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Original Research Article

A Comparative Study between Pulse Oximetry and Doppler Study in Diabetic Foot with Peripheral Vascular Disease

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Abstract:

Background: Peripheral arterial disease (PAD) is a common and clinically important complication in patients with diabetes mellitus. Early identification of impaired peripheral perfusion is essential to prevent diabetic foot ulceration, gangrene, and amputation. Although Duplex ultrasound and ankle-brachial index (ABI) are established diagnostic modalities, their use may be limited by technical requirements and, in the case of ABI, arterial calcification in diabetic patients. Pulse oximetry is a simple, non-invasive and inexpensive bedside tool that may provide an alternative method for assessing distal tissue perfusion.

Aim: To evaluate the diagnostic accuracy and clinical utility of pulse oximetry in assessing peripheral vascular disease in diabetic patients, using Duplex ultrasound as the reference standard, and to determine its correlation with ABI and Fontaine staging.

Materials and Methods: A hospital-based prospective cross-sectional observational study was conducted in the Department of General Surgery, Narayana Medical College, Nellore, Andhra Pradesh, over 12 months. The study included diabetic patients with diagnosed peripheral vascular disease and/or foot ulceration or a history of foot ulceration. Pulse oximetry measurements were obtained from the fingers and great toes after acclimatization to room temperature. ABI and Duplex ultrasound examination were subsequently performed. Disease severity was assessed using the Fontaine classification. Diagnostic performance was evaluated using sensitivity, specificity, positive predictive value, negative predictive value and accuracy.

Results: The study included 100 participants, with a mean age of 60.25 ± 9.98 years; 69% were males. The most frequent age group was 50–69 years (67%). Uncontrolled diabetes mellitus (88%), hypertension (70%) and smoking (64%) were the major associated risk factors. Fontaine Stage I was observed in 18%, Stage IIa in 23%, Stage IIb in 20%, Stage III in 22% and Stage IV in 17%. Mean toe SpO_2 was 90.45 ± 8.63% on the right and 89.23 ± 8.12% on the left, while mean ABI was 0.83 ± 0.25 and 0.81 ± 0.25, respectively. Toe SpO_2 showed a strong positive correlation with ABI (right: $r=0.74$, $p<0.0001$; left: $r=0.88$, $p<0.0001$). Toe SpO_2 progressively decreased with increasing Fontaine stage ($p<0.05$). Pulse oximetry demonstrated sensitivity of 92.73% on the right and 91.67% on the left, with overall accuracy of 91% and 94%, respectively. ABI showed sensitivity of 89.09% and 89.58%, with an accuracy of 87% on both sides.

Conclusion: Pulse oximetry demonstrated good correlation with ABI and Duplex ultrasound findings and showed a significant relationship with the severity of peripheral arterial disease according to Fontaine staging. Its high sensitivity, simplicity, low cost and non-invasive nature suggest that toe pulse oximetry may be a useful bedside screening tool for diabetic foot patients, particularly at primary and secondary healthcare levels. However, it should complement rather than replace clinical assessment, ABI and Duplex ultrasound when definitive vascular evaluation is required.

Keywords: Diabetic Foot; Peripheral Arterial Disease; Pulse Oximetry; Ankle-Brachial Index; Duplex Ultrasonography.

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Introduction

Peripheral arterial disease (PAD) represents a frequent vascular complication in individuals with diabetes mellitus and is a major contributor to long-term morbidity and mortality on a global scale. PAD incidence demonstrates a progressive rise with increasing age, from nearly 0.3% per year in individuals aged 40–55 years to about 1% annually in those above 75 years of age. [1] PAD is common

among both men and women after 45 years of age, with approximately 10 million individuals in India suffering from the disease. It may become a significant health issue in India due to its aging population. Multiple vessel involvement is noted in around 74% patients. Involvement of coronary vessels is noted in 40%, carotid vessels in 14% and renal arteries in 17%. [2]

