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Correlation of severity of peripheral arterial disease of lower limbs with ankle brachial pressure index

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Abstract
Introduction: The ankle brachial pressure index (ABPI) is non-invasive tool for screening as well as assessing the severity of peripheral artery disease in patients who present with lower-extremity symptoms.
Methods: A total of 100 patients were included in this prospective observational study who attended cardiothoracic and vascular surgery unit, Bir Hospital with peripheral arterial disease (PAD). The ratio of higher ankle pressure to higher brachial pressure was calculated and correlated with symptoms and clinical features of PAD.
Results: Of total 100 patients, the 84(84%) patients had ABPI less than 0.9. 52.6% patients with mild intermittent claudication had ABPI 0.4-0.9. Among 66 patients with severe PAD, 17(25.7%) had ABPI less than 0.4 and 42(63.3%) had ABPI 0.4-0.9.
Conclusion: ABPI is cheap noninvasive tool to assess the PAD with sensitivity for 84% patients (ABPI<0.9).

Keywords: Peripheral vascular disease (PAD), Ankle brachial pressure index (ABPI)

Introduction

Peripheral arterial disease [PAD] is classified as acute or chronic. It occurs from the occlusion of the lumen of artery that results into inadequate blood flow to the limb. Atherosclerosis is the major risk factor for of PAD [1]. The other risk factors smoking, diabetes, hypertension, dyslipidemia, obesity, physical inactivity and increased age are also associated with PAD. Leriche-Fontaine classified PAD into four stages; no symptoms, intermittent claudication [mild <200meter and severe > 200meter distance], rest pain, and trophic lesions respectively. About 10% of patients with PAD are presented with classic claudication and 40% are asymptomatic [2]. The ankle-brachial pressure index (ABPI) is a simple, noninvasive test used to predict severity and the prognosis, regarding the limb salvage and future cardiovascular events. The patient is diagnosed as PAD when ABPI is ≤ 0.9 [3]. PAD is graded as mild to moderate if ABPI 0.4 to 0.9 and ABPI less than 0.40 is suggestive of severe PAD [4]. An ABPI of value greater than 1.3 is also considered as abnormal, suggestive of non-compressible vessels like diabetes. ABPI 1 to 1.4 is normal.

Materials and methods

This was prospective observational hospital based study conducted in cardiothoracic and vascular surgery [CTVS] unit in Bir hospital from September 2017 to January 2019. The total 100 patients were included in the study. All age groups of patients coming in CTVS unit with diagnosis of PAD were included. Patients with amputated limb and who did not give consent were excluded from the study. Medical history and risk factors like age, smoking, hypertension, diabetes were taken. Clinical symptoms like intermittent claudication, rest pain, ulcer, and gangrene were noted. The clinical sign of peripheral arterial disease pallor, pulselessness, paresthesia, paralysis, and poikilothermia were noted. Systemic examination of the patients was done. The patient was kept in rest for 5 to 10 minutes in supine position. The blood pressure cuff was placed about 2.5 cm above the antecubital fossa for the brachial pressure and about 5 cm above the medial malleolus for the ankle pressures. Ankle arterial pulse signal was noted using hand held doppler before inflating the blood pressure cuff. Then cuff is inflated at least 20 mm Hg above the point where the arterial doppler sound disappears and slowly deflated until the doppler sound reappears.

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The pressure at which the doppler signal of the arterial pulse reappears was the systolic pressure. The ankle-brachial pressure index [ABPI] was calculated by dividing the ankle systolic blood pressures by the brachial systolic blood pressures. After recording ABPI, it was correlated with clinical symptoms and signs of PAD. The laboratory tests were done to detect the presence of dyslipidemia, diabetes, and major metabolic derangement (e.g., renal or hepatic insufficiency). A baseline electrocardiogram (ECG) and Echocardiography were also done at the time of diagnosis. Arterial Doppler study and computed tomography angiography of the affected limb were also performed.

