Arteriovenous fistula (AVF) maturation failure as a result of a peri-anastomotic stenosis is currently a huge clinical problem. Despite the magnitude of the clinical problem, however, there is minimal information about the pathogenesis of this condition. The aim of this study was to describe the cellular (macrophage) infiltrate at different time points following AVF creation in a pig model of AVF stenosis. Bilateral AVFs were placed in 8 pigs. Animals were sacrificed at 2d, 7d, 28d and 42d. Multiple formalin fixed paraffin embedded blocks were sequentially cut at 4 mm intervals for the first 2.5 cms of the venous segment beyond the anastomosis. Sections were stained for pig macrophages using a streptavidin biotin immunohistochemical technique and scored using a semi-quantitative scoring scale (Range 0-4+ with 0 = 0-10% macrophages; 1+ =11-25%, 2+ = 26-50%, 3+ = 51-75%, 4+ = 76-100%). The adventitia (A), intima-media (IM) and endothelium (E) were separately scored at each of the time points and data from different blocks for a single AVF was averaged.

Maximal macrophage infiltration occurred at 2d (mean for all 3 layers combined =1.14+/−0.2). The individual scores for macrophage infiltration within the different vessel wall layers at 2 days were similar (A = 1.29+/−0.04; IM = 1+/−0; E = 1.2+/−0.5). In marked contrast there was minimal infiltration at 7d (0.06+/−0.03; p < 0.001 for a comparison of 2d versus 7d), with a complete absence of macrophages at 28d and 42d. Interestingly, many regions of the venous segment at 2d had a very marked macrophage infiltration (> 75%) on one side of the vein only, with minimal infiltration of the opposite wall.

The early and transient infiltration of macrophages into the vessel wall (at 2d only) together with a selective infiltration to one side of the venous segment (perhaps due to differences in hemodynamic stress) suggest future novel therapeutic targets for AVF stenosis.
Differences in Anatomical Configuration Influence Flow and Diameter in a Pig Model.

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Arteriovenous fistula (AVF) failure due to venous segment stenosis is an important clinical problem, responsible for a significant clinical morbidity and economic cost. Studies have suggested that a rapid increase in flow and diameter after AVF creation could be a marker for successful AVF maturation. The aim of this study was to examine the effect of anatomical configuration on changes in flow and diameter in a pig model of AVF stenosis.

Curved (C) and straight (S) AVFs were placed bilaterally in 8 pigs. Blood flow was measured using duplex doppler ultrasound immediately after AVF creation (0d) and at 2d, 7d and 28d. Diameter was measured immediately after AVF creation (calipers) and at the 2d, 7d and 28d time points (64 slice CT scans) at 4 representative points (8 mm, 11 mm, 19 mm and 25 mm) proximal to the AV anastomosis.

The mean blood flow and diameter for the curved and straight AVF configurations at different time points are shown in Table 1. C-AVFs had a greater blood flow and diameter at all time points as compared to S-AVFs. The interval change in flow (ml/min/day or mmd) was greater in C-AVFs as compared to S-AVFs between 0-2d (C = 53 mmd, S = 27 mmd); 2d-7d (C = 148 mmd, S = 113 mmd) and 7d-28d (C = mmd, S = 61 mmd). Similarly the percentage change in diameter was greater in C-AVFs as compared to S-AVFs between 0-2d (C = +48%, S = +45%), 2d-7d (C = +38%, S = +16%) and 7d-28d (C = +34%, S = -7%).

The greater absolute values for flow and diameter in the C-AVFs, the continuing relative increase over defined time intervals in both these parameters for the C-AVFs and finally the relative reduction in diameter between 7d-28d for the S-AVFs as opposed to a continuing increase in the C-AVFs; all suggest that differences in anatomical configuration of an AVF could have a very significant impact on clinical outcomes. Studies to translate these findings into the clinical setting are currently in progress.

<table>
<thead>
<tr>
<th>TIME</th>
<th>FLOW (ml/min)</th>
<th>DIAMETER (mm)</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Curved</td>
<td>Straight</td>
</tr>
<tr>
<td>0d</td>
<td>1139</td>
<td>862</td>
</tr>
<tr>
<td>2d</td>
<td>1245</td>
<td>916</td>
</tr>
<tr>
<td>7d</td>
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<tr>
<td>28d</td>
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</tbody>
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Aggressive Interventions for Fistula Maturation: A Double-Edged Sword?

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Primary AVF failure remains a significant barrier in improving AVF use. With the significant emphasis from the Fistula First Initiative to increase AVF incidence and prevalence, more interventions have been required to promote AVF maturation. The objective of this study was to evaluate short and long-term survival in AVFs requiring interventions to promote maturation compared to those without interventions to promote maturation. A retrospective review of our hemodialysis patients who received AVFs from 2002 to 2006 was performed. 127 patients had AVFs placed during this period. 74.8% were male, 69.3% blacks, 53.5% diabetics, 70.1% had upper arm AVFs, and 42.5% required intervention before AVF maturation. Cumulative survival and post-dialysis primary (unassisted) patency were compared between those patients requiring interventions before maturation and those who did not. Kaplan-Meier survival analysis was used to model AVF patency. No demographic differences was found between patients who had an intervention before AVF maturation and those who did not. Patients with interventions prior to AVF maturation compared to those without interventions had worse cumulative survival (797 vs 970 days, p= 0.0044), worse post-dialysis primary (unassisted) patency (96 vs 605 days, p=0.004), and longer time to first AVF use (127 vs 85 days, p=0.0068). Patients with interventions prior to maturation required more interventions to maintain patency after use on dialysis (1.85 vs 1.65; p=0.560), but was not statistically significant. Patients requiring interventions (endovascular or surgical) prior to AVF maturation had worse short and long-term outcomes. Interventions before maturation may induce endothelial injury, inflammation, and oxidative stress, thus, reducing AVF survival.
Perivascular Endothelial Cell Matrices (Vascugel) Enhance Dialysis Vascular Access Survival in Diabetic Patients

