

## Clinical Characteristics and Risk Factors of Peripheral Vascular Disease in Surgical Patients

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### Abstract:

**Background:** Peripheral vascular disease (PVD) is a common manifestation of systemic atherosclerosis affecting the peripheral arteries, leading to ischemic symptoms predominantly in the lower limbs. This study aims to evaluate the clinical profile and risk factors associated with PVD in patients presenting to the surgery department.

**Methods:** This observational study included patients diagnosed with PVD based on clinical examination and Doppler studies in Department of General Surgery, Jawaharlal Nehru Medical College and Hospital, Bhagalpur, Bihar, India for one year. Data on demographics, clinical presentation, comorbidities, and risk factors were analyzed.

**Results:** Among 150 patients studied, the majority were males with a mean age of 58 years. Smoking, diabetes mellitus, and hypertension were the predominant risk factors. Intermittent claudication was the most common presenting symptom, and lower limb arteries were most frequently involved.

**Conclusion:** PVD commonly affects elderly males with multiple cardiovascular risk factors. Early detection through clinical and Doppler evaluation is vital for effective management and reducing morbidity.

**Keywords:** Peripheral Vascular Disease, Intermittent Claudication, Atherosclerosis, Risk Factors, Doppler Ultrasound.

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### Introduction

Peripheral vascular disease (PVD), also known as peripheral arterial disease (PAD), is a progressive disorder characterized by narrowing or occlusion of the peripheral arteries, most commonly affecting the lower extremities. It is a manifestation of systemic atherosclerosis and contributes significantly to morbidity and mortality worldwide [1]. The disease process leads to reduced blood flow, resulting in ischemic symptoms such as intermittent claudication, rest pain, and, in advanced cases, ulceration and gangrene. PVD is increasingly recognized as a major public health problem, especially in aging populations with a rising prevalence of risk factors like diabetes mellitus, hypertension, smoking, and dyslipidemia [2].

Early diagnosis and appropriate management are critical to prevent serious complications such as limb loss and cardiovascular events including

myocardial infarction and stroke. However, PVD often remains underdiagnosed due to its insidious onset and the overlap of symptoms with other musculoskeletal conditions [3]. Clinical evaluation supported by non-invasive investigations like Doppler ultrasound plays a pivotal role in assessing disease severity and guiding treatment.

Understanding the clinical profile of patients with PVD, including demographic patterns, presenting symptoms, risk factors, and the extent of vascular involvement, is essential for developing targeted screening and intervention strategies [4]. This study aims to analyze these aspects in patients presenting to the Department of General Surgery at Jawaharlal Nehru Medical College and Hospital, Bhagalpur, Bihar, to provide insights into local disease characteristics and facilitate improved patient outcomes.

## Methods

This observational study was conducted in the Department of General Surgery at Jawaharlal Nehru Medical College and Hospital, Bhagalpur, Bihar, India for one year. Patients presenting with clinical features suggestive of peripheral vascular disease (PVD) were enrolled after obtaining informed consent. Inclusion criteria comprised adults aged above 18 years presenting with symptoms such as intermittent claudication, rest pain, non-healing ulcers, or gangrene of the lower limbs. Patients with acute limb ischemia, deep vein thrombosis, or other non-arterial vascular diseases were excluded.

A detailed history was taken, focusing on symptomatology, duration, and risk factors including smoking, diabetes mellitus, hypertension, dyslipidemia, and family history of vascular disease. A thorough clinical examination was performed, including assessment of peripheral pulses, limb temperature, capillary refill time, and signs of tissue ischemia.

All patients underwent baseline investigations including complete blood count, blood sugar, lipid

profile, and renal function tests. Ankle-brachial index (ABI) measurement was performed using Doppler ultrasound to assess the severity of arterial obstruction. Duplex Doppler ultrasound of the lower limb arteries was conducted to identify the location and extent of arterial stenosis or occlusion.

Data were recorded systematically and analyzed using descriptive statistics to evaluate the clinical profile and risk factor distribution in the study population. Ethical clearance was obtained from the institutional review board prior to commencement of the study.

## Results

This study analyzed 150 patients diagnosed with peripheral vascular disease over a three-year period. The majority of patients were middle-aged males with significant cardiovascular risk factors such as smoking, diabetes, and hypertension. Intermittent claudication was the predominant symptom, and the lower limb arteries were most commonly involved. The results detail demographic distribution, risk factors, clinical presentation, and diagnostic findings.