Results
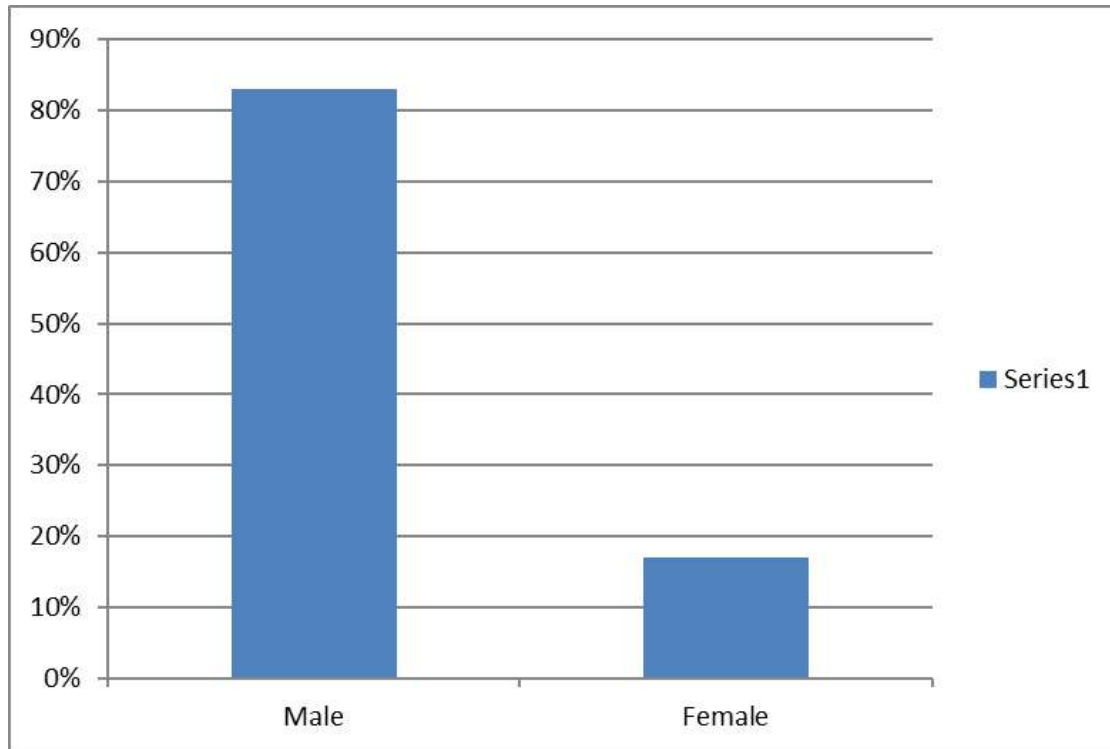There were 100 patients included in this study. The Left lower limb was more affected (56%) than right (44%).

Fig 1: Sex

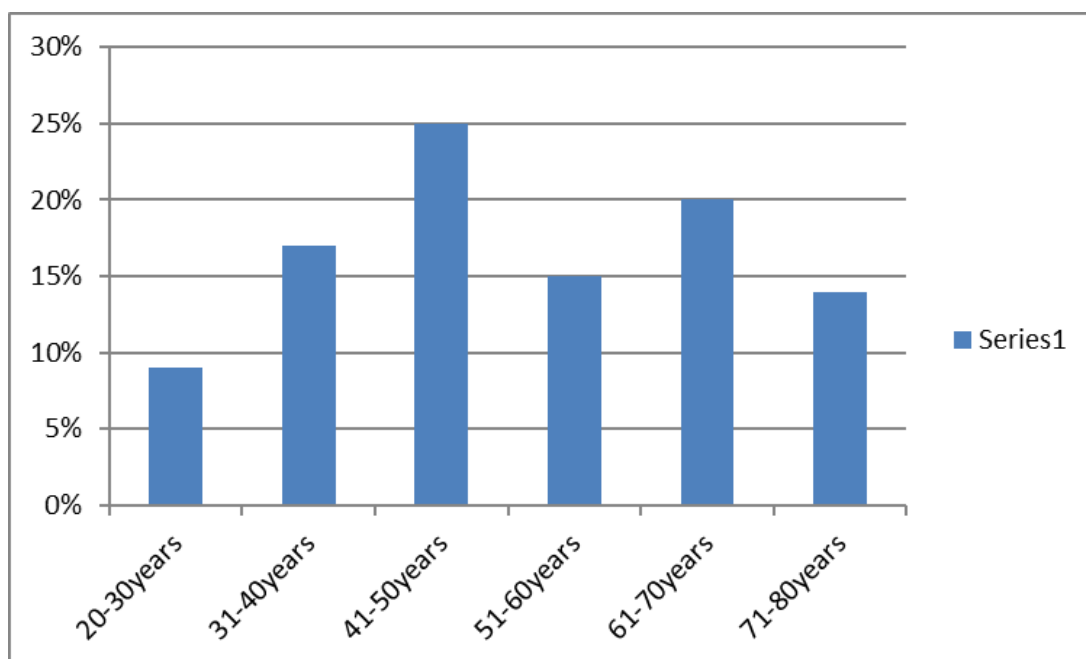Total 100 patients, male 83(83%) and female 17(17%)

Fig 2: Age group.