PAD is a multifactorial deterioration of arteries except those supplying the heart and within the brain. This is due to impairment of circulation, leading to ischemia of the affected end organs [1]. The pathological basis of PAD is predominantly atherosclerosis, characterized by progressive arterial wall thickening and reduced elasticity, ultimately leading to luminal narrowing or occlusion and compromised blood flow. [3]

Clinically, PAD is associated with significant morbidity, manifesting as intermittent claudication, rest pain, muscle wasting, chronic ulcers, gangrene, functional limitation, and in advanced cases, limb amputation, thereby contributing to increased mortality risk. [3] This poses a significant medical and socio-economic problem on society. A critical concern in managing diabetic patients with PAD is the early detection and monitoring of compromised tissue perfusion, particularly in the lower extremities, to prevent the development of diabetic foot ulcers and subsequent complications such as gangrene and amputation.

The accurate diagnosis of PAD remains a challenge due to the limitations of existing clinical tools. Palpation of pulse is easy to perform but has inter-observer variability. Dorsalis pedis may be absent congenitally in 4 to 12% of the population. [4] Ankle-brachial index (ABI) is widely accepted as a screening tool for PAD; however its clinical utility is constrained by complexity of the procedure, time requirements, and the need for operator expertise. [5] Additionally, medial arterial calcification (Monckeberg sclerosis) frequently observed in diabetic patients may lead to falsely elevated ABI values, reducing diagnostic accuracy. [5]

Doppler ultrasound evaluates peripheral arterial flow using waveform analysis and duplex color mapping. It is accurate but expensive, requires technical skills and is observer-dependent. The current gold standard for evaluation of peripheral vascular disease is angiography. [6] It is costly, invasive, with low patient compliance. [6] There is a risk of contrast-induced nephropathy and hence contraindicated in patients with renal problems. These barriers underscore the urgent need for a diagnostic bridge that is both reliable and accessible at the primary care level.

Pulse oximetry has gained attention as a simple, cost-effective, and non-invasive modality, often referred to as the “fifth vital sign”. [7] While routinely used for systemic oxygen monitoring, its potential role in assessing localized peripheral tissue perfusion in diabetic vascular disease remains insufficiently explored. Unlike more complex imaging, pulse oximetry can be performed rapidly by both medical and paramedical personnel, even in resource-limited settings.

This study is designed to investigate the correlation and synergistic potential of pulse oximetry and Doppler ultrasound in assessing tissue perfusion among diabetic patients. By examining the concordance and discordance between these two techniques, this research seeks to determine if the simpler, more accessible pulse oximeter can effectively complement or provide a viable alternative to more technical assessments. Ultimately, this investigation aims to refine diagnostic protocols, allowing for earlier intervention and more effective management strategies to mitigate the severe complications of peripheral vascular disease in the diabetic population. In this study, the terms peripheral arterial disease (PAD) and peripheral vascular disease (PVD) have been used interchangeably.

Aim: To evaluate the diagnostic accuracy and clinical utility of pulse oximetry as a non-invasive bedside tool for assessing the severity of Peripheral Vascular Disease (PVD) and predicting high-risk foot complications in diabetic patients, using Duplex Ultrasound as the reference standard. Objectives: To determine the sensitivity, specificity, and overall diagnostic accuracy of distal SpO2 and Ankle-Brachial Index (ABI) in detecting arterial occlusive disease in diabetic feet compared to Duplex Ultrasound, to assess the correlation between SpO2 saturation levels and clinical disease severity as classified by the Fontaine Staging system. And thus to evaluate the predictive value of pulse oximetry and Doppler ultrasound for identifying high-risk diabetic foot conditions, such as ulceration and gangrene. To explore the severity and location of arterial occlusive disease, presence of neuropathy, and wound characteristics. To elucidate the clinical implications of discrepancies between pulse oximetry and Doppler ultrasound results and their impact on patient outcomes and management pathways.

Materials and Methods

This was a Hospital-based prospective cross-sectional observational study done in Department of General Surgery, Narayana Medical College, Nellore, and Andhra Pradesh for a period of 12 months in 50 Patients attending the outpatient departments (OPDs) and those admitted as a diagnosed case of PVD.

