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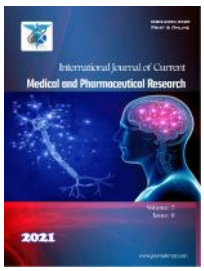

Case Report

A CASE OF HAEMODIALYSIS ACCESS INDUCED DISTAL ISCHAEMIA (HAIDI)

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ABSTRACT

Chronic kidney disease (CKD) is a serious health problem worldwide and its burden on health care is increasing progressively. As the kidney function deteriorates and end-stage renal disease (ESRD) approaches, the patients require renal replacement therapy (RRT). Haemodialysis is the most preferred option for RRT. This requires repeated access to circulation for frequent maintenance haemodialysis (MHD). Arteriovenous fistula (AVF) is the preferred vascular access for MHD owing to its durability and low complication rate. Such access can result in complications. One such complication of AVF is distal hypoperfusion leading to rest pain & digital ischemia even resulting in gangrene.

We present a case of 62 years old male who was a known case of Type2 Diabetes Mellitus (T2DM) and CKD for 5-years. He was on MHD for the past three years. His glycaemic status was well controlled with lifestyle modification & DPP4 Inhibitor (teneligliptin). He presented with slowly progressive rest pain, blackish discolouration of left thumb and index finger for past one year. Clinical exam and Doppler studies of left hand were suggestive of digital hypoperfusion distal to AVF. He was managed conservatively with NSAIDs, calcium channel blockers, hand warming and exercises. The purpose of this case report is to highlight this uncommon complication of the most used vascular access for MHD.

INTRODUCTION

As renal function in chronic kidney disease (CKD) declines, there comes a stage when survival depends on replacement of the renal functions by either dialysis or renal transplant. Haemodialysis is a major therapeutic option available in the management of end-stage renal disease (ESRD). The diabetics form 20 - 50% of patients requiring RRT, especially in developed countries. Poor glycaemic control, long duration of diabetes, presence of microangiopathy, ethnicity, pre-existing hypertension, family history of diabetic nephropathy and family history of hypertension all are known risk factors for development of diabetic nephropathy. An access to the circulation is required to carry out regular sessions of maintenance haemodialysis (MHD) in such cases. Different sites, grafts & catheters have been used for this purpose. The common types of vascular accesses used for HD are Central Venous Catheter (CVC), arteriovenous graft (AVG) and arteriovenous fistula (AVF). The AVF, described by Brescia and Cimino, is the most adopted form of vascular access because unlike AVG, it can function for years, is not prone to clotting and is not as likely to get infected as CVC.[1]However, AVF is also not without its own problems and complications. AVF takes 4-6 weeks' time to mature and alternate temporary vascular access may be required during maturation phase.

The complications of AVF are lymphedema, infection, aneurysm, stenosis, congestive heart failure, steal syndrome, ischaemic neuropathy, and thrombosis.[2] Haemodialysis access-associated peripheral limb ischemia (HAPI) constitutes up to 6% of all the complications of AVF.[3] Low resistance in the AVF veins and retrograde flow in the palmar arch jeopardizes the adequate perfusion because of diversion through the arteriovenous anastomosis. A mature AVF can lead to decrease in the distal blood flow causing hypoxia, ischaemia and even necrosisin the region distal to the fistula. The emergence of this syndrome is widely known as steal syndrome. The elderly and the diabetics are particularly at risk. This phenomenon remains clinically dormant till the compensatory mechanisms for distal perfusion by collateral vessels are exhausted.[4] The clinical signs of upper limb ischaemia include reduced movement of the wrist with a sense of coldness in the hand, a colour change to pale yellow or purple, pain at rest and/or during exercise, and may progress to necrosis and gangrene.[5]