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Dialysis access graft (AVG) and fistula (AVF) failure as a result of venous stenosis is an important clinical problem which is thought to be more severe in diabetic patients with CKD and ESRD; and for which there are no effective therapies. Vascugel is comprised of allogeneic aortic endothelial cells embedded in a gelatin matrix, which inhibits stenosis and promotes dilatation in experimental models of arteriovenous stenosis. We have previously described the feasibility and safety of Vascugel when placed around the anastomotic and venous outflow sites of AVGs and AVFs (V-HEALTH clinical study). In this sub-study, we describe the impact of Vascugel on dialysis access survival in diabetic patients from the V-HEALTH study. 39 of the 65 V-HEALTH patients were diabetic, of which 28 received Vascugel and 11 received placebo (matrix without endothelial cells). The composite safety end point was defined as the occurrence of local wound infection, thrombosis or intervention at 4 weeks. Primary and assisted primary patency, were used as efficacy end points at 24 weeks. There was a significant improvement in both the primary and assisted primary patency in the Vascugel group (48% for Vascugel vs. 20% for placebo (p=0.00543) and 88% for Vascugel vs. 52% for placebo (p=0.0089), respectively). There was also an improvement in the safety end point in Vascugel patients with a 27% incidence of local wound infection, thrombosis or intervention at 4 weeks for placebo, compared to 8% for Vascugel patients, p=0.156.

Our results suggest that Vascugel may be particularly effective in preventing access failure in high-risk diabetic patients, perhaps through its beneficial effects on endothelial function.

Rerouting Procedure for Arteriovenous Accesses: Is it Worth Using the Side Branches?

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At times the outflow track of an arteriovenous access ends abruptly in a stump or is unsuitable to serve as an adequate conduit for optimal blood flow. In many cases, the drainage of blood to the right atrium finds its way through one or more collaterals. In this analysis, we present an approach to divert the drainage through a suitable side branch by augmenting its size using the percutaneous balloon angioplasty (PTA) procedure. Fifteen patients with an inadequate main outflow tract and drainage through existing collaterals were included in this study. Demographic characteristics revealed: age=60±14 years, male=10, Caucasian=8, Hispanic=5, Black=3, hypertensive=10, diabetics=6. There were eight brachiocephalic and five radiocephalic fistulae and three arteriovenous loop grafts. A suitable outflow side branch was chosen based on angiography and treated with PTA. Blood flow was successfully diverted to the right atrium through the side branch in all but two cases. In these cases, the side branch ruptured and the accesses were lost. In three cases, two PTA procedures were required at two to three weeks interval to establish adequate outflow. None of the three patients needed a tunneled dialysis catheter during the augmentation phase. All accesses are working with an average follow-up of 19.5±8 months. Patients have required on average 2.1 procedures/year. We suggest that simple PTA can assist in augmenting the size of an existing side branch to adequately reroute blood flow to the right atrium. This minimally invasive approach is a suitable alternative to a more invasive surgical intervention.
Transjugular renal biopsy performed by an Interventional nephrology program- A retrospective observational study

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Kevin Martin, Saint Louis University
Rizwan Qazi, Saint Louis University
Alejandro Alvarez, Saint Louis University
Paul Schmitz, Saint Louis University
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Background: Obtaining renal tissue is critical in the diagnosis and management of patients with unclear cause of renal disease. Bleeding diathesis, liver disease and obesity are some of the contraindications for percutaneous renal biopsy. In such high-risk patients, transjugular renal biopsy is a safe and effective procedure. Our experience with transjugular renal biopsy performed by academic interventional nephrologists is reported.

Study design: A retrospective observational cohort study.

Settings and Participants: 23 patients with either acute or chronic kidney disease with contraindications for percutaneous renal biopsy, who underwent transjugular renal biopsy performed by interventional nephrologists at our university.

Predictor: Transjugular renal biopsy.

Outcomes: Efficacy and safety of transjugular renal biopsy.

Results: 23 TJRBs were reviewed. 17 out of 23 were male, the patients’ age ranged between 19 and 82 with a mean and standard deviation of 52.8 ± 14.4. 20 out of 23 (87%) of the procedures yielded adequate tissue for pathologic diagnosis. 3 (13%) patients required blood transfusions, none required coil embolization or nephrectomy and there were no deaths because of the procedure. Patients who had adequate tissue for diagnosis and follow up information was available (n=18), performing TJRB had clinical impact to a varying degree (7 were initiated on immunosuppression, 1 had discontinuation of immunosuppression, in 7 it provided prognostic information, and in 3 appropriate recommendation was made for kidney transplantation).

Limitations: Performing transjugular renal biopsy requires high technical expertise, and an interventional radiology suite. Our study lacks control groups to compare efficacy and safety to other available options (open, laparoscopic or percutaneous renal biopsy).