Intervention for Peripheral Vascular Disease, Vascular Malformation and Dialysis Access: An experience from Dhulikhel Hospital

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Abstract

Background

Peripheral Vascular Disease includes venous diseases and arterial diseases and capillary malformations. Venous disease includes varicose veins occurring either as a distinct entity or as a part of complex venous syndromes. Peripheral Arterial Diseases are common vascular conditions presenting as limb claudication and ischemia of lower extremity. One common vascular malformation involves capillaries of skin presenting as port wine stains. Arteriovenous fistulas are an iatrogenic communication between peripheral arteries and veins made for achieving a high flow access for hemodialysis in patients with End Stage Renal Disease.

Methods

All cases of intervention done in the catheterization laboratory of Dhulikhel Hospital for peripheral vascular diseases, vascular malformation and dialysis access from December 1st 2020 to November 30th 2022 were included in the study. Details on demographic parameters of the patient, types of peripheral vascular diseases, indication for intervention, type of intervention were noted. The diseases were classified into residual varicose veins, vascular malformation (venous malformation, capillary malformation, arteriovenous malformation, lymphatic malformation, mixed malformation e.g. in Klippel Trenaunay Syndrome), dialysis access failure and peripheral arterial disease. For the procedures requiring fluoroscopy, they were performed in Philips Allura machine, under local anesthesia and taking standard precautions for excess exposure of radiation to operators. For cases requiring ultrasonography, Siemens P300 ultrasound machine with 8-10MHz linear probe was used.

Results

A total of 637 patients were included in the study in which 57.1% were male and 42.9% were female. The mean age of the patient was 38.2 years. There were 37.2% patients with residual varicose veins, 31.4% with vascular malformation, 8.6% with peripheral arterial disease, 13.2% with chronic kidney disease for dialysis catheter insertion or manipulation and 9.6% with chronic kidney disease for arteriovenous fistula intervention. Of the vascular malformation cases, 54.5% were of venous malformation, 16.5% were of capillary malformation, 16% were of arterio-venous malformation, 11% were of mixed malformation and 2% were of lymphatic malformation.

Conclusions

Interventions in the catheterization laboratory can address different peripheral vascular diseases, vascular malformation and dialysis access. We feel that performing these procedures in the catheterization laboratory has aided in our ability to do these sometimes-complex procedures as we get excellent resolution of our radiographic pictures.

Keywords: *Arteriovenous fistula, Central vein stenosis, Peripheral vascular diseases, Varicose veins, Vascular malformation.*

Introduction

Peripheral vascular diseases are abnormal conditions of blood vessels that can lead to significant cardiovascular morbidity.[1] These include varicose veins, vascular malformations and peripheral arterial diseases. Depending upon the vessel involved, the patient can present with complaints of claudication, dilation of veins, ulceration and limb swelling. When left untreated, these can lead to life and limb-threatening complications thereby warranting an early management.

Some of the iatrogenic fistulas created for hemodialysis in CKD patients often present with problems of flow, failure in maturation and swelling of arms and neck. In cases requiring urgent hemodialysis, intervention such as catheterization of internal jugular vein with tunneled or non-tunneled catheters are required.

Vascular malformations can occur in veins, arteries, or capillaries. Small capillary malformations are treated with intralesional steroid injections. Venous malformations often require ultrasound guided sclerotherapy. Larger arterial malformations are treated with targeted coiling/embolization of the feeding vessel.

Interventions for peripheral vascular disease and dialysis access were started at the Dhulikhel hospital in December 2021. Despite the high prevalence of these disorders, there is not a lot of literature reporting the use of interventional radiologic techniques for the treatment of these problems. Thus, the main aim of this study is to report the use of interventional radiology to augment the treatment of several vascular diseases.