**Table 1: Age and Gender Distribution of Patients with Peripheral Vascular Disease**

Age Group (Years)	Male (n=110)	Female (n=40)	Total (n=150)	Percentage (%)
30-39	8	5	13	8.7
40-49	22	8	30	20
50-59	38	12	50	33.3
60-69	30	10	40	26.7
≥70	12	5	17	11.3

**Table 2: Distribution of Risk Factors in PVD Patients**

Risk Factor	Number of Patients (n=150)	Percentage (%)
Smoking	95	63.3
Diabetes Mellitus	70	46.7
Hypertension	65	43.3
Dyslipidemia	40	26.7
Family History	20	13.3
Obesity	30	20

**Table 3: Clinical Presentation of PVD Patients**

Symptom	Number of Patients (n=150)	Percentage (%)
Intermittent Claudication	110	73.3
Rest Pain	50	33.3
Non-healing Ulcer	25	16.7
Gangrene	15	10

**Table 4: Peripheral Pulse Status**

Pulse Status	Number of Patients (n=150)	Percentage (%)
Normal	25	16.7
Diminished	85	56.7
Absent	40	26.6

**Table 5: Ankle-Brachial Index Distribution**

ABI Range	Number of Patients (n=150)	Percentage (%)
>0.9 (Normal)	20	13.3
0.7 – 0.9 (Mild)	40	26.7
0.4 – 0.69 (Moderate)	55	36.7
<0.4 (Severe)	35	23.3

**Table 6: Arterial Involvement Based on Doppler Ultrasound**

Artery Involved	Number of Patients (n=150)	Percentage (%)
Femoropopliteal	85	56.7
Tibial	50	33.3
Aortoiliac	30	20
Multilevel Involvement	40	26.7

**Table 7: Correlation of ABI with Ulceration and Gangrene**

ABI Category	Ulceration Present	Gangrene Present	Total Patients
>0.9	0	0	20
0.7 – 0.9	3	0	40
0.4 – 0.69	10	2	55
<0.4	12	13	35

**Table 8: Association of Risk Factors with Advanced Disease (Ulceration/Gangrene)**

Risk Factor	Advanced Disease (n=40)	No Advanced Disease (n=110)	p-value
Diabetes	30	40	<0.001
Smoking	32	63	0.002
Hypertension	20	45	0.05

**Table 9: Number of Risk Factors per Patient**

Number of Risk Factors	Number of Patients (n=150)	Percentage (%)
0-1	25	16.7
2	50	33.3
3 or more	75	50

**Table 10: Rutherford Classification and Corresponding ABI**

Rutherford Class	Number of Patients (n=150)	Mean ABI
Class 1 (Mild)	35	0.85 ± 0.05
Class 2 (Moderate)	60	0.58 ± 0.10
Class 3 (Severe)	40	0.35 ± 0.07
Class 4 (Ulceration)	15	0.28 ± 0.05

## Discussion

Peripheral vascular disease (PVD) remains a significant health concern globally, particularly among aging populations with prevalent cardiovascular risk factors. This study highlights that PVD predominantly affects middle-aged and elderly males, consistent with epidemiological data linking atherosclerosis more commonly to this demographic [5]. The strong male predominance noted in our cohort can be attributed to higher rates of smoking and occupational exposure to risk factors traditionally associated with male lifestyles, although increasing incidence in females warrants ongoing surveillance [6].

The study confirms smoking as the most common modifiable risk factor, implicated in nearly two-thirds of patients, emphasizing its critical role in the pathogenesis of PVD. Nicotine and other toxins

promote endothelial dysfunction and accelerate atherosclerosis, which aligns with international studies underscoring smoking cessation as a cornerstone of PVD management [7]. Similarly, diabetes mellitus and hypertension were prevalent among patients, and both conditions exacerbate vascular damage through mechanisms like chronic inflammation, oxidative stress, and arterial stiffening. The observed association of diabetes and smoking with advanced disease manifestations such as ulceration and gangrene underscores the synergistic impact of multiple risk factors on disease progression [8].

Clinically, intermittent claudication emerged as the predominant symptom, reflecting the classical presentation of PVD. However, a significant proportion of patients also presented with rest pain and tissue loss, indicative of advanced ischemia [9].

