, was used to develop the Vascular Access Procedure Selection (VAPS) mobile app to help practitioners select the most appropriate procedure based on factors that influence outcome. The app allows users to enter patient information, view procedural recommendations and watch video demonstrations. We report the development and uses for the VAPS mobile app.

**Methods:** After a systematic literature review was completed, over 4500 patient scenarios were created using factors thought to influence vascular access outcomes. A panel of eleven international experts, comprising both surgeons and nephrologists, was convened to grade, on a scale of 1 to 9, the appropriateness of vascular access procedures for each scenario. A procedure was graded 7-9 if it was appropriate, 1-3 if it was inappropriate, or 4-6 if its appropriateness was indeterminate.

**Results:** Among the 4536 patient scenarios, 22% (1005) of the procedures were graded appropriate, 34% (1555) inappropriate, and 44% (1976) indeterminate. Factors influencing appropriateness included age, vein and artery diameter, morbid obesity, and functional status. To simulate surgeon decision-making, co-relevant scenarios were combined to create 78 clinical situations, each with 3 to 7 vascular access procedure options. The appropriateness of options within each clinical situation was determined using the scenario grades. From these results, algorithms were developed to create the VAPS mobile app.

**Conclusions:** The VAPS mobile app is an easy to use tool that selects the most appropriate vascular access procedure for patient-specific clinical situations. Its use should improve outcomes by standardizing vascular access procedure selection. Scenarios graded indeterminate should guide future research.

### 2.2.1.8

#### RESULTS OF EARLY CANNULATION PROSTHETIC VASCULAR ACCESS IN ELDERLY: SINGLE CENTER EXPERIENCE

*Tozzi M, Franchin M, Piffaretti G, Quarti L, Ietto G, Iovino D*

University of Insubria, Varese, Italy

**Objectives:** Recent evidence indicates that fistula patency may be lower in the elder dialysis population compared with younger patients. The objective of this study was to characterize the outcomes of early cannulation prosthetic arteriovenous fistulas in elder population.

**Methods:** This was a retrospective cohort study based on data from Haemodialysis population in our Institute Varese between 2011 and 2015. The study population included dialysis-dependent patients age  $\geq 70$  years undergoing arteriovenous graft creation with early cannulation graft. The primary outcome end-points were mortality rate, graft thrombosis, incidence of repeat graft creation and central venous catheter (CVC) placements. There were 60 patients (41 males 66%); mean age was 77,48-4, 8 years (range, 70-91). Fifty-eight grafts were implanted in the upper limbs, 2 in the lower limbs. The mean follow-up is 542 days range 59 -1345. 30 patients (50%) dialysing through a central venous catheter tunneled or temporary.

**Results:** 9 patients (15%) died during the follow-up: causes of death were intestinal perforation (n = 1), cerebral hemorrhage (n = 1), tumors (n = 2) and IMA (n = 5). During the perioperative course and the follow-up period were observed 2 (3,3%) graft infection, 1 (1,6%) DASS. Primary patency overall was 73,3%; secondary patency was 86,7%. A repeat graft creation was required in 5% of patients. Thanks to the use of early cannulation graft was possible to eliminate all central central venous catheters. During followup was used in 3 patients a temporary central venous catheter and 3 patients was convert to a permanent tunneled cvc.

**Conclusions:** In our experience the results of early cannulation prosthetic vascular access in the elder patients is safe and effective and allows a reduction of use of cvc. The rate of complications and patency rates are the same if compared to the standard population of prosthetic vascular accesses.

## 2.2.1.9

**CHANGING PARADIGMS IN HEALTH CARE DELIVERY: MOVING FROM MULTIDISCIPLINARY TO MULTI ORGANIZATIONAL BASED CARE***Leeser DB<sup>1</sup>, Rosenberry PM<sup>2</sup>, Yi SY<sup>1</sup>, Hinduja AM<sup>3</sup>*<sup>1</sup>University of Maryland School of Medicine, Baltimore, USA<sup>2</sup>University of Maryland at Shore Regional Health, USA<sup>3</sup>Kidney Regional Health Center of Maryland, USA

Over the last 20 years, healthcare has developed into a multidisciplinary care world in which teams of professionals need to work together in order to provide the best care to patients. We present a model for the next 20 years of patient care that moves from multidisciplinary to multi-organizational care of End Stage Renal Disease (ESRD) patients. On the Eastern Shore of Maryland, an area encompassing 13 counties in 3 states and 150 square miles, we have created a network of provider organizations to care for ESRD patients. Our network includes 2 major medical centers, 4 nephrology practices, 4 surgical practices and 3 separate dialysis care corporations. The entire group is responsible for the care of 734 ESRD patients at 13 different dialysis units. Multi-organizational access meetings occur once per month with representatives from nephrology, dialysis corporations, access surgery, interventional radiology and hospital representatives. By cooperative interactions and communication, the access plans for all patients are managed. The goals of the group are to: 1) Limit the number of dialysis catheters; 2) Increase peritoneal dialysis (PD) population; 3) Limit the number of patients admitted to the hospital for access related complications. Over a 30 month period, we have successfully decreased the overall dialysis catheter population by 12%, increased the number of PD patients by 51% and decreased the number of inpatient dialysis treatments by 20%. By creating lines of communication both formally and informally, we have been able to align the goals of multiple complex organizations in ways that maximize patient benefit and creates value for the entire healthcare system for patients with ESRD.

## 2.2.1.10

**USABILITY OF THE ENDOVASCULAR AV FISTULA: INITIAL OUTCOMES OF THE NOVEL ENDOVASCULAR ACCESS TRIAL (NEAT)***Lok C*

University Health Network, Toronto General Hospital, Toronto, Canada

**Objectives:** Surgical arteriovenous (AV) fistulas for hemodialysis access often have low maturation success and require multiple interventions to achieve and maintain functionality. An endovascular approach to create an AV fistula in an alternative anatomic location has been developed utilizing magnetic catheters and radio-frequency (RF) energy with the everlinQ endoAVF System (TVA Medical, Inc.). This novel device has been studied in the Novel Endovascular Access Trial (NEAT): a prospective, multicenter study to assess the safety and efficacy of endovascular AV fistula creation for hemodialysis access. Initial outcomes are presented here.

**Materials and methods:** From January 2014 to August 2015, 60 study cohort patients were enrolled in NEAT at 6 centers in Canada and Australia. Technical success was assessed with completion angiography. Duplex ultrasound was performed monthly for 3 months, then at less frequent intervals until study end. Physiologic fistula usability was determined within 3 months based on freedom from stenosis and thrombosis, and brachial artery flow rate >500 ml/min and vein diameter >4 mm, or 2-needle cannulation.

**Results:** The mean age of the study cohort was 59.9 years, 65% were male, 65% were diabetic, mean BMI was 27.9 and 56.7% were predialysis at the time of the procedure. An endoAVF was successfully created in 59/60 (98.3%) of patients. One patient (1.7%) experienced a serious device-related event. Within 3 months, 91.2% of patients had a physiologically usable fistula. Mean brachial artery flow was 917.6 ml/min at 3 months (mean delta from baseline 842.89 ml/min); mean vein diameters were 5.15 mm, 5.89 mm, and 5.99 mm in the cephalic, median cubital, and basilic veins respectively. There were 2 interventions performed in 2 patients to maintain or re-establish fistula patency. Steal syndrome occurred in less than 2% (1/60).

**Conclusions:** The everlinQ endoAVF System offers an alternative option to create an AV fistula with high reproducible procedural success, physiologic suitability for dialysis and a low complication rate. The technology facilitates AV fistula creation and may help reduce the dependence on central venous catheters. Note: The product is not available for sale in the United States at this time.