Inclusion criteria: Diabetic patients with diagnosed peripheral vascular disease, presence of foot ulceration or history of foot ulceration. Exclusion criteria: Patients with severe PAD requiring immediate in-

tervention, Patients with acute foot infections or osteomyelitis, History of foot amputation.

Methodology: Patients once acclimatised to the room temperature of 22-28°C, were made to lie comfortably in supine posture on the couch of the examination room. Nail polish if applied was removed. Pulse oximeter was applied first to the right index finger and the left index finger of the patient and the readings noted, following which the probe was applied to right great toe and left great toe and the readings were noted.

Statistical analysis: Demographic details of the study population were described in percentages. Diagnostic accuracy of the test under study was predicted as sensitivity, specificity, PPV, and NPV with 95% Confidence Intervals (CI). Data were analysed statistically using descriptive statistics, chi square test and Student t-test. P-value <0.05 was considered as statistically significant. IBM SPSS (Statistical Package for the Social Sciences) version 20 and MS Excel were used for data analysis.

Results

Table 1: Age and Gender Distribution of Study Participants

Age range (in years)	Frequency (%)
40-49	15 (15%)
50-59	35 (35%)
60-69	32 (32%)
70-79	12 (12%)
>80	6 (6%)
Total	100
Mean+SD	60.25±9.98
Range	40
Minimum	42
Maximum	82
Male	69 (69%)
Female	31 (31%)

Table 2: Presenting Complaints Duration in Month's Distribution

Duration in months	Frequency (%)
<1	18 (18%)
1-10	65 (65%)
11 – 15	17 (17%)
Total	100 (100%)
Mean ± SD	7.32 ± 4.19

Table 3: Presenting Complaints

Presenting complaints	Number (N)	Percentage (%)
Intermittent claudication right lower limb	22	22.00%
Intermittent claudication left lower limb	21	21.00%
Asymptomatic	18	18.00%
Rest pain of left foot	10	10.00%
Rest pain of right foot	9	9.00%
Gangrene of left 5th toe	5	5.00%
Gangrene of right great toe	3	3.00%
Gangrene of left 2nd toe	3	3.00%
Rest pain of both lower limb	3	3.00%
Gangrene of right 4th & 5th toe	2	2.00%
Gangrene of left great toe	2	2.00%
Gangrene of right 2nd toe	1	1.00%
Gangrene of right 2nd & 3rd toe	1	1.00%

Table 4: Distribution of Cases Based On Fontaine Staging

Fontaine stage	Frequency (%)
Stage I	18 (18%)
Stage II a	23 (23%)
Stage II b	20 (20%)
Stage III	22 (22%)
Stage IV	17 (17%)
Total	100 (100%)

Table 5: Various Co-Morbidities of Study Participants

Co-Morbidity	Frequency (%)
Uncontrolled Diabetes mellitus	88 (88%)
Hypertension	70 (70%)
Smoking	64 (64%)
Hyperlipidaemia	23 (23%)
Known Heart disease	22 (22%)
Diabetes mellitus & HTN	18 (18%)

Table 6: Distribution Based On Spo2 Levels

SPO2	Minimum	Maximum	Mean ± SD
Right Finger	96	100	98.02 ± 0.88
Left Finger	96	99	97.49 ± 0.71
Right Toe	67	99	90.45 ± 8.63
Left Toe	69	99	89.23 ± 8.12

Table 7: Minimum and Maximum Ankle Brachial Index

ABI	Minimum	Maximum	Mean ± SD
Right	0.2	1.38	0.83 ± 0.25
Left	0.2	1.23	0.81 ± 0.25

Table 8: Duplex Ultrasound Findings in the Study

Duplex ultrasound	Right		Left	
	N	%	N	%
Normal	45	45.00%	52	52.00%
Atherosclerosis with Monophasic flow	25	25.00%	22	22.00%
Atherosclerosis with biphasic flow	19	19.00%	17	17.00%
Diffuse atherosclerosis	11	11.00%	9	9.00%

