

Original Research Article

Clinico-imaging patterns of arterial and venous pathologies in lower limb in R.D. Gardi Medical College Ujjain, Madhya Pradesh

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ABSTRACT

Background: Various arterial and venous pathologies like peripheral arterial disease (PAD), Varicose Veins (VV) and Deep Vein Thrombosis (DVT) are most commonly occurring condition with complain of pain, claudication, swelling, gangrene and dilated veins. Due to late presentation, it is associated with increasing incidence of surgical management which can also lead to amputation of limb in later stages. Aiming at increasing in prevention and conservative management will only be possible on early diagnosis and primordial prevention which requires to find relationship between lifestyle and chronic condition with various vascular disease.

Methods: A total of 67 cases were studied over a period of 1.5 years. Their clinical diagnosis along with various radiological diagnosis was compared and its sensitivity, specificity, PPV, NPV, FPR, NPR and accuracy was calculated accordingly.

Results: In this study, we found out that vascular disease is associated with sedentary lifestyle, smoking or chewing tobacco or dyslipidaemia. The common presenting symptoms were pain, claudication, swelling, gangrene and dilated veins. In the radiological investigation on comparison between catheter angiography/venography with other modalities showing specificity and sensitivity.

Conclusions: In this study, we concluded that colour doppler, CT angiography and catheter angiography has highest accuracy in diagnosing arterial pathology, and Colour Doppler and CT venography has highest accuracy in diagnosing venous pathology.

Keywords: CT angiography, Doppler, CT venography, Deep venous thrombosis, Peripheral arterial disease, Varicose veins

INTRODUCTION

The main arterial and venous pathologies of lower limb are Peripheral Arterial Disease (PAD), Varicose Veins (VV) and Deep Venous Thrombosis (DVT).

Peripheral arterial disease, also known as arteriosclerosis obliterans, is primarily due to result of atherosclerosis. The atheroma is composed of a core of cholesterol joined to proteins with a fibrous intravascular covering, gradually progressing to completely occlude lumen

medium and large sized arteries. Thrombus are of atherosclerotic nature that often occurs in lower limb, its major factors are aneurysms, aortic dissection, bypass grafts, sepsis, hypotension and underlying atherosclerotic narrowing of arterial lumen. Plaque is formed as a result which results in vascular stenosis and frequent vascular dilatation to maximize end-organ damage. Once the occlusion is sufficient it can reduce the oxygen supply to the end-organ which causes decrease in supply by demand causing ischemia. The most severe form of PAD

is critical limb ischemia causing rest pain or impending limb loss and finally gangrene.¹

Varicose veins (VV) is tortuous, dilated subcutaneous veins which permit reverse flow due to primary pathology or secondary to deep venous pathology. GSV is most commonly affected followed by SSV. The main factor affecting is sustained hypertension which increases the diameter of the superficial vein hence causing valve incompetence. Failure of valve causes reflux causing Primary Valvular Incompetence (PVI) which is due to loss of mural elastin and collagen. Rarely VV may be due to congenital valvular agenesis or hypoplasia, or due to arteriovenous malformations.²

Deep Venous Thrombosis have been associated with Virchow's triad of Hypercoagulability, Stasis of blood and Endothelial damage.³ Anything that slows or obstructs the blood causing stasis can increase in viscosity of blood and form microthrombi, these may grow and propagate and cause pooling of blood hence causing severe pain and if the thrombi travel and obstructs the pulmonary vein, can cause Pulmonary Embolism.

Objectives of this trial were to study pathological anatomy of vascular system of lower limb in afflicted person and to study recurrence after treatment. Also, patient selection for vascular surgery and patient compliance in cases on suitable medication.

METHODS

Study type

A retrospective study was done pertaining to cases of vascular surgery which involves PVD, varicose veins and deep venous thrombosis.

Study centre

All patients reporting to OPD and IPD with complaints of claudication dilated veins, chronic ulcers, skin changes, swelling in lower limb/s, clinical features suggesting of peripheral vascular disease of R.D. Gardi Medical College, Ujjain, Madhya Pradesh, India.

