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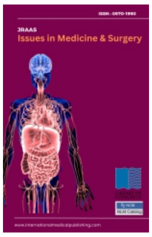

Research Article

Section: Radiodiagnosis

Comparative Evaluation of Multidetector Computed Tomography Angiography & Color Doppler Ultrasonography in Lower Limb Peripheral Arterial Disease

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HIGHLIGHTS

- Excellent CDUS sensitivity
- Accurate MDCTA stenosis grading
- Near-perfect diagnostic agreement
- Superior distal vessel visualization
- Combined imaging enhances accuracy

Key Words:
Peripheral arterial disease
MDCT angiography
Color Doppler ultrasonography

ABSTRACT

Introduction: Peripheral arterial disease (PAD) is a common vascular disorder that necessitates precise imaging for accurate diagnosis and effective management. Among the available non-invasive imaging techniques, Color Doppler Ultrasonography (CDUS) and Multidetector Computed Tomography Angiography (MDCTA) are widely utilized, each offering unique benefits in vascular assessment. **Aims & Objectives:** This study aimed to evaluate and compare the diagnostic performance of CDUS and MDCTA in patients with lower limb PAD, focusing on their sensitivity, specificity, overall accuracy in grading arterial stenosis. **Materials & Methods:** A hospital-based descriptive cross-sectional study was carried out on 48 patients, accounting for 96 lower limbs, all clinically suspected of having PAD. Each participant underwent both CDUS and MDCTA examinations. Arterial stenosis was categorized into five groups: normal, mild (≤50%), moderate (50–70%), severe (≥70%), and complete occlusion. Statistical analysis was conducted using IBM SPSS version 26, with a p-value of less than 0.05 considered statistically significant. **Results:** Most participants were male (72.9%), with the highest proportion falling within the 61–70 years age group (39.6%). Claudication emerged as the most frequent presenting complaint (44.8%). CDUS demonstrated excellent sensitivity (100%) and high specificity (89.7%) when compared with MDCTA, achieving an overall diagnostic accuracy of 93.6%. There was near-perfect agreement between the two modalities ($\kappa = 0.86$), along with strong diagnostic performance (AUC = 0.93). However, CDUS showed a tendency to overestimate stenosis in infrapopliteal segments, where specificity was relatively reduced, while MDCTA provided better visualization of distal vessels. **Conclusion:** CDUS serves as a highly sensitive, non-invasive screening tool, especially effective for proximal arterial segments. MDCTA remains a reliable reference standard, offering superior anatomical detail and precise stenosis grading necessary for treatment planning. A combined imaging approach enhances diagnostic accuracy, particularly for evaluating distal arterial involvement.

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INTRODUCTION

Peripheral arterial disease (PAD) is a chronic, progressive atherosclerotic condition characterized by narrowing or occlusion of arteries supplying the lower limbs, most commonly involving the femoropopliteal and infra popliteal segments. The disease originates from endothelial dysfunction triggered by risk factors such as smoking, diabetes, hypertension, dyslipidemia, and chronic kidney disease, leading to lipid deposition, inflammation, and plaque formation within arterial walls [1]. Clinically, PAD ranges from asymptomatic stages to intermittent claudication and advanced chronic limb-threatening ischemia, which may result in ulcers, gangrene, or amputation. Importantly, PAD is also a marker of systemic atherosclerosis and is associated with increased risks of myocardial infarction, stroke, and cardiovascular mortality [2].

Globally, PAD affects over 200 million individuals, with prevalence increasing significantly in individuals above 60 years and in diabetics, who often develop distal and rapidly progressive disease. In India, prevalence ranges from 5% to 25%, though underdiagnosis remains a major concern [3]. Community-based and hospital studies highlight a high burden of asymptomatic disease and strong associations with risk factors such as smoking, diabetes, hypertension, and socioeconomic status [4]. Multiple interacting risk factors, including age, genetic predisposition, and elevated homocysteine levels, contribute to disease progression, emphasizing the importance of early detection and risk modification [5].The pathophysiology involves progressive luminal narrowing due to atherosclerotic plaque accumulation, reducing blood flow and causing ischemia, particularly during exertion when metabolic demand increases [6]. Advanced disease leads to critical limb ischemia, impaired wound healing, and increased susceptibility to infections, which may progress to tissue necrosis and systemic complications [7].

Additionally, PAD reflects generalized vascular pathology, contributing to cardiovascular events such as coronary artery disease and stroke [8].

Diagnosis relies on clinical assessment supported by objective tests such as the ankle–brachial index, along with imaging modalities including duplex ultrasonography, computed tomography angiography (CTA), & magnetic resonance angiography [9]. Color Doppler ultrasonography (CDUS) is widely used as a first-line tool due to its noninvasive nature, real-time hemodynamic assessment, and high sensitivity, particularly in femoropopliteal segments. However, it is operator dependent and may be limited in obese patients, heavily calcified vessels, or distal arteries. Multidetector CT angiography (MDCTA) provides high-resolution, three-dimensional vascular mapping with excellent diagnostic accuracy, especially for multilevel disease and preoperative planning, though it involves radiation exposure and contrast-related risks [10].

Comparative studies suggest that CTA performs better in aortoiliac and complex disease, whereas duplex ultrasound demonstrates comparable accuracy in femoropopliteal segments, with reduced reliability in infrapopliteal arteries [11]. Factors such as patient characteristics, technical expertise, and lesion location influence diagnostic accuracy of both modalities. In special populations like diabetics and patients with chronic kidney disease, imaging selection requires careful consideration due to distal disease patterns and contrast-related risks [12].

Given the clinical importance of accurate imaging, there remains no universal consensus regarding the optimal modality for all patient groups. While CDUS is suitable for initial screening and follow-up, MDCTA offers superior anatomical detail for intervention planning. Therefore, a systematic comparison of these modalities is essential to determine their relative diagnostic performance and to guide evidence-based imaging strategies.