Case report

A 62-year-old, non-smoker male was hospitalised with history of persistent pain, numbness, and black discolouration of the left thumb and forefinger for past one year. He was diagnosed as a case of T2DM with CKD five-years back and had been on MHD for three-years. The clinical examination revealed averagely nourished individual. His pulse was 84 beats per min (BPM), regular, and the left radial artery was slightly weaker than its right counterpart. His blood pressure and Oxygen saturation (SaO_2) was 97% on room air. The ophthalmoscopic examination revealed a few microaneurysms, suggestive of mild, non-proliferative diabetic retinopathy. There was

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proximal swelling of left index finger & thumb with dry blackish discolouration. The middle and distal phalanges were thinned out, the skin was ulcerated and there was atrophy of the pulp and nail. The movements at inter-phalangeal & metacarpophalangeal joints were restricted & painful. A linear well healed scar of AVF (Images 1a and 1b) was also seen on the radial aspect of forearm about 03-cm above the wrist joint.

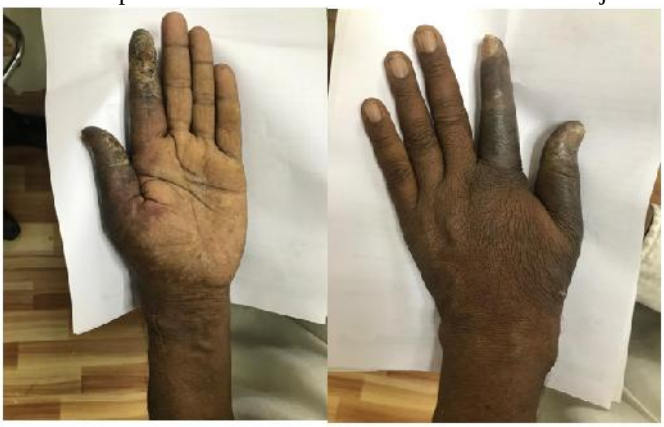

Image 1a and 1b- Dry Gangrenous Thumb and Index Finger of Left (AVF) HAND

Investigations His haemoglobin (Hb) was 9 gm/dl; total and differential leucocyte counts were within normal range. Blood urea was 93.2 mg/dl, serum creatinine 5.7mg/dl and blood urea nitrogen (BUN) was 43.55mg/dl. Serum sodium and potassium were 145 mmol/l and 4.3mmol/ respectively. Glycated haemoglobin (HbA1c) was 5.9%.

Doppler Study of Blood Vessels of left upper limb including subclavian, axillary, brachial, radial and ulnar arteries was done using GE Healthcare LOGIQ F6 L6 Probe 7Hz frequency high frequency probe on colour and spectral pre-sets. Moderate atherosclerotic changes were noted in all visualized arteries.AVF formed between left radial artery & cephalic vein at wrist was 07 mm deep from skin surface. Fistula was patent & in good working condition.AVF velocity was 174 cm/sec. Flow calculations in the Doppler studies are given below:

Internal Diameter(Left Arm)	**Velocity**
At Elbow-	
Brachial Artery-5.8 mm	Velocity- 55 cm/sec
Cephalic Vein-3.0 mm	
Basilic Vein- 3.1 mm	
At Wrist-	
Radial Artery- 1.8 mm	Velocity- 40 cm/sec
Ulnar Artery- 2.8 mm	Velocity-63 cm/sec
Basilic Vein- 2.1 mm	
Cephalic Vein- 2.9 mm	
Blood Flow Left Arm:	
Brachial Artery: 871.44 ml/min	
Flow at AVF: 689.23ml/min	
Radial Artery (Post-Fistula): 61.04 ml/min	
Ulnar Artery: 232.64 ml/min	

The diagnosis of dialysis access-associated steal syndrome leading to digital ischemia of left thumb & index finger was made (clinical stage IV). Conservative management includingcalcium channel blockers, anti-platelets, hand-warming, and hand exercises for digital ischemia was started. Adequate glycaemic control was ensured. Surgical consultation was sought & surgical intervention was planned for later date.