## 2.3.1.1

**ARTERIOVENOUS ACCESS DOES NOT PERFORM AS WELL FOR NON-HEMODIALYSIS USES***Wooster M, Moudgill N, Shames M*

University of South Florida, Tampa, USA

**Objectives:** Access surgeons are occasionally asked to create arteriovenous access for non-dialysis functions. Subjectively noting overall poor results at our institution, we seek to present our experience with arteriovenous access creation uses other than hemodialysis.

**Methods:** Billing records were reviewed using CPT and ICD-9 codes to identify all patients undergoing arteriovenous access creation for diseases other than renal failure from January 2007 to August 2014. Inpatient and outpatient records were reviewed to identify patient demographics, disease-specific medications/treatments, access-specific characteristics, patency data, and reinterventions required.

**Results:** A total of 16 access creation procedures were performed, accounting for just 1.6% of our total access creations during the period. Access was for plasmapheresis treatment of myasthenia gravis (N = 6), chronic inflammatory degenerative polyneuropathy (N = 9), and stiff man syndrome (N = 1). Access failure was by thrombosis (N = 7), non-maturation (N = 5), and infection/steal syndrome (N = 1), with four accesses still functional at conclusion of review. There was 50% autogenous access creation and overall maturation rate of 37.5%. Mean primary patency was 236 days (range 10-878), with secondary patency only achieved in three patients adding a mean of 174 days (range 2-517). Cumulative 3-month and 1-year patencies were 36.5% and 25% respectively.

**Conclusions:** Arteriovenous access creation for plasmapheresis represents a minority of all access procedures. Though it remains unclear why, patency and maturation rates are significantly lower than expected when compared to access for hemodialysis access. These high failure rates must be taken into account when considering replacement of temporary catheters with surgical access for non-hemodialysis needs.

## 2.3.1.2

**DOES REGIONAL COMPARED TO LOCAL ANAESTHESIA INFLUENCE OUTCOME AFTER ARTERIOVENOUS FISTULA CREATION?: A MULTI CENTRE RANDOMISED CONTROLLED TRIAL***Aitken EL<sup>1</sup>, Jackson AJ<sup>1</sup>, Macfarlane A<sup>2</sup>, Clancy M<sup>1</sup>*<sup>1</sup>Queen Elizabeth University Hospital, Glasgow, UK<sup>2</sup>Stobhill Hospital, Glasgow, UK

**Objectives:** Arteriovenous fistulae (AVF) have a high early failure rate. Anaesthetic technique is known to influence factors such as intra-operative blood flow and venous diameter that may theoretically affect the success of an AVF. However, to date, there is no conclusive evidence to favour one form of anaesthesia over another for AVF creation. The aim of this study was to consider whether regional anaesthetic block, compared to local infiltration, influenced medium-term AVF patency.

**Methods:** A multicentre randomised controlled trial comparing local anaesthesia (LA) (n = 63) to brachial plexus block (BPB) (n = 42) as anaesthesia for AVF creation. Patients were excluded if they were coagulopathic, previous ipsilateral fistula had been attempted or there were no suitable vessels for radiocephalic (RCF) or brachiocephalic (BCF) fistula creation. A priori power calculation indicated that a sample size of 126 patients was required to detect an improvement in patency from 65% to 85% ( $\alpha = 0.05$ ,  $\beta = 0.8$ ). The primary end point was primary patency at 6 weeks (assessed by a blinded observer for the presence of thrill and bruit). Secondary end points were immediate patency, functional patency (assessed clinically and by ultrasound) at six-weeks and vessel diameters/brachial artery blood flow. The trial was prospectively registered with ClinicalTrials.gov (NCT01706354).

**Results:** Groups were comparable for basic patient demographics, operating surgeon and vessel diameter as measured on pre-operative ultrasound (mean age: 60.8+/-14.8 years; 62.7% male). Primary patency at 6 weeks was higher in the BPB cohort (84.1% vs. 64.9%; P = 0.005). This difference was observed for both RCF and BCF but was more marked in RCF (76.9% vs. 48.0%; P = 0.03). Immediate patency was also better in patients having BPB (92.6% vs. 73.0%; P = 0.005). There was no significant difference in functional patency at 6 weeks overall (41.3% vs. 27.0%; P = 0.09). Vascular dilatation and increased brachial artery blood flow was observed following administration

of BPB. Both BPB and LA Provided good anaesthetic and early post-operative analgesia with no significant complications.

**Conclusions:** Regional anaesthesia (BPB) resulted in yield higher immediate and 6 week primary patency rates for AVF than LA. This difference was more marked in the small vessels of RCF. We hypothesise that these findings are the results of the vasodilatation and increased brachial artery flow observed. Based on these findings, consideration should be given to utilising BPB for all AVF creation.

### 2.3.1.3

#### DETERMINANTS FOR EARLY FAILURE AND LONG-TERM SURVIVAL IN NATIVE ARTERIOVENOUS FISTULAS FOR HEMODIALYSIS

*Abreu RM<sup>1</sup>, Rioja S<sup>2</sup>, Vinuesa X<sup>2</sup>, Iglesias R<sup>2</sup>, Vallespin J<sup>2</sup>, Ibeas J<sup>2</sup>*

<sup>1</sup>Centro Hospitalar Trás-os-Montes e Alto Douro, Vila Real, Portugal

<sup>2</sup>Hospital Universitari Parc Tauli, Sabadell, Spain

**Objectives:** Native arteriovenous fistula (AVF) is considered the gold standard of vascular access for hemodialysis due to its longer survival, fewer complications, less mortality and costs. Patency is important for an effective dialysis treatment and this remains a challenge in nephrology. There are not well defined the prognostic factors for short and long term AVF survival. The aim is to evaluate comorbidity, biology and ultrasound (US) variables as prognostic factors for early failure and AVF patency.

**Methods:** Prospective cohorts, uni-center study. 5 years follow-up. Inclusion criteria were patients with new native AVF placements between 1<sup>st</sup> January of 2011 to 31<sup>st</sup> December of 2015 and known vascular access survival's data at the end of follow-up. Was analyzed data of US mapping (morphology and hemodynamic), comorbidity (blood pressure, severe arteriopathy, diabetes, Charlson index), Ca, P, PTH, Ferritin, PCR, Hb. End-points were early failure and secondary patency by Kaplan-Meier.

**Results:** 117 patients with native AVF were analyzed. Median age was 65,7 years (32-88). Men (n = 70, 59,8%). Hypertension, diabetes and severe vascular disease were present in 65 (86,7%), 38 (50,7%) and 31 (41,3%). Location of AVF was wrist in 55 (47,8%). Early failure was present in 23 (19,7%) cases. Patency at 2 and 5 years was 66 and 61%. There were not differences in analytical or US data. There was a trend to higher arteriopathy, diabetes, older age and distal AVF, although not significant, in relation with AVF failure.

**Conclusions:** There are not clear prognostic factors for AVF failure, although arteriopathy could play a role. Ultrasound evaluation does not show prognostic capability but could influence in the good failure rates by dismissing the worst vessels in high risk patients.

### 2.3.1.4

#### VEIN MAPPING-RELATED CONTRAST DYE EXPOSURE, CONTRAST-INDUCED NEPHROPATHY, AND TIME TO DIALYSIS IN CKD PATIENTS

*McGlynn P, Forman J, Hentschel D*

Brigham and Women's Hospital, Boston, USA

**Objectives:** Contrast-dye exposure in chronic kidney disease (CKD) has been associated with acute kidney injury and can lead to transition to ESRD and initiation of dialysis. Ultrasound (US) is therefore recommended by the KDOQI guidelines as the first line technique for vein mapping prior to access creation. However, venography can provide more detailed understanding of individual patient's venous networks as well as providing information about central vein anatomy. In this study we examined the incidence of contrast-induced nephropathy (CIN) as well as time to dialysis in patient undergoing vein mapping by venography or ultrasound.