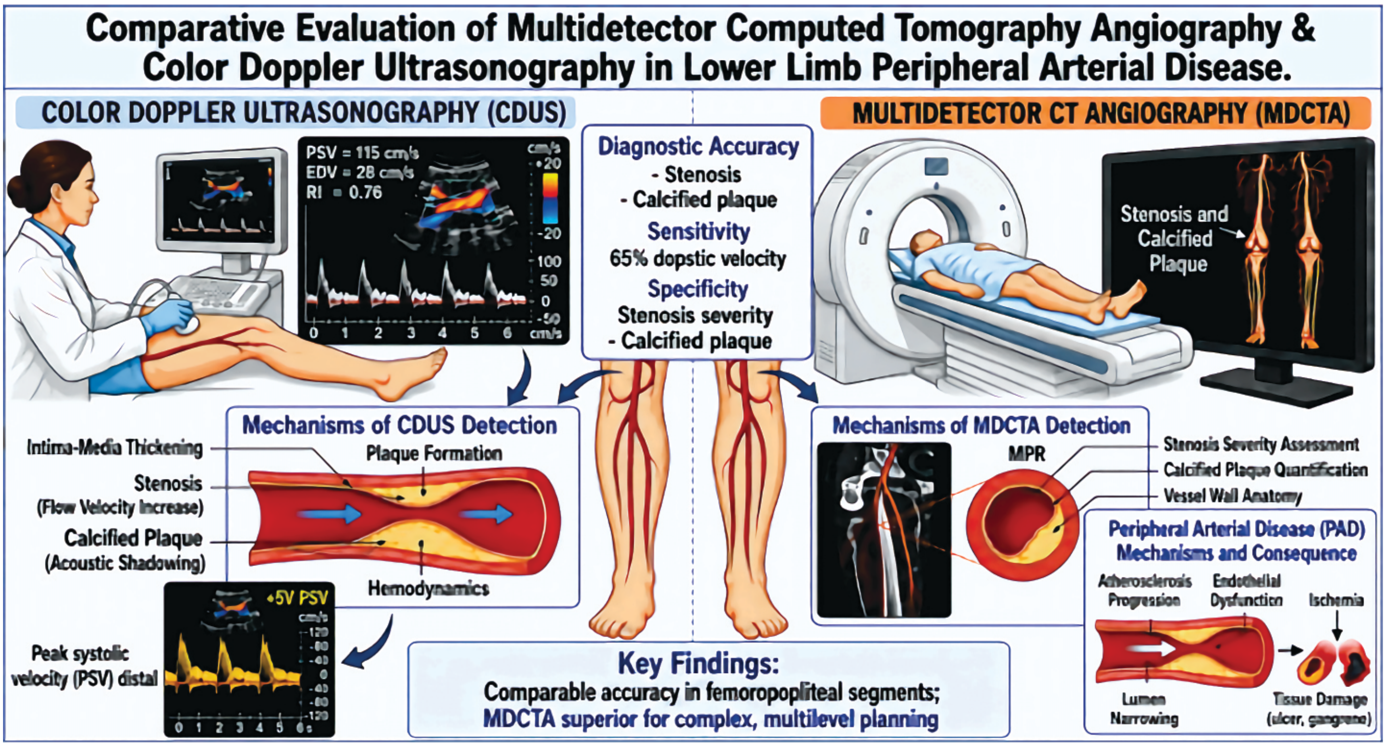

Figure 1: Comparative Evaluation of MDCTA and CDUS in Lower Limb Peripheral Arterial Disease.

This study addressed the need to evaluate and compare CDUS and MDCTA in lower limb PAD to improve diagnostic accuracy, optimize clinical decision making, and enhance patient outcomes [13]. **Figure 1** illustrates the diagnostic role of MDCTA and CDUS in assessing arterial stenosis, plaque characteristics, and disease severity in lower limb PAD, highlighting their comparable accuracy and complementary clinical applications.

This study aims to compare the role of Color Doppler Ultrasonography (CDUS) and MDCT angiography in lower limb peripheral arterial disease. The objective is to assess the diagnostic accuracy and to compare the sensitivity and specificity of Color Doppler Ultrasonography and MDCT angiography in diagnosing lower limb peripheral arterial disease.

MATERIAL & METHODS

This hospital based descriptive cross-sectional study was conducted at the Department of Radio-diagnosis, K.D. Medical College Hospital and Research Centre, Mathura, Uttar Pradesh from June 2024 to December 2025. Ethical approval has been obtained from the Ethical Approval Committee of K.D. Medical College Hospital and Research Centre, Mathura, Uttar Pradesh.

Study Population

The study population included all patients referred to the Department of Radiodiagnosis with a clinical diagnosis of lower limb peripheral vascular disease. Pregnant women were excluded from participation. Patients with elevated blood urea nitrogen and serum creatinine levels were also excluded due to potential risks associated with imaging procedures. Additionally, individuals who declined consent or refused to participate in the study protocol were not included in the study population.

Data Analysis

Data were entered, coded, and analyzed using IBM SPSS version 26. Descriptive statistics were applied to summarize demographic and clinical variables. Diagnostic performance of Color Doppler Ultrasonography was evaluated against MDCT angiography as the reference standard by calculating sensitivity, specificity, positive predictive value, negative predictive value, and overall accuracy. Agreement between modalities was assessed using Cohen's kappa statistic, while Receiver Operating Characteristic analysis was performed to determine diagnostic performance, with $p < 0.05$ considered statistically significant.