Methods

All cases of intervention done in the Catheterization laboratory (cath lab) of Dhulikhel Hospital for peripheral vascular diseases, vascular malformation and dialysis access from December 1st 2020 to November 30th 2022 were included in the study. Details on demographic parameters of the patient, types of peripheral vascular diseases, indication for intervention, type of intervention were recorded. All the intervention was done under local anesthesia and patients were monitored for a minimum of an hour in the post procedure bay of the cath lab. Following discharge, if any problems occurred, the patients are asked to contact the cath lab team or visit the emergency department of the hospital. The patients are asked to follow up in a week. If sutures are placed in the intervention site, they are asked to come for a dressing change on the third day post procedure and have sutures taken out at a week. The diseases were classified into residual varicose veins, vascular malformation (venous malformation, capillary malformation, arteriovenous malformation, lymphatic malformation, mixed malformation e.g. in Klippel Trenaunay Syndrome), dialysis access failure and peripheral arterial disease. Additionally, the data on causes of dialysis access failure were classified into stenosis of peripheral vein or thrombosis or central vein stenosis. Details on the different procedures, drugs used, devices and accessories used for intervention of above-mentioned diseases were done as per the "Guidelines on intervention for vascular diseases at Dhulikhel Hospital Catheterization lab 2022".

Procedures requiring fluoroscopy in cath lab were performed in Philips Allura machine, taking standard precautions for excess exposure of radiation to operators. Where ultrasonography was required, Siemens P300 ultrasonography with linear probe of 8-10MHz was used. The use of minimal amounts of radiation and contrast was also ensured. All the procedures were done by one or both of the vascular surgeons in the department with ten and three years of experience along with trained medical officers and nurses of the department. The database was made in Microsoft access 2019 (Microsoft corporation) and analysis was done using Statistical Package for Social Sciences 13 (SPSS Inc., Chicago). The nominal variables were expressed in frequency and percentage. Scalar variables were expressed as mean, standard deviation and range.

Results

A total of 637 patients were included in the study. The mean age of the patient was 38.2 yrs (SD: 18.2, Range: 6 months to 88 years). There were a total of 364 (57.1%) male patients and 273 (42.9%) female patients. Details on the number of patients in different diagnoses are shown in Table 1. Highest proportion of patients belonged to residual varicose veins followed by vascular malformation. Table 2 shows the number of patients in different vascular malformation types. More than half of such patients were of venous malformation. This was followed by capillary malformation and arterio-venous malformation. There were 22 patients of Klippel-Trenaunay (KT) Syndrome who had mixed vascular malformation. Typical cases of patients with vascular malformations, central vein stenosis, venogram, permanent catheter insertion, angiography and KT Syndromes are shown in Figure 1-6.

Table 1: Categorization of patients with Peripheral Vascular Disease and ones requiring dialysis access.

Diagnosis category	Number	Percentage
Residual Varicose veins	237	37.2%
Vascular malformations	200	31.4%
Peripheral arterial disease	55	8.6%
CKD for dialysis access (catheter insertion/ manipulation)	84	13.2%
CKD for dialysis access(AV fistula intervention)	61	9.6%

Table 2: Different types of Vascular Malformation requiring intervention.

Vascular malformation subclassification	Number	Percentage (N=200)
Venous malformation	109	54.5%
Capillary malformation	33	16.5%
Arterio-venous malformation	32	16%
Lymphatic malformation	4	2%
Mixed malformation (e.g. KT Syndrome)	22	11%

Table 3: Intervention for dialysis access (Catheter insertion/manipulation)

Intervention category	Number	Percentage (N=84)
Tunneled cuffed catheter insertion	53	63.1%
Tunneled cuffed catheter manipulation	25	29.8%
IJ Catheter insertion	6	7.1%

Table 4: Intervention for dialysis access (AV fistula)

Intervention category	Number	Percentage (N=61)
Stenosis of central vein	56	93.4%
Stenosis of peripheral veins	4	6.5%

