ORIGINAL RESEARCH

Efficacy of Duplex Ultrasonography (DUS) and Multidetector Computed Tomography Angiography (MDCTA) in the evaluation of peripheral arterial disease of the lower limb- A comparative study

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ABSTRACT
Background: Peripheral Arterial Disease is a condition in which there is a buildup of plaque in the arteries that supply blood to the limbs, typically the legs.The present study was conducted to assess the efficacy of Duplex Ultrasonography (DUS) and Multidetector Computed Tomography Angiography (MDCTA) in the evaluation of peripheral arterial disease of the lower limb. **Materials & Methods:** 60 patients of peripheral arterial disease of both genders underwent Duplex ultrasonography and MDCT angiography. **Results:** Out of 60 patients, males were 36 and females were 24. Common clinical findings were gangrene in 10 patients, grade 2 claudication in 22, grade 3 claudication in 24 and grade 4 claudication in 4 patients. The difference was significant (P< 0.05).MDCTA was statistically significant in the detection of the length of stenotic segments in comparison to Duplex ultrasound. The difference was significant (P< 0.05). The diagnostic accuracy of DUS and MDCTA for Collateral flow was 94% and 96% respectively, for vessel wall calcification was 96% and 98% and for thrombosis was 95% and 97% respectively. The difference was significant (P< 0.05). **Conclusion:** In the assessment of peripheral artery disease, duplex ultrasonography can be utilized as a preliminary imaging modality, followed by MDCT angiography. For the diagnosis and pre-interventional work-up of PAD, particularly in the infra-popliteal segments, MDCT angiography is more sensitive and specific.
Key words: Peripheral Arterial Disease, thrombosis, MDCTA

INTRODUCTION

Peripheral Arterial Disease (PAD) is a condition in which there is a buildup of plaque in the arteries that supply blood to the limbs, typically the legs.[1] This buildup of plaque, consisting of fatty deposits, cholesterol, calcium, and other substances, can restrict or block blood flow to the muscles and tissues in the affected areas.[2]PAD often presents with symptoms such as pain, cramping, or fatigue in the legs, especially during physical activity. This is known as intermittent claudication. In severe cases, PAD can lead to pain at rest, non-healing wounds, and tissue loss.The risk factors for developing PAD include smoking, diabetes, high blood pressure, high cholesterol, aging, and a family history of vascular disease.[3]

Peripheral vascular disease is currently assessed using a variety of non-invasive imaging techniques, including magnetic resonance angiography (MRA), multidetector computed tomography angiography (MDCTA), and duplex ultrasound (DUS).[4] In addition to being non-invasive and inexpensive, duplex ultrasonography also poses no risk of ionizing radiation exposure.[5] It allows for the quick localization of arterial stenosis and occlusions as well as the assessment of the functional state of the vessels through the measurement of flow velocity. A minimally invasive imaging method called MDCT angiography is being used more and more to assess PVD.[6]The present study was conducted to assess efficacy of Duplex Ultrasonography (DUS) and Multidetector Computed Tomography Angiography

(MDCTA) in the evaluation of peripheral arterial disease of the lower limb.

MATERIALS & METHODS

The present study consisted of 60 patients of peripheral arterial diseaseof both genders. All gave their written consent to participate in the study.

Data such as name, age, gender etc. was recorded. A thorough clinical examination was done.

Duplex ultrasonography and MDCT angiography was done. Duplex ultrasonography of lower limb arteries from the level of common femoral artery till the dorsalis pedis artery was done. MDCT angiography was then performed by using Philips Ingenuity 128 slices MDCT scanner.

MDCT angiography was graded as follows: • Grade 0: normal or no stenosis • Grade I: Mild arterial stenosis (1-49 % stenosis) • Grade II: Moderate arterial stenosis (50-74% stenosis) • Grade III: Severe arterial stenosis (75-99% stenosis). Grade IV: 100 % or complete occlusion.Data thus obtained were subjected to statistical analysis. P value < 0.05 was considered significant.

RESULTS

Table I Distribution of patients

Total- 60		
Gender	Male	Female
Number	36	24

Table I shows that out of 60 patients, males were 36 and females were 24.

Table II Assessment of clinical findings

Clinical findings	Number	P value
gangrene	10	0.85
grade 2claudication	22	
grade 3 claudication	24	
grade 4 claudication	4	