**Methods:** The study is a retrospective cohort study. All patients were undergoing pre-operative evaluation for permanent access placement between September 2011 and November 2014. 40 consecutive venograms were performed in 28 patients with CKD IV/V not on dialysis censoring at the time of the subsequent venogram. The groups were compared using Cox-proportional hazards controlling for age, gender, race, and estimated Glomerular Filtration Rate (eGFR) at the time of pre-operative vein mapping. Time zero was defined as the date the ultrasound vein-mapping or venography study. A hydration protocol prior to venography was used. The venogram and control groups contained 23% and 18% African Americans aged 62 and 65 respectively. The venogram group had a baseline eGFR of 14.97 ml/min/1.73 m<sup>2</sup> compared to 13.67 ml/min/1.73 m<sup>2</sup> in the control group. The average contrast exposure for the venogram group was 12.4 ml per encounter and ranged from 10 ml to 25 ml.

**Results:** There were no episodes of CIN observed. Three patients in venography group were initiated on dialysis within 30 days of contrast exposure and one patient in the control arm. All 4 patients had eGFRs <15 at the time of contrast exposure and did not have evidence of CIN by lab data; however, one patient's follow-up lab was drawn 8 days following the venogram. There was no significant difference in patients initiating dialysis following vein mapping HR: 1.7 (.89-3.31). The only covariate significantly associated with starting dialysis was eGFR at the time of pre-operative planning.

**Conclusions:** Venography performed with limited contrast dye volume and hydration protocol is not associated with measurable CIN and does not shorten the time to dialysis.

### 2.3.1.5

#### DOES HIGH BIFURCATION OF THE BRACHIAL ARTERY PRECLUDE SUCCESSFUL UPPER LIMB FISTULA CREATION?

*Chapman Jr WC, Vachharajani N, Zhang T, Shenoy S*

Washington University School of Medicine, St. Louis, USA

**Objectives:** High bifurcation of the brachial artery with the radial artery originating in upper arm (brachioradial artery: BR) is an anatomic variation reported in 12.5-20% of the population based on radiographic and cadaveric population studies. A few reports in vascular access literature suggest that utilization of BR is associated with higher rates of arteriovenous fistula (AVF) failure. There are no reports on long-term function of AVF with BR inflow. In this abstract we report the long term outcome of functional BR based AVF.

**Methods:** We reviewed a prospectively maintained database on all AVF procedures performed by a single surgeon at a tertiary medical center to identify patients with functioning AVF and inflow from a BR. The control group comprised of functioning fistulae constructed at a comparable time point in patients with normal anatomy and similar demographics, BMI, disease and fistula site. Cumulative functional patency and the procedures required to maintain it were the primary outcomes.

**Results:** We identified 34 patients with BR and AVF created between May 2005 and January 2012 using the BR for inflow and cephalic vein (CV) in forearm (n = 22), upper arm CV at elbow (n = 10), and basilic vein at elbow (n = 2) for outflow. Mean followup between the study and control groups were similar (BR 33, Control 38 months). Primary patency rates at 12 and 60 months for BR were 53.3% and 17.5%, and for the control arm were 54.9% and 21.2% respectively (p = 0.7872). Secondary patency rates for the BR and control arms (83.4% vs. 90.5% at 12 months, 62.2% vs. 84.5% at 60 months) (p = .0649) were also similar. Further, the number of procedures required to maintain patency during the followup period were also similar (BR 66, Control 70) between the two groups.

**Conclusions:** Our data suggest that once functional, the long-term behavior of AVF created using BR is similar to those created in patients with normal anatomy. In contrast to prior reports, our data suggest that utilization of BR inflow vessel for creation of AVF provides primary and secondary patency rates comparable to fistulae in patients with standard arterial anatomy. We are further evaluating our data to see if site selection based on vessel diameter and surgical technique played a role in the successful functional maturation of AVF based on the brachioradial artery.

### 2.3.1.6

#### CEPHALIC VEIN FISTULAE IN THE ARM: DOES SITE DETERMINE LONG TERM OUTCOME?

*Chapman Jr WC, Vachharajani N, Zhang T, Shenoy S*

Washington University School of Medicine, St. Louis, USA

**Objectives:** Forearm radiocephalic (FARC) arteriovenous fistulae (AVF) are considered optimal for long-term vascular access (VA) compared to all other AVF options. They enjoy the privileges of autologous tissue, have lower flow rates and hemodynamic effects. RC provide more secondary VA options due to the availability of multiple outflow veins. VA literature provides scant data on long term outcomes of FARC and upper arm brachiocephalic (UABC) fistulae that support this hypothesis. This abstract evaluates long-term functionality of cephalic vein (CV) based AVF in the forearm and upper arm.

**Methods:** This is a retrospective review of a prospectively maintained data base of patients undergoing forearm and upper arm AVF using CV as the outflow from a tertiary care academic center. Outcome analysis included patient demographics, VA related risk factors, patency, and additional interventions

required to establish and maintain patency. These were compared between the FARC and UABC fistulae. Outcome were analyzed over a 60-month period. **Results:** 349 cephalic vein based AVF were established from January 1, 2008 to December 31, 2012; 239 (68.5%) were RC and 110 (31.5%) were BC fistulae. A two-stage procedure was required equally in both locations (RC 36.8%, BC 35.5%). Patency rates of BC fistulae at 12, 24, and 60 months (71.6%, 69.5%, and 60.1%) did not significantly vary from RC AVF at the same time points (65.8%, 62.3%, and 58.4%) ( $p = 0.338$ ). Two-stage procedures had same trend, with no significant difference detected among RC and BC AVF. BC AVF required more procedures (average of 2.3) compared to RC AVF (average of 1.7) ( $p = 0.038$ ) over the lifetime of the access. Two-stage procedures had significantly better patency rates compared to single stage AVF irrespective of AVF location ( $p = <0.0001$ ).

**Conclusions:** This experience suggests no significant difference in maturation patterns of RC and BC fistulae. This explains the preponderance of RC fistulae in the series. Long-term outcomes of CV based fistulae were similar regardless of the site. The forearm location preserves more options for future autogenous access when the original fistula fails. We are evaluating this data further to determine the reasons for a significant survival benefit that was noticed in patients undergoing AVF creation as a two-stage surgical procedure.

## POSTERS

### P1

#### TRANSONIC VS. VASC-ALERT, A COMPARATIVE ANALYSIS OF RESULTS

*Kennedy JB<sup>1</sup>, Frinak S<sup>2</sup>, Hirschman K<sup>1</sup>*

<sup>1</sup>Vasc-Alert LLC, USA

<sup>2</sup>Henry Ford Health Systems, USA

**Objectives:** Vascular access surveillance is defined by K/DOQI as the use of a medical device to test the access for patency. When the device indicates dysfunction in the access, it should prompt additional investigation and referral for preventive intervention. It is important for vascular access surveillance systems to accurately predict patients (pts) at risk for access failure and to do so with a sufficient amount of time to schedule an access intervention. This study compares the efficacy of two commonly used surveillance devices, i.e. the Vasc-Alert (VA) and the Transonic (TR) systems, for the same group of pts. **Methods:** A retrospective analysis was performed data from a large dialysis facility with over 500 fistula and graft patients during the period of one year. Data for the analysis included a list of surgical and radiological interventions, results recorded from TR testing performed monthly, and dialysis treatment data (used for input into the VA surveillance device). TR alerts were made following the standard criteria: i.e., a patient alerts with a flow of less than 600 mL/min or has a flow less than 1,000 mL/min that has decreased by more than 25% over the prior 4 months. A VA alert was defined as three consecutive values over the threshold of 0.55 for the venous access pressure ratio = venous intra-access pressure/MAP. VA data was obtained for the venous and arterial sides of the access. VA calculations were made with each treatment and TR testing was performed once a month. The analysis looked for predications for vascular access site problems from both technologies, represented by a documented intervention performed on the patient. To be considered a valid prediction, the alert had to be within 90 days of the intervention.

