Prophylactic distal revascularization with interval ligation and simultaneous arteriovenous fistula creation in high-risk patients

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Dialysis access-related ischemic steal syndrome is a well-recognized dialysis access complication. When severe, manifestations include rest pain, hand dysfunction, and tissue loss. Dialysis access attempts on the affected extremity are usually abandoned after a diagnosis of steal syndrome, and patients are often left catheter-dependent. Prophylactic distal revascularization with interval ligation has been described in patients at high-risk for steal syndrome. We present our experience with prophylactic distal revascularization with interval ligation performed simultaneously with arteriovenous fistula creation to prevent the recurrence in five patients and review the current body of literature supporting its use. (J Vasc Surg Cases 2015;1:87-9.)

Dialysis access-steal syndrome (DASS) is a well-recognized access-related complication and occurs in up to 5% to 8% of dialysis patients.[1,2] When DASS is severe, manifestations can include rest pain, hand dysfunction, and tissue loss. These patients require prompt surgical intervention to improve hand perfusion and prevent permanent hand dysfunction or amputation, or both. Several surgical procedures have been described to surgically treat DASS after access creation. Early reports of managing DASS have included access ligation; however, this left patients without a permanent access. Schanzer et al[3] originally described in 1988 a procedure that could resolve distal ischemia while still maintaining access patency, distal revascularization, and interval ligation (DRIL).

Several factors have been associated with an increased risk of DASS, including anatomic considerations (including peripheral vascular disease), brachial artery-based access,[4] and lower extremity access.[5] Among the comorbidities that have also been associated with DASS are peripheral vascular disease, diabetes, female gender, and hypertension.[4,6] Finally, patients who have previously experienced DASS represent the group at highest risk for recurrence. With the durability and success of the DRIL procedure, there may be a role for prophylactic DRIL (pDRIL) in patients who have are high risk to develop DASS. The available literature for pDRILs is extremely limited. This study was performed to report outcomes of pDRILs when performed simultaneously with arteriovenous fistula (AVF) creation.

METHODS

A retrospective review was performed of all patients who underwent a planned pDRIL and simultaneous hemodialysis access procedure (Fig) from July 2003 to July 2014 at two academic institutions. No patients had active DASS symptoms. The University of Pittsburgh's Institutional Review Board approved this study before data collection, and a waiver of consent was granted because all data were already in existence and the study exhibited minimal risk. Descriptive statistics included age, sex, comorbid conditions, prior episodes of DASS, and operative details, and patient outcomes were reviewed and reported.

A literature search was performed using PubMed, identifying any case reports or case series of prophylactic or preemptive DRILs. All major studies reporting DRIL outcomes were also reviewed to identify cases of prophylactic placement.

RESULTS

Five patients (three women) underwent a simultaneous DRIL and AVF placement. All patients previously developed DASS after a brachial artery AVF, surgically treated with ligation. Patients were a mean age of 64 years (range, 39-80 years). All patients had peripheral vascular disease, diabetes mellitus, hypertension, and end-stage renal disease and were receiving hemodialysis through a tunneled dialysis catheter (TDC). The mean number of previous access procedures was 2.6 per patient (excluding access ligation). All patients had a preoperative angiogram that did not demonstrate proximal disease or severe forearm occlusive disease.

All new AVF were brachial based and placed on the same side as the patient's previous episode of steal. AVF

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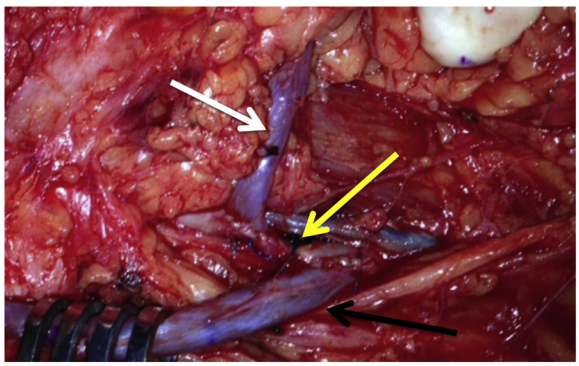

Fig. Intraoperative image shows new brachiocephalic arteriovenous fistula (AVF) creation (*white arrow*), brachial-brachial bypass (*black arrow*), and interval brachial artery ligation (*yellow arrow*).

types included 3 basilic vein transpositions (single staged), 1 brachial vein transposition, and 1 brachial artery-to-axillary vein graft using translocated femoral vein. DRIL bypass conduits included saphenous vein in three and basilic vein in two.