Study period

This study was conducted for 1.5 years starting from January 2020 to June 2021.

Selection criteria

All patients complaining of claudication dilated veins, chronic ulcers, skin changes, swelling in lower limb/s consistent with decreased arterial supply with detailed history and examination especially peripheral pulsation suggesting of peripheral vascular disease.

Inclusion criteria

Inclusion criteria was patient of all age group presenting with arterial and venous pathologies in lower limb.

Exclusion criteria

Exclusion criteria were all those patients without conclusive diagnosis of arterial and venous pathologies of lower limb; history of anaphylaxis to dye; pregnant female; bleeding diathesis.

Procedure

All patient with peripheral vascular disease of all age group. Study variables: age, sex, addiction, occupation, comorbidities (DM, HTN, dyslipidemia), ABPI, peripheral pulsations, USG color doppler, computerized tomography angiography, catheter angiography and computed tomography venography.

Statistical analysis

All statistical analysis has been done by the help of SPSS 23 version statistical software. For quantitative data frequency distribution, measures of central tendency, dispersion, and graphical representation has been applied. For qualitative data frequency distribution, percentage and various diagrammatic representations have been applied. Results were tabulated and analyzed by two way contingency tables and Kappa statistics. Sensitivity, specificity, positive predictive value and negative predictive value were obtained.

RESULTS

Significant Association was found between age groups and diagnosis with <0.05 , occurrences of DVT was associated to higher age group (50%) (Chi-Square= 30.67 $p=0.00$) (Figure 1).

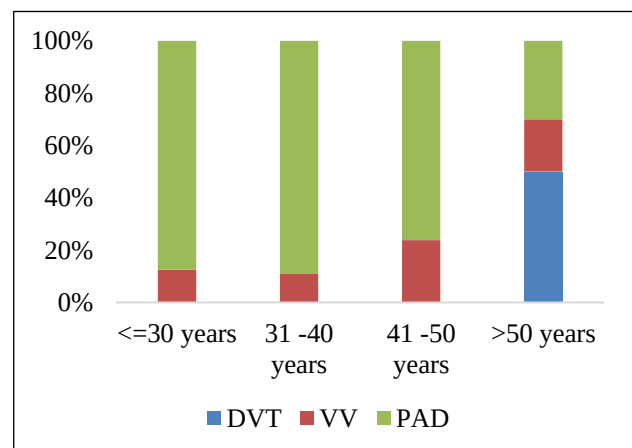


Figure 1: Age-wise distribution of population into respective diagnosis.

Significant association was found between age groups and diagnosis with <0.05 , occurrences of PAD was significantly associated to family history (84.1%) (Chi-square = 9.78, $p = 0.280$, Figure 2) (Chi-square= 16.67, $p=0.00$, Figure 3).

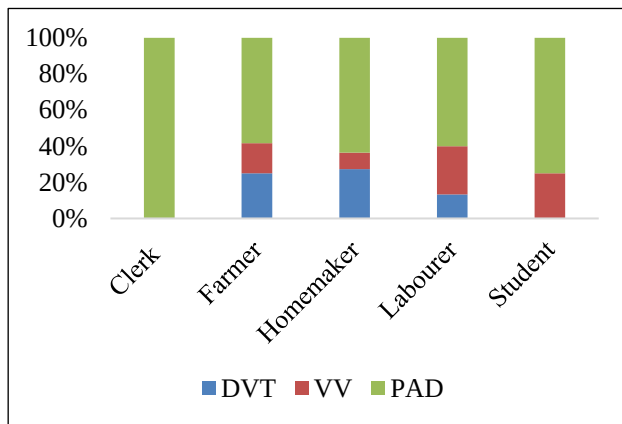


Figure 2: Diagnosis-wise distribution of study population based on their occupation.