Table II, graph I show that common clinical findings was gangrene in 10 patients, grade 2 claudication in 22, grade 3 claudication in 24 and grade 4 claudication in 4 patients. The difference was significant (P< 0.05).
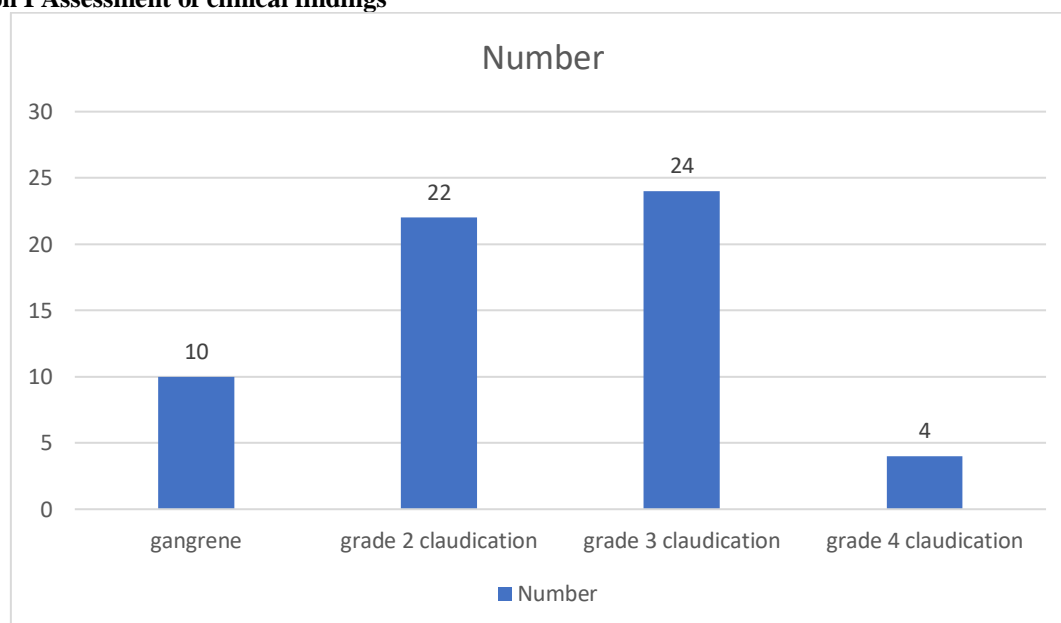
Graph I Assessment of clinical findings

Table III Comparison of MDCTA VS duplex USG in the detection of length of stenotic segment

Length of stenosis	Diagnostic accuracy (%)	Agreement	P value
Dorsalis pedis artery	96	0.70	0.03
Common femoral artery	98	0.90	0.02
Anterior tibial artery	99	0.92	0.01
Posterior tibial artery	98	0.90	0.02
Peroneal artery	97	0.84	0.02
Superficial femoral artery	96	0.70	0.03

Deep femoral artery	98	0.90	0.02
Popliteal artery	95	0.67	0.04

Table III show that MDCTA wasstatistically significant in detection of the length ofstenotic segments incomparison to Duplex ultrasound. The difference was significant (P< 0.05).

Table IV Diagnostic accuracy of DUS VS MDCTA

Characteristics	DUS	MDCTA	P value
Collateral flow	94%	96%	0.04
Vessel wall calcification	96%	98%	0.03
Thrombosis	95%	97%	0.05

Table IV show that diagnostic accuracy of DUS and MDCTA for Collateral flow was 94% and 96% respectively, for vessel wall calcification was 96% and 98% and for thrombosis was 95% and 97% respectively. The difference was significant (P< 0.05).

DISCUSSION

The management of PAD aims to relieve symptoms, prevent complications, and improve overall cardiovascular health.[7] Lifestyle modifications, such as smoking cessation, exercise, and a healthy diet, are crucial. Medications may be prescribed to control blood pressure, cholesterol levels, and manage symptoms.[8] In severe cases, procedures like angioplasty or surgery may be required to open or bypass blocked arteries.Untreated PAD can lead to serious complications, including infections, non-healing ulcers, and in extreme cases, amputation.[9] Additionally, individuals with PAD are at an increased risk of cardiovascular events such as heart attack and stroke.Lifestyle modifications play a key role in preventing and managing PAD. This includes quitting smoking, adopting a healthy diet, engaging in regular physical activity, and managing conditions like diabetes and hypertension.[10,11]The present study was conducted to assess efficacy of Duplex Ultrasonography (DUS) and Multidetector Computed Tomography Angiography (MDCTA) in the evaluation of peripheral arterial disease of the lower limb.

We found that out of 60 patients, males were 36 and females were 24. Suman et al[12] in their study 50 patients with a mean age of 55.76 ± 12.3 years were assessed over a period of two years. Diagnostic accuracy of MDCT angiography superseded Duplex Ultrasonography in the delineation of extent of disease and in the detection of hemodynamically significant stenosis (p < 0.001). Overall diagnostic accuracy of MDCTA in the evaluation of stenosis or thrombosis of popliteal, anterior tibial, posterior tibial, and dorsalis pedis arteries was more than duplex ultrasound with a p-value of less than 0.001. The extent of vessel wall calcification and collateralisation was better delineated on MDCT angiography.The image reconstruction with CT angiography provided better arterial tree delineation and an added advantage over DUS.

We observed that common clinical findings was gangrenein 10 patients, grade 2 claudication in 22, grade 3 claudication in 24 and grade 4 claudication in 4 patients. We observed that diagnostic accuracy of DUS and MDCTA for Collateral flow was 94% and 96% respectively, for vessel wall calcification was 96% and 98% and for thrombosis was 95% and 97% respectively. We found that MDCTA was statistically significant in the detection of the length of stenotic segments in comparison to Duplex ultrasound. Netam et al[13]assessed the role of CT angiography in peripheral vascular disease and comparison with color Doppler ultrasound. They examined 50 patients by CT angiography and color Doppler ultrasound who were suspected for arterial disease. They found Color Doppler ultrasound detected more normal vessel segment, grade-1 and grade-2 stenosis. In stenosis grade-3 and grade-4 CT angiography and Color Doppler ultrasound are equally sensitive. Doppler sonography was better than CT angiography in the diagnosis of early onset (Grade I & II) cases, with a better assessment of soft plaques.

The limitation of the study is the small sample size.

CONCLUSION

Authors found that in the assessment of peripheral artery disease, duplex ultrasonography can be utilized as a preliminary imaging modality, followed by MDCT angiography. For the diagnosis and pre-interventional work-up of PAD, particularly in the infra-popliteal segments, MDCT angiography is more sensitive and specific.

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