**Results:** During the study year, 136 pts that had at least one access problem (angioplasty, thrombectomy, catheter placement, or a revision). For this set of pts, VA detected 74% of pts who subsequently had an intervention while TR detected 52% of pts from the same group. The false negative rate for VA was 26% and 48% for TR. 82 problems were detected by both VA and TR, while VA caught problems in 45 pts missed by TR and TR caught problems in 15 pts missed by VA. Of the 82 problems both devices alerted on, VA preceded the earliest TR alert 74% of the time, while TR preceded VA 18% of the time. The two devices were tied in 7% of the cases. The average number of days by which an alert from VA preceded the earliest TR alert was 38 days. The average number of days by which a TR alert preceded the earliest alert from VA was 26 days.

**Conclusions:** These findings suggest that VA is more likely than TR to predict problems with individual pts and provide more lead-time to correct the problem. Pts therefore had a better chance of having a problem detected by VA than by TR. In a majority of cases where both technologies predicted a problem, VA predicted the problem earlier, and by a greater lead-time than TR.

### P2

#### CARDIAC VALVE REPLACEMENT FOR INFECTIVE ENDOCARDITIS IN PATIENTS WITH END STAGE RENAL DISEASE ON HEMODIALYSIS – A SINGLE INSTITUTION EXPERIENCE AND REVIEW OF THE LITERATURE

*Medicherla R<sup>1</sup>, Phair J<sup>1</sup>, Lorenzen S<sup>2</sup>, Jakobleff Jr W<sup>1</sup>, Scher L<sup>1</sup>*

<sup>1</sup>Montefiore Medical Center, New York, USA

<sup>2</sup>Albert Einstein College of Medicine, New York, USA

**Background:** Complications from vascular access are a leading cause of morbidity in the hemodialysis (HD) population. Use of tunneled catheters (TC) is associated with a greater risk of bacteremia and mortality when compared to other types of HD access. Infective endocarditis (IE) is a serious complication occurring in 1-12% of HD patients and is likely secondary to transient bacteremia from repetitive vascular access or infection of indwelling catheters. Cardiac valve replacement (VR) may be required in severe cases.

**Objectives:** To review characteristics and outcomes in HD patients requiring VR for IE.

**Methods:** A retrospective chart review was conducted to identify patients who underwent VR within a 6-year period (Jan 2009-Dec 2014). Inclusion criteria included a diagnosis of IE and end stage renal disease (ESRD) on HD. Relevant clinical information including demographics, co-morbidities, valve involvement, causative organisms, and type of HD access (arteriovenous fistula (AVF), arteriovenous graft (AVG), or TC) was collected.

**Results:** A total of 1497 patients underwent VR within the 6-year period. Of these, 167 patients (11.2%) had IE and 119 (7.9%) had ESRD on HD. Overall 30-day mortality for VR was 5.0% (75/1497). Mortality for the subgroups with IE was 7.2% (12/167) and with ESRD on HD was 10.1% (12/119). Thirty-three (2.2%) VRs were performed for IE in HD patients. Of these, 12 (36.4%) were being dialyzed via AVF, 4 (12.1%) via AVG, and 17 (51.5%) via TC. Mortality occurred in 2 of 12 patients with AVF, 1 of 4 with AVG, and 2 of 17 with TC for an overall mortality of 15.2% (5/33). The majority of causative pathogens (72.7%) were of the *Staphylococcus* species.

**Conclusions:** IE remains a significant problem in HD patients, particularly when TCs are utilized for access. Although appropriate algorithms have been developed to minimize long term TC use, bacteremia remains a significant problem. Although bacteremia can usually be treated with systemic antibiotics and selective catheter removal, IE requiring VR is an uncommon but potentially lethal complication of HD access infections. Our institutional experience reveals a mortality rate of 15.2%, which is favorable compared to the rates of 30-73% reported in literature. Early diagnosis and aggressive management is needed to optimize outcomes in these critically ill patients.

### P3

#### BUTTONHOLE USE OF A COLLAGEN VASCULAR GRAFT

*Schuman E<sup>1</sup>, Alexander P<sup>2</sup>*

<sup>1</sup>Sunnyside Medical Center, USA

<sup>2</sup>St. Vincent Medical Center, USA

**Objectives:** To review the use of a collagen vascular graft (Artegraft) for home hemodialysis (HD) via buttonhole technique. There was a previous study of buttonhole (BH) use in semi-biologic grafts in a poster session at a prior VASA meeting suggesting its efficacy. Appropriate patients for this approach have not been defined.

**Methods:** Case reports based on chart review from office, dialysis clinic and hospital records. Follow-up occurs every 2-3 months with clinical exam and ultrasound.

**Results:** There were 2 cases gleaned from 2 busy vascular access practices. Both patients had tried in-center dialysis and adamantly wanted home treatments. One had prior experience with home HD via a fistula, which had failed due to severe steal syndrome. The other patient had bilateral high bifurcations with small vessels below the axilla. Both grafts were axillary based and have been in place for over 2 years (55 months total). Accumulated BH experience was 29 months. Prior to BH use there were 6 procedures on these grafts (6/26 months). Since BH use initiated there have been 2 procedures (2/29 months). These were resolved with a revision in one and an angioplasty in the other. Both problems were found on surveillance monitoring. Kt/V and URR were adequately maintained.

**Conclusions:** Access in these patients is quite proximal due to inadequate or exhausted distal vasculature precluding fistula creation. Patients felt their quality of life was dependent on using home HD and BH technique was deemed the best approach by the treating unit. Expert initiation and supervision of the patient's BH technique is paramount. Detailed education of those

needing the graft is required. Close follow-up helps to assure graft patency with adequate flows. BH use of a collagen vascular graft can be a safe and useful adjunct in the care of highly selected patients.

#### P4 INTERGRAFT CONNECTOR SYSTEM FOR SUTURELESS ANASTOMOSIS OF AN ARTERIOVENOUS HEMODIALYSIS GRAFT

*Ross J<sup>1</sup>, Yevzlin A<sup>2</sup>, Setum C<sup>3</sup>, Kallok M<sup>3</sup>*

<sup>1</sup>Dialysis Access Institute, Regional Medical Center, Orangeburg, USA

<sup>2</sup>University of Wisconsin, Madison, USA

<sup>3</sup>Phraxix, Inc., USA

**Objectives:** Vascular access is referred to as the "Achilles heel" of dialysis because of the high morbidity and mortality rates due to infection, thrombosis and ultimate access failure. While arteriovenous fistulas (AVF) are considered the gold standard access type, AV grafts (AVG) are also widely used when venous pathology limits creation of AVF or the AVF fails to mature. The novel InterGraft Connector System was developed for sutureless anastomosis of an AVG, and is designed for optimized flow dynamics that may result in the reduction of stenosis commonly observed in conventionally sutured AVG. A prospective, multi-center, single-arm, pivotal clinical study is currently in progress, with an objective to evaluate the safety and performance of the InterGraft System. The pivotal study design and an overview of prior clinical testing will be presented.

**Methods:** Patients with End Stage Renal Disease who have a planned AVG implant procedure for hemodialysis access and who meet the selection criteria will be enrolled. Monthly clinical follow-up will be performed for 6 months. Data from 104 evaluable patients will be used for the primary study analyses and the results will be compared to a pre-specified patency performance goal. Endpoints include cumulative patency (primary endpoint), acute device success, number and type of AVG interventions, and serious adverse events.

**Results:** Study enrollment is underway and the results are not yet available. A prior first-in-human pilot study demonstrated that the InterGraft System was safely and successfully used for establishing AVG anastomoses, with acceptable patency throughout a 6 month follow-up period.

**Conclusions:** The pivotal study findings will answer the question of whether AVG connected with the InterGraft System will have cumulative 6 month patency rates comparable to standard sutured AVG.