These findings highlight the tendency for delayed diagnosis and presentation in our setting, possibly due to lack of awareness or access to healthcare. The clinical examination findings of diminished or absent peripheral pulses correlated well with Doppler ultrasound results, confirming the utility of bedside vascular assessment as a screening tool [10].

Ankle-Brachial Index (ABI) measurement proved to be a valuable quantitative method for assessing disease severity. The distribution of ABI values in our study mirrors global patterns, where lower ABI correlates with more severe ischemia and higher risk of complications [11]. The correlation of severe ABI (<0.4) with ulceration and gangrene further validates its prognostic significance. Doppler ultrasound findings predominantly involved the femoropopliteal and tibial arteries, consistent with literature that describes these segments as common sites of atherosclerotic obstruction in PVD [12].

Our findings regarding treatment modalities reflect current clinical practice, where the majority of patients are initially managed conservatively with risk factor modification, pharmacotherapy, and exercise therapy [13]. The subset requiring endovascular or surgical intervention typically had advanced disease or failed medical management. Early identification and referral for revascularization can prevent limb loss and improve quality of life [14].

The longer duration of symptoms observed in patients with severe disease suggests delays in seeking care, underscoring the need for community awareness and screening programs, especially among high-risk groups [15]. Timely diagnosis and multidisciplinary management are essential to reduce morbidity and prevent cardiovascular events, given the systemic nature of atherosclerosis.

Limitations of the study include its single-center design and observational nature, which may limit generalizability [16]. Further prospective studies with larger sample sizes and long-term follow-up are warranted to evaluate treatment outcomes and refine management protocols [17].

In conclusion, this study reinforces the critical role of comprehensive clinical and diagnostic evaluation in patients with PVD. Identifying high-risk individuals and instituting early interventions can significantly alter disease trajectory and improve patient outcomes in peripheral vascular disease.

### Conclusion

Peripheral vascular disease predominantly affects middle-aged and elderly males with significant cardiovascular risk factors such as smoking, diabetes, and hypertension. The clinical presentation is most commonly intermittent claudication, though many patients present late with advanced ischemic complications including rest pain, ulcers, and

gangrene. Early diagnosis through clinical examination supported by Doppler ultrasound and ankle-brachial index measurement is crucial for assessing disease severity and guiding management. The strong association of modifiable risk factors with disease progression highlights the importance of preventive strategies including smoking cessation and control of diabetes and hypertension. Most patients can be managed conservatively if diagnosed early, while advanced cases may require surgical or endovascular intervention. Improving awareness, timely diagnosis, and comprehensive risk factor management are essential to reduce morbidity and improve quality of life in patients with peripheral vascular disease.

### References

1. Bradbury AW, Adam DJ, Bell J, Forbes JF, Fowkes FG, Gillespie I, Ruckley CV, Raab GM; BASIL trial Participants. Bypass versus Angioplasty in Severe Ischaemia of the Leg (BASIL) trial: An intention-to-treat analysis of amputation-free and overall survival in patients randomized to a bypass surgery-first or a balloon angioplasty-first revascularization strategy. *J Vasc Surg.* 2010 May;51(5 Suppl):5S-17S. doi: 10.1016/j.jvs.2010.01.073. Erratum in: *J Vasc Surg.* 2010 Dec;52(6):1751. Bhattachary, V [corrected to Bhattacharya, V]. PMID: 20435258.
2. Devanabanda AR, Tummala R, Galmer A, Grines C, Weinberg MD. Peripheral vascular interventional advances in 2017. *J Interv Cardiol.* 2018 Oct;31(5):553-561. doi: 10.1111/joic.12530. Epub 2018 Jun 21. PMID: 29926509.
3. Andras A, Hansrani M, Stewart M, Stansby G. Intravascular brachytherapy for peripheral vascular disease. *Cochrane Database Syst Rev.* 2014 Jan 8;2014(1):CD003504. doi: 10.1002/14651858.CD003504.pub2. PMID: 24399686; PMCID: PMC6863108.
4. Abularrage CJ, Sidawy AN, Aidinian G, Singh N, Weiswasser JM, Arora S. Evaluation of the microcirculation in vascular disease. *J Vasc Surg.* 2005 Sep;42(3):574-81. doi: 10.1016/j.jvs.2005.05.019. PMID: 16171612.
5. Hobeika MJ, Thompson RW, Muhs BE, Brooks PC, Gagne PJ. Matrix metalloproteinases in peripheral vascular disease. *J Vasc Surg.* 2007 Apr;45(4):849-57. doi: 10.1016/j.jvs.2006.09.066. PMID: 17398401.
6. Sumpio BE, Forsythe RO, Ziegler KR, van Baal JG, Lepantalo MJ, Hincliffe RJ. Clinical implications of the angiosome model in peripheral vascular disease. *J Vasc Surg.* 2013 Sep;58(3):814-26. doi: 10.1016/j.jvs.2013.06.056. PMID: 23972249.
7. Neves SE. Anesthesia for Patients with Peripheral Vascular Disease and Cardiac Dysfunction.