Table 9: Involvement of Pad on Duplex Usg

Involvement	Frequency
Unilateral - Right	46
Unilateral – Left	39
Bilateral	9

Table 10: Correlation between Spo2 and Abi

	Spo2	Pearson correlation coefficient (r)	P value
RABI	Right Finger	0.18	0.04*
	Right Toe	0.74	<0.0001*
LABI	Left Finger	0.08	0.33
	Left Toe	0.88	<0.0001*

Table 11: Fontaine Stage and Spo2 Levels

Fontaine stage	RF	RT	P value	LF	LT	P value
I	97.82±1.0	94.2±4.18	<0.05*	98.2 ± 1.2	95.4± 3.3	<0.05*
II a	97.51±0.58	91.5±5.36	<0.05*	98 ± 0.75	92.5 ± 4.8	<0.05*
II b	97.44±0.51	91.2±6.22	<0.05*	97.25±0.52	89.6±6.3	<0.05*
III	97.35±0.62	87.8±8.5	<0.05*	97.7±0.68	88.2±8.4	<0.05*
IV	97.40±0.55	85±9.7	<0.05*	98.04±0.65	83.7±12.04	<0.05*

Table 12: Sensitivity, Specificity, Predictive Values and Accuracy of Pulse Oximetry and Abi

Index test - Result		PVD (By duplex USG)		Sensitivity % (95% CI)	Specificity % (95% CI)	PPV % (95% CI)	NPV % (95% CI)	Accuracy
		Present no	Absent no					
Pulse oximetry Right	Positive	51	5	92.73 (82.41—97.98)	88.89 (75.95 - 96.29)	91.07 (81.65-95.9)	90.91 (79.47—96.27)	91 (83.60 95.8)
	Negative	4	40					
Pulse oximetry Left	Positive	44	2	91.67 (80.02 97.68)	96.15 (86.79 - 99.53)	95.65 (84.93 - 98.85)	92.59 (83-96.97)	94 (87.4 - 97.77)
	Negative	4	50					
ABI Right	Positive	49	7	89.09 (77.75 - 95.89)	83.44 (70.54 - 93.51)	87.5 (77.88 93.3)	86.36 (74.65—93.16)	87 (78.8 - 92.89)
	Negative	6	38					
ABI Left	Positive	43	8	89.58 (77.34 - 96.53)	84.62 (71.92 93.12)	84.31 (73.83—91.1)	89.9 (79.2 95.31)	87 (78.8 - 92.89)
	Negative	5	44					

Discussion

The following discussion evaluates the study results in the context of current clinical literature, focusing on the demographic profile, clinical presentation, and the comparative efficacy of diagnostic modalities like Pulse Oximetry (SpO2) and Ankle-Brachial Index (ABI) across various Fontaine stages of Peripheral Arterial Disease (PAD).

Demographic Profile and Clinical Presentation: The study observed a mean age of 60.25±9.98 years, with the highest prevalence of PAD in the 50–69 age groups (67%). This matches with global epidemiological data which indicates that the prevalence of PAD increases significantly after age 50. Our study findings align with the study conducted by Parameswaran et al, where they observed a mean age of 63 years with an age range of 41- 84 years. [43] Kwon et al in their study observed the mean age 68.2 ± 12.4. [4] Hardeep et al in their study reported that the age of all patients included were between 32-85 years. [8] The most common age group studied was between 43-69 years with a mean age of 56.45±12.96 years. [9]

The male predominance (69%) in this study reflects established trends where men are traditionally at higher risk for atherosclerosis, although recent studies suggest the gap is narrowing in older populations. The results are similar to Deep et al study where 57% patients were male and 43% patients were female. [8] In Badri et al study, the reported incidence was male (60%), female (40%) [6], similar to the present study.

