**Patient Name:** \_\_\_\_\_

**Date of Birth**: \_\_\_\_\_\_\_\_

**Operating Physician:** Peter H. Lin, M.D.

**Date of Service:** \_\_\_\_\_\_\_\_

**Referring physician:** \_\_\_\_\_\_\_

**Pre-operative Diagnosis:** End stage renal disease

**Post-operative Diagnosis:** Same.

**ICD-10 Diagnosis Codes:**

I10 Essential (primary) hypertension

N18.6 End stage renal disease

E11.51 Type 2 diabetes mellitus with diabetic peripheral angiopathy without gangrene

T82.858A Stenosis of vascular prosthetic devices, implants and grafts, initial encounter

T82.868A Thrombosis of vascular prosthetic devices, implants and grafts, initial encounter

R22.32 Localized swelling, mass and lump, left upper limb

M79.602 Pain in left arm

**Procedures Performed:**

1. Puncture of left brachioaxillary graft with ultrasound guidance (CPT# 76937)
2. Percutaneous mechanical thrombectomy with transluminal balloon angioplasty of peripheral dialysis segment (CPT# 36905)
3. Percutaneous transluminal balloon angioplasty and central dialysis segment (CPT# 36907)

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2. Percutaneous transluminal balloon angioplasty of peripheral dialysis segment (CPT# 36902)

2. Percutaneous intravascular stent placement of peripheral dialysis segment (CPT# 36903)

2. Mechanical thrombectomy and/or thrombolysis of peripheral dialysis segment (CPT# 36904)

2. Mechanical thrombectomy and/or thrombolysis with balloon angioplasty of peripheral dialysis segment (CPT# 36905)

2. Mechanical thrombectomy and/or thrombolysis with intravascular stent placement of peripheral dialysis segment (CPT# 36906)

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3. Percutaneous transluminal balloon angioplasty and central dialysis segment (CPT# 36907)

3. Percutaneous stent placement of central dialysis segment (CPT# 36908)

3. Percutaneous embolization of dialysis segment (CPT# 36909)

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4. Intravascular ultrasound of the left brachioaxillary dialysis graft (CPT# 37252), axillary vein (CPT# 37253), subclavian vein (CPT# 37253-XS), innominate vein (CPT# 37253-XS), and superior vena cava (CPT# 37253-XS)

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5. Placement of tunneled dialysis catheter (CPT# 36558)

5. Removal of tunneled dialysis catheter (CPT# 36589)

**Fluoroscopy time:** 3.5 minutes

**Fluoroscopic images obtained:** 20

**Contrast:** 15 cc of Optiray-240.

**Medication:** 1% buffered lidocaine locally.

**EBL:** Minimal.

**Complications:** None.

**Moderate sedation:** Under physician supervision, 0.5 mg Versed and 25 mcg fentanyl were administered intravenously for moderate sedation. Pulse oximetry, heart rate and BP are continuously monitored by an independent trained observer present. Dr. Lin was present during the entire procedure and spent 45 minutes of face to face sedation time with the patient.

**Merit-Based Incentive Payment System (MIPS) Codes:** G9500

**MIPS Measure:** #145: Radiation Exposure indices, OR Exposure Time and Number of Fluorographic Images Documented in Final Procedure Report

**Clinical History:**

**======== Dialysis Access Intervention =======**

The patient reports recent problem with the arteriovenous access due to increased arm pain and swelling following hemodialysis.

The patient reports recent difficulty with dialysis in the arteriovenous access with increased arm swelling and pain, as well as increased venous pressure during hemodialysis sessions.

The patient reports recent difficulty with dialysis in the arteriovenous access due increased arm swelling and pain, as well as prolonged bleeding from needle cannulation sites following hemodialysis.

The patient reports recent difficulty with dialysis in the arteriovenous access with prolonged bleeding from needle cannulation sites, as well as poor flow in the arteriovenous access during hemodialysis sessions.

Additionally, the patient’s recent dialysis adequacy test showed a low dialysis clearance with KT/V ratio of less than 1.0, which represents AV access recirculation with AV graft malfunction resulting in inadequate hemodialysis.