RESULTS

In this study of 48 patients (96 limbs), most individuals were in the 61–70 years age group (39.6%), followed by 51–60 years (35.4%), indicating higher prevalence in older populations, with no significant association between age and sex ($p = 0.275$). A marked male predominance was observed (72.9%), which was statistically significant ($p = 0.0015$). Among limbs analyzed, most were symptomatic, with claudication being the most common presentation (44.8%), followed by rest pain (29.2%) & and ulceration (18.8%), showing significant variation ($p < 0.001$).

CDUS evaluation of the common femoral artery revealed predominantly normal (40.6%) or mild stenosis (32.3%), with few severe cases and no occlusions. On limb-wise analysis using Color Doppler Ultrasonography, the common femoral artery most demonstrated normal patency (40.6%), followed by mild (The distribution was not statistically significant ($p > 0.05$) **(Table 1)**.

Limb-wise evaluation of the superficial femoral artery using Color Doppler Ultrasonography showed mild stenosis (≤50%) as the most common finding in 42.7% of limbs, with normal arteries in 16.7%, moderate stenosis in 22.9%, severe stenosis in 16.7%, and a single occlusion (1%). The differences in stenosis grades were not statistically significant ($p > 0.05$) **(Table 2)**. Limb-wise assessment of the popliteal artery using Color Doppler Ultrasonography showed mild stenosis (≤50%) as the most common finding in 46.9% of limbs, with normal arteries in 10.4%, moderate and severe stenosis each in 18.8%, and occlusion in 5.2%. The differences in stenosis grades were not statistically significant ($p > 0.05$) **(Table 3)**.Limb-wise evaluation of the anterior tibial, posterior tibial, and dorsalis pedis arteries using Color Doppler Ultrasonography in 96 limbs showed that mild (≤50%) stenosis was the most common finding across all three arteries, occurring in 36.5% of anterior tibial, 43.8% of posterior tibial, and 41.7% of dorsalis pedis arteries **(Table 4)**. Moderate (50–70%) and severe (≥70%) stenosis were less frequent in the anterior tibial artery (23.9% each), while in the posterior tibial artery, severe stenosis (27.1%) slightly exceeded moderate (20.8%) **(Table 5)**.

The dorsalis pedis artery showed moderate stenosis in 13.5% and severe stenosis in 19.8% of limbs. Complete occlusion was observed in 8.3% of anterior tibial, 5.2% of posterior tibial, and 10.4% of dorsalis pedis arteries, while normal patency was relatively low, ranging from 3.1% in the posterior tibial to 14.6% in the dorsalis pedis artery **(Table 6)**.

Overall, the distribution of stenosis grades was not statistically significant, and there was a trend of increasing moderate and severe stenosis in distal arteries compared to proximal vessels, with distal arteries showing more advanced disease patterns .Limb-wise evaluation of the common femoral artery using MDCT angiography showed normal arteries as the most common finding in 40.6% of limbs, with mild stenosis (≤50%) in 32.3%, moderate stenosis in 23.9%, severe stenosis in 3.2%, and no occlusions. The differences in stenosis grades were not statistically significant ($p > 0.05$) **(Table 7)**.

Limb-wise assessment of the superficial femoral artery using MDCT angiography showed mild stenosis (≤50%) as the most common finding in 42.7% of limbs, with normal arteries in 16.7%, moderate stenosis in 23.9%, severe stenosis in 15.6%, and a single occlusion (1%). The differences in stenosis grades were not statistically significant ($p > 0.05$) **(Table 8)**. Limb-wise evaluation of the popliteal artery using MDCT angiography showed mild stenosis (≤50%) as the most common finding in 46.9% of limbs, with normal arteries in 10.4%, moderate stenosis in 19.8%, severe stenosis in 17.7%, & occlusion in 5.2%. The differences in stenosis grades were not statistically significant

($p > 0.05$) **(Table 9)**. Limb-wise assessment of the anterior tibial artery using MDCT angiography showed mild stenosis (≤50%) as the most common finding in 42.7% of limbs, with normal arteries in 16.7%, moderate stenosis in 21.8%, severe stenosis in 10.4%, and occlusion in 8.3%. The distribution of stenosis grades was highly statistically significant ($\chi^2 = 20.12$, $p < 0.001$) **(Table 10)**. Limb-wise evaluation of the posterior tibial artery using MDCT angiography showed mild stenosis (≤50%) as the most common finding in 45.8% of limbs, with normal arteries in 15.6%, moderate stenosis in 14.6%, severe stenosis in 19.8%, and occlusion in 4.2%. The distribution of stenosis grades was highly statistically significant ($\chi^2 = 51.98$, $p < 0.001$) **(Table 11)**.

Limb-wise assessment of the dorsalis pedis artery using MDCT angiography showed mild stenosis (≤50%) in 41.7% of limbs, with normal arteries in 22.9%, moderate stenosis in 16.7%, severe stenosis in 12.5%, and occlusion in 6.2% **(Table 12)**. The distribution of stenosis grades was not statistically significant ($\chi^2 = 9.44$, $p \approx 0.05$).

Among the 48 patients, hypertension was present in 64.6%, showing a statistically significant association with peripheral arterial disease ($\chi^2 = 8.17$, $p < 0.05$), indicating it as the most prevalent risk factor. Smoking was reported in 60.4% of patients and was also significantly associated with the disease ($\chi^2 = 4.17$, $p < 0.05$), highlighting its role in vascular damage and atherosclerosis progression. Diabetes was present in 56.3% of patients, but its distribution was not statistically significant ($p > 0.05$), suggesting that while common, it was not a significant risk factor in this cohort. Overall, hypertension emerged as the leading risk factor, followed by smoking and then diabetes.

Table 13 shows strong agreement between CDUS and MDCT in evaluating stenosis distribution. Findings were identical or nearly identical in the CFA, SFA, and popliteal artery, while CDUS tended to grade more moderate-to-severe disease in distal arteries (ATA, PTA, and DPA) compared with MDCT.