Nearly half of the subjects belonged to male gender, with a mean age of 65.6 years. Mean duration of diabetes was 9.6 years in a study by Ria Mario Siao et al. [10] Though reason for this is uncertain, one of the attributes may be the fact that the incidence of smoking is more seen in men when compared to women. Another attribute could be the positive effect of oestrogen on cardiovascular system in women.[11] However, recent literature emphasizes that while symptoms may be more prevalent in men, the burden of subclinical and asymptomatic PAD in women is increasingly recognized as a significant public health concern. [12]

Clinical Presentation and Fontaine Staging: The duration of symptoms in the study population was primarily between 1 and 10 months (65%), with a mean of 7.32 months. Kwon et al in their study reported their mean duration in months as 8.2 ±4.1. These findings were similar to present study 2. [4] The study utilized the Fontaine classification to stage the severity of PAD. Notably, 18% of participants were asymptomatic (Fontaine Stage I), while the majority presented with intermittent claudication (Stages IIa and IIb) or more severe rest pain and tissue loss (Stages III and IV). These findings underscore the insidious nature of PAD, where many patients remain asymptomatic until the disease reaches advanced stages.

Asymptomatic PAD (Stage I): The identification of 18% asymptomatic cases highlights the importance of screening in high-risk groups. Current guidelines from the European Society of Cardiology (ESC) [13] and American Heart Association (AHA) [14] strongly advocate for ABI screening in asymptomatic patients with cardiovascular risk factors, as subclinical PAD is a potent predictor of future major adverse cardiovascular events (MACE).

Symptomatic PAD (Stages II-IV): Intermittent claudication remains the hallmark symptom, yet the study found a significant number of patients at Stage IV (12.3% with gangrene or ulcers). This progression to Chronic Limb-Threatening Ischemia (CLTI) is associated with high rates of amputation and mortality if not addressed through early revascularization.

This relatively long duration before clinical presentation suggests a delay in seeking medical attention, a common issue in PAD management where early symptoms like intermittent claudication are often attributed to "old age" or "arthritis".

Co-morbidities and Risk Factors: Diabetes mellitus (88%) and hypertension (70%) were the most prevalent co-morbidities among the study participants, followed by smoking (64%). The high prevalence of diabetes is particularly noteworthy, as diabetic patients are at a significantly higher risk for multilevel arterial disease and media sclerosis, which can complicate the diagnosis of PAD using traditional methods like ABI. The combination of diabetes and hypertension in 18% of patients further elevates the risk of cardiovascular events and limb loss.

Kwon et al reported co-morbidities as follows: DM (69.4%), smoker (65.3%), hypertension (65.3%), known heart disease (24.48%), and hyperlipidaemia (16%). [4] These findings were similar to present study. In Hardeep et al study, 37 out of 51 patients (i.e. 72.5%) suffering from coronary artery disease (CAD) showed presence of PVD. This was statistically significant with a p-value of 0.005. 35 out of 43 patients (i.e. 81.4%) showing clinical signs of atherosclerosis suffered from PVD which was statistically significant with a p-value of 0.001. The correlation of mean total cholesterol and mean serum triglycerides with PVD were found to be significant. [8]

Comparative Efficacy of SpO2 and ABI: The study compared the diagnostic accuracy of toe SpO2 and ABI against Duplex Ultrasound (USG), the reference standard. In the present study, SpO2 levels in the right finger the mean SPO2 levels were 98.02 ± 0.88 and left finger it was 97.49 ± 0.71 and in Right toe it was 90.45 ± 8.63 and left toe was 89.23 ± 8.12. The mean value of ankle brachial index on the right side was found to be 0.83 ± 0.25 and on the left side was 0.81 ± 0.25. Pulse Oximetry (SpO2): Pulse oximetry demonstrated high sensitivity (92.73% on the right; 91.67% on the left) and accuracy (91% on the right; 94% on the left). Ankle-Brachial Index (ABI): ABI showed slightly lower sensitivity (89.09% on the right; 89.58% on the left) and an overall accuracy of 87% for both limbs.

According to current literature, while ABI is the "gold standard" for initial screening, its sensitivity can drop in diabetic populations due to arterial calcification. [51] The results of this study suggest that toe pulse oximetry may be a more sensitive screening tool in such populations, offering a simple, non-invasive alternative that reflects distal tissue perfusion.

