"Prediction of amputation by ABPI in Diabetic foot"

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ABSTRACT: Background: ABPI is the ratio of ankle systolic blood pressure to brachial blood pressure.The highest presure in the dorsalis pedis, posterior tibial and peroneal artery serves as the numerator, with the highest brachial systolic being the denominator. Normal ABPI values range from 0.9 to 1.3. The study was conducted to determine the diagnostic accuracy of ankle branchial pressure index (ABPI) in predicting amputation in diabetic foot .

Aims and objective: To make use of ABPI values in predicting amputation in diabetic foot .

Material and method: A Prospective study was done in 50 patients presented with diabetic foot insurgery department, swarooprani nehru hospital prayagraj and prediction of amputation was decided on the basis of ABPI values.

Results: In our study out of 50 patients,25 patients have managed conservatively and 25 patients has managed by amputation. Prediction of amputation was 100%(23 out of 23 patients) if ABPI cut off for amputation was <0.4 , prediction 80.64%(25 out of 31 patients) if ABPI cut off was <0.7 and prediction was 67.56%(25 out of 37 patients) if ABPI cut off was <0.9.In this study lower ABPI is associated with amputation and delayed wound healing.

Conclusion: ABPI can be used as a routine tool in all patients with diabetic foot ulcers for screening peripheral arterial disease so that the decision for amputation can be made early during diabetic foot.

Keywords: Diabetic foot ulcers, Ankle brachial pressure index, ABPI,

INTRODUCTION:

Diabetes is world wide problem. The number of people with diabetes rose from 108 million in 1980 to 422 million in 2014 . The prevalence of diabetes among adult over 18 year of age rose from 4.7% in 1980 to 8.5% in 2014[1]. Diabetes is fast gaining the status of a potential epidemic in India with more than 62 million diabetic individual currently diagnose.[2,3]

Diabetes mellitus is a disorder in which the concentration of blood glucose is persistently raised above the normal range. It occurs either because of a lack of insulin or because of the presence of factors which oppose the action of insulin. Hyperglycemia results from insufficient insulin action. There are many associated metabolic abnormalities—notably the development of hyperketonemia when there is a severe lack of insulin, together with alterations of fatty acids, lipids, and protein turnover. Diabetes is a permanent condition in all but a few special situations in which it can be transient. A wide variety of disturbances affecting the central and peripheral nervous systems, vascular system either directly or indirectly, may be encountered in patients with diabetes mellitus. Some genetic disorders that may be accompanied by diabetes, the consequences of acute metabolic decompensation, and somatic and autonomic neuropathies, cerebrovascular disease, certain infections that have a particular association with diabetes and, finally, congenital malformations.The aetiology of diabetes in india is multifactorial and individual genetic factor with environmental influences such as obesity associated with rising living standard,steady urbon migration and life style changes. Majority of diabetic patient develop foot ulcer in one point of time or other during the course of their illness.

Diabetic foot ulcer[4] is one of the major concern of the complication of diabetes mellitus, especially among the older population. Diabetic foot ulcer have been found to affect health related quality of life in various dimention ,such as physically, mentally, socially and economically. Despite the frequency of complications involving diabetic patient's lower limbs, primary care practitioners frequently neglect to examine their feet and neglected by patient himself. A significant number of such patient will require longterm hospital treatment and amputation .

Being the cause of the highest healthcare burden among diabetics, the prevention and treatment of foot ulcers remain a considerable challenge. Lower limb ischemia and vascularity determines healing in diabetic foot ulcers and plays

as a major role in predicting lower limb amputations. Vascularity of the lower limb is assessed by clinical examination, hand held and color doppler or angiographic studies. Ankle branchial pressure index (ABPI)[5] is the ratio of ankle systolic blood pressure to brachial blood pressure.The highest presure in the dorsalis pedis, posterior tibial and peroneal artery serves as the numerator, with the highest brachial systolic being the denominator. Normal ABPI values range from 0.9 to 1.3 and it ranges from 0.7- 0.89 in patients with intermittent claudication(sign of ischemia), 0.4-0.69 in patients with ischemia at rest(sign of arterial obstruction) and less than 0.4 in those with impending or active gangrene/necrosis. The decision of amputation in patients diabetic foot ulcers is usually delayed due to the time consuming first line management, surgical debridement. The decision of amputation is reached when there is no sign of healing after multiple debridement's or when angiography or doppler reveals reduction in lower limb vascularity. Angiography is considered the gold standard but due to the high cost and limited use in patients with renal failure, ABPI becomes a viable investigation in decision making in a resource poor setting. The present study aims to determine the diagnostic accuracy of ankle branchial pressure index (ABPI) in predicting amputation in diabetic foot.

AIMS AND OBJECTIVE: To make use of ABPI values in predicting amputation in diabetic foot .

MATERIAL AND METHOD: Study was carried out in P.G. Department of Surgery, S.R.N. Hospital associated with M.L.N Medical College, Prayagraj from September 2019 to September 2020 after approval from the ethical committee and after obtaining written and informed consent either from patient or their legal heir. All patient with provisional diagnosis of diabetic foot was part of study. Exclusion criteria were severe foot oedema which can interfere the Ankle Brachial Pressure Index (ABPI) examination. . Routine investigation incluiding Hb ,TLC , BS(F/PP), HBA1c ,KFT was sent on the day of admission. Clinical examination was perform on bed side. Radiological tests were also be perform to support the diagnosis and management. Ankle-brachial pressure index (ABPI) was measured with patients in supine positions using a vascular doppler and sphygmomanometer. Systolic pressure is measured on both arms of the brachial artery and on the posterior tibialis artery and dorsal pedis at both limbs. Patients were managed by Strict glycemic control, maintained with the use of diabetic diet, oral hypoglycemic agents and insulin.Culture from the deeper tissues aids in selecting appropriate antibiotics. While awaiting the results of wound culture, patients was given empirical broad spectrum antibiotic regimen. Antibiotics were preferably given intravenously for limb threatening infections.Tramadol, NSAID, Gabapentin and pregabalin had been used for symptomatic relief for painful neuropathy. Amputation was done in patient having osteomyelitis or gangrenous foot at level of ankle, below knee or above knee depends upon level of lesion and Disarticulation was done at level of ankle or knee in operative room under block or spinal anaesthesia. Data processing includes data collection and data tabulation. The collected data is processed using the Microsoft Excel program and the SPSS program, which then presented in a descriptive table format.