The most common age group were 41-50 years including 25(25%) patients, followed by 61-70 years group including 20(20%) patients. 71- 80 years group were 14(14%) patients.
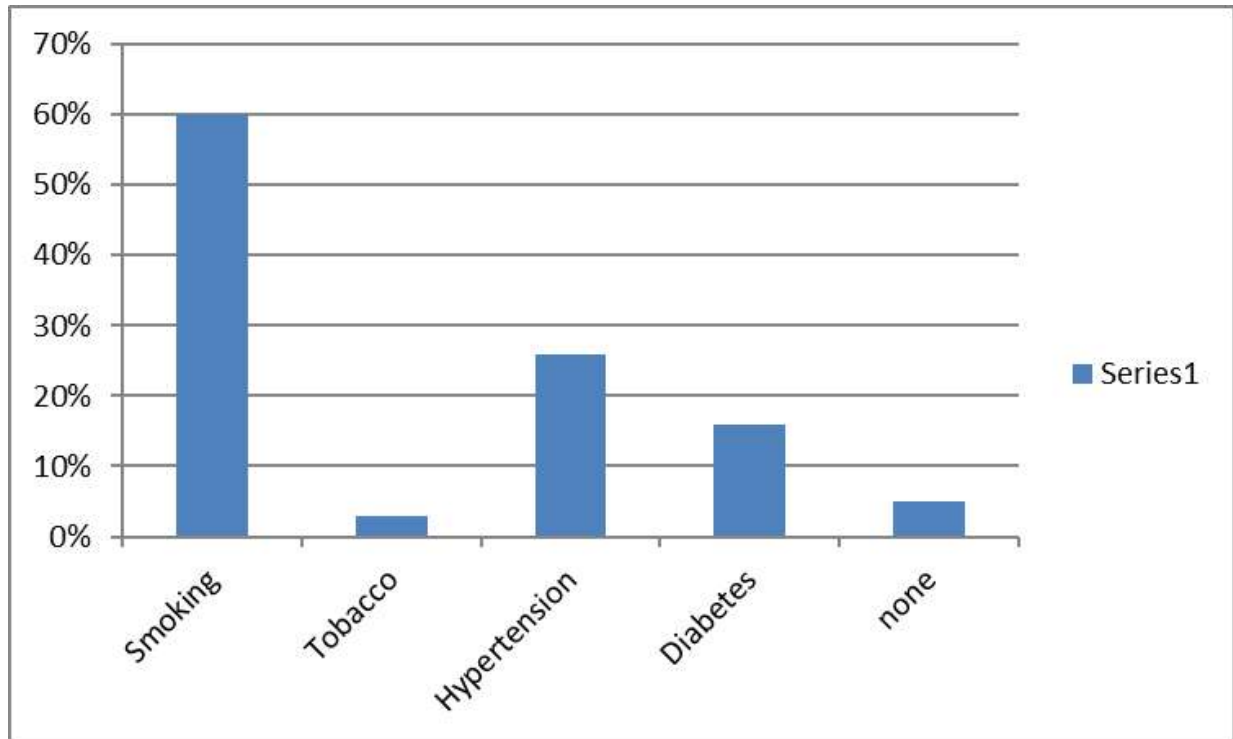
Fig 3: Risk factors