DISCUSSION

CKD is a global health problem & prevalence of ESRD has increased over the past decade.[6] in patients with ESRD, haemodialysis becomes a permanent management modality especially for those who either opt out or have no prospect of kidney transplantation.[7] The scarce availability of kidney donors and the increased survival of patients with CKD implies that most patients with ESRD require a prolonged period of RRT for maintenance of internal milieu, necessitating the creation of a vascular access. Though an ideal vascular access does not exist, AVF is preferred over AVG and AVG over CVC.[8]

AVF can function for years and, unlike CVC and AVG, it is not prone for infection and clotting. AVF is evidently the best approach for easy access to the circulation in patients on MHD.[9,10,11] However, AVF are not without complications. The immediate surgical complications include haemorrhage, low venous flow or hematoma formation and surgical site infection. The late complications include infection, high output heart failure, development of aneurysm (true or false), fistula vein stenosis, fistula thrombosis, steal syndrome**,** andischaemicneuropathy.[2] Vascular access associated peripheral limb ischemia has been termed as Dialysis Access associated Steal Syndrome (DASS), Haemodialysis Access Induced Distal Ischemia (HAIDI) and Haemodialysis Access Induced Peripheral Ischemia (HAPI). The important risk factors for developing HAIDI are, proximal access (brachial artery), diabetes mellitus, female gender, coronary artery disease, peripheral vascular disease &history of HAIDI with a prior AV access. Various mechanisms including atherosclerosis of arm arteries, reversal of blood flow and recurrent regional hypotension during haemodialysis have been hypothesized.[12]However, the exact pathophysiology of limb ischemia in patients with vascular access is not clear. The incidence of ischemia in the wrist AVF is low because of collateral circulation via ulnar and other smaller arteries enhancing distal perfusion. Steal may even be beneficial in radio-cephalic AVFs as it is an indication of open collaterals contributing to access maturation. In our hospital approximately 85 patients are registered for MHD every year for last five years. This is the first recorded case of AVF associated digital ischemia.

Hand ischemia because of steal in patients with an AV access is a serious problem in patients on MHD. The steal is not a rare phenomenon. In fact, haemodynamically the steal is noticed in up to 73.3-100% of patients with radio cephalic AVF, but it is severe enough to cause hand ischaemia requiring treatment in only approximately 5% of cases.[13,14,15]The management is dependent on the clinical stage of HAIDI and has been classified as under:

Stage I	Pale/ livid hand and/or cool hand without pain
Stage IIa	Tolerable pain during exercise and/or during dialysis
Stage IIb	Intolerable pain during exercise and/or during dialysis
Stage III	Rest pain or loss of motor function
Stage IVa	Limited tissue loss, potential for preservation of hand function
Stage IVb	Irreversible tissue loss, significant hand function is lost

Clinical Stage I and IIa may be treated conservatively with hand warming, hand exercises, pain killers and vasospastic drugs. Prostaglandin analogues (misoprostol and iloprost) have been tried in treatment of HAIDI stage IIb and stage III with optimistic results.[16]The patients considered suitable for

surgical intervention must undergo angiography to evaluate for presence of arterial stenosis proximal as well as distal to the AV access. Angioplasty of arterial stenosis can restore arterial perfusion and potentially relieve HAIDI symptoms. If restitution of arterial inflow and distal arterial perfusion does not alleviate the symptoms, the patient may have to undergo surgical intervention. The surgical approaches includeangioplasty, Distal Revascularization-Interval Ligation (DRIL), Proximalisation of Arterial Inflow (PAI), Revision using Distal Inflow (RUDI), Ligation of the AV access, and Banding of the inflow.[17] The fistula closure remain the last option for management.

CONCLUSION

Hand ischemia in the patients with arteriovenous access for HD is a rather rare but serious complication. It is seen more commonly in proximal rather than distal AVF. The hand ischemia results from arterial steal and can be seen both in low flow and high flow fistulas. Various mechanisms have been proposed including but not limited to atherosclerosis of arm vessels, reversal of blood flow and recurrent intra-dialysis hypotension. The management entails trial of conservative approach in early stages (clinical stages I and IIa), trial prostaglandin analogues and angioplasty in later stages, and regularisation of blood flow in more severe cases.

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