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The patient has a prior history of venous stent placement in the dialysis access venous circulation due to intraluminal stenosis.

The patient has enlarging AV access pseudoaneurysm with associated skin breakdown from needle access site. This has resulted in increased arm pain and swelling.

The patient is s/p AV fistula pseudoaneurysm resection with AV graft revision, and a known history of AV graft dysfunction with central venous stenosis.

The patient has a known history of pacemaker placement via the subclavian vein. The pacemaker wires in the central venous circulation have resulted in venous obstruction resulting in central venous hypertension and dialysis access malfunction.

The patient has a known history of central venous occlusion including innominate vein and superior vena cava thrombosis, caused in part from prior central venous catheter insertion.

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The patient underwent the initial AV access creation under my care on \_\_\_\_\_\_. Since then, the patient has developed AV access thrombosis and has undergone multiple AV graft thrombectomy procedures in the past. The patient recently underwent an AV access thrombectomy procedure on \_\_\_\_\_\_\_ under my care. A recent venous duplex ultrasound revealed intraluminal stenosis of AV access as well as central venous obstruction. The duplex ultrasound showed diminished flow rate with high grade intraluminal stenosis in the AV access. I have discussed with the patient regarding potential benefits and risks of the treatment plan. The purpose of the procedure is to evaluate the circulation of the dialysis access with venography and intra-vascular ultrasound. Appropriate endovascular interventions including thrombectomy, balloon angioplasty, and/or stent placement will be performed to treat the intraluminal stenosis. Potential risks of the procedure include arm and hand ischemia, nerve injury, arm numbness, wound infection, bleeding, pulmonary embolism, myocardial infarction, stroke, and death. The overall risk of these complications is 2%. The patient accepts these benefits and risks of the recommended treatment.

**======= Thrombosed AV access #1 =======**

The patient reports a two-day history of AV access thrombosis, and the patient is scheduled for dialysis access thrombectomy and endovascular interventions.  The patient underwent the initial AV access creation under my care on \_\_\_\_\_\_. Since then, the patient has a history of AV access thrombosis and has undergone multiple AV graft thrombectomy procedures in the past. The patient recently underwent an AV access thrombectomy procedure on \_\_\_\_\_\_\_ under my care. I have discussed with the patient regarding potential benefits and risks of the treatment plan. The purpose of the procedure is to evaluate the circulation of the dialysis access with venography and intra-vascular ultrasound. Appropriate endovascular interventions including thrombectomy, balloon angioplasty, and/or stent placement will be performed to treat the intraluminal stenosis. Potential risks of the procedure include arm and hand ischemia, nerve injury, arm numbness, wound infection, bleeding, pulmonary embolism, myocardial infarction, stroke, and death. The overall risk of these complications is 2%. The patient accepts these benefits and risks of the recommended treatment.

**======= Thrombosed AV access #2 =======**

The patient recently developed AV access thrombosis, and was referred to us by the dialysis center for a thrombectomy procedure. The patient underwent the initial AV access creation under my care on \_\_\_\_\_\_. Since then, the patient has a history of AV access thrombosis and has undergone multiple AV graft thrombectomy procedures in the past. The patient recently underwent an AV access thrombectomy procedure on \_\_\_\_\_\_\_ under my care. I have discussed with the patient regarding potential benefits and risks of the treatment plan. The purpose of the procedure is to evaluate the circulation of the dialysis access with venography and intra-vascular ultrasound. Appropriate endovascular interventions including thrombectomy, balloon angioplasty, and/or stent placement will be performed to treat the intraluminal stenosis. Potential risks of the procedure include arm and hand ischemia, nerve injury, arm numbness, wound infection, bleeding, pulmonary embolism, myocardial infarction, stroke, and death. The overall risk of these complications is 2%. The patient accepts these benefits and risks of the recommended treatment.

