Original Research Paper

Volume - 16 | Issue - 05 | May - 2026 | PRINT ISSN No. 2249 - 555X | DOI : 10.36106/ijar

Radio-Diagnosis

MULTIDETECTOR CT ANGIOGRAPHY OF LOWER LIMB VASCULAR PATHOLOGIES: A PROSPECTIVE ANALYSIS OF RISK FACTORS AND ANATOMICAL DISTRIBUTION IN MALES

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ABSTRACT **Background:** Peripheral arterial disease (PAD) and lower limb vascular trauma constitute a significant global health burden. Accurate anatomical mapping is essential for guiding endovascular or surgical interventions. This study aimed to evaluate lower limb vascular lesions using Multidetector Computed Tomography (MDCT) angiography and to correlate clinical risk factors with the anatomical distribution of disease in the aortoiliac versus femoropopliteal segments. **Methods:** A prospective descriptive study was conducted involving 50 patients presenting with clinical signs of PAD or lower limb vascular trauma. Patients underwent CT peripheral angiography using a 16-slice scanner. Parameters assessed included patient demographics, clinical risk factors, plaque morphology, Trans-Atlantic Inter-Society Consensus (TASC II) classification, and Rutherford categories. **Results:** The cohort comprised 50 male patients (mean age 54.48 ± 10.69 years). Atherosclerotic occlusion was the predominant pathology (74%), followed by trauma-related presentations (18%). Smoking (58%), Diabetes Mellitus (50%), and Hypertension (48%) were the leading risk factors. A striking anatomical divergence was observed: the aortoiliac segment predominantly exhibited simpler focal disease (54.5% TASC A), whereas the femoropopliteal segment bore a severe disease burden (60.5% TASC D). Diabetics and smokers demonstrated a statistically robust predilection for complex, multi-level femoropopliteal occlusions. Furthermore, TASC D classifications in the femoropopliteal segment directly correlated with advanced clinical ischemia (Rutherford Categories 4–6). **Conclusion:** MDCT angiography provides exceptional non-invasive visualization of peripheral vascular lesions. Synergistic risk factors—particularly smoking and diabetes—disproportionately drive complex, diffuse occlusive disease in the femoropopliteal segment rather than the aortoiliac segment. MDCT accurately correlates this anatomical severity with clinical presentation, serving as an indispensable roadmap for revascularization.

KEYWORDS :

INTRODUCTION

Diseases of the lower limb vasculature represent a major and accelerating burden on healthcare systems worldwide, driven by rising incidences of diabetes, hypertension, tobacco use, and metabolic syndrome[1]. The clinical manifestations of peripheral arterial disease (PAD) range from intermittent claudication to chronic limb-threatening ischemia (CLTI), ultimately threatening limb viability and patient survival[2].The successful management of PAD relies heavily on the systematic assessment of the anatomical extent of arterial lesions and the adequacy of distal run-off circulation. The Trans-Atlantic Inter-Society Consensus II (TASC II) classification provides standardized guidelines for grading the complexity of aortoiliac and femoropopliteal disease, directly influencing the choice between endovascular therapy and surgical bypass[3].Historically, Digital Subtraction Angiography (DSA) served as the gold standard for vascular mapping[4]. However, advancements in multidetector computed tomography (MDCT) have revolutionized peripheral vascular imaging. MDCT peripheral angiography provides rapid, high-resolution, three-dimensional isotropic datasets that non-invasively map the entire vascular tree from the infrarenal aorta to the pedal arches[5].This study aimed to characterize lower limb vascular lesions using MDCT angiography and to critically correlate specific clinical risk factors with the morphological patterns and anatomical distribution (aortoiliac versus femoropopliteal) of the disease.

MATERIALS AND METHODS

Source of Data

The present study was conducted on patients attending the Department of Radiology at Basaveshwara Teaching and General Hospital, attached to H.K.E. Society's Mahadevappa Rampure Medical College, Kalaburagi.

Ethical Approval

Ethical approval was obtained from institutional ethical committee and written consent was obtained from all the patients after explaining in detail the entire research protocol.

Method of Collection of Data

Study Design

This study was a prospective observational study.

Place of Study

The study was carried out in the Department of Radiodiagnosis, Basaveshwara Teaching and General Hospital, Kalaburagi, attached to H.K.E. Society's Mahadevappa Rampure Medical College, Kalaburagi.

Duration of Study

The duration of the study was 18 months.

Sample Size

A total of 50 patients were included in the study.

Sampling Technique

Patients were selected using simple random sampling.