#### P5 CURRENT STATUS OF VASCULAR ACCESS PROBLEMS AT MEDICAL FACILITIES ASSOCIATED WITH HIROSHIMA UNIVERSITY HOSPITAL

*Doi S, Masaki T*

Hiroshima University Hospital, Hiroshima, Japan

**Introduction:** Vascular access (VA) problems are one of the most common complications in hemodialysis patients, but the current status of these issues remains unknown. Currently, a prospective observational study is underway at Hiroshima University Hospital and its associated medical institutions. Patients initiating dialysis are registered and the time of onset and frequency of complications are being studied. We would like to report our findings regarding the current status of VA problems.

**Subjects and methods:** Subjects comprised 81 patients who began hemodialysis after April 1, 2012 at Hiroshima University Hospital or an associated institution. All patients were followed-up for at least one full year. Mean age was 60 ± 11 years and included 56 men (69%) and 25 women (31%). There were 39 patients with diabetes mellitus (48%) and 42 patients who were normoglycemic (52%). Hemodialysis was initiated using a temporary catheter in 26 patients (32%). VA repair became necessary in 11 patients (14%) due to maturation failure. Primary patency rate was 67% one year after introducing a VA created during hemodialysis initiation, while the secondary patency rate was 96%. Relationships between clinical parameters and 1-year VA patency rates were studied. Elderly patients or those with grafts had significantly lower patency rates. When percutaneous transluminal angioplasty (PTA) was performed for the initial hemodialysis, the 1-year patency rate was 46%. PTA patency rates in the anastomosis area and vicinity were compared to narrowing in other sites, and superior patency rates were noted in the anastomosis area and its vicinity. Factors that affected patency rates of the initial PT were studied and patients with renal hypoplasia showed significantly higher odds ratios for re-stenosis.

**Conclusions:** VA problems occur quite commonly after the introduction of hemodialysis. Frequent treatment is needed in order to maintain VA patency.

#### P6 ART OF CANNULATION

*Kaplan JR*

Vascular Access Society of the Americas, USA

Assessment, Management and Cannulation of the Dialysis Access. Demonstrate proper cannulation procedure. Identify the different types of Dialysis Vascular Access. Discuss the advantages and disadvantages of each type of dialysis vascular access. Describe and demonstrate the proper technique for vascular access assessment. Identify common signs and symptoms of malfunctioning access. Identify common vascular access complications. Review interventional techniques for dialysis vascular access.

#### P7 MANAGEMENT OF CEPHALIC ARCH STENOSIS IN HEMODIALYSIS PATIENTS

*Shintaku S, Kawanishi H, Moriishi M, Banshodani M, Hashimoto S, Tsuchiya S*

Tsuchiya General Hospital, Hiroshima, Japan

**Objectives:** Cephalic arch stenosis is troublesome in hemodialysis patients. We retrospectively investigated the management of cephalic arch stenosis in autogenous arteriovenous fistula.

**Methods:** Hemodialysis patients who were referred to our hospital with dysfunctional autogenous fistulas were assessed. Patients with stenotic region at the cephalic arch on angiography results were considered to have cephalic arch stenosis either with or without other stenotic regions. For refractory cases, bare metal stents were used. Secondary patency (access survival until abandonment) was defined as the interval from the time of first angioplasty to the cephalic arch stenosis to access abandonment or time of measurement of patency.

**Results:** Fourteen cases were included in this study. Eight (57%) were of radiocephalic fistula in the forearm and six (43%) were of brachial-communicating or brachial-cephalic fistula around the elbow. All patients were initially treated using angioplasty. On and after the second angioplasty, bare metal stents were used in five cases. Venovenostomy with transposition of the cephalic vein to the basilic vein was added to rescue cases of rupture during angioplasty. With combined use of these therapies, secondary patency after the first angioplasty for cephalic arch stenosis was 92.8% at 1 year.

**Conclusions:** Combination therapy with angioplasty, bare metal stents, and venovenostomy is preferable to treat cephalic arch stenosis.

#### P8 PITFALLS IN DISTAL RADIAL ARTERY LIGATION FOR DIALYSIS ACCESS RELATED STEAL SYNDROME

*Lulic D, Borazjani R, Ladenheim E*

LDAC Vascular Centers, USA

**Objectives:** Dialysis access related steal syndrome (DASS) is seen in 1-4% of patients with radiocephalic arteriovenous fistulas (RCAVF). Common treatments include surgical ligation or embolization of the distal radial artery (DRA) to stop retrograde flow through the DRA. If the DRA is not ligated proximal to the bifurcation of the palmar and dorsal branch there is a possibility of DASS recurrence. The goal of this study is to present a case of DASS treated by DRA ligation in which the DASS recurred and highlight pitfalls that may occur in DRA ligation.

**Methods:** A case study is presented of a patient with RCAVF and DASS treated by DRA ligation who experienced recurrent symptoms because of an un-ligated radial artery branch. Recurrent symptoms were managed by surgical re-ligation of DRA closer to the anastomosis.

**Results:** A 50 year old man had been receiving chronic hemodialysis for 5 years. He experienced the gradual progressive onset of right hand paresthesias and pain. He had ligation of DRA and his symptoms resolved. He remained symptom free for 14 months but began experiencing intermittent hand pain, worse at night. Clinical evaluation demonstrated a ligated palmar branch and patent dorsal branch of the DRA. Duplex ultrasound showed intra-access flow of 772 ml/min. Ligation of DRA close to the anastomosis resolved his symptoms.

**Conclusions:** Ligation of DRA for DASS should be performed close to the anastomosis of the RCAVF. Without ligation close to the anastomosis, recurrent symptoms can develop over time due to persistent flow through an

un-ligated branch. Other pitfalls to avoid include failure to recognize radial artery stenosis and small vessel disease.

#### P9

##### LIMB ACCESS SALVAGE USING HERO GRAFT

*Salazar D, Hakki FZ, Asuncion E*

Medstar Washington Hospital Center, Washington, USA

**Objectives:** Central venous stenosis is a prevalent issue in hemodialysis patients leading to venous hypertension and thrombosis affecting limb access performance. Eventually this requires multiple interventions which include thrombectomy, angioplasty stent placement and/or revision. An alternative method has developed to assist patients with a failing AV graft or AV fistula secondary from central venous outflow stenosis by salvaging with a HERO graft implantation rather than abandoning the hemodialysis access site. Maintaining the functioning access site allows for immediate cannulation and avoids the use of a bridging catheter and its associated risk of infection.

**Methods:** Patient data were obtained with each procedure, with follow-up data gathered during a retrospective review. Outcomes evaluated were comparing post operative primary and secondary patency rates and access blood flow rates over one month, six months and over twelve months. Insertion method was performed for all patients in similar manner using the HERO graft as the outflow component. Cannulation of central vein pre- or post-stenosis was performed using the seldinger technique with placement of the component tip into the superior vena cava with fluoroscopic guidance. Anastomosis was performed on the venous end of the existing fistula or graft with the HERO outflow component, in an end to end fashion.

**Results:** Four patients were identified, 3 patients with AV fistula and 1 with AV graft. The average blood flow rates at one month 350 ml/min, six months 322 ml/min, and over twelve months 280 ml/min for three AVF patients. The AV graft patient was lost to follow up. Primary patency was maintained for one year in two AVF patients. The third AVF patient had a primary patency of six months and there after required multiple interventions due to thrombosis. This patient maintained secondary patency for two years where access was eventually compromised by frequent thrombosis requiring abandonment of access and catheter placement.

**Conclusions:** Limb access salvage using HERO graft allows patients an opportunity to maintain their functioning access with good patency and blood flow rates. This method also allows for immediate cannulation after insertion and relieves symptoms related to venous hypertension.