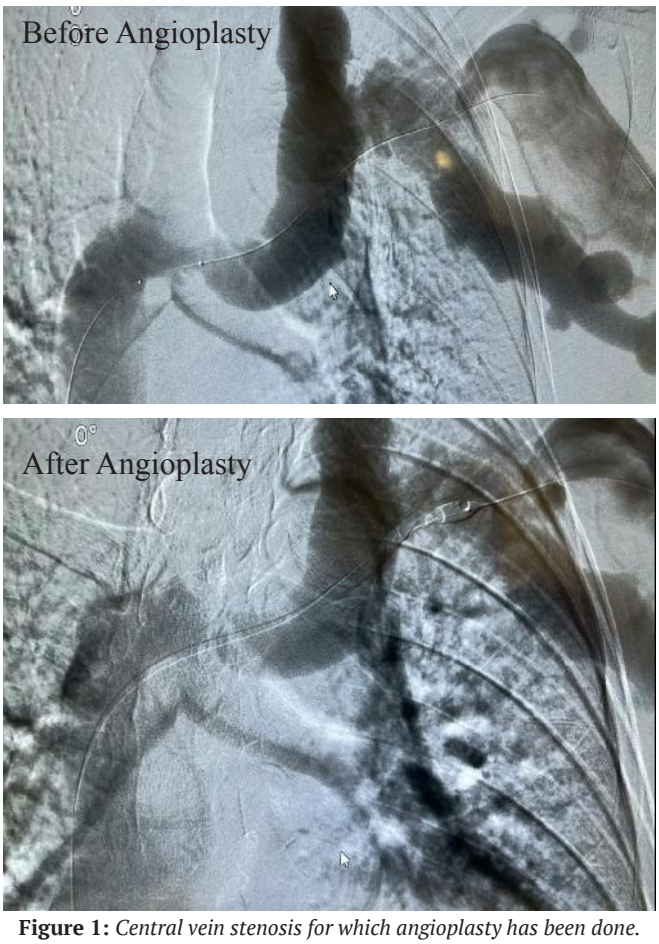

Figure 1: *Central vein stenosis for which angioplasty has been done.*

Figure 2: *Different vascular malformations in which intervention has been done.*