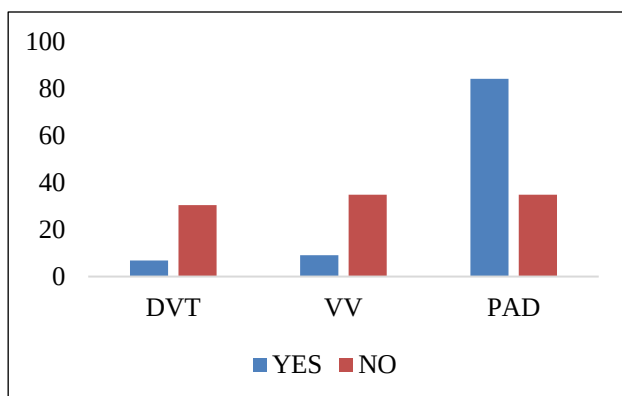


Figure 3: Distribution of study population based on presence or absence of family history.

Smoking is seen as most common addiction followed by tobacco chewing, also with both. Hence our study shows a strong correlation between smoking and PAD (Figure 4).

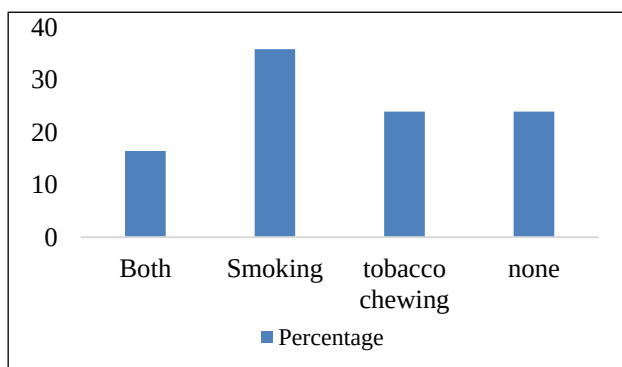


Figure 4: Distribution of study population based on presence or absence of addiction.

No significant association was found between hypertension incidence or diabetes mellitus and diagnosis.

Significant association was found between presence of dyslipidaemia and diagnosis with <0.05 , occurrences of PAD was significantly associated to presence of dyslipidaemia (67.2%).

Significant association was found between sedentary lifestyle and diagnosis with <0.05 , occurrences of PAD was significantly associated to presence of sedentary lifestyle (70.6%) (Figure 5).

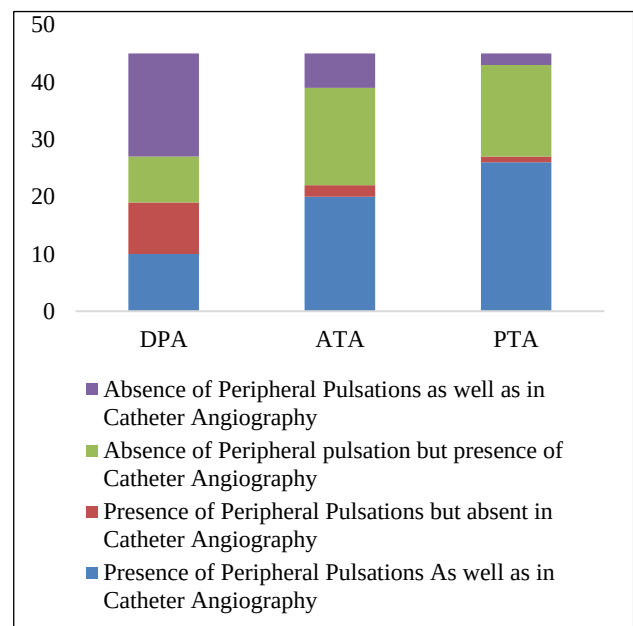


Figure 5: Comparison of peripheral pulsation and catheter angiography as diagnostic modality for DPA, ATA, PTA.