Figure 2. Comparison of Common Femoral Artery (CFA) Stenosis Severity on CDUS and MDCT. The bar chart compares the distribution of common femoral artery stenosis severity (normal, mild, moderate, severe, and occlusion) assessed by color Doppler ultrasonography (CDUS) and multidetector computed tomography (MDCT). Both imaging modalities demonstrated nearly identical findings, indicating excellent agreement in the evaluation of CFA stenosis.

Figure 3. Comparison of Superficial Femoral Artery (SFA) Stenosis on CDUS and MDCT. Distribution of stenosis severity grades showing close agreement between CDUS and MDCT. **Figure 4.** Comparison of Popliteal Artery Stenosis on CDUS and MDCT. Distribution of stenosis severity grades showing close agreement between CDUS and MDCT. **Figure 5.** Comparison of Anterior Tibial Artery (ATA) Stenosis on CDUS and MDCTA. Distribution of stenosis severity grades showing close agreement between CDUS and MDCTA. **Figure 6.** Comparison of Posterior Tibial Artery (PTA) Stenosis on CDUS and MDCTA. Distribution of stenosis severity grades showing close agreement between CDUS and MDCTA. **Figure 7.** Comparison of Dorsalis Pedis Artery (DPA) Stenosis on CDUS and MDCTA. Distribution of stenosis severity grades showing close agreement between CDUS and MDCTA.

Comparative analysis of stenosis distribution showed that Color Doppler Ultrasonography (CDUS) closely matched MDCT angiography in proximal arteries like the common and superficial femoral arteries and the popliteal artery, with only minor variations. However, in distal arteries such as the anterior tibial, posterior tibial, and dorsalis pedis, CDUS tended to overestimate stenosis compared to MDCT, confirming MDCT as the gold standard for precise assessment while CDUS remains a reliable screening tool.

Color Doppler Ultrasonography (CDUS) demonstrated excellent overall performance in evaluating peripheral arterial disease, showing perfect agreement with MDCT angiography in proximal arteries (CFA, SFA, POP) with 100% sensitivity, specificity, and accuracy, while distal arteries (ATA, PTA, DPA) showed moderate agreement with slightly lower specificity (<80%) but maintained high overall accuracy (>90%). Across all arteries, CDUS exhibited 100% sensitivity, 89.7% specificity, an 85.3% positive predictive value, a 100% negative predictive value, and an overall diagnostic accuracy of 93.6%, with Cohen's kappa of 0.86 indicating almost perfect agreement with MDCT. ROC curve analysis further confirmed excellent diagnostic performance, with an AUC of 0.93.

These results highlight CDUS as a highly reliable, non-invasive screening tool for detecting significant stenosis, while MDCT angiography remains superior for precise anatomical delineation and accurate grading of stenosis, particularly in infra popliteal arteries where CDUS may overestimate disease severity.

Table 1: CDUS-CFA Distribution of Stenosis with Coding (n=96)

Code	Stenosis Grade	Number of Limbs	Percentage (%)	Chi-square (χ^2)	p-value
1.	Normal	39	40.6		
2.	Mild (≤50%)	31	32.3		
3.	Moderate (50 –70%)	23	23.9		
4.	Severe (≥70%)	3	3.2	1.02	0.601
5.	Occlusion	0	0		
Total		**96**	**100**		

Table 2: CDUS-SFA Distribution of Stenosis with Coding (n = 96)

Code	Stenosis Grade	Number of Limbs	Percentage (%)	Chi-square (χ²)	p- value
1.	Normal	16	16.7		
2.	Mild (≤50%)	41	42.7		
3.	Moderate (50-70%)	22	22.9		
4.	Severe (≥70%)	16	16.7	6.82	0.078
5.	Occlusion	1	1.04		
Total		**96**	**100**		

Table 3: CDUS-POP Distribution of Stenosis with Coding (n = 96)

Code	Stenosis Grade	Number of Limbs	Percentage (%)	Chi-square (χ²)	p- value
1.	Normal	10	10.4		
2.	Mild (≤50%)	45	46.9		
3.	Moderate (50–70%)	18	18.8	6.82	0.078
4.	Severe (≥70%)	18	18.8		
5.	Occlusion	5	5.2		
Total		**96**	**100**		

Table 4: CDUS-ATA Distribution of Stenosis with Coding (n = 96)

Code	Stenosis Grade	Number of Limbs	Percentage (%)	Chi-square (χ²)	p-value
1.	Normal	7	7.3		
2.	Mild (≤50%)	35	36.5		
3.	Moderate (50 –70%)	23	23.9	6.82	0.078
4.	Severe (≥70%)	23	23.9		
5.	Occlusion	8	8.3		
Total		**96**	**100**		

Table 5: CDUS-PTA Distribution of Stenosis with Coding (n=96)

Code	Stenosis Grade	Number of Limbs	Percentage (%)	Chi-square (χ²)	p-value
1.	Normal	3	3.1		
2.	Mild (≤50%)	42	43.8		
3.	Moderate (50 –70%)	20	20.8	1.34	0.719
4.	Severe (≥70%)	26	27.1		
5.	Occlusion	5	5.2		
Total		**96**	**100**		

Table 6: CDUS-DPA Distribution of Stenosis with Coding (n=96)

Code	Stenosis Grade	Number of Limbs	Percentage (%)	Chi-square (χ²)	p-value
1.	Normal	14	14.6		
2.	Mild (≤50%)	40	41.7		
3.	Moderate (50 –70%)	13	13.5	2.41	0.492
4.	Severe (≥70%)	19	19.8		
5.	Occlusion	10	10.4		
Total		**96**	**100**		

Table 7: MDCT Angiography – CFA Distribution of Stenosis with Coding (n = 96)