Smoking is common risk factor including 60(60%) patients, hypertension 26(26%) patients, diabetes 16(16%) patients, tobacco 3(3%) patients and no risks factors in 5(5%) patients.
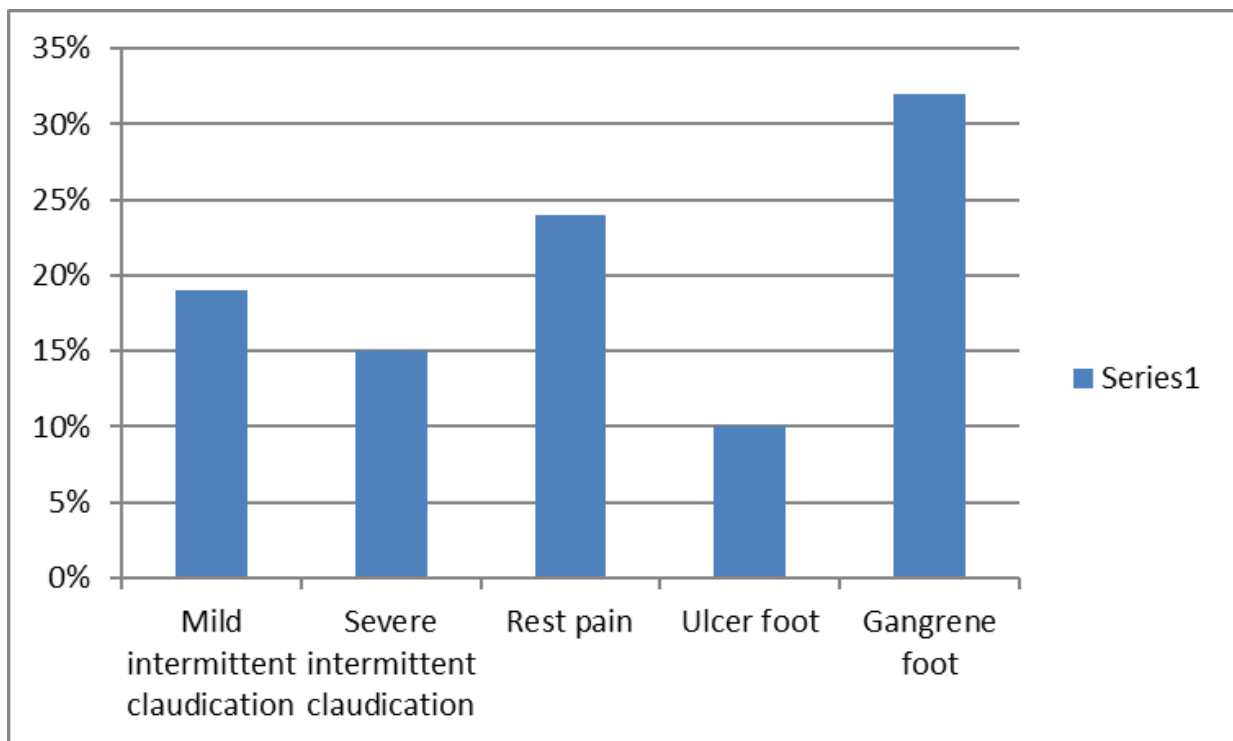