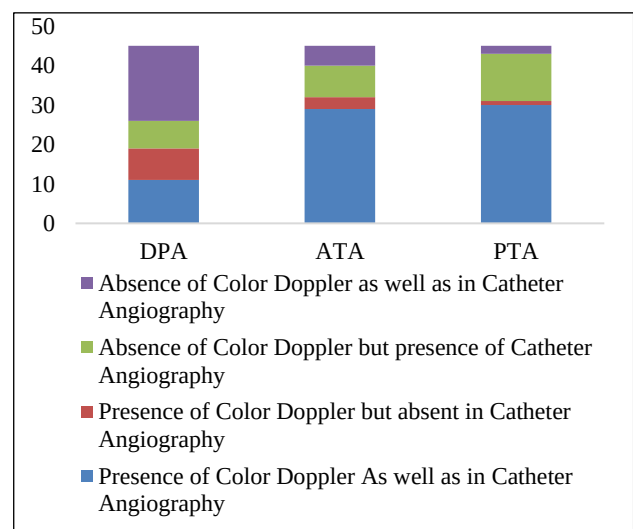


Figure 6: Comparison of color doppler and catheter angiography as diagnostic modality for DPA, ATA, PTA.

In our study population pain (77.60%), claudication (56.70%), gangrene (29.9%), swelling (38.8%) and dilated veins (17.90%) was the main presenting symptom (Figure 6 and Figure 7).

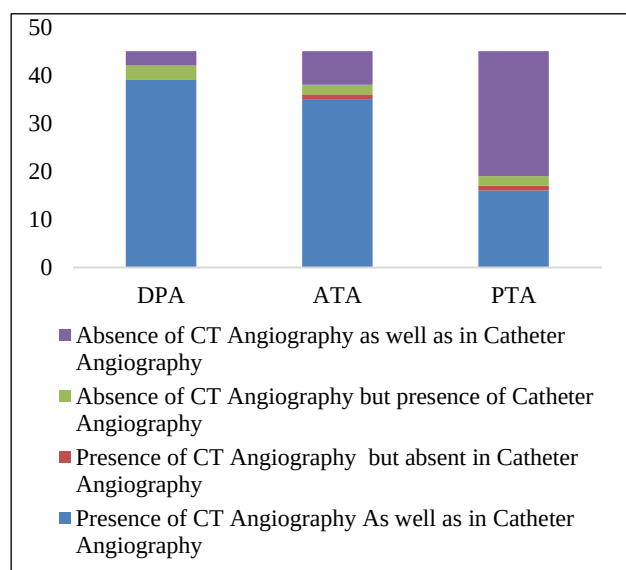


Figure 7: Comparison of CT angiography and catheter angiography as diagnostic modality for DPA, ATA, PTA.

In our study all the affected individuals were given trial of medical therapy of the 44 PVD affected individuals 20 had to undergo surgical amputation, whereas of whole population 44.4% (20) had to undergo surgical amputation for management of PAD.

For the treatment of varicose vein, all 12 cases were given medical therapy first, but 33.3% (4) had to undergo minimal invasive sclerotherapy procedures, 33.3% (4) had to undergo surgical management, while rest were managed conservatively by mechanical or pharmacological intervention.

DISCUSSION

The youngest age group was 22yrs and oldest was 80yrs. Most common age group, overall was 41 to 50yrs (31.3%) while if considering disease specifically PAD was 31 to 50 yrs, VV was 41 to 50yrs and DVT was more than 50yrs. DVT was significantly associated with higher age group. No significant association was found between gender groups.

Tobacco exposure was most common addiction (76.1% or 51 cases out of 67), where 35.8% (24 cases) smoked, 23.9% (16 cases) chewed and 16.4% (11 cases) had both addictions. Hence this shows a strong correlation between smoking and PVD. 44 cases had positive family history of PVD, hence it shows a strong association with of family history. 30 cases (44.8%) are labourers by

occupation, hence there is no significant association found.

On finding association with various chronic condition we found that 26 cases (38.8%) had a history of diabetes mellitus, hence there is no significant association, 45 cases (67.2%) had a positive history of hypertension, hence a significant association was found between hypertension and PVD, 34 out of 67 (50.7%) cases had a sedentary lifestyle, hence it is significantly associated with PVD and 28 cases (41.8%) had dyslipidemia, hence it shows significant association between dyslipidemia and PVD.⁴ In one of the study it is found that the most common presentation of peripheral arterial disease is Intermittent claudication.¹⁰

The main presenting symptoms, 38 cases (56.7%) had claudication as main presenting symptom, it was due to lack of awareness and education in the study population. Duration of symptom ranges from 6 months to 2 years, 20 cases (29.9%) presented with gangrene of a part of limb. It was due to lack of awareness.

