

# A Comparative Efficacy of MDCT Angiography and Colour Doppler

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**Abstract:** *Imaging plays a crucial role in the management of patients with peripheral arterial disease. The present study compared colour Doppler ultrasonography findings with MDCT angiography in patients with peripheral arterial disease in the lower extremity. 40 patients with signs and symptoms of peripheral arterial occlusive disease referred for evaluation by imaging by colour doppler ultrasonography and MDCT angiography were studied. There was statistically significant difference in the detection of the extent of segment involvement in DFA. There is significant difference in the detection of the extent of segment involvement in popliteal artery. There is statistically extremely significant difference in the detection of the extent of segment involvement in ATA. MDCT is better than Doppler in detecting the length of stenosis in the arterial system. MDCT is better than Doppler in detecting the presence of thrombosis especially in the infra-popliteal segment. Even though MDCT is not statistically significant than Doppler in detecting the number of collateral segments, as the arterial tree is better delineated in MDCT.*

**Keywords:** colour Doppler ultrasonography, MDCT angiography, efficacy

## 1. Introduction

Peripheral arterial disease is a very important health problem in the developing world which is increasing in its incidence due to the increase in the predisposing factors.[1] Peripheral arterial disease is diffuse in nature and contributes significantly towards the morbidity and mortality in the industrialized world.[2] Peripheral arterial disease is mostly due to atheromatous narrowing or occlusion of an artery or arteries. The first manifestation of symptomatic PVD patients is often intermittent claudication, which eventually progresses to critical limb ischemia i.e rest pain and tissue necrosis.[3] Imaging plays a crucial role in the management of patients with peripheral arterial disease. Colour Doppler ultrasonography is the initial imaging modality of choice for PVD investigation, despite its wide use; it has lower sensitivity than MDCT angiography which is considered as an upcoming modality in the evaluation of lower extremity PVD.[4] MDCT angiography is regarded to be a promising modality in lower extremity arterial imaging. It is a reliable non-invasive tool in quantifying the length, number and grade of stenosis.[5] It mainly delineates the presence or absence of significant obstruction to the blood flow, the site and anatomical extent of obstruction, the status of collaterals and distal vasculature which is crucial for planning the treatment as well as to monitor the results of therapy and disease progression.[6] The aim of our study was to compare colour Doppler ultrasonography findings with MDCT angiography in patients with peripheral arterial disease in the lower extremity.

## 2. Subjects and Methods

This is a comparative study done on 40 patients with signs and symptoms of peripheral arterial occlusive disease referred for evaluation by imaging by colour doppler ultrasonography and

MDCT angiography to the in the Department of Radio Diagnosis, at Polyclinic "At Luigi Monti" in Tirana, Albania were included in the study. The study was done for a period of 2 years from 2016 to 2018. All colour Doppler ultrasonography were performed using PHILIPS HD 11 equipment and the arterial system of the lower limb was scanned with a linear phased array (5-12MHZ) transducer. A complete occlusion was confirmed by reducing the colour scale and/or using the power Doppler. Arteries were evaluated for calibre, lumen, flow velocity and spectral wave pattern. The average scan time was 15 to 30 minutes for each limb. The data collected from the patient was classified according to the level of atherosclerotic disease present by triplex imaging. In patients whom at least one stenosis was present in the lower limbs of between 50-70% were classified as having moderate disease and placed into the moderate disease group, in patients whom at least one stenosis between 70-99% were classified as having significant disease and placed into the significant group and in patients whom an occlusion were placed in the occlusive group. The 16 slice MDCT angiography was performed following assessment by an arterial colour Doppler. The scan direction was craniocaudal from the level of infrarenal aorta to the pedal arch. The 150 ml of non-ionic contrast media was injected at a rate of 4 ml/s with a pressure injector. The images were then acquired with a slice thickness of 1.25 mm and collimation of 1.00 mm with a table feed of 27mm/s and a gantry rotation period of 0.8s. The tube voltage is 140kv with mAs between 250 and 300, and the average scan time was 30 to 40 s. Images were analyzed for plaques, extent and pattern of luminal narrowing and for the collateral flow. The grading was done.