Fig 4: Symptoms and sign

The patients presented with intermittent claudication were 34, among which 19(19%) had mild and 15(15%) had severe iintermittent claudication. Rest pain were on 24(24%) patients, ulcer foot on 10(10%) patients and gangrene foot on 32(32%) patients respectively.
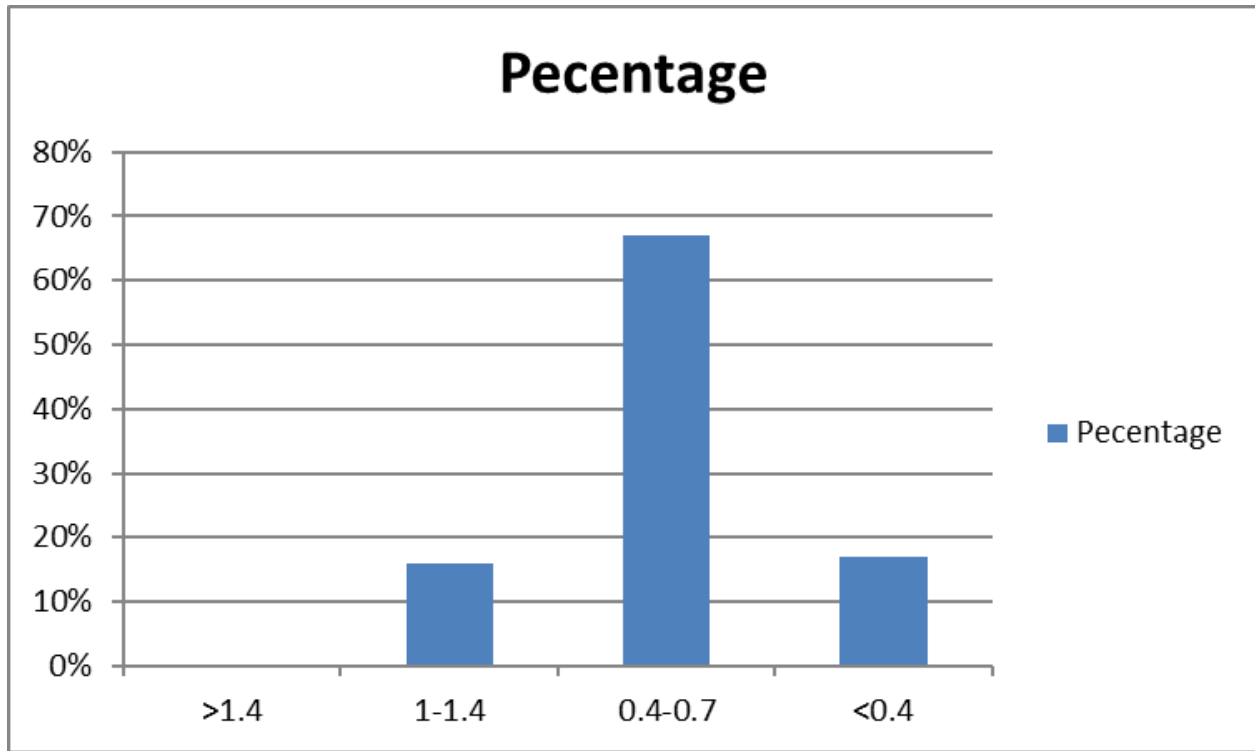
Fig 5: ABPI with percentage

The patients with ABPI 0.4-0.9 were 67(67%), less than 0.4   were 17(17%), 1-1.4 were 16(16%) respectively

Table 1: Symptoms and ABPI

ABPI	Intermittent claudication mild	Intermittent claudication severe	Rest pain	ulcer	Gangrene
>1.4					
1 – 1.4	9(47.3%)		3(12.5%)	1(10%)	3(9.6%)
0.8 -0.9	5(26.3%)		4(16.6%)	2(20%)	6(18.7%)
0.4 -0.7	5(26.3%)	15(100%)	10(41.6%)	6(60%)	14(43.7%)
<0.4			7(29.1%)	1(10%)	9(28.1%)
Total	19	15	24	10	32

There were 19 patients with mild intermittent claudication, among 10(52.6%) had ABPI 0.4 – 0.9. 15 patients were with severe claudication and 15(100%) had ABPI 0.4-0.9. Among 24 patients with rest pain, 14(58.2%) patients had ABPI 0.4-0.9. Among 10 patients with ulcer foot, 8(80%) had ABPI 0.4 - 0.9. Among 32 patients with gangrene foot, 20(62.4%) had ABPI 0.4 -0.9.

Discussion
Among 100 patients, 83% were male and 13% were female with male to female ratio 6.3:1. Our study is similar to study done on 3209 where male patients were 71% [5]. The reason for more male patients in our study may be due to smoking habit in male than female. In this study the most common group affected was 41 to 50 years which included 25% and PAD in 70 to 80 years were 14%. Our study is not similar to the study where the prevalence of PAD was relatively rare before 40-50 years and more frequent [6], especially after 70 years. Our study is nearly similar to other study which showed PAD affects 15%-20% of persons older than 70 years of age [7]. The reason for higher incidence of PAD in age less than 50 years in our study may be due to low socioeconomic condition and higher rate of smoking in those age groups.
In our study Smoking was most common (60%) risk factor for PAD followed by smoking hypertension (26%) and diabetes (16%). Our study was similar to the study where smokers were