ABPI is the most common measure to define PAD.⁵ ABI of ≤ 0.9 has greater than 90% sensitivity. In our study it was reported that 11 cases (16.4%) had ABI of 0.9 value, 20 cases (29.9%) had ABI of 0.8 value, 11 cases (16.4%) had ABI of 0.7 value, 2 cases (3%) had ABI of 0.6 value and 1 case (1.5%) had ABI of 0.5 value.

All affected individuals were given a trial of aggressive risk factor modification like cessation of tobacco chewing and smoking, control of diabetes and hypertension, along with dietary restriction at reducing LDL cholesterol and obesity, in addition medical therapy was also given which includes analgesics, antiplatelets like aspirin and clopidogrel, vasodilators like cilastazol and pentoxifylline, along with exercise rehabilitation. As per one study by Hennion et al, it stated that majority of cases respond to change in lifestyle along with conservative management in peripheral arterial diseases, majority required only risk factor modification to prevent further progression of disease.⁴ In our study PAD (out of 45 cases) 25 cases (55.6%) relieved on medication and 20 cases (44.4%) had to undergo surgical amputation, while in VV all (12) cases got conservative management which includes compression stockings, leg elevation and medical treatment with analgesics.

There were four cases (33.3%) had to undergo minimal invasive chemical sclerotherapy while 4 cases (33.3%) had to undergo surgery for VV. All cases of DVT (10 cases) managed on physical measures like elastic compression stockings, pharmacologic thrombolysis using LMWH (enoxaparin), unfractionated heparin, factor Xa inhibitors (fondaparinux, rivaroxaban).

This study observed only below knee PAD, involving ATA, PTA, DPA (Tables 1-3).

Table 1: Rate of recurrence of varicose veins after medical.

Recurrence	Frequency	Percentage
Yes	14	20.9
No	53	79.1
Total	67	100

Table 2: Association between different imaging modalities in PAD in ATA.

Association between	Sensitivity (%)	Specificity (%)	Kappa value
Peripheral pulse examination and catheter angiography	56	67	0.62
Colour Doppler and catheter angiography	61	70	0.67
CT angiography and catheter angiography	89	96	0.94

Table 3: Association between different imaging modalities in PAD in PTA.

Association between	Sensitivity (%)	Specificity (%)	Kappa value
Peripheral pulse examination and catheter angiography	54	75	0.57
Colour Doppler and catheter angiography	78	63	0.75
CT angiography and catheter angiography	95	88	0.93

Table 4: Association between different imaging modalities in PAD in DPA.

Association between	Sensitivity (%)	Specificity (%)	Kappa value
Peripheral pulse examination and catheter angiography	62	67	0.62
Colour Doppler and catheter angiography	71	67	0.84
CT angiography and catheter angiography	93	100	0.93

CT venography is taken as gold standard in lower limb. The comparison of colour Doppler with CT venography provided in Table 4.

Table 5: Colour doppler in venous pathology.

Vein	Sensitivity	Specificity	Kappa value
GSV	71	60	0.66
SSV	75	63	0.67

CT venography is taken as gold Standard in lower limb. Comparison of colour Doppler with CT venography shows 88% sensitivity, 50% specificity and 0.80 kappa value. In a study by Olin et al, it showed that CT is gold standard for vascular pathology than MRA and colour Doppler the only disadvantage being exposure to ionizing radiation.

CONCLUSION

Investigation modalities like colour doppler, CT angiography, catheter angiography are best to detect early and significant compromise of arterial and venous system.