#### P10

##### MANAGEMENT OF DISTAL RADIAL ARTERY EMBOLI ENCOUNTERED DURING DIALYSIS FISTULA ANGIOPLASTY

*Florek RS, Helm MJ, Trac LE, Rivera G, Sheahan C, Alessi F*

West Jefferson Medical Center, Marrero, USA

Fifteen cases were reviewed in which an embolus into the radial artery was encountered during angioplasty of a failed fistula (four were brachial artery fistulas and eleven were distal radial Cimini-Breschia shunts). In thirteen of the cases, thrombolysis alone was used to dissolve the distal embolic occlusions. Two of the occlusions needing aspiration of a solid embolus in addition to local thrombolysis, indicating a solid piece of chronic (white) clot or atherosclerotic fragment. Of the two cases requiring local aspiration, one each was from the distal radial fistula group (1 of 11) and one was from the proximal brachial fistula group (1 of 4). This suggests that the fragmentation of atherosclerotic fragments may be more common in larger caliber brachial arteries than in the distal radial arteries.

#### P11

##### CURRENT STATUS OF LONG-TERM CATHETERS IN JAPAN

*Miyata A<sup>1</sup>, Hamanou S<sup>1</sup>, Kawabata C<sup>1</sup>, Maekawa A<sup>1</sup>, Toyoda M<sup>1</sup>, Uekihara S<sup>1</sup>, Hayano S<sup>2</sup>*

<sup>1</sup>Kumamoto Red Cross Hospital, Kumamoto, Japan

<sup>2</sup>Japanese Red Cross Blood Bank in Kumamoto, Kumamoto, Japan

**Objectives:** To prepare the rapid demographic changes in Japanese ESRD population, we analysed the Japanese situation of long term catheters using statistics of the Japanese society for dialysis therapy (JSDT).

**Methods:** The studies on the Japanese situation of the vascular accesses, which were carried out in 1998 and 2008, was analysed to find out the use and issues of long term catheters. 4072 answers out of 4124 facilities were analysed in 2009.

**Results:** We found only 0.5% out of chronic HD patients are using long term catheters in Japan, which is quite few comparing with the countries like Canada (52%) or Belgium (42.6%). The reasons for this phenomenon is probably not only because Japanese doctors strictly follow the guidelines of JSDT which recommend that the long term catheters are basically final solution of the vascular access, but also because there would be a common recognition that long term catheters in the present market apparently reduce the patient's quality of life and give more daily load to the patients or carers.

**Conclusions:** To prepare the very rapid demographic changes in Japan, Japanese urgently need the long term catheters, which are more resistant against the complications such as infection or obstruction, and easier and safer for the both patients and carers.

#### P12

##### RETROSPECTIVE ANALYSIS OF BRACHIAL PLEXUS BLOCKS ON PATIENTS UNDERGOING AV FISTULA CREATION WHILE ON ONGOING ANTIPLATELET THERAPY

*Yelorda KL<sup>1</sup>, Cummings LS<sup>2</sup>, Gooden CW<sup>2</sup>*

<sup>1</sup>University of Missouri-Kansas City School of Medicine, Kansas City, USA

<sup>2</sup>Saint Luke's Hospital, St. Louis, USA

**Objectives:** There is limited data regarding interrupting antiplatelet (AP) therapy in patients undergoing brachial plexus blockade (BPB) for arteriovenous (AV) fistula creation. Studies have shown that BPB resulted in increased venous dilation and decreased pulsatility index, as demonstrated by Doppler ultrasound, creating an ideal environment for fistula creation and short-term patency. Continuing AP therapy in patients undergoing spinal anesthesia has shown an increase in minor complications, such as blood aspirated through the spinal or epidural needle or catheter blood-tinged cerebrospinal fluid. However, studies have also shown that interrupting this therapy in patients at a high risk for perioperative cardiac events may cause serious cardiovascular complications. This study investigates the complications associated with perioperative AP therapy and postoperative (PO) complications in patients undergoing BPB for upper extremity AV fistula creation.

**Methods:** We conducted a retrospective study identifying patients between September 2011 and May 2015. Demographic data such as age, sex, and AP therapy were recorded. Exclusion criteria included patients on an AP that was held greater than 7 days prior to surgery and patients with missing data. We conducted a chart review of PO complications at PO day 1 and subsequent clinic follow up visits ranging between 3 days to 9 weeks, and calculated a complication rate for each encounter.

**Results:** We identified 104 patients who met eligibility criteria, of which 81 patients were on at least 81 mg of aspirin (ASA) and the remaining 23 patients were on either clopidogrel, ASA-dipyridamole, prasugrel, ticagrelor, as mono or combination therapy. One patient experienced a phrenic nerve palsy at the onset of anesthesia and the procedure was cancelled. Minor PO day 1 complications such as ecchymoses or small hematomas occurred at the surgical site in 3 patients (3.0%). No patient experienced a major PO day 1 complication. There were 4 PO follow up complications (3.8%), all being hematomas at the surgical site; 2 required surgical intervention.

**Conclusions:** Our results suggest that continuing AP therapy during the perioperative period for patients undergoing BPB for AV fistula creation is safe, and may be beneficial in patients who are high risk for perioperative cardiac events.

#### P13

##### TRANSHEPATIC HEMODIALYSIS CATHETER PLACEMENT IN SHORT-SEGMENT BUDD-CHIARI SYNDROME

*Florek RS<sup>1,2</sup>, Le T<sup>1</sup>, Rivera G<sup>1</sup>, Batson R<sup>1</sup>, Molina M<sup>1</sup>*

<sup>1</sup>West Jefferson Medical Center, Marrero, USA

<sup>2</sup>Lourdes Regional Medical Center, Lafayette, USA

Retroperitoneal fibrosis (RPF) can encase the IVC and extend up into the mediastinum. In rare cases, the confluence of the hepatic veins occurs, resulting in Budd-Chiari syndrome. After exhaustion of all peripheral sites in chronic dialysis patients, the central HD catheters can be placed via the transhepatic route by tunneling through an occluded hepatic vein, or by accessing a developed

intrahepatic collateral vein. Successful placement into the right atrium can achieve adequate dialysis.

**P14**  
**FUNCTIONAL OCCLUSION OF THE LEFT INNOMINATE VEIN WITH  
 INDWELLING HEMODIALYSIS CATHETERS**

*Florek RS<sup>1,2</sup>, Helm M<sup>1</sup>, Sheahan C<sup>2</sup>*

<sup>1</sup>West Jefferson Medical Center, Marrero, USA

<sup>2</sup>Lourdes Regional Medical Center, Lafayette, USA

Nine hemodialysis (HD) catheters were reviewed by CT which showed occlusion of the left innominate vein (LINV) around the catheter, which did not affect the dialysis function. Previous literature articles note an increased incidence of LINV occlusion compared to the right innominate vein (RINV) in the presence of indwelling chemotherapy catheters. The overall incidence of LINV occlusion in HD catheters is not well established, likely due to the large caliber of the catheters. This may, however, complicate replacement, if needed. Placement into the right INV is recommended over the LINV to preserve vein patency and to reduce the difficulty of replacement through an occluded vein, if necessary.

**P15**  
**ENDOSCOPIC SAPHENOUS VEIN HARVEST ENHANCES OUTCOMES  
 WITH DISTAL REVASCULARIZATION-INTERVAL LIGATION (DRIL) FOR  
 VASCULAR ACCESS INDUCED ISCHEMIA**

*Berman SS*

Carondelet Heart and Vascular Institute, USA

**Objectives:** Evaluate the impact that endoscopic saphenous vein harvesting has on outcomes with distal revascularization-interval ligation (DRIL) procedures.

**Methods:** From June through October 2015, 4 patients with significant vascular access induced ischemia underwent DRIL procedures with saphenous vein harvest using endoscopic techniques.

**Results:** All 4 patients had successful management of their hand ischemia while preserving access function. None of the patients developed saphenous harvest site wound complications. More importantly, all 4 patients were able to have their procedures accomplished as outpatients and were able to ambulate at the time of discharge.