Code	Stenosis Grade	Number of Limbs	Percentage (%)	Chi-square (χ²)	p- value
1.	Normal	39	40.6		
2.	Mild (≤50%)	31	32.3		
3.	Moderate (50–70%)	23	23.9		
4.	Severe (≥70%)	3	3.2		
5.	Occlusion	0	0	5.12	0.077
Total		**96**	**100**		

Table 8: MDCT Angiography – SFA Distribution of Stenosis with Coding (n = 96)

Code	Stenosis Grade	Number of Limbs	Percentage (%)	Chi-square (χ^2)	p-value
1.	Normal	16	16.7	6.82	0.078
2.	Mild (≤50%)	41	42.7		
3.	Moderate (50 –70%)	23	23.9		
4.	Severe (≥70%)	15	15.6		
5.	Occlusion	1	1.0		
Total		**96**	**100**		

Table 9: MDCT Angiography – POP Distribution of Stenosis with Coding (n = 96)

Code	Stenosis Grade	Number of Limbs	Percentage (%)	Chi-square (χ^2)	p- value
1.	Normal	10	10.4	1.12	0.772
2.	Mild (≤50%)	45	46.9		
3.	Moderate (50–70%)	19	19.8		
4.	Severe (≥70%)	17	17.7		
5.	Occlusion	5	5.2		
Total		**96**	**100**		

Table 10: MDCT Angiography – ATA Distribution of Stenosis with Coding (n = 96)

Code	Stenosis Grade	Number of Limbs	Percentage (%)	Chi-square (χ^2)	p-value
1.	Normal	16	16.7	20.12	<0.001
2.	Mild (≤50%)	41	42.7		
3.	Moderate (50 –70%)	21	21.8		
4.	Severe (≥70%)	10	10.4		
5.	Occlusion	8	8.3		
Total		**96**	**100**		

Table 11: MDCT Angiography – PTA Distribution of Stenosis with Coding (n = 96)

Code	Stenosis Grade	Number of Limbs	Percentage (%)	Chi-square (χ^2)	p-value
1	Normal	15	15.6	51.98	<0.001
2	Mild (≤50%)	44	45.8		
3	Moderate (50–70%)	14	14.6		
4	Severe (≥70%)	19	19.8		
5	Occlusion	4	4.2		
Total		**96**	**100**		

Table 12: MDCT Angiography – DPA Distribution of Stenosis with Coding (n = 96)

Code	Stenosis Grade	Number of Limbs	Percentage (%)	Chi-square (χ^2)	p-value
1	Normal	22	22.9	9.44	0.05
2	Mild (≤50%)	40	41.7		
3	Moderate (50–70%)	16	16.7		
4	Severe (≥70%)	12	12.5		
5	Occlusion	6	6.2		
Total		**96**	**100**		

Table 13: Artery-wise Comparison of Stenosis Distribution (n = 96)

Artery	Modality	Normal (%)	Mild (%)	Moderate (%)	Severe (%)	Occlusion (%)	Key Observation
CFA	CDUS	40.6	32.3	23.9	3.2	0	Identical distribution
	MDCT	40.6	32.3	23.9	3.2	0	
SFA	CDUS	16.7	42.7	22.9	16.7	1.0	Nearly identical distribution
	MDCT	16.7	42.7	23.9	15.6	1.0	
POP	CDUS	10.4	46.9	18.8	18.8	5.2	Nearly identical distribution
	MDCT	10.4	46.9	19.8	17.7	5.2	(minor variation)
ATA	CDUS	7.3	36.5	23.9	23.9	8.3	Moderate/Severe disease on CDUS
	MDCT	16.7	42.7	21.8	10.4	8.3	& Mild disease on MDCT
PTA	CDUS	3.1	43.8	20.8	27.1	5.2	Moderate/Severe disease on CDUS
	MDCT	15.6	45.8	14.6	19.8	4.2	& Normal/Mild on MDCT
DPA	CDUS	14.6	41.7	13.5	19.8	10.4	Severe/occlusion on CDUS & More
	MDCT	22.9	41.7	16.7	12.5	6.2	normal, less severe on MDCT