PAD affects large portion of population and is associated with morbidity and mortality. Early identification allows modification of risk factors to reduce risk. Non-invasive physiologic vascular studies are an important tool in diagnosis of PAD, and allows characterization of site and severity, although not directly employing imaging. Patients in this study were from rural geography and were illiterate and poor, so presented late when disease progress to stage of rest pain, ulceration or gangrene. Objective quantification by colour Doppler, CT angiography and catheter angiography appeared to be more theoretical than guiding the treatment, while clinical assessment was the best tool for extending suitable treatment to the patient in late course of disease. Most of PAD were due to thromboangitis obliterans in smaller arteries making it difficult to design a treatment modality by locating proximal lesion with the help of radiological investigations, while on the other hand these investigations act like a prognostic value as initial baseline for further references.

For evaluating superficial venous insufficiency, Duplex USG is an essential modality. CT Venography has shown to be the best for evaluating varicose veins, also helping

in describing anatomy of the patient's venous system thereby increasing confidence towards surgical approach. 3-Dimensional reconstruction helps in the better outcome.

Ultrasound is the investigation of choice for lower and upper extremity whereas its accuracy is less in calf and pelvic veins and in the asymptomatic patients.

CT pulmonary angiography and CT venography are comprehensive assessment for diagnosis of DVT and pulmonary embolism, it also helps in planning of therapy.

CT venography is now solely used in lower extremities, when used via inguinal approach it acts as a road mapping technique prior to IVC filter placement, and it is also used in various therapeutic procedures like thrombolysis, percutaneous thrombectomy, angioplasty and stent placement.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee of R.D. Gardi Medical College, Ujjain, Madhya Pradesh, India

REFERENCES

1. European Stroke Organisation. Tendera M, Aboyans V, Bartelink ML, Baumgartner I, Clément D, Collet JP, et al. ESC Guidelines on the diagnosis and treatment of peripheral artery diseases: Document covering atherosclerotic disease of extracranial carotid and vertebral, mesenteric, renal, upper and lower extremity arteries: the Task Force on the Diagnosis and Treatment of Peripheral Artery Diseases of the European Society of Cardiology ESC. Eur Heart J. 2011;32(22):2851-906.
2. Meijer WT, Grobbee DE, Hunink MG, Hofman A, Hoes AW. Determinants of peripheral arterial disease in the elderly: the Rotterdam study. Arch Intern Med. 2000;160(19):2934-8.
3. Simon F, Oberhuber A, Floros N, Düppers P, Schelzig H, Duran M. Pathophysiology of chronic limb ischemia. Gefasschirurgie. 2018;23(Suppl 1):13-18.
4. Hennion DR, Siano KA. Diagnosis and treatment of peripheral arterial disease. Am Fam Physician. 2013;88(5):306-10.
5. Resnick HE, Lindsay RS, McDermott MM, Devereux RB, Jones KL, Fabsitz RR, et al. Relationship of high and low ankle brachial index to all-cause and cardiovascular disease mortality: the Strong Heart Study. Circulat. 2004;109(6):733-9.
6. Olin JW, Kaufman JA, Bluemke DA, Bonow RO, Gerhard MD, Jaff MR, et al. Atherosclerotic Vascular Disease Conference: Writing Group IV: imaging. Circulat. 2004;109(21):2626-33.
7. Sandison AT. Degenerative vascular disease in the Egyptian mummy. Medical History. 1962;6:77-81.
8. Harvey W. De Motu Cordis et Sanguinis in Animalibus. Oxford: Blackwell, 1628. Harvey W. Circulatione Sanguinis. Oxford: Blackwell; 1649.
9. Quesnay M. Traite de la Gangrene. Paris, 1771. 5 Allibert PC. Recherches sur une Occlusion Peu Connue des Vaisseaux Arteriels Considerees Comme Cause de Gangrene. Paris, 1828.
10. Cruveilhier M. Anatomie Pathologique de Corps Humain. Paris: Bailliere Tindall, 1842. 7 Bouley JF. Claudication Intermittent des Membres Posterieurs, determinee par L'obliteration des Arteres Femorales. Recl Med Vet EcAlfort. 1831;8:517-27.

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