Duplex Ultrasound Findings: In Duplex ultrasound of right lower limb, 25% had atherosclerosis with monophasic flow, 19% had atherosclerosis with biphasic flow, 11% had diffuse atherosclerotic disease and findings were normal among 45% of the patients. In Duplex ultrasound of left lower limb, 22% had atherosclerosis with monophasic flow, 17% had atherosclerosis with biphasic flow, 9% had diffuse atherosclerotic disease and normal duplex ultrasound was reported among 52% of the patients.

Involvement of PAD on Duplex ultrasound unilateral right side involvement was observed in 46% of the patients and unilateral left side involvement was observed in 39% of the participants and bilateral involvement is observed in 9% of the patients. These findings highlight the utility of imaging in localizing the disease and assessing its hemodynamic impact on distal flow patterns. In study by Ria Mario Siao [10], out of 155 limbs studied, 9.7% had no evidence of stenosis, while the others had stenosis (mild to severe with areas of total occlusion). Hemodynamic significance was determined when the stenosis was at least 50% as they require treatment. [15] Hemodynamically significant stenosis was present in 38.7%.

Correlation of SpO2 with Disease Severity: A core focus of this study was the correlation between SpO2 levels and disease severity. The results demonstrated a clear, statistically significant decline in SpO2 levels as the Fontaine stage progressed. While comparing the Fontaine stage and SpO2 levels, in the present study we observed that the reading of pulse oximeter corresponds to the severity of the disease.

This significant drop ($p < 0.05$ across all stages) suggests that SpO2 measured at the toes is highly sensitive to the reduction in distal perfusion. There was a gap widening noted in more advanced disease. Recent studies have compared SpO2 to ABI, finding that while ABI remains the "gold standard" for initial diagnosis, it has limitations—specifically in diabetic patients where arterial calcification can lead to falsely elevated readings.

In contrast, pulse oximetry provides a functional assessment of tissue oxygenation that is less affected by vessel wall stiffness. The study's finding that SpO2 significantly correlates with Fontaine stages (e.g., Stage IV showing mean SpO2 as low as 83.7%) supports the potential of pulse oximetry as a simple, bedside tool for gauging the severity of limb ischemia. Pulse oximetry measures oxygen saturation in the blood. When there is a decrease in blood flow, the oxygen saturation also comes down. This concept is the basic of the present study. In vascular surgery this concept is used to assess the vessel patency after reconstruction procedures. [16]

A study comparing ankle brachial index, pulse oximetry and trans-cutaneous oximetry with angiography in patients with limb ischemia was done by Joyce et al. They showed that pulse oximetry results were more comparable to angiography results. [17]

Nebojsa et al in their study reported that pulse oximetry readings varied with the different stages of disease. They noted SpO2 readings as 95.33±1.41% in Fontaine stage I, 92.14±2.27% in Fontaine stage IIa, 79.67±2.73% in Fontaine stage IIb, 62.54±4.39% in Fontaine stage III and 46.67±6.16% in Fontaine stage IV. [3] Though there is a reduction in the readings from as the stage progresses, absolute numbers do not match with our study.

Diagnostic Accuracy: In the present study, the pulse oximetry had a sensitivity of 92% and a specificity of 92% and the ankle brachial index had a sensitivity of 89% and specificity of 84%.NSensitivity: A 2025 systematic review reported SpO2 sensitivity ranging from 44% to 76% in hospital settings. However, other studies specifically in diabetic populations found SpO2 to be more sensitive (up to 98.3%) than ABI (77.9%) for screening. Specificity: ABI typically maintains higher specificity (up to 97.5%) compared to SpO2 (41.4%) in some screening contexts. This suggests that while SpO2 is excellent for identifying at-risk patients (screening), ABI is better for confirming the diagnosis. The study's data supports the "Toe SpO2 Gradient" theory [18], where a significant difference between finger and toe SpO2 (or a drop in toe SpO2 upon elevation) is indicative of PAD. Furthermore, the Pearson correlation coefficient showed a strong positive correlation between toe SpO2 and ABI (r=0.74 on the right; r=0.88 on the left), indicating that SpO2 reliably mirrors hemodynamic changes in the limb.