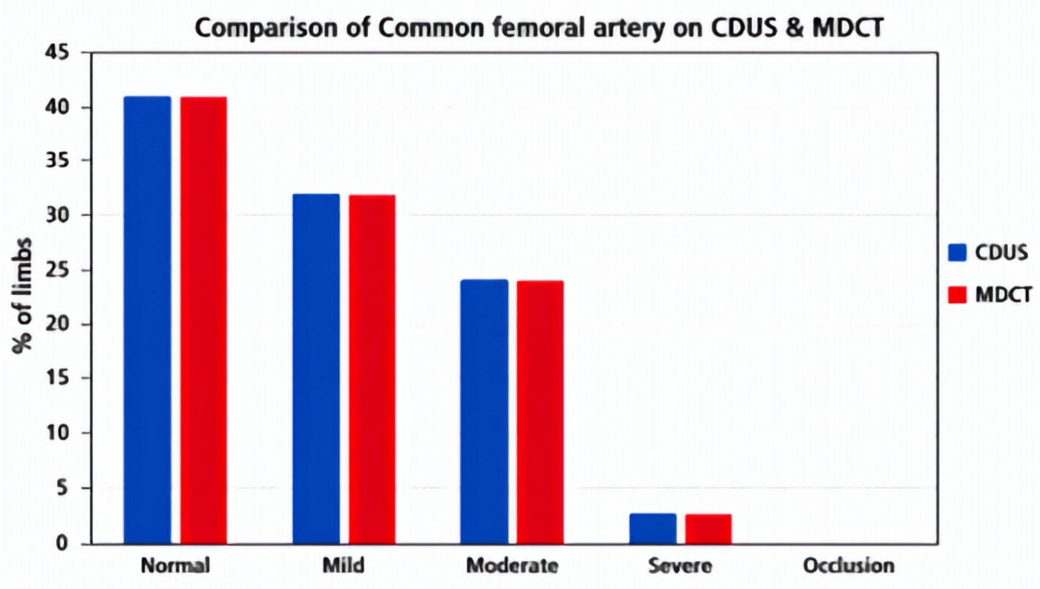

Figure 2: CFA Stenosis: CDUS vs MDCTA

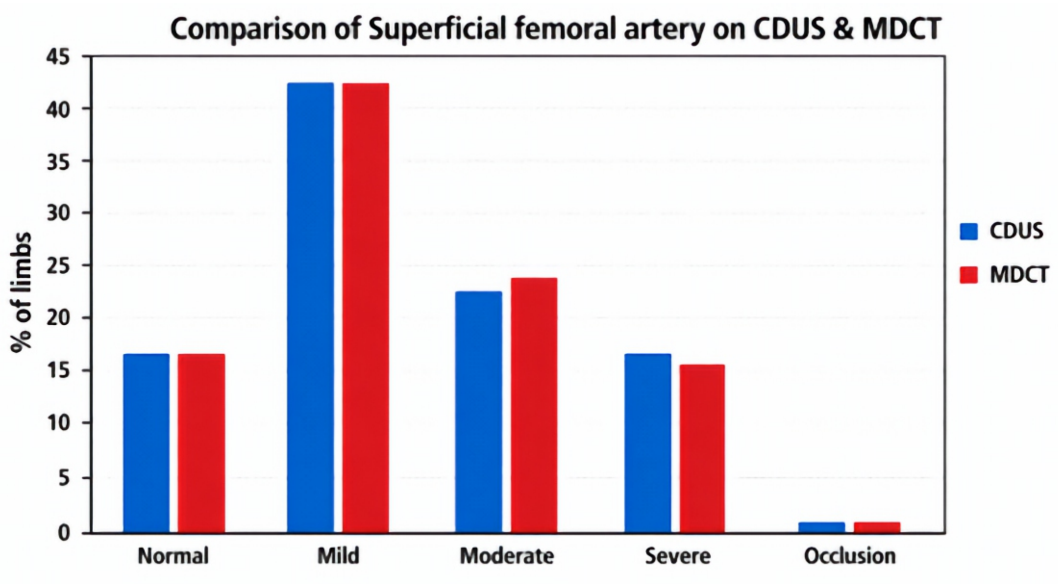

Figure 3: SFA Stenosis: CDUS vs MDCTA

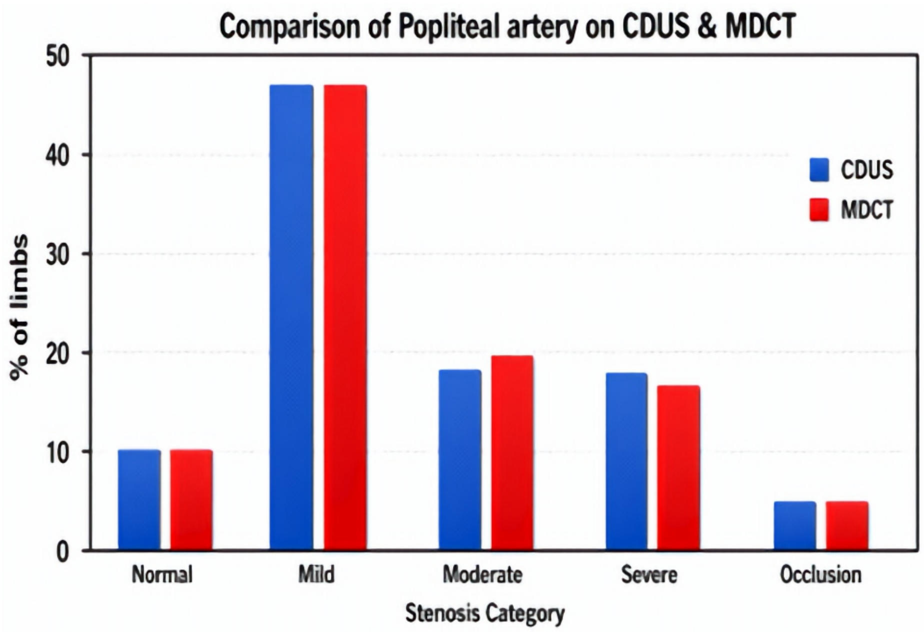

Figure 4: POP Stenosis: CDUS vs MDCTA

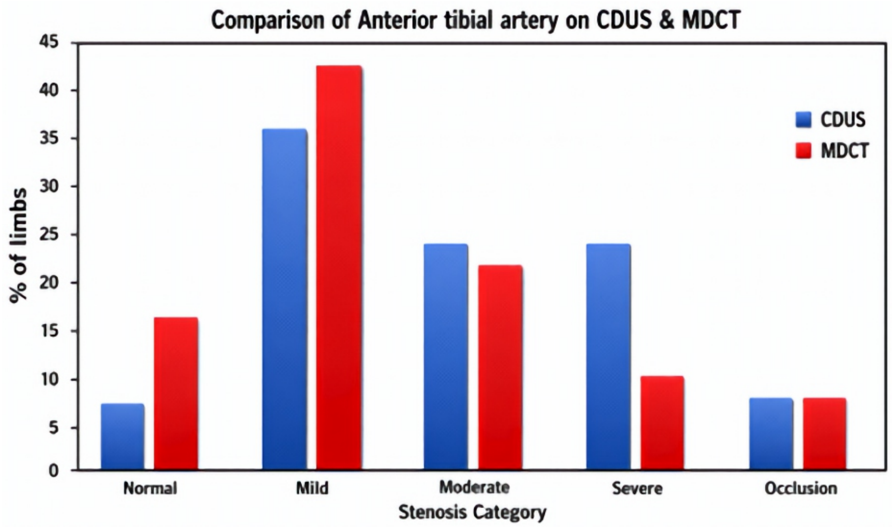

Figure 5: ATA Stenosis: CDUS vs MDCTA

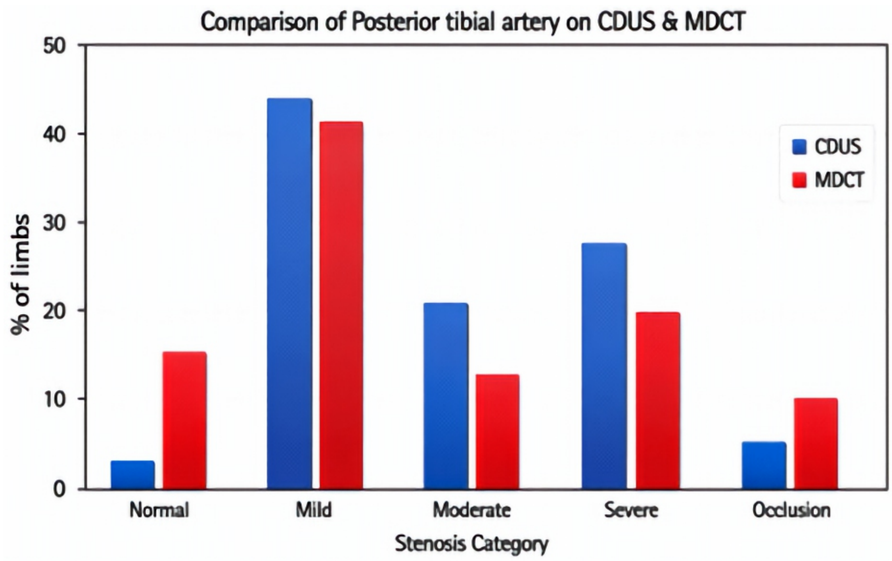

Figure 6: PTA Stenosis: CDUS vs MDCTA

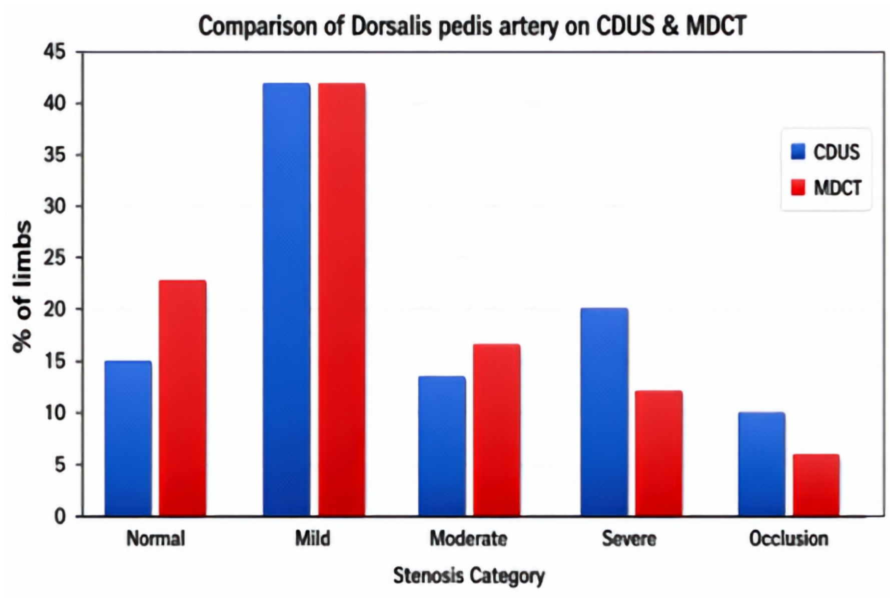

Figure 7: DPA Stenosis: CDUS vs MDCTA

DISCUSSION

In the present study, a comparative evaluation of multidetector computed tomography angiography (MDCT angiography) and Color Doppler Ultrasonography (CDUS) was performed in 48 patients (96 limbs) with lower limb peripheral arterial disease. The majority of patients belonged to the 61–70 years age group (39.6%) and there was a marked male predominance (72.9%), consistent with the known epidemiological pattern of the disease. Claudication was the most frequent presenting symptom (44.8%), followed by rest pain (29.2%) and ulceration (18.8%), reflecting progressive ischemic manifestations commonly seen in advanced disease [13,14].

On CDUS evaluation, proximal arteries such as the common femoral artery showed predominantly normal to mild stenosis, with normal findings in 40.6% and mild stenosis in 32.3% of limbs, while moderate and severe stenosis were less common. These findings are consistent with previous studies demonstrating that proximal segments are often less severely affected compared to distal vessels. **Zakir M, et. al; 2021,** emphasized the higher sensitivity of CT angiography and the complementary role of combined imaging approaches. **Cansu A, et. al; 2013,** highlighted the superiority of CT-based imaging in detailed vascular assessment and treatment planning [14,15].

Segment-wise analysis revealed that disease severity increased distally. While proximal arteries such as the common femoral and superficial femoral arteries predominantly exhibited normal to mild stenosis, the popliteal artery showed higher proportions of mild (46.9%), moderate (18.8%), and severe stenosis (18.8%). Distal infrapopliteal arteries, including the anterior tibial artery (ATA), posterior tibial artery (PTA), and dorsalispedis artery (DPA), demonstrated a higher burden of moderate and severe stenosis along with occlusions.