There were no 30-day complications or development of perioperative DASS. At the last follow up (mean, 244 days), all AVFs were functional and the pDRILs remained patent, with a mean access maturation time of 56 days. Two patients died in the follow-up period (postoperative days 40 and 83) of causes unrelated to their dialysis access.

DISCUSSION

This study reviewed five patients who were at high-risk for the development of DASS due to a history of DASS after a previous access procedure in the same arm, leading to access ligation. These patients are very challenging cases to providing permanent dialysis access.

The literature review identified one case report[7] and two retrospective DRIL series in which pDRIL patients were included.[8,9] The first description of a pDRIL was by Lebow et al,[7] where a patient at high risk for the development of steal had intraoperative signs of DASS. They subsequently performed a DRIL procedure, and the patient did not develop DASS postoperatively. Anaya-Ayala et al[8] performed two pDRILs as part of their series. Both were high-risk due to medical comorbidities and a lower extremity access configuration. Lastly, Scali et al[9] reported the largest series, with eight patients undergoing pDRIL. Six of these patients had a history of DASS, whereas the other two had distal forearm occlusive disease. These patients were part of a larger series, and details about their outcomes were not specified.

A reasonable option in this patient population is leaving them TDC dependent. DASS patients have severe comorbidities and sometimes a limited life expectancy. However, leaving a functional patient with a reasonable life expectancy TDC dependent is inappropriate due to the known risk of increased all-cause mortality, fatal infections, and cardiovascular mortality directly related to TDCs.[10]

The other alternative is to abandon the DASS extremity and perform the next access procedure in the contralateral arm, using techniques to minimize the risk that DASS will develop. This may include using a more distal artery for fistula inflow and, hopefully, lowering the risk of ischemia. Another well-described technique is using the proximal artery as inflow or using the proximalization of arterial inflow technique preoperatively.[11]

With the published success of the DRIL procedure,[2,4] it becomes a favorable option to not only treat DASS but also prevent its recurrence. pDRILs were placed with no complications, and all AVFs reached maturation. The pDRIL was placed in the same extremity as the patient's previous steal, with no development of DASS.

DRIL improves DASS symptoms in 80% to 100% of patients,[1,2,9,12,13] and reported bypass primary patency is 95% at 1 year and 78% at 5 years.[9] The high rate of resolution of symptoms and excellent bypass patency has made the DRIL procedure a popular, durable surgical therapy for DASS.

pDRIL placement represents an aggressive application of a procedure with excellent outcomes and patency. Patients with a history of DASS represent the highest risk of developing DASS, or better said, the recurrence of DASS. Lebow et al[7] and Anaya-Ayala et al[8] performed pDRILs in patients at high medical risk with good outcomes. Scali et al[9] performed most of their pDRILs to prevent recurrence, but also performed pDRILs in two patients with forearm occlusive arterial disease. These cases highlight that carefully selected high-risk DASS patients can safely undergo access placement with prevention of DASS with a pDRIL.

The literature includes reports of 16 patients who have undergone a pDRIL. This is a limited experience and, therefore, should be reserved for select patients. Despite the known risk factors for DASS, the patient-specific risks are difficult to determine and hard to quantify for patients. To date, our institutions have reserved pDRIL to prevent recurrence of DASS after a documented episode. pDRILs have been reserved for patients who are functional and will live long enough to benefit from an AVF over a TDC. pDRIL expands the available access choices in these patients. Although adding DRIL to the access procedure presumably increases the overall surgical risks, we did not observe this. The available literature for thrombotic complications of DRIL bypasses is smaller than this series but remains a realistic concern, and patients should be counseled.

CONCLUSIONS

DASS represents a severe complication and a major obstacle to future dialysis access. In patients with a history of DASS, a pDRIL at the time of access creation prevents the development of DASS and may be applicable to other high-risk patients. Further research is needed to quantify patient's risk for the development of DASS and who may therefore benefit from a prophylactic DRIL procedure.

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