In the study done by Parameswaran et al, the sensitivity of pulse oximetry was found to be 77 % with 95 % confidence interval and specificity was found to be 97 % with 95% confidence interval, while ABI had 63 % sensitivity with confidence interval of 95 % and 97 % specificity with confidence interval of 95 %. [43] In the study conducted by Kwon et al, the sensitivity and specificity of pulse oximetry were 44.4% and 96.1% respectively. [4]

Hardeep et al in their study on 100 diabetes patients reported that pulse oximetry is better than ABI for the screening for asymptomatic PVD among diabetics. But, ankle brachial index is considered more accurate than pulse oximetry in diagnosing asymptomatic PVD in diabetic patients. [8]

A similar study was conducted by M Satheesh Kumar et al, where a total of 120 patients with type 2 diabetes mellitus aged >40 years and asymptomatic with regards to symptoms and signs of PVD were included. In the study the pulse oximetry has a sensitivity of 74.1% and a specificity 95.7%, while those of ankle brachial index were 70.3% and 87.1 respectively. The positive predictive value and negative predictive value of pulse oximetry were 83.3% and 92.7% respectively and those of ankle brachial index were 61.3% and 91.0% respectively. [19]

In the study done by Badri et al, the pulse oximetry was found to have 74.14% sensitivity and 97.10% specificity. Ankle brachial index had 60.6% sensitivity and 97.12% specificity. The positive predictive value and negative predictive value of ABI were 90.9% and 87.9% respectively. Combination of both the pulse oximetry and ankle brachial index had improved results. The sensitivity and specificity in the combined approach were 87% and 94.20% respectively, while the positive predictive value and negative predictive value were 87% and 94.20% respectively. [6] These findings match with our study. Thus pulse oximetry is as good and comparable as ankle brachial index for the evaluation of peripheral vascular disease. It is a simple, effective, cheap tool that can be employed even at basic health care level and doesn't requires any skill to master, can be used even by a basic health care worker and doesn't have any inter-observer variability. We can use pulse oximetry as a routine diagnostic tool in peripheral vascular disease evaluation. We can train health care workers at primary health care and sub-centre levels to assess PVD with pulse oximetry, which can aid in early detection of peripheral vascular disease there by significantly reducing the complications of the disease and preventing major amputations. By this we can reduce the socio-economic burden and improve the quality of life in millions of people.[20]

Conclusion

As the population ages, incidence of peripheral vascular disease increases, especially when they have other coexisting comorbidities like Diabetes. PAD affects quality of life as the efficiency of an individual is deceased further leading to morbidity and mortality. There are a significant proportion of patients who are asymptomatic. These factors necessitate an early diagnosis of peripheral vascular disease and initiation of timely management. It is practically not possible to mobilise the whole community to tertiary and secondary care centres to diagnose PAD. Hence there is a need for a simple and effective tool that aids the diagnosis of PAD both easily and reliably by health care workers at basic healthcare level.

Pulse oximetry can be a potential solution for this problem. It can effectively diagnose both symptomatic and asymptomatic individuals and gives a better reach in the community as it is cheap and simple to use device. The sensitivity and specificity of pulse oximetry is better when compared to ankle brachial index. Thus symptomatic and high risk asymptomatic individuals can be screened at primary health care and sub-centre levels and can be educated regarding the disease, its severity and the outcome. This will help us to promote early inter-

vention or referral to higher centres for further evaluation and intervention. Thereby severe complications of the disease can be avoided and quality of life of patient's improved.

Pulse oximetry plays a major role in vascular assessment of the diabetic foot. Doppler remains the gold standard among non-invasive techniques with robust sensitivity and specificity. Pulse oximetry, though attractive for point-of-care screening, has limitations and variable diagnostic performance. Integration of both, along with clinical assessment and other modalities (ABI, imaging), enhances detection and guides management, potentially reducing the risk of ulcers and amputations.

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