Figure 3: *Image of central vein stenosis*

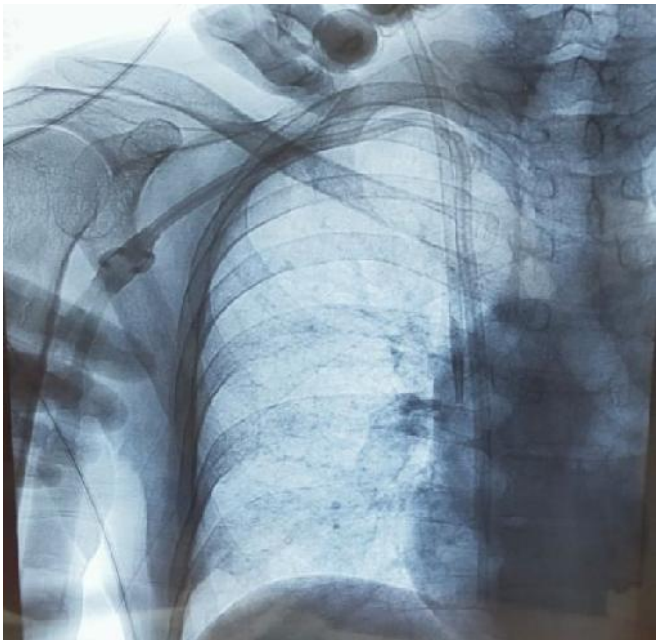

Figure 4: *Image of tunneled cuffed catheter.*

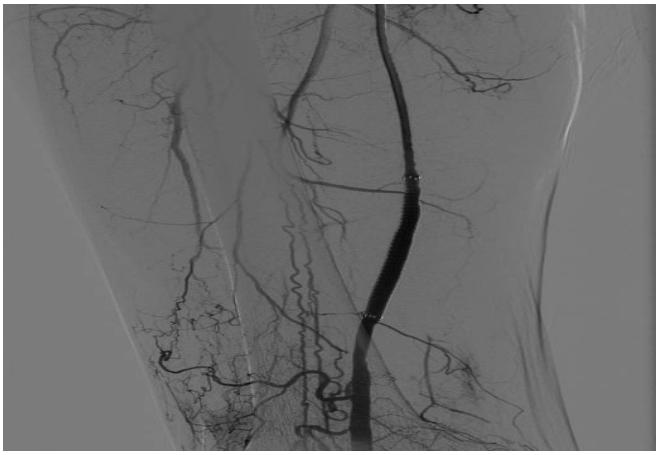

Figure 5: *Angiography findings of peripheral arterial disease after stenting*

Figure 6: *Typical cases of KT Syndrome for which intervention was done*

Discussion

There are various modalities of treatment for vascular diseases. They can be classified as conservative, medical, minimally invasive, and surgical. Conservative treatment modalities, such as exercises and lifestyle modification, are used for intermittent claudication due to peripheral arterial disease and early stage varicose veins. Similarly, various surgical treatment modalities are available for vascular diseases.[2] At one time open surgical procedures were the mainstay in the treatment of these problems. Less invasive interventional radiologic procedures are now a reasonable, of not preferred alternative means of treatment. Intervention for vascular disease is an evolving field and many advances have been done to treat varieties of vascular diseases. Interventions such as balloon angioplasty, stenting, use of grafts, vascular radiations and coiling are recent endovascular treatment options for various vascular diseases.[3] Intervention for vascular diseases are expected to replace about 50% of conventional vascular surgeries. [3]

Residual varicose veins account for the highest number of cases subjected for intervention. Dhulikhel hospital has treated more than 1600 varicose veins cases via radio frequency ablation with/without adjunct procedures till date.[4] Similarly, the treatment protocol for the management of varicose veins is followed using conservative hemodynamic correction of venous insufficiency (CHIVA) method , in which the sources of the reflux are treated primarily and if there is any significant residual varicose veins, they are addressed as a separate procedure in the Catheterization laboratory.[5] Although frequent visits are required, this is associated with need of sclerotherapy only in necessary patients, thus preventing lesser need of sclerotherapy.[6]

Venous malformation was found in more than 50% of all the malformations in our study. The reason for this might be because venous malformations are the most common type of malformations accounting for 1-4% of the individuals.[7] In addition, Dhulikhel Hospital is one the few centers in Nepal to address vascular malformation via intervention and a huge number of such cases are referred from all parts of the country including our neighboring country India for management. The hospital is also a referral center for multiple cases of Klippel Trenaunay Syndrome with complex vascular malformation for possible intervention.[8]

Among the dialysis cases, the use of AVF is found to be 25% among hemodialysis patients in Nepal. This data is from the high volume dialysis center in Nepal but as our center is not a primary dialysis center, we mostly receive cases requiring intervention for failed dialysis access. Hence there is a higher proportion of cases of tunneled cuffed catheter insertion/manipulation and intervention for central vein stenosis in our study. In a study done in Nepal by Basnet et al. in 2021, the use of tunneled cuffed catheters was only 2%.[9] Dhulikhel is a referral center for patients that have trouble with their catheters and fistulas.

The presence of AV fistula can lead to severe central vein stenosis compromising adequate blood flow. A study done in 2004 found that of 69 patients who underwent tunneled catheter, 29 patients (42%) had central vein stenosis.[10] Major factors responsible for central vein stenosis and fistula failure was found to be longer time on hemodialysis and a history of previous hemodialysis catheter insertion.[11] Studies have found central vein stenosis more in patients with tunneled cuffed catheter compared to that without history of it.[12]

Conclusion

Interventions in the catheterization laboratory can help address different peripheral vascular diseases, vascular malformations and dialysis access. The catheterization lab affords excellent radiographic resolution and we feel this helps us make better decisions of how to do the procedure and hopefully this equates to a better result.

Ethical approval

All procedures performed in this study involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Declaration of competing interest

There are no conflicts of interest.

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