======= **Permacath removal and AV access venography (#1)** ======

The patient has end stage renal disease who has an upper extremity dialysis access and a tunneled dialysis catheter in the jugular vein. The arteriovenous graft creation was performed on \_\_\_\_\_\_\_\_\_ under my care. The patient currently receives hemodialysis via the upper extremity AV graft, and the permacath is no longer being used for hemodialysis. A recent venous duplex ultrasound revealed intraluminal stenosis in the dialysis access as well as a diminished flow rate of less than 500mL/min, which was indicative of impending dialysis graft thrombosis. The patient reports a recent history of dialysis difficulty in the AV access during hemodialysis as well as neck swelling which may be caused in part by catheter-induced central venous stenosis. Based on these considerations, the patient is scheduled for AV access venography and endovascular interventions, as well as central venous interventions with permacath removal. I have discussed with the patient regarding potential benefits and risks of the treatment plan. The purpose of the procedure is to evaluate the central venous circulation and ensure there is no residual thrombus or permacath-associated stenosis in the jugular vein or superior vena cava. Appropriate endovascular interventions including thrombectomy or balloon angioplasty of jugular vein stenosis will be performed if clinically indicated. The permacath will also be removed at the same setting. I have also discussed with the patient regarding the benefits and risks of AV access intervention. The purpose of this procedure is to identify potential intraluminal stenosis of the upper extremity AV access circulation. Appropriate endovascular interventions including balloon angioplasty and/or stenting will be performed to treat the intraluminal stenosis. Potential risks of the procedure include arm and hand ischemia, nerve injury, arm numbness, wound infection, and bleeding. The overall risk of these complications is 2%. The patient accepts these benefits and risks of the recommended treatment.

======= **Permacath removal and AV access venography (#2)** =====

The patient has end stage renal disease who previously underwent an upper extremity AV graft creation on \_\_\_\_\_\_\_ under my care. The patient also has a tunneled dialysis catheter dialysis which is no longer being used for hemodialysis. A recent venous duplex ultrasound revealed intraluminal stenosis in the dialysis graft as well as a diminished flow rate of less than 400mL/min, which was indicative of impending dialysis graft thrombosis. The patient reports a recent history of dialysis difficulty in the AV access during hemodialysis as well as neck swelling which may be caused in part by catheter-induced central venous stenosis. Based on these considerations, the patient is scheduled for AV access venography and endovascular interventions, as well as central venous interventions with permacath removal. I have discussed with the patient regarding potential benefits and risks of the treatment plan. The purpose of the procedure is to evaluate the central venous circulation and ensure there is no residual thrombus or permacath-associated stenosis in the jugular vein or superior vena cava. Appropriate endovascular interventions including thrombectomy or balloon angioplasty of jugular vein stenosis will be performed if clinically indicated. The permacath will also be removed at the same setting. I have also discussed with the patient regarding the benefits and risks of AV access intervention. The purpose of this procedure is to identify potential intraluminal stenosis of the upper extremity AV access circulation. Appropriate endovascular interventions including balloon angioplasty and/or stenting will be performed to treat the intraluminal stenosis. Potential risks of the procedure include arm and hand ischemia, nerve injury, arm numbness, wound infection, and bleeding. The overall risk of these complications is 2%. The patient accepts these benefits and risks of the recommended treatment.

======= **New Permacath Placement** ==========

The patient has been diagnosed with end stage renal disease which will require urgent hemodialysis. The patient is therefore scheduled for Permacath placement so hemodialysis can be initiated. I have discussed with the patient regarding potential benefits and risks of the treatment plan. The purpose of the procedure is to insert a tunneled dialysis catheter in the jugular vein to allow hemodialysis. Potential risks of the procedure include neck pain, neck hematoma, bleeding, wound infection, catheter infection, catheter occlusion, pneumothorax, cardiac tamponade, and nerve injury. The overall risk of these complications is 2%. The patient accepts these benefits and risks of the recommended treatment.