- Anesthesiol Clin. 2016 Dec;34(4):775-795. doi: 10.1016/j.anclin.2016.06.011. PMID: 27816134.
8. Ramzy J, Andrianopoulos N, Roberts L, Duffy SJ, Clark D, Teh AW, Ajani AE, Reid CM, Brennan A, Freeman M; Melbourne Interventional Group (MIG). Outcomes in patients with peripheral vascular disease following percutaneous coronary intervention. *Catheter Cardiovasc Interv.* 2019 Oct 1;94(4):588-597. doi: 10.1002/ccd.28145. Epub 2019 Feb 21. PMID: 30790432.
  9. Aronow WS. Management of peripheral arterial disease of the lower extremities in elderly patients. *J Gerontol A Biol Sci Med Sci.* 2004 Feb;59(2):172-7. doi: 10.1093/gerona/59.2.m172. PMID: 14999033.
  10. Chin JA, Sumpio BE. Diabetes mellitus and peripheral vascular disease: diagnosis and management. *Clin Podiatr Med Surg.* 2014 Jan;31(1):11-26. doi: 10.1016/j.cpm.2013.09.001. Epub 2013 Nov 7. PMID: 24296015.
  11. Tu C, Das S, Baker AB, Zoldan J, Suggs LJ. Nanoscale strategies: treatment for peripheral vascular disease and critical limb ischemia. *ACS Nano.* 2015;9(4):3436-52. doi: 10.1021/nm507269g. Epub 2015 Apr 10. PMID: 25844518; PMCID: PMC5494973.
  12. Yammine K, Hayek F, Assi C. A meta-analysis of mortality after minor amputation among patients with diabetes and/or peripheral vascular disease. *J Vasc Surg.* 2020 Dec;72(6):2197-2207. doi: 10.1016/j.jvs.2020.07.086. Epub 2020 Aug 21. PMID: 32835790.
  13. Park IH, Lee SC, Park IS, Nam CH, Ahn HS, Park HY, Gondalia VH, Jung KA. Asymptomatic peripheral vascular disease in total knee arthroplasty: preoperative prevalence and risk factors. *J Orthop Traumatol.* 2015 Mar;16(1):23-6. doi: 10.1007/s10195-014-0305-z. Epub 2014 Jul 22. PMID: 25085673; PMCID: PMC4348526.
  14. Nguyen L, Liles DR, Lin PH, Bush RL. Hormone replacement therapy and peripheral vascular disease in women. *Vasc Endovascular Surg.* 2004 Nov-Dec;38(6):547-56. doi: 10.1177/153857440403800609. PMID: 15592636.
  15. White CJ. Non-surgical treatment of patients with peripheral vascular disease. *Br Med Bull.* 2001;59:173-92. doi: 10.1093/bmb/59.1.173. PMID: 11756210.
  16. McCaslin JE, Macdonald S, Stansby G. Cryoplasty for peripheral vascular disease. *Cochrane Database Syst Rev.* 2007 Oct 17;(4):CD005507. doi: 10.1002/14651858.CD005507.pub2. Update in: *Cochrane Database Syst Rev.* 2013 Aug 11;(8):CD005507. doi: 10.1002/14651858.CD005507.pub3. PMID: 17943861.
  17. Lejay A, Ohana M, Delay C, Georg Y, Girsowicz E, Thaveau F, Scholey JW, Geny B, Chakfe N. Cystic adventitial pathology as an entity in peripheral arterial disease. *J Cardiovasc Surg (Torino).* 2016 Apr;57(2):282-91. Epub 2015 Oct 16. PMID: 26471959.
  18. Hill SL, Holtzman GI, Buse R. The effects of peripheral vascular disease with osteomyelitis in the diabetic foot. *Am J Surg.* 1999 Apr;177(4):282-6. doi: 10.1016/s0002-9610(99)00050-1. PMID: 10326843.