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# "COLOUR DOPPLER ULTRASONOGRAPHY IN PERIPHERAL ARTERIAL DISEASE OF LOWER LIMB"

KEYWORDS: Duplex colour doppler; Peripheral arterial disease; Hemodynamically significant stenosis / occlusion; Atherosclerosis; Smoking; Intermittent Claudication.

**Dr B.SRIHARI**
Post graduate of Radiology ASRAM medical college, Eluru

**Dr B. Venkateswarlu**
Professor of Radiology ASRAM medical college, Eluru

**Dr S.Venkateswar rao**
Professor of radiology ASRAM medical college, Eluru

**ABSTRACT** *Peripheral arterial disease and its most common manifestation, intermittent claudication are associated with considerable morbidity and mortality. Patients with PAD, even in the absence of myocardial infarction or ischaemic stroke, have approximately same relative risk of death from cardiovascular causes as do patients with a history of coronary or cerebrovascular disease1. Therefore focus must be on vascular risk factor management ie atherosclerosis. Major technical advances have been made in recent years in the development of non – invasive imaging modalities. Duplex scanning of peripheral arteries is easily available, cost effective, non invasive and easily repeatable method of evaluation of lower limb arteries.*

## INTRODUCTION

Peripheral arterial disease is the most common condition affecting the arteries of lower extremity. Compromise of arterial flow due to stenosis and occlusions can result in limb is chemia, which may manifest as claudication, rest pain, local tissue loss (ulceration), and, potentially, amputation. Patients with PAD may have symptoms but can also be asymptomatic. These patients have an increased risk of mortality, myocardial infarction and stroke. It is an independent risk factor for vascular disease in other regions, resulting in increased rate of cardiovascular events and mortality. It adversely affects the functional status of the limb and is associated with poor quality of life[2].

The most common cause in the lower limb arterial occlusive disease is atherosclerosis. Less common causes include thromboembolism, acute thrombotic occlusion, micro embolism, trauma and vasculitis including vasospastic disorders and Beurger"s disease.

Ultrasonic imaging provides a non-invasive assessment of the arterial circulation in the lower limb and is accepted as a valuable diagnostic technique. Grey-scale images identify plaque and thrombus, duplex assessment provides a measurement of blood velocity through a vessel, and colour doppler imaging enables the rapid localization of arterial stenosis and occlusions.

Its association with interventional endovascular processing explain its significant development these days. . It thus allows the evaluation, the quantification and the follow-up of the arterial diseases by carrying out a precise vascular mapping that can guides the radiological or surgical processing if necessary. Colour Doppler imaging is safe, popular, cost effective, repeatable, noninvasive procedure for investigating lower limb arteries[3].

Ultrasound currently remains an important modality in the evaluation of peripheral arterial disease, and even if MR angiography eventually becomes the preeminent technique in the evaluation of this disease, Ultrasound will likely continue to have a role in many settings, such as for targeted questions (eg, postangioplasty assessment, pseudoaneurysms), in portable examinations, for patients unable to cooperate for MR imaging, and where expensive CT and MR equipment are not available[4].

## MATERIALS AND METHODS :

The study consisted of 50 patients with symptoms and signs suggestive of lower limb arterial insufficiency. The arterial system from common iliac artery to the dorsalis pedis artery was examined to study the location, size, echogenicity, stenosis, peak systolic velocity changes and spectral wave form changes at the site of atherosclerotic plaque from one segment to another. The observation in percentages were compared and analysed with previously done studies.

Type of study :
Lower limb arterial Doppler study done on patients with clinically diagnosed peripheral vascular insufficiency.

It was a prospective cross – sectional study.

Place of study:
The study was carried out in the Department of Radiology, ASRAM Medical College Hospital by Philips Envisor Doppler machine by a linear 3 – 12 MHz probe and a curvilinear 3 – 5 MHz probe.

Duration of study:
The study was carried out over a duration of 2 years from October 2013to September 2015.

Patients :
The study consisted of 50 patients.

Inclusion criteria:
Clinically suspected cases of peripheral arterial diseases

Exclusion criteria:
Pregnancy and paediatric patients.

## DISCUSSION

Peripheral arterial diseases form one of the most important cause of morbidity and death world wide[1,3]. P.A.D. can affect your quality of life, make walking difficult, or worse, increase your risk of heart attack, stroke, leg amputation, and even death. Early diagnosis and treatment of P.A.D. can help to:– Prevent disability and restore your mobility Stop the disease from progressing Lower your risk for heart attack, heart disease, and stroke.

For long angiography has been considered the Gold standard in

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evaluation of PVD and is done before any surgery is planned. This investigation is done to demonstrate the extent of the lesion, condition of vessels above the lesion, development of collaterals and reformation of distal vessels. It provided excellent anatomical detail.

With the recent introduction of CTA, MRA, the study has become further improvised but because of their high cost and unavailability, colour doppler Duplex sonography becomes the most easily available modality for evaluation of arteries. Over the past several years, interest in non invasive testing of PVD has increased rapidly. The use of the Duplex sonography has revolutionized the investigation of blood vessels. Colour Doppler is the most valuable of the noninvasive tests.

Colour Doppler imaging is safe, popular, cost effective, repeatable, noninvasive procedure for investigating lower limb arteries[3].

**Age distribution:**
In our study 90% of the cases were above the age of 40 years and 10% of the cases were between the age of 15-40 years. It is well accepted fact that the lower extremity arterial disease is the disease of middle and older age groups as cited by Cossman et al 23, Hughson et al.