**Technique:** The risks, benefits, and alternatives of the procedure were discussed with the patient. Written informed consent was obtained. The patient's medication records were evaluated and reviewed within the patient’s chart. The patient's laboratory values were carefully reviewed within the patient’s chart. The patient was placed in the supine position on the angiographic suite and the left arm was prepped and draped in the standard usual sterile fashion. 1% lidocaine was used to anesthetize the arm. Next under real-time ultrasound guidance, a 21-gauge micropuncture needle was used to access the arteriovenous graft. An ultrasound image was saved. A microcatheter-introducer sheath was inserted. A 0.035” guidewire was inserted through the sheath into the AV graft and exchanged for a 6 French sheath. Contrast injection was performed using Optiray contrast to evaluate the luminal patency of the AV graft as well as central venous circulation. A 0.014’ guidewire placed in the AV graft through the introducer sheath which was followed by an intravascular ultrasound catheter. Intraluminal examination of the AV graft as well as the central venous circulation was performed using IVUS using a pullback technique. Vessel examined using intravascular ultrasound included the AV graft, axillary vein, subclavian vein, innominate vein, and superior vena cava. The intravascular ultrasound images were saved on a local workstation and used for interpretation and to guide treatment.

These angiographic evaluations including intravascular ultrasound revealed the followings: 1. Brachioaxillary AV graft with \_\_\_ % luminal stenosis and intraluminal thrombus. 2. Axillary vein with \_\_\_% luminal stenosis. A pre-existing nitinol stent with intra-stent stenosis was identified. 3. Subclavian vein with \_\_\_% luminal stenosis. An extrinsic compression caused in part by the first rib and clavicle compression was identified. 4. Innominate vein with 10% luminal stenosis. 5. Superior vena cava with patent flow without luminal stenosis.

========= < Thrombectomy + PTA of Peripheral Dialysis Segment, CPT# 36905 > ========

Based on these findings, we proceeded with mechanical thrombectomy and balloon angioplasty of the AV graft first. Percutaneous thrombectomy of the brachioaxillary graft was performed using the aspiration thrombectomy technique. An angioplasty balloon catheter was inserted over the region of thrombus and the balloon was inflated to macerate the thrombus using the Fogarty thrombectomy method. The thrombus was aspirated via the introducer sheath connecting to an aspirating syringe. A total of 10ml of thrombus was aspirated from the introducer sheath. Balloon angioplasty of the AV graft was next performed using an \_\_\_ 8 mm angioplasty balloon to correct the intraluminal stenosis. The balloon was insufflated to 12 atmospheric pressure for 30 seconds. A repeat angiogram was performed following the intervention.

We next performed balloon angioplasty to treat the intraluminal stenosis of the axillary vein. An axillary venous stent was identified in the axillary vein with a high-grade intra-stent stenosis. \_\_\_\_ vs. \_\_\_\_ A high grade intraluminal stenosis caused by an sclerotic valve was identified. The venous stenosis was treated with balloon angioplasty using an 8 mm angioplasty balloon. The balloon was insufflated to 12 atmospheric pressure for 30 seconds. A completion angiogram was performed following the intervention.

======= < PTA of Peripheral Dialysis Segment, CPT# 36902 > ========

Based on these findings, we proceeded with balloon angioplasty of the AV graft first. Balloon angioplasty of the AV graft was performed using an \_\_\_ 8 mm angioplasty balloon which was positioned over the intraluminal stenosis. The balloon was insufflated to 12 atmospheric pressure for 30 seconds. A repeat angiogram was performed following the intervention.

We next performed balloon angioplasty to treat the intraluminal stenosis of the axillary vein. An axillary venous stent was identified in the axillary vein with a high-grade intra-stent stenosis. \_\_\_\_ vs. \_\_\_\_ A high grade intraluminal stenosis caused by an sclerotic valve was identified. The venous stenosis was treated with balloon angioplasty using an 8 mm angioplasty balloon. The balloon was insufflated to 12 atmospheric pressure for 30 seconds. A completion angiogram was performed following the intervention.

======= < Percutaneous Stenting of Peripheral Dialysis Segment, CPT #36903 > ========

Based on these findings, we proceeded with transluminal stent placement of the axillary vein. We placed a \_\_\_\_ mm x \_\_\_\_ mm Nitinol stent across the stenotic segment of the axillary vein. Once the stent was deployed, the stent catheter was removed, and balloon angioplasty was performed using a \_\_\_ mm balloon across the stented axillary vein. A repeat angiogram was performed following the intervention.