Sample Size Calculation

The sample size was calculated based on the following statistical parameters:

- $\alpha = 0.05$, representing the probability of rejecting the null hypothesis when it is true. A confidence level of 95% was used, corresponding to a Z value of 1.96.
- $\beta = 0.2$, representing the probability of failing to reject the null hypothesis when it is false, corresponding to a study power of 80% (0.82).
- σ^2 represented the population variance.

Participants - Inclusion and Exclusion Criteria

Inclusion Criteria:

- Patients with a clinical diagnosis suggestive of peripheral arterial disease (PAD), such as claudication, rest pain, non-healing ulcers, or gangrene.
- Patients with a history of lower limb trauma where injury to the arterial or venous system was suspected.

Exclusion Criteria:

- Patients with anaphylactic reaction to non-ionic contrast agents.
- Patients with deranged renal parameters (Serum Creatinine > 1.3)
- Pregnant women.

Study Procedure

The study procedure was systematic and followed a strict protocol. After ethical clearance was obtained, potential participants were identified from the routine clinical referrals to the Department of Radiodiagnosis. Eligible patients were approached, and the study's nature, purpose, risks, and benefits were explained in detail in their vernacular language (Kannada) using the patient information sheet. Written informed consent was obtained prior to any study-related procedure.

Pre-procedure: A detailed clinical history was recorded using the study proforma. Vital signs were checked, and a baseline renal function test (serum creatinine) was reviewed. A test dose of 1 ml of non-ionic iodinated contrast media was administered intradermally to

rule out acute hypersensitivity, though a history of allergy was a key exclusion criterion.

Imaging Procedure: The CT angiography was performed on the Philips 16-slice MDCT scanner. Patients were positioned supine on the scanner table. A non-contrast topogram (scout image) was acquired initially. For the angiogram, a bolus of non-ionic iodinated contrast media (dose calculated as per body weight, typically 80-100 ml) was injected intravenously at a high flow rate (3-5 ml/sec) using a dual-head mechanical injector. Bolus tracking software was used to trigger the scan once contrast opacification in the abdominal aorta reached a predefined threshold (usually 150 HU). The scan covered from the level of the diaphragm (T12 vertebra) to the toes to include the entire infrarenal aorta, iliac vessels, and runoff arteries. For venous phase imaging in cases of suspected DVT, a delayed scan was acquired approximately 2-3 minutes after the arterial phase from the inferior vena cava to the calf veins.

Post-procedure: Patients were monitored for any immediate adverse reactions to the contrast medium. The acquired volumetric data was transferred to a dedicated Advanced Visualization Workstation for post-processing. Multiplanar Reconstructions (MPR), Maximum Intensity Projections (MIP), Curved Planar Reconstructions (CPR), and Volume Rendered (VR) images were generated to optimally visualize the vascular anatomy and pathology.

RESULTS

Demographics and Clinical Presentation The study cohort consisted exclusively of male patients (n=50, 100%), with a mean age of 54.48 ± 10.69 years (range: 28–70 years). The primary clinical presentation was severe intermittent claudication (26%), followed by moderate claudication (20%) and pain/swelling secondary to trauma (20%). Advanced ischemic symptoms, including rest pain (14%) and major tissue loss/gangrene (6%), were notably present.

Prevalence of Risk Factors The distribution of classical risk factors was prominent: smoking was present in 58% of the cohort, Diabetes Mellitus (DM) in 50%, Hypertension (HTN) in 48%, and Hyperlipidaemia in 28%. Additionally, 30% of patients reported a prior history of COVID-19 infection.

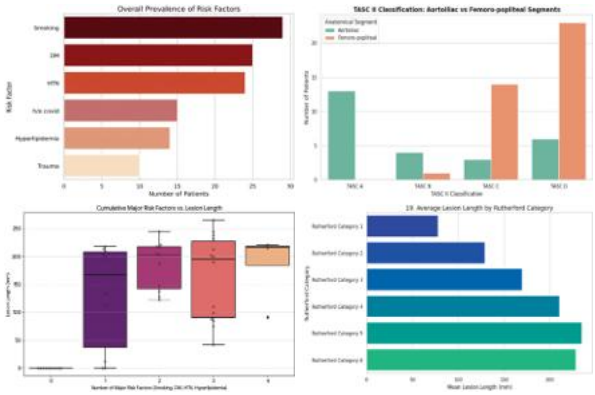
Vascular Pathology and Plaque Characterization Atherosclerotic occlusive disease was the dominant pathology, affecting 37 patients (74%). Trauma accounted for the primary presentation in 9 patients (18%), who generally demonstrated non-atherosclerotic, normal primary arterial trunks on imaging. Among the atherosclerotic patients, plaque morphology was highly variable. Mixed plaques were the most common (45.9%), followed by calcified plaques (37.8%) and non-calcified plaques (16.2%). Mixed and non-calcified plaques were associated with the longest mean lesion lengths (179.4 mm and 181.3 mm, respectively).