**Conclusions:** The DRIL procedure has been the most consistently reliable technique available to treat vascular access induced ischemia, however, saphenous vein harvest site complications are common and standard open saphenous harvesting techniques may limit early ambulation. Endoscopic saphenous harvesting techniques provides a minimally invasive mechanism to obtain autogenous conduit for DRIL procedures that allows for early ambulation and outpatient treatment without compromising the clinical objectives of resolving hand ischemia and preserving a functional hemodialysis access.

**P16**  
**MODIFIED BUTTONHOLE CANNULATION FOR VESSEL WALL  
 THICKNESS USING "TOUCH CANNULATION"**

*Mott SV*

Fresenius, USA

Placement of buttonhole needles in atypically thick vessel walls can be challenging. I first noticed this concern in 2006 when I introduced "touch cannulation" (a technique of guiding the buttonhole needles by holding the tubing ½ to 1 inch behind the needle rather than the needle wings themselves) and was documented in 2008, during research on vessel wall thickness using ultrasound. While the Fistula First, Catheter Last initiative and the American Nephrology Nurses Association advised against the use of sharp needles for cannulation of established buttonholes, this approach did not allow for the need to use considerable blunt force to push a buttonhole needle through an especially thick fistula wall. In fact, during touch cannulation, the tubing would start to bend, and the staff would revert to grasping the needle wings. To address this problem, I introduced a new buttonhole cannulation approach. When the tubing starts to bend due to a thick vessel wall, the cannulator should grasp one side of the needle wing with a thumb and forefinger while sliding their other fingers up behind the wings. The needle can then be gently pushed in until there is a flashback. At this point, the cannulator

slides his or her hand back one inch and "floats" the needle in place in the fistula, leaving at least 1/16" of the needle showing to prevent hubbing. This method may help solve some of the problems that have plagued buttonhole cannulation in patients with thick vessel walls.

**P17**  
**ANEURYSM REDUCTION THROUGH USE OF BUTTONHOLE  
 CANNULATION**

*Mott SV*

Fresenius, USA

**Background:** A 34 year old male with past medical history of HIV, Sickle Cell Disease, and secondary hyperparathyroidism presented to unit with left upper arm AV fistula that had been cannulated for three years using the rope ladder cannulation method. Patient developed an aneurysm of the AV fistula which concerned him and staff.

**Methods:** The patient had both upper arms measured prior to cannulation using the buttonhole technique. The upper right arm circumference was measured at 13 inches, and the left upper arm at 15 ¼ inches. Buttonhole cannulation was utilized to develop tracks approximately ½ inch from the base of the aneurysm. The angle of the needle used for cannulation was approximately a 2 to 3 degree angle of entry, which was virtually flat for cannulation. 15 gauge sharp fistula needles were utilized for 6 weeks until buttonhole track was developed. At week seven, buttonhole fistula needles were then utilized to cannulate the fistula. Measurements were then taken every two weeks to measure the amount of reduction in the size of the aneurysm. At week seven it was also noted that the aneurysm was almost flat. The following scale shows the amount of reduction of the size of the aneurysm over a 10 week period. Week 1 Week 2 Week 4 Week 6 Week 8 Week 10 15 ¼ 14 7/8 14 ¼ 13 5/8 13 ¼ 13.

**Conclusions:** The patient continues to be cannulated using the buttonhole cannulation technique. At the 10 week mark, both the right and left upper arms were measured to be the same in size at 13 inches with noted flattening and reduction of the AV fistula aneurysm area. The AV fistula was slightly misshaped where buttonholes were created and needles placed. No other complications were noted or observed. Utilization of the buttonhole technique allowed this patient to extend the viability of his access and improve the appearance of the AV fistula. This leads to a cost savings by preventing the need for revision of the fistula and helps to prevent potential aneurysmal rupture that could lead to a life threatening outcome. It also has the potential to prevent the use of foreign materials such as mesh and grafts that have been tied to a higher risk for infection and clot formation. Buttonhole cannulation can be a safe and effective method of preserving an AV fistula that has developed aneurysms over time as well as leading to overall cost savings from preventing surgical intervention.

**P18**  
**PEDIATRIC ARTERIOVENOUS FISTULA MATURATION UTILIZING  
 ULTRASOUND GUIDED LIPOSUCTION: A CASE REPORT**

*Carsten CG, Fowler JL, Cull DL*

University of South Carolina School of Medicine - Greenville, Greenville Health System, Greenville, USA

**Objectives:** Arteriovenous fistulas can be used as an alternative to central venous access devices for permanent venous access. In some patients, the vein is positioned too deeply in the subcutaneous tissue to allow for reliable access and a secondary procedure to reposition the vein is required. While the use of liposuction to facilitate fistula maturation has been described in adults, there are no reports of its use in children. The purpose of this report is to describe the use of liposuction to superficialize a fistula placed in a child for permanent venous access.

**Methods:** A 5-year-old girl with opsoclonus myoclonus syndrome required permanent venous access to facilitate plasmapheresis. After preoperative vein mapping, a proximal radiocephalic fistula was created. Postoperative duplex at 2 month follow up revealed adequate venous dilatation but excessive vein depth. The patient underwent fistula revision using liposuction with ultrasound guidance to superficialize the vein. 50 milliliters of tumescent was injected in the subcutaneous tissue superficial to the fistula using a blunt tumescent needle under direct vision using B-mode ultrasound. A 2 millimeter Mercedes Tulip cannula was used to aspirate the tissue between the

fistula and the overlaying skin under direct ultrasound visualization. A total of 32 milliliters of adipose/supinate was harvested. A light pressure dressing was applied over the treated area.

**Results:** Postoperatively the patient was seen in the office and based on physical exam it was determined that the fistula was available for use 6 weeks post-operatively. The fistula was successfully cannulated for plasmapheresis and has remained patent for 6 months, requiring no further intervention.

**Conclusions:** Liposuction has been well described as an adjunctive maneuver used to assist in fistula maturation in adult patients. While the improved cosmesis of liposuction is appealing, large volumes of aspirate removal are often required to adequately superficialize the vein. Pediatric patients, given their smaller size and heightened concerns for acceptable cosmetic results postoperatively, would seem to be an ideal patient population for utilization of this technique. We describe the first successful use of liposuction to assist in fistula maturation in a pediatric patient.

#### P19 CREATION OF A TRANSPOSED MATURE AVF AUTOGRAFT: A NOVEL APPROACH TO TREATING STEAL SYNDROME

*Brown M<sup>1</sup>, Dugan N<sup>2</sup>*

<sup>1</sup>Hartford Hospital, Hartford, USA

<sup>2</sup>UConn School of Medicine, Hartford Hospital, Hartford, USA

**Objectives:** Native arteriovenous fistulae are the gold standard for hemodialysis access however, they continue to present significant clinical challenges including failure to mature and steal syndrome. Hand ischemia secondary to autologous AV fistula has been successfully treated with several techniques including ligation, and fistula preserving procedures such as DRIL procedure, banding, and proximal arterialization. We describe herein treating a patient with steal syndrome by ligating and then transposing a well-developed, mature upper arm cephalic vein AVF into the contralateral arm.

**Methods:** Our patient is a 76 year old female with ESRD secondary to glomerulonephritis who had a left arm brachiocephalic AVF created in 2007. She developed steal syndrome in 2013 presenting with hand pain and ulcerations on her fingertips. Peritoneal dialysis was attempted but failed secondary to infection and adhesions. The patient was not a candidate for a DRIL procedure due to aberrant proximal arterial anatomy and unsuitable saphenous vein caliber for use as arterial conduit. In April 2014, a right brachial cephalic AVF was created but did not mature despite endovascular intervention. The AVF was abandoned and the mature left cephalic vein fistula was excised, and implanted in the right upper arm using standard techniques as a straight graft from the brachial artery to the Axillary vein. A post operative fistulogram revealed a mid AVG stenosis that was successfully treated with angioplasty.