**Sex distribution:**
Among 50 diagnosed cases of peripheral vascular insufficiency, patients who underwent

Doppler study 38 (76%) were males and 12 (24%) were females. Hughson et al observed that 2% of males and 1% of females had symptoms of peripheral vascular disease.

**Signs and symptoms**:
Intermittent claudication, rest pain and ulcer are very important signs of lower limb ischaemia. We found 60% of patients in this study having intermittent claudication. Tetsuo Ostida et al56 found 69 out of 144 ischemic limbs of TAO having this symptom.

In our study 25% cases had gangrene and 22% cases had ulcers. B. Ranjan noted that the maximum gangrene was associated with distal blocks and popliteal blocks. The incidence of gangrene being 50% in each case, while with femoropopliteal it was 20%. Out study shows that the maximum block at the level of femoro- popliteal trunk followed by distal run-off arteries.

Other symptoms are colour changes (42%), coldness(34%) and Paresthesias (24%).

**Risk factors :**
In our study 48 % of the patients were smokers with average smoking of 25- 30 cigarettes/ bedis per day for a period ranging from 10-30 years. Tobacco smoking affects both arteriosclerosis obliterans and thromboangitis obliterans (TAO) but TAO is exclusively seen in young smokers. The relationship between smokers and PVD is known since 1911 when

**Plaque characterization and percentage of stenosis :**
In our study we found atherosclerotic plaque was moderately echogenic in 41.3% of patients, strongly echogenic in 37.9% and low in echogenicity in 20.6% of patients.

Among 50 patients studied with peripheral vascular insufficiency 29 (58%) patients had atherosclerotic plaque suggesting that significant number of patients had peripheral arterial disease. Out of 29 plaque patients 16 patients had significant stenosis i.e. 50-99% occlusion 15 patients had 1-49% stenosis. Out of 50 patients studied, 19 (38%) patients had complete occlusion.

Among the patients who had hemodynamically significant stenosis 75% had lesions at femoro-popliteal segment, 35% at iliac-segment and 40% at infrapopliteal segment.

**PSV ratio:**
Among patients who had plaque 15 (30%) had PSV ratio of 2-4, 4(8%) had PSV ratio >4, 12 (24%) had <2 and 16 (40%) patients had total block. PSV at stenosis and ratio of PSV at stenosis is compared with velocity 1-2cm upstream in a non diseased segment.

**Spectral waveform changes:**
In our study spectral waveform changes were observed and the 2 main features, which are altered are, the overall shape of the waveform and the degree of spectral broadening as a result of flow disturbance.

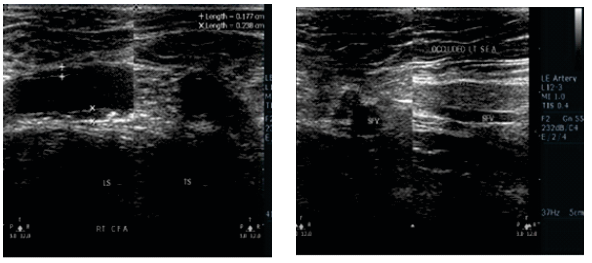
The spectral waveform was monophasic i.e. loss of third and then second phase of the normal triphasic waveform at the areas of hemodynamically significant stenosis and distal to it. The width of the first, systolic complex is increased and overall height is decreased.

These changes result in dampening of the waveform which is most marked when there is proximal occlusion.

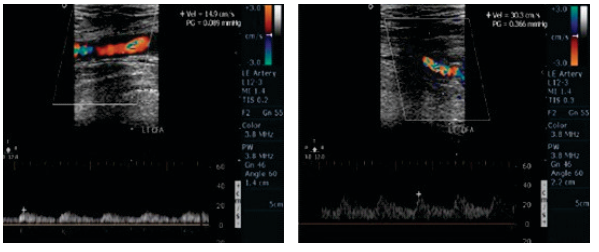
The turbulence generated beyond the stenosis resulted in spectral broadening and spectral fill-in under normal window under the first phase systolic peak.

No flow was recorded in cases of occlusion. In cases with distal disease the changes which were seen are the reduced diastolic component, evident from the loss of third component and reduced peak systolic velocity.

Other findings included diffuse irregularity of the vessel wall and resultant irregular colour fill-in in most of the patients suggesting increased Intima-medialthickness.



OCCLUDED EXTERNAL ILIAC AND SFA



REFORMED BY COLLATERALS WITH LOW RESISTANT MONOPHASIC FLOW IN THE ARTERIES OF LEG

**Results :**
Common presenting symptom was intermittent claudication. Among 50 patients examined, 70% of them had hemodynamically significant stenosis. Smoking and hyperlipidemia had a strong association with the development of plaque. Most of these patients with atheromatous plaque were males with a male – female ratio 3:1. 75% of plaques were found at femoropopliteal segment , predominantly on right side. 38% of patients had complete occlusion. Predominant type of these plaques were moderately echogenic i.e., 41%. In this study 30% had PSV ratio of 2-4 and 8% had >4.

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## CONCLUSION

Elderly people are with increased risk of peripheral arterial disease. Males are more commonly affected with smoking as the commonest risk factor. The other common risk factors include diabetes and hyperlipidemia. The commonest site of pathology is femoro-popliteal segment.

Duplex color Doppler sonography can accurately locate the site and extent of stenosis/occlusion.

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