======= < Mechanical Thrombectomy + Stenting of Peripheral Dialysis Segment, CPT #36906 > ========

Based on these findings, we proceeded with mechanical thrombectomy and intravascular stent placement of the AV graft and axillary vein. Percutaneous thrombectomy of the brachioaxillary graft was performed using the aspiration thrombectomy technique. An angioplasty balloon catheter was inserted over the region of thrombus and the balloon was inflated to macerate the thrombus using the Fogarty thrombectomy method. The thrombus was aspirated via the introducer sheath connecting to an aspirating syringe. A total of 10ml of thrombus was aspirated from the introducer sheath. We next placed a \_\_\_\_ mm x \_\_\_\_ mm Nitinol stent across the stenotic segment of the AV graft and axillary vein. Once the stent was deployed, the stent catheter was removed, and balloon angioplasty was performed using a \_\_\_ mm balloon across the stented axillary vein. A repeat angiogram was performed following the intervention.

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======= < PTA of Central Dialysis Segment, CPT# 36907 > ========

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We next performed balloon angioplasty to correct the intraluminal stenosis of the subclavian vein. A high-grade intraluminal stenosis caused in part by the extrinsic compression of the first rib and clavicle was identified. The venous stenosis was treated with balloon angioplasty using an 8 mm angioplasty balloon. The balloon was insufflated to 12 atmospheric pressure for 30 seconds. A completion angiogram was performed following the intervention.

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The sheath and catheter were then removed and hemostasis was achieved with a 4-0 Monocryl suture as well as manual compression. Sterile dressings were applied.

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======= < Permacath Removal > ========

Next we turned our attention to permacath removal procedure. Local anesthesia using 1% lidocaine was injected over the catheter insertion site. A hemostat was used to carefully open the skin site where the catheter exited, which loosened the cuffed portion of the catheter from the adjacent tissue. Next with steady traction pressure, the catheter was removed from the right neck and right chest region. Manual pressure was applied in the right chest region for 20 minutes to achieve hemostasis. Appropriate dressing was applied over the incision site.

======= < Permacath Placement > ========

Next we turned our attention to permacath placement procedure. Local anesthesia using 1% lidocaine was injected over the catheter insertion site. Using a portable ultrasound unit, the jugular vein was visualized and accessed percutaneously. A guidewire was inserted in the vein, which was followed by dilator and peel away sheath placement into the vein. Next we made an inferior lateral counter incision using a scalpel approximately 5 cm away from the venous puncture site. A double lumen tunneled dialysis Permacath was inserted subcutaneously from the counter incision site and brought out through the venous puncture site. The Permacath was introduced into the vein via the peel-away sheath. The position of the catheter was placed in the vena cava which was confirmed by fluoroscopy. A 3-0 prolene suture was used to anchor the catheter to the skin site securely. Excellent blood flow was withdrawn from the catheter lumens without difficulty. High concentration of heparin solution was used to pack the Permacath catheter. Appropriate dressing was applied over the incision site.

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The patient tolerated the procedure well without complication. I was present throughout the entire procedure.

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**Findings:**

1. Brachioaxillary AV graft with \_\_\_ % luminal stenosis and intraluminal thrombus.

2. Axillary vein with \_\_\_% luminal stenosis. A pre-existing nitinol stent with intra-stent stenosis was identified.

3. Subclavian vein with \_\_\_% luminal stenosis. An extrinsic compression caused in part by the first rib and clavicle compression was identified.

4. Innominate vein with 10% luminal stenosis.

5. Superior vena cava with patent flow without luminal stenosis.

**Treatment Outcomes:**

1. Successful balloon angioplasty and thrombectomy of left brachioaxillary AV graft with resultant luminal patency.
2. Successful balloon angioplasty of left subclavian vein with resultant luminal patency.
3. Successful removal of tunneled dialysis catheter.

**Plan:**

The patient may continue with hemodialysis via the AV graft, and is instructed to return for follow up clinic evaluation with surveillance duplex ultrasound in four weeks.

Due to the residual high grade luminal stenosis despite of endovascular interventions, the patient will be scheduled for surgical revision and possible new AV graft creation in 2 weeks.

Discharge instructions were reviewed with the patient and a follow up visit was scheduled.

**Thank you for the opportunity to participate in the care of your patient.**

**Regards,**



**Peter H. Lin, M.D.**

**Vascular Surgery**