69% but not similar for hypertensive (66%) and diabetics (35%) patients [9]. Female sex, hypertension, and smoking were identified as predictors for PAD. Smoking and diabetes are associated with worse outcomes of other risk factors [10] and had the strongest correlation being with PAD [11] which was similar to our study. The risk of PAD is 2-3 times higher in smoker and leads to critical ischemia [12]. The prevalence of smoking is 34.6% and the incidence of Burger's disease (TAO) is more in India [13]. Diabetes is qualitative and quantitative risk factor as each 1% increase in glycosylated hemoglobin is associated with a 25% increase in the risk for PAD [14]. The diabetic patients may have abnormally high ankle pressure and consequently, have a false negative evaluation of the ABPI.
In this study, 34% patients were presented with intermittent claudication which was similar to the study whose prevalence of intermittent claudication in age 60-65 years was 35% and 70% in age 70-75 years. Our study was not similar to the study which showed PAD with intermittent claudication were 5% in ages of 55 and 74 years [15]. The presentation of intermittent claudication in our study was more .This may be due that our patients were unaware of the disease initially and come to hospital late when the affected artery is totally blocked and they felt pain on walking due to inadequate blood supply. Solanki *et al*. studied on 110 patients of PAD with diabetics in India which showed 46% had symptomatic PAD and 35% had low ABPI [16]. Studies showed a difference of 0.03 between ABPI to the right

compared to the left lower limb [8].

Patients with ABPI less or equal to 0.5 are likely to have rest pain [17]. In our study 10(41.6%) patients with rest pain had ABPI 0.4-0.7 and 7(29.1%) patients had ABPI less than 0.4. In our study there were 20(63%) patients with intermittent claudication who had ABPI 0.4 to 0.7. which was similar to Study by Criqui *et al.* where claudication was 49% in patients with ABPI < 0.6 compared to 34% in patients with ABI between 0.6 and < 0.9 [18]. This study was also similar to McDermott *et al.* as ABPI < 0.6 were at higher risk of having impaired walking abilities [19].

In our study leg ulcer was 10(10%) which was nearly similar to other study, which showed chronic leg ulcers 44% and associated with tobacco and young males [13]. But not similar to O'Brien *et al.* [20] in Ireland where the prevalence of leg ulcers was 0.12% but 1.03% in the patients aged 70 years. As our patients are from lower socioeconomic class they walk on bare foot which causes trauma to foot leading to ulcer. Out of 50 patients 52% patients were of leg ulcer, 42 patients (84%) had ABPI value >0.90 and 7 patients (14%) had ABPI value <0.90. Our study was not similar to above study as 10% patients had ulcer and 10% had ABPI >0.9, 20% had ABPI 0.8 to 0.9 and 60% had ABPI 0.4 to 0.7 and 10% had < 0.4%. The reason for more ulcer in their study was due to 86% patients were smoker associated with anemia, hypoproteinemia, and the total number of patients they studied were 50% less than our study [13]. ABPI <0.4 increases the risk of limb loss, gangrene, ulceration and delayed wound healing [21]. Our study showed 10% patients with ulcer and 28.1% patients with gangrene foot had ABPI < 0.4. Ankle systolic pressure less than 60 mmHg, rather than the ABPI has been found to correlate better in terms of viability of the lower extremities in PAD [22]. Numerous studies have reported that the ABPI has a sensitivity of more than 90% and a specificity of more than 95% in diagnosing 50% stenosis of the lower extremity arteries [23].

Feigelson *et al.* [24] evaluated the sensitivity of an ABPI < 0.8 to be 70% in patients with PAD. Lijmer *et al.* [25] has reported that ABPI less than 0.9 had a sensitivity of 79% and specificity of 82% to 100% [26, 27, 28]. In our study, 84(84%) patients had ABPI less than 0.9. 52.6% patients with mild intermittent claudication had ABPI 0.4-0.9 and 100% patients with severe claudication had ABPI 0.4-0.7. Among 66 patients with severe PAD in our study, 17(25.7%) had ABPI less than 0.4 and 42(63.3%) had ABPI 0.4-0.9. Although ABPI <0.90 is highly sensitive and specific for the presence of PAD, [22] the hand-held doppler may not precisely detect ankle systolic pressures less than 30 mmHg. It is also important to note that 5% of patients with PAD will have an ABPI greater than 0.90 due to calcification of arteries, resulting in falsely elevated lower-extremity pressures [4].

Conclusion

The most common risk factor for PAD is smoking The most common presentation is intermittent claudication (34%). ABPI is cheap noninvasive tool to assess the PAD with sensitivity for 84% patients (ABPI<0.9). 52.6% of mild intermittent claudication had ABPI 0.4-0.9, 25.7% of severe PAD had ABPI less than 0.4 and 63.3% had ABPI 0.4-0.9.

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