Anatomical Distribution: Aortoiliac vs. Femoropopliteal A distinct disparity was observed in the anatomical burden of disease. In the aortoiliac segment, lesions tended to be less complex; among the classifiable segments, 54.5% were graded as TASC A (focal short lesions), while 27.3% were TASC D. Conversely, the femoropopliteal segment exhibited profound morphological severity. TASC D classifications (diffuse disease or chronic total occlusions >20 cm) accounted for an overwhelming 60.5% of the diseased segments, followed by TASC C at 36.8%.

Correlation of Risk Factors with Anatomical Segments Risk factors strongly dictated the location and severity of the disease:

- **Diabetes Mellitus:** Diabetics exhibited fewer complex aortoiliac lesions but almost exclusively presented with TASC D lesions in the femoropopliteal segment, frequently accompanied by heavy medial wall calcification and compromised distal run-off.
- **Smoking:** Smokers demonstrated a highly pronounced shift toward TASC C and TASC D femoropopliteal lesions, indicating rapid acceleration of long-segment intimal hyperplasia.
- **COVID-19 History:** Patients with a history of COVID-19 presented predominantly with TASC C and D femoropopliteal lesions, suggesting potential post-viral hypercoagulable exacerbation of baseline atherosclerosis.

Clinical and Anatomical Concordance A direct correlation was established between anatomical severity and clinical presentation. Patients with TASC D femoropopliteal lesions consistently mapped to advanced Rutherford Categories (3 through 6). All instances of major tissue loss (Rutherford 6) were exclusively associated with TASC D anatomical pathology.



DISCUSSION

The present study validates the diagnostic efficacy of MDCT peripheral angiography while illuminating the distinct patho-physiological impacts of specific risk factors on the lower limb arterial tree.

The demographic profile of our cohort (100% male, peak age in the sixth decade) and the high prevalence of smoking (58%) and diabetes (50%) align closely with global epidemiological data for PAD. The data unequivocally demonstrates that atherosclerosis preferentially targets the femoropopliteal segment with high-grade severity in populations burdened by these specific risk factors.

The robust correlation between diabetes and TASC D femoropopliteal lesions observed in this study supports the "microvascular-macrovascular continuum" theory. Diabetes induces advanced glycation end-product deposition and endothelial dysfunction, driving diffuse, multi-level distal disease and dense calcification rather than isolated proximal large-vessel stenoses. MDCT proved invaluable in delineating this calcific burden, accurately mapping the distal run-off vessels—a critical step in determining bypass graft targets when endovascular approaches are precluded by heavy calcification.

Similarly, smoking exhibited a pronounced effect on the femoropopliteal segment. The hemodynamic shear stress in the superficial femoral artery, combined with tobacco-induced inflammatory pathways, likely accounts for the high prevalence of long-segment (TASC D) mixed plaques in this cohort. Interestingly, the notable 30% prevalence of prior COVID-19 infection among patients with advanced occlusive disease warrants attention. Recent literature indicates that SARS-CoV-2 provokes endothelial injury and systemic hypercoagulability. The high incidence of TASC D lesions in post-COVID patients suggests that the virus may trigger acute-on-chronic in-situ thrombosis over previously moderate plaques.

Furthermore, the study confirms a highly concordant relationship between the TASC II morphological grading and the Rutherford clinical grading. The progression from focal TASC A disease to diffuse TASC D disease mathematically and clinically predicts the progression from intermittent claudication to chronic limb-threatening ischemia.

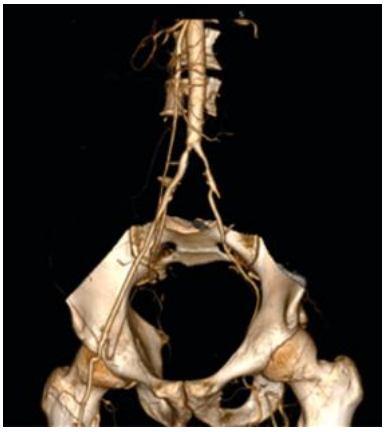
Finally, in the 18% of the cohort presenting with trauma, MDCT acted as an excellent triage tool. Its high negative predictive value allowed for the safe exclusion of hard vascular signs (e.g., transection, pseudoaneurysm), safely guiding orthopaedic management without the morbidity of invasive catheter angiography.

