Distal Revascularization and Interval Ligation as a Useful Option for Steal Syndrome

Zia Ur Rehman[1], M. Younus Durrani[1], Hassan Ishaq[2] and Ziad Sophie[1]

[1]*Department of Surgery, Aga Khan University Hospital, Stadium Road, Karachi, Pakistan*
[2]*Medical Student, Aga Khan University Hospital, Stadium Road, Karachi, Pakistan*

ABSTRACT

Distal revascularization and interval ligation (DRIL) is considered a useful option to relieve haemodialysis access-related steal syndrome. The results of this procedure are not known in the local setup. This is a case series of patients who underwent DRIL between January 2005 and December 2015. A total of ten patients (9 females) were included in the study. All the patients presented with grade 3 steal syndrome. Seven patients had rest pain while three had tissue loss. Polytetrafluoroethylene was used in all patients as the brachio-brachial bypass graft. All patients had smooth recovery except one patient who had postoperative brachio-brachial graft thrombosis and required thrombectomy. In all the cases, access was preserved. Steal symptoms resolved completely in all patients except for two, who had partial relief of rest pain and neurological symptoms. DRIL is a safe and effective procedure for resolution of steal syndrome and in preserving access at the same time.

Key Words: *Dialysis access steal, Distal revascularization and interval ligation (DRIL), Hand ischemia, Steal syndrome.*

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INTRODUCTION

Ischemic steal syndrome is a rare complication of arteriovenous fistula creation. It is due to high blood flow going into a low resistance vein and due to the reversal of flow away from the higher resistance distal arterial bed into the vein. The management of patients with mild ischemia is expectant. Definitive treatment is reserved for patients with moderate and severe ischemia manifesting as rest pain, severe paresthesias, paralysis, cyanosis or gangrene. Several options including ligation of arteriovenous fistula, banding, proximalization of arterial inflow and distal revascularization and interval ligation (DRIL),[1,2] are proposed for this condition. DRIL involves a bypass conduit from artery proximal to the arteriovenous fistula to a distal recipient artery with ligation of the artery in between the fistula and the distal anastomosis. Conceptually, this combination increases peripheral perfusion to the hand while simultaneously blocking retrograde blood flow to the access.[3]

The aim of this study is to evaluate the outcomes of DRIL procedure to treat hemodialysis-associated ischemic steal syndrome patients.

METHODOLOGY

This is a case series of all patients undergoing DRIL procedure from January 2005 to December 2015 at Department of Surgery, Aga Khan University Hospital, Karachi. The data was collected from the medical records of the patients after getting an exemption from the Institutional Ethical Review Committee (4239-Sur-ERC-16). It included the patients' demographics, their complaints, clinical diagnosis and created access type. It also included the type of intervention and any intra- and post-operative complications. Symptomatic improvement after the intervention, if any, was also recorded. Diagnosis of these patients was mainly based on clinical history and physical examination. Patients with Grade 1 and 2 steal syndrome were treated conservatively. DRIL was only performed on patients with tissue loss or persistent rest pain (grade 3 steal Syndrome). The technique of the DRIL procedure was performed with the standard technique described in literature.[4]

SPSS version 19 was used for statistical analysis. Quantitative variables like age, duration of symptoms, and hospital stay were presented as mean $\pm$ standard deviation (SD). Categorical variables were reported as percentages.

Correspondence to: Dr. Zia Ur Rehman, Section of Vascular Surgery, Department of Surgery, Aga Khan University Hospital, Stadium Road, Karachi, Pakistan
E-mail: ziaur.rehman@aku.edu

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RESULTS

A total of 10 patients (9 of them women) underwent DRIL procedure during the review period and all were included in the study. The mean age of the group was 57 $\pm$6.7 years. All the patients presented with grade 3 steal syndrome. Three (30%) patients presented with tissue loss while seven (70%) patients had rest pain. Four

Table I: Studies mentioning outcomes of distal revascularization and interval ligation (DRIL).

Study/year	Study duration (years)	Number of patients	Number of DRIL procedures	Follow-up period	Proportion of patients with improvement (%)	DRIL patency (%)	Vascular access
Gupta N (2011)[1]	5	21	21	6 months	17 (81.0)	-	14 (66)
Anaya-ayala (2012)[5]	6.5	33	33	12 months	25 (75.8)	31 (93.5)	31 (94)
Aimaq R (2013)[6]	7	77	81	60 months	64 (79.0)	45 (56)	74 (96.9)
Scale ST (2013)[7]	10	126	134	14.8 months	110 (87.3)	-	114 (85)
Leake AE(2015)[2]	10	59	59	23 days	57 (96.6)	59 (100)	59 (100)
Rehman ZU (2018)	10	10	10	6 months	8 (80)	10 (100)	10 (100)

(40%) patients had brachioaxillary arteriovenous bridge graft while six (60%) patients had basilic transposition arteriovenous fistula. There were four (40%) patients having motor deficits and two (20%) patients having sensory deficits. All the procedures were done under general anaesthesia. Polytetrafluoroethylene (PTFE) was used in all patients as the brachio-brachial bypass graft. The selection of patients for this procedure and the choice of graft were at the operating surgeon's discretion. All patients had a smooth recovery except for one patient who had brachio-brachial graft thrombosis immediately post-procedure. This required thrombectomy. In all the cases, access was preserved. Steal symptoms resolved, and the wound healed in all patients with tissue loss. Two patients (20%) had persistent rest pain and sensory loss. Although over time, the pain decreased, but there was no improvement in the neurological status of the patients.