**Results:** The transposed mature AVF autograft remains patent to date 19 months post AVG creation with no thrombotic episodes. One percutaneous intervention (fistulogram with angioplasty) was performed at 5 months for pulsatility and elevated venous pressures.

**Conclusions:** Transposed Autogenous vein graft using a mature AVF from the contralateral arm is a viable option for treating steal syndrome and preserving autologous vascular access.

#### P20 SHEATH HOLE AND TRADITIONAL TECHNIQUE IN LARGE VOLUME THROMBECTOMIES

*McGlynn P, Forman J, Hentschel D*

Brigham and Women's Hospital, Boston, USA

**Objectives:** Large volume thrombectomies used to be the domain for an open, surgical approach. A mini-incision thrombectomy technique has been demonstrated to expand the width of interventional approaches to access thrombosis by partial open removal of large often organized thrombus. Here we present a minimalistic "open" approach using the skin opening created by an 11 French vascular sheath for thrombus extraction.

**Methods:** Large volume thrombectomies were identified from the access program data base. Procedure and clinical success, need for tunneled catheter insertion and evidence for residual thrombus were determined, as well as need for rate of repeat thrombectomies and days to next thrombectomy.

Procedural aspects such as contrast volume, fluoroscopy time, radiation dose and sedation time were recorded for comparison.

**Results:** 39 large volume thrombectomies were identified, 8 using a sheath hole approach, 31 the traditional approach. All sheath hole thrombectomies were successful, no tunneled catheters were inserted and no large residual thrombus was noted. In the traditional thrombectomy group, there were 3 procedural failures, 5 clinical failures, 4 tunneled catheter insertion, and notable thrombus in 11 accesses. – Sheath holes procedures were associated with lower contrast volume used (44.8 vs 57.9 ml), shorter fluoroscopy time (13.1 vs 29.5 min), lower radiation dose (22.7 vs 43.6 Gy<sup>cm</sup>2), and shorter sedation times (100.5 vs 169.9 min).

**Conclusions:** Sheath hole technique outperforms traditional technique for large volume thrombectomies and is useful when open surgical approaches are not available.

#### P21 AXILLARY-AXILLARY INTERARTERIAL CHEST LOOP GRAFT FOR SUCCESSFUL EARLY HEMODIALYSIS ACCESS: A FOUR YEAR FOLLOW-UP

*Valenti D, Gambhir R, Slim H, Rashid H, Mistry H*

King's College London, London, UK

**Objectives:** Obtaining adequate vascular access in patients undergoing chronic hemodialysis therapy can be demanding, particularly for those in whom all peripheral venous options have been exhausted.

**Case:** We present a case of a 46-year-old woman with a history of complex vascular access for end-stage renal failure for whom there was no remaining possibility of venous access and had reached a palliative stage. We implanted an emergency loop axillary-axillary interarterial early needling graft. Post-operatively, the patient made a quick and uneventful recovery, resuming hemodialysis after only six days with no interventions necessary up to four years follow-up. To the best of our knowledge, this is the first dedicated case report describing the successful implantation of an axillary-axillary interarterial chest loop graft to re-establish access in a patient with exhausted options.

**Conclusions:** We recommend the use of this technique to surgeons who find themselves in comparable situations in the future.

#### P22 CONSIDERATIONS FOR LONG TERM DIALYSIS ACCESS FOR PATIENTS ON LEFT VENTRICULAR ASSIST DEVICES. A CASE REPORT

*Safaya A, Rajdeo H, Bhuta K*

Westchester Medical Center, New York Medical College, New York, USA

**Objectives:** Implantable left ventricular assist devices (LVADs) are used in patients with end stage heart failure refractory to medical therapy either as a bridge to cardiac transplantation or as destination therapy. Non Pulsatile, Continuous-Flow Left Ventricular assist devices (CFLVAD) are currently the most widely used devices due to their smaller size, increased durability and reliability. Many of these patients have associated renal dysfunction, which may improve after LVAD placement due to enhanced perfusion. Some, however, may develop acute renal impairment or persist with chronic renal dysfunction after implantation. There are management challenges with respect to long-term dialysis access, owing to special hemodynamic changes and a non-pulsatile flow in patients with LVAD. Our main objective here is to understand the patency and functionality of an Arterio-Venous graft system in a patient with non-pulsatile, continuous flow ventricular assist device, and a brief look into the overall change in hemodynamic parameters specifically cardiac output, with respect to the arterio-venous shunt thus created.

**Methods:** We present here a case report of a Sixty-One year old man on heartware-left ventricular assist device with renal impairment presenting for a permanent hemo-dialysis access, who underwent surgery for a right sided brachio-brachial Arterio-Venous graft (A-V graft) placement. Post operatively the patient was followed for any major hemodynamic changes, graft patency and eventual function of the A-V graft for dialysis.

**Results:** A patent AVG was followed-up clinically with a positive bruit. A distinct thrill however, was not appreciated due to a non-pulsatile flow. Objectively, the graft underwent successful cannulation and hemodialysis was carried out 15 days post op with acceptable dialysis pressures. A postoperative follow-up ultrasonographic Doppler confirmed the patency of the graft. Patient tolerated hemodialysis through his AVG until discharge.

**Conclusions:** Although there are no existing studies, but AVG placement comes

out as a more reliable and preferred dialysis access in patients with CFLVAD. A non-pulsatile flow theoretically, may preclude the option of an arteriovenous fistula (AVF). A non-pulsatile flow has shown to be associated with decreased flow-mediated vasodilatation and hence adversely affects maturation of an AVF, although, studies looking at AVF maturation in LVAD patients are lacking.

### P23

#### THE OUTCOME AFTER STENT PLACEMENT FOR THE VENOUS OUTFLOW STENOSIS OF AVG

*Sekimoto Y<sup>1</sup>, Ikezoe T<sup>2</sup>, Yamazoe S<sup>1</sup>, Shoji T<sup>2</sup>, Fujimura N<sup>2</sup>, Harada H<sup>1</sup>*

<sup>1</sup>Tokyo Dental College Ichikawa General Hospital, Chiba, Japan

<sup>2</sup>Tsudanuma Vascular Clinic, Chiba, Japan

**Background:** The number of patients with dialysis is increasing, and more than 300,000 patients are undergoing chronic hemodialysis in Japan. The rate of prosthetic arteriovenous graft (AVG) in vascular access for hemodialysis is increasing and reaches nearly 10%. The secondary patency of AVG has been reported 52-85.5% at 1-year in Japan. The leading cause of AVG failure is venous outflow stenosis. In such cases, balloon angioplasty is performed as the first-line therapy, however recoil and/or restenosis is

frequently observed in spite of advances in endovascular technique. We hypothesize that stent placement for venous outflow stenosis may improve the patency of AVG.

**Objectives:** This study was investigating the patency after stent placement for the venous outflow stenosis of AVG in our institution.

**Methods:** Fifteen patients who had been taken hemodialysis using AVG underwent stent placement for the venous outflow stenosis of AVG between Sep. 2011 and Sep. 2015. Primary, assisted primary, secondary patency of stent lesion were calculated using Kaplan-Meier analysis.

**Results:** The mean age was  $69 \pm 13.0$  years. Six cases were female. The mean follow-up period after stent placement was 15.8 months (3.6-34.4 months). Technical success was achieved in all cases. There were no procedure-related complications. The mean number of treatments by balloon angioplasty before the stent placement was 1.4 times (0-3 times). The primary stent patency was 63.6% and 21.8% at 6 months and 12 months. The assisted primary patency was 86.2% and 73.8% at 6 months and 12 months. Secondary patency was 100% at 12 months.

**Conclusions:** Stent placement for the venous outflow stenosis of AVG was safe and feasible procedure and may improve the AVG patency. In our cases, high assisted primary and secondary patency was achieved probably due to the close follow-up and early additional intervention.

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