CONCLUSION

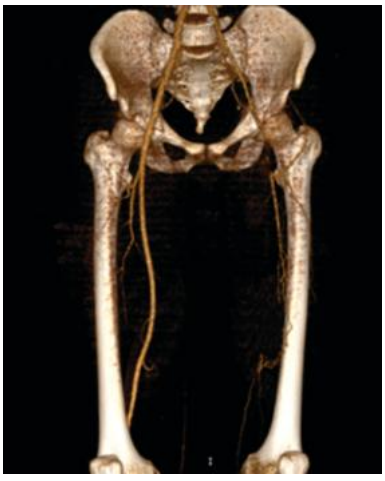
MDCT peripheral angiography is an indispensable, highly accurate, non-invasive diagnostic modality for the evaluation of lower limb vascular lesions. This study highlights a critical pathophysiological paradigm: synergistic risk factors, primarily diabetes and smoking, exert their most destructive morphological impact on the femoropopliteal segment, driving patients toward complex TASC D occlusions and advanced clinical ischemia. By simultaneously defining plaque morphology, quantifying lesion length, grading TASC severity, and assessing distal run-off, MDCT provides a comprehensive anatomical roadmap that directly optimizes

therapeutic decision-making in both chronic ischemic and acute traumatic settings.

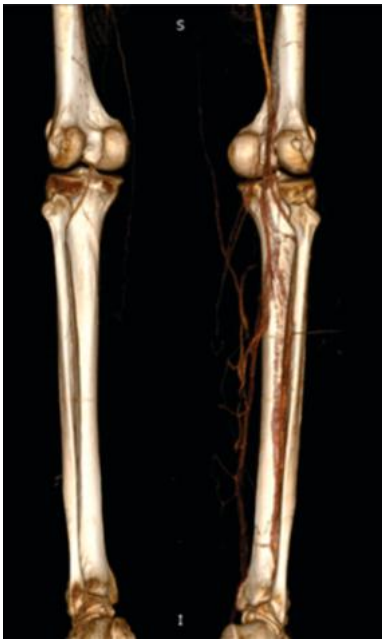
Cases



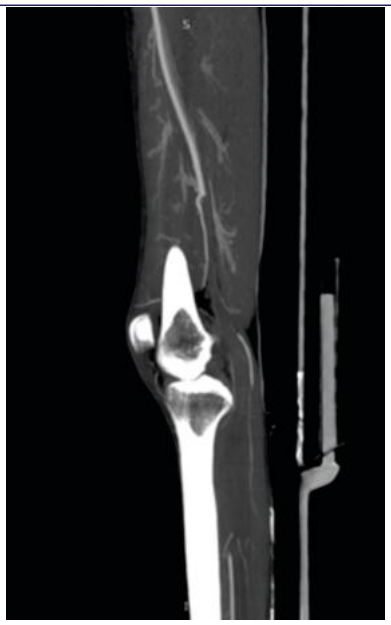
Long Segment Left External Iliac Artery Occlusion Involving Origin of Common Femoral Artery - TASC C lesion



Severe Atherosclerotic Stenosis of Left Proximal Superficial Femoral Artery With Multiple Collaterals and Atheromatous Occlusion of Distal Superficial Femoral Artery and Popliteal Artery - TASC D



Long Segment Atherosclerotic Stenosis Involving Popliteal Artery With Non Visualization of Tibial and Peroneal Vessels - TASC Class D lesion



On CT Angiogram Non Contrast Opacification of Popliteal Artery With Collaterals - Chronic Arterial Thrombosis

REFERENCES

1. Fowkes FG, Rudan D, Rudan I, Aboyans V, Denenberg JO, McDermott MM, et al. Comparison of global estimates of prevalence and risk factors for peripheral artery disease in 2000 and 2010: a systematic review and analysis. Lancet. 2013;382 (9901):1329-1340.
2. Conte MS, Bradbury AW, Kolh P, White JV, Dick F, Fitridge R, et al. Global vascular guidelines on the management of chronic limb-threatening ischemia. J Vasc Surg. 2019;69(1 Suppl):3S-125S.e40.
3. Norgren L, Hiatt WR, Dormandy JA, Nehler MR, Harris KA, Fowkes FG, et al. Inter-Society Consensus for the Management of Peripheral Arterial Disease (TASC II). J Vasc Surg. 2007;45(1 Suppl):S5-S67.
4. Met R, Bipat S, Legemate DA, Reekers JA, Koelemay MJ. Diagnostic performance of computed tomography angiography in peripheral arterial disease: a systematic review and meta-analysis. JAMA. 2009;301(4):415-424.
5. Fleischmann D, Hallett RL, Rubin GD. CT angiography of peripheral arterial disease. J Vasc Interv Radiol. 2006;17(1):3-26.