The patients had a mean follow-up for six months. The patency of grafts was confirmed clinically and by hand-held Doppler. There was no late graft thrombosis or wound-related complications.

DISCUSSION

DRIL is generally acceptable (Table I), but there are always some objections.[3] Its technique is complex and lengthy, there is a need to create two anastomoses, and requirement of general anaesthesia. There is also concern that the main axial artery is ligated, and the patient is reliant on perfusion on a graft.

Despite these limitations, this procedure provides us a good physiological explanation of relieving the hand ischemia, and at the same time, maintaining the access. This is evident in the present case series. The rest pain of the patients was relieved and wounds of the patients with tissue loss got better. All procedures were done under general anaesthesia, which the patients tolerated well. Prosthetic graft was used instead of a vein, which decreased operative time and also eliminated complications associated with harvesting the vein. There is always a fear of prosthetic graft getting infected, but it was not the case in any patient. None of these patients had late graft thrombosis.

Most of these patients were females and diabetic; and all the accesses were created from the distal brachial artery. These findings are consistent with most of the other studies.[5-8]

One of the initial patients got graft thrombosis in the immediate postoperative period and his hand ischemia got worse. He had thrombectomy and there was a kink noted due to relatively longer graft. It was corrected and the patient had improvement in his symptoms and his graft remained patent.

This is an experience from an academic centre with dedicated expertise as well as special interest in access surgery. DRIL is one of many methods used over time to treat patients with Grade 3 steal syndrome. Others were banding, proximalization of inflow and ligation of arteriovenous fistula in these patients. This study is unique as all the brachio-brachial grafts were created with a prosthetic graft. General wisdom favours autologous over the prosthetic, due to less risk of infection. Using alternative to vein graft, provides ease of use and ready availability. It also decreased operative time and donor site wound-related complications. The potential fear of getting graft infection was not seen in any patient.

In this series, two of the patients had the severe neurological deficit. Although the pain settled, but they only got partial improvement in their sensory deficit. This may be due to the fact that patients could have had irreversible neurological damage due to severe ischemia. They did not get complete relief even after revascularization. The same findings were noted by Aimaq *et al*. who noticed that only 56% of patients with neurological deficit improved compared to 90% of patients with tissue loss.[6] Limitations of this study are: being a retrospective study and a single-centre study.

CONCLUSION

DRIL is an effective procedure for relieving hand ischemia and in preserving the access. Patients with rest pain and tissue loss benefit more from it than with neurological deficit.

ETHICAL APPROVAL:
Ethical approval from Hospital Ethical Review Committee was obtained prior to initiation of the sutdy.

PATIENTS' CONSENT:
Consent has been taken from the patients.

CONFLICT OF INTEREST:
Authors declared no conflict of interest.

AUTHORS' CONTRIBUTION:
ZUR: Study concept, data analysis, investigation, writing,

critical review, final approval of the article.
MYD: Data collection, investigation, critical review and revision; final approval of the article.
HI: Data collection, data analysis, critical review and revision, final approval of the article.
ZS: Study concept, critical review and revision, final approval of the article.

REFERENCES

1. Gupta N, Yuo TH, Konig G, Dillavou E, Leers SA, Chaer RA, *et al*. Treatment strategies of arterial steal after arteriovenous access. *J Vasc Surg* 2011; **54**:162-7.
2. Leake AE, Winger DG, Leers SA, Gupta N, Dillavou ED. Management and outcomes of dialysis access-associated steal syndrome. *J Vas Surg* 2015; **3**:754-61.
3. Ingemar Davidson, Gerald Beathard, Maurizio Gallieni, John Ross. The DRIL procedure for arteriovenous access ischemic steal: A controversial approach. *J Vasc Access* 2017; **18**:1-2.
4. Misskey J, Yang C, MacDonald S, Baxter K, Hsiang Y. A comparison of revision using distal inflow and distal revascularization-interval ligation for the management of severe access-related hand ischemia. *J Vasc Surg* 2016; **63**:1574-81.
5. Anaya-Ayala JE, Pettigrew CD, Ismail N, Diez-De Sollano AL, Syed FA, Ahmed FG, *et al*. Management of dialysis access-associated "steal" syndrome with DRIL procedure: Challenges and clinical outcomes. *J Vasc Access* 2012; **13**: 299-304.
6. Aimaq R, Katz SG. Using distal revascularization with interval ligation as the primary treatment of hand ischemia after dialysis access creation. *J Vasc Surg* 2013; **57**:1073-8.
7. Scali ST, Chang CK, Raghinaru D, Daniels MJ, Beck AW, Feezor RJ, *et al*. Prediction of graft patency and mortality after distal revascularization and interval ligation for hemodialysis access-related hand ischemia. *J Vasc Surg* 2013; **57**:451-8.
8. Huber TS, Larive B, Imrey PB, Radeva MK, Kaufman JM, Kraiss LW, *et al*. Access-related hand ischemia and the Hemodialysis fistula maturation study. *J Vasc Surg* 2016; **64**:1050-8.