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### 3. Results and Discussion

Peripheral vascular disease is increasing in frequency with an increase in life expectancy and increase in its comorbid conditions like advancing age, diabetes mellitus and hypertension. This disease is associated with a lot of morbidity due to its global involvement.[7] Following cancer and heart disease, complications of atherosclerosis causing PVD is the third leading cause of death in the world. Precise diagnosis will therefore help to obtain a better understanding of the natural history of this condition and also determine a therapeutic regimen and prognosis.[8] Doppler ultrasound, Duplex Sonography, combining high resolution imaging and doppler spectrum analysis has proved to be popular, non-invasive, accurate and cost effective means of assessing peripheral vascular disease.[9] With the emergence of MDCT in clearly delineating the extent of arterial tree involvement in a non-invasive way and giving a result comparable to the invasive cumbersome angiography, MDCT is the present modality of choice in imaging the vascular tree before any intervention. MDCT is safe, has faster acquisition and is observer independent hence reliable. [10] In our study of comparison of colour doppler ultrasound with MDCT 40 patients with 80 limbs were evaluated for the extent of disease in the lower limb arterial system and the data was compared with the existing studies available and the following observations were made to find an agreement between colour doppler ultrasound with MDCTA. We studied 40 patients of peripheral vascular disease, out of these 40 patients 30 (75%) were male patients and 10 (25%) were female patients. In a study by Bergamini et al,[11] it was concluded that PVD is a disease which affects middle aged and the elderly which is comparable with our study in which out of 40 patients studied the age group involved mostly 61-70 years 43% with 17 patients and 38 patients out of 40 were either of middle or old age. Among the smoking group the incidence and grade of claudication was more than that of non-smokers. 100% of smokers had severe claudication, grade 3 or grade 4 as per the Boyd's classification which is statistically extremely significant indicating that in smoking worsens the progression of PVD at a faster rate. In our study we concluded that as the age advances the degree of stenosis increases which is comparable with the study by, our study also showed that with advancing age the involvement of larger arteries increases which is comparable to study by Sensier et al.[12] We found that hypertension is a common and important risk factor for vascular disorders of hypertensives at presentation; about 2-5% has intermittent claudication, with increasing prevalence with age in the different studies by Sensier et al.[12] In the study by Joshi et al,[13] the overall rate of helical CT was better in detecting lesions of the infrapopliteal arteries. In their study they concluded that sixteen-detector row CT angiography is an accurate and reliable noninvasive alternative to conventional DSA in the assessment of aortoiliac and lower extremity arteries in patients with peripheral arterial disease.

In our study when colour doppler ultrasound was compared to MDCT in detecting the infra popliteal the segment blocks MDCT was better in detecting the infra popliteal the segment

blocks and the length of with a p value of  $< 0.001$  which is statistically highly significant. In our study when colour doppler ultrasound was compared to MDCT in detecting the femoro-popliteal region in the DFA, MDCT was better in detecting the segment block, and the length of with a p value of  $< 0.01$  which is statistically significant, but SFA though the percentage was better there was no statistically significant significance. In our study in comparison to colour doppler ultrasound though the number of collateral circulation recognition was not statistically significant in the lower limb arterial systems MDCTA was significantly better than colour doppler ultrasound in evaluation of the morphologic features of the runoff arteries in their full length which is an important imaging finding, hence MDCT is needed before vascular intervention. Romano et al,[14] compared the efficacy of multidetector computed tomography angiography and duplex ultrasonography to diagnose mild peripheral arterial occlusive disease. In their study forty-three patients with 774 segments in patients with intermittent claudication and leg pain, diagnosed as mild PAOD, had undergone DUS followed by MDCTA of lower limb. MDCTA detected obstructed or stenotic lesions in 16.8% of arteries; they concluded that MDCTA could be used as a screening tool in patients with mild lower extremity PAOD as it is a non-invasive and more accurate modality when compared to DUS. In our study we found that MDCT is better in diagnosing the lesions in PVD. Doppler is also an effective tool which can detect the lesions to a comparable extent when no intervention is planned and only medical therapy is considered. In our study we also found that in comparison to colour doppler ultrasound in detecting hemodynamically significant stenosis, in the lower limb arterial systems MDCTA was significantly better statistically than colour doppler ultrasound. In our study we also concluded that the PSV ratio is higher before the level of stenosis and as the grade of the stenosis increases the spectral wave form pattern progressively worsens from the normal triphasic to biphasic in mild to moderate stenosis to monophasic in moderate to severe stenosis.

### 4. Conclusion

MDCT is better than Doppler in detecting the length of stenosis in the arterial system. MDCT is better than Doppler in detecting the presence of thrombosis especially in the infrapopliteal segment. Even though MDCT is not statistically significant than Doppler in detecting the number of collateral segments, as the arterial tree is better delineated in MDCT, this modality is needed to be performed before any vascular intervention is planned. Doppler is also an effective tool which can detect the lesions to a comparable extent when no intervention is planned and only medical therapy is considered.

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