For instance, in the ATA, moderate and severe stenosis were each observed in 23.9% of limbs, with occlusion in 8.3%. These findings reflect the progressive nature of atherosclerosis and are supported by **Collins R, et. al; 2007,** which reported superior diagnostic accuracy of CT angiography in segmental analysis, and **Lin YH, et. al; 2025,** who emphasized the complexity of distal arterial anatomy [11,16].

MDCT angiography findings in the present study paralleled those of CDUS but provided more precise delineation of lesion severity and extent. Proximal arteries again showed predominantly normal to mild disease, while distal arteries exhibited higher proportions of significant stenosis and occlusion.

In the ATA, mild stenosis was observed in 42.7% of limbs, followed by moderate (21.8%) and severe stenosis (10.4%), with occlusion in 8.3%. Similar trends were noted in the PTA. **Pan Z, et. al; 2019** & **Raskin D, et. al; 2019,** emphasized the importance of accurate distal vessel evaluation for clinical decision-making and revascularization planning [17,18].

Comparative analysis between CDUS and MDCT angiography demonstrated excellent agreement in proximal arterial segments, including the common femoral and superficial femoral arteries, with minimal variation between the two modalities. However, in distal infrapopliteal arteries, CDUS showed a tendency to overestimate stenosis severity compared to MDCT angiography, resulting in only moderate agreement in these segments. **Malaichamy A, et. al; 2024** and **Cansu A, et. al; 2013,** highlighted the limitations of CDUS in distal vessel evaluation and reinforcing the superior accuracy of MDCT angiography in these regions [15,13].

In terms of diagnostic performance, CDUS demonstrated excellent sensitivity (100%) and high overall diagnostic accuracy (93.6%) when compared with MDCT angiography as the reference standard.

However, specificity was relatively lower (89.7%), indicating a tendency toward overestimation of stenosis, particularly in infrapopliteal arteries. **Kayhan A, et. al; 2012** and **Kosmala A, et. al; 2022,** reported higher lesion detection rates with CT angiography and variability in specificity due to factors such as vascular calcification. **Kosmala A, et. al; 2022,** confirmed the high reliability of duplex ultrasound in proximal segments [19,20].

Agreement analysis using Cohen's kappa demonstrated an almost perfect agreement (κ = 0.86) between CDUS and MDCT angiography, indicating strong concordance in detecting significant stenosis. **Elsaied FM, et. al; 2015,** reported in other vascular territories. Furthermore, receiver operating characteristic (ROC) curve analysis revealed an area under the curve (AUC) of 0.93, indicating excellent diagnostic performance of CDUS. **Zhiqiang L, et. al; 2024** and **Sultan W, et. al; 2025,** emphasized the strong diagnostic capability of Doppler ultrasound while acknowledging the complementary role of CT angiography [21-23].

Overall, the findings of this study suggested that while CDUS is a highly sensitive, non-invasive, and reliable screening modality, particularly for proximal arterial segments, MDCT angiography provides superior anatomical detail and more accurate grading of stenosis, especially in distal vessels. Therefore, a combined imaging approach may offer optimal diagnostic accuracy and improved clinical decision-making in the management of lower limb peripheral arterial disease [23].

CONCLUSIONS

The present study demonstrates that both Color Doppler Ultrasonography (CDUS) and Multidetector CT angiography are effective non-invasive modalities for evaluating lower limb peripheral arterial disease. CDUS showed excellent sensitivity (100%) and high diagnostic accuracy (93.6%), particularly in proximal arteries, making it a safe, cost-effective, and widely accessible screening tool.

However, it tends to overestimate stenosis in distal infra popliteal arteries due to technical limitations. In contrast, MDCT angiography offers superior specificity, detailed anatomical visualization, and accurate stenosis grading, making it more suitable for distal vessel assessment and pre-interventional planning, thus supporting a complementary role for both modalities.

LIMITATIONS & FUTURE PERSPECTIVES

The study's limitations include a single-centre setting, a relatively small sample size, and a short study duration, which may limit the broader applicability of the results. Future studies should incorporate multicentre designs with larger populations to enhance validity, assess long-term outcomes, and investigate advanced diagnostic & management approaches. Such efforts will improve overall patient care & help minimize complications.

CLINICAL SIGNIFICANCE

The clinical significance of this study lies in its potential to bridge the gap between research findings and practical health-.care, diagnosis, and treatment outcomes. By highlighting real-care applications. It emphasizes the importance of translating scientific observations into meaningful improvements in patientworld relevance, the study contributes to evidence based medical practice and supports informed clinical decision making. Ultimately, the findings aim to enhance patient quality of life, optimize therapeutic strategies, and promote better disease management in clinical settings.

ABBREVIATIONS

PAD: Peripheral Arterial Disease
CDUS: Color Doppler Ultrasonography
MDCTA: Multidetector Computed Tomography Angiography
AUC: Area Under the Curve

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AUTHOR CONTRIBUTIONS

All authors significantly contributed to the study conception and design, data acquisition, or data analysis and interpretation. They participated in drafting the manuscript or critically revising it for important intellectual content, consented to its submission to the current journal, provided final approval for the version to be published, and accepted responsibility for all aspects of the work. Additionally, all authors meet the authorship criteria outlined by the International Committee of Medical Journal Editors (ICMJE) guidelines.

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CONFLICT OF INTEREST

Authors declared that there is no conflict of interest.

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All data generated and analyzed are included within this research article. The datasets utilized and/or analyzed in this study can be obtained from the corresponding author upon a reasonable request.

USE OF ARTIFICIAL INTELLIGENCE (AI) & LARGE LANGUAGE MODEL (LLM)

The authors confirm that no AI & LLM tools were used in the writing or editing of the manuscript, and no images were altered or manipulated using AI & LLM.

AUTHOR'S NOTE

This article serves as an important educational tool for the scientific community, offering insights that may inspire future research diretions. However, they should not be relied upon independently when making treatment decisions or developing public health policies.

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