RESULTS :Data collected from 50 subjects, fulfilling the inclusion and exclusion criteria of the study. Out of 50 patient 74% (n=37) participants were males and 26% (n=13) were females. The mean age of diabetic foot among male participants was 63.8 and among female participants was 58.1 years respectively.

TABLE 1: ABPI of study participants:

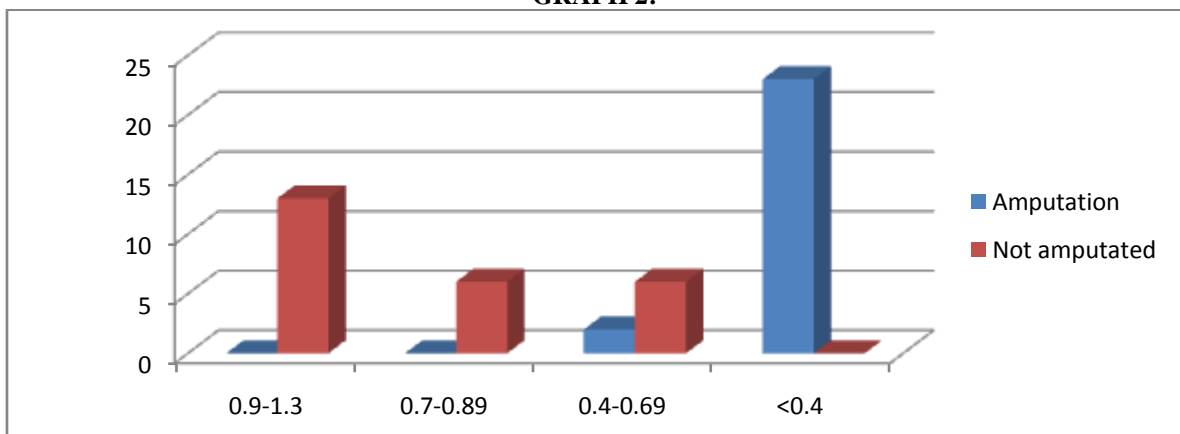| ABPI	N (%)
≥0.9	13(26%)
0.7-0.89	6(12%)
0.4-0.69	8(16%)
<0.4	23(46%)

GRAPH:1
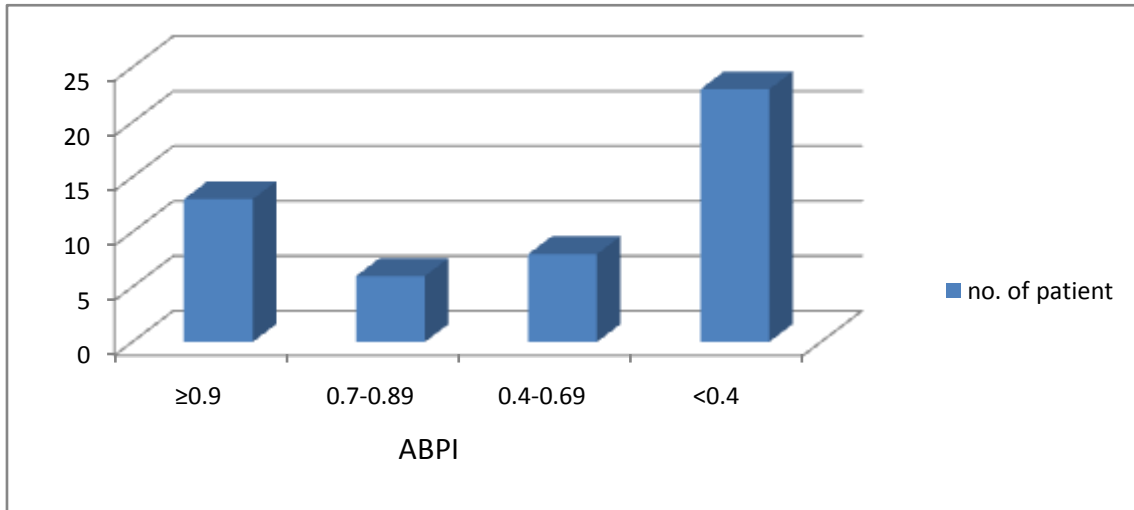
The mean ABPI was 0.67 of total 50 subject and only 26% (n=13) had normal ABPI 0.9-1.3 with mean 1.1 .

36%(n=6)had 0.7-0.89 ABPI with mean 0.78 , 22%(n=8) had 0.4-0.69 ABPI with mean 4.51 and 14%(n=23)had <0.4 ABPI with mean 0.16 .

TABLE.2: Association between amputation and ABPI

	0.9-1.3	0.7-0.89	0.4-0.69	<0.4
Amputation	0	0	2	23
Not amputated	13	6	6	0

GRAPH 2:

Out of 50 patient,13(26%)patient with ABPI 0.9-1.3 managed by conservatively with zero amputation. Out of 6(12%) patient with ABPI 0.7-0.89 , all 6(12%) patients managed by conservatively with zero amputation. Out of

8(16%) patients with ABPI 0.4-0.69 , 2(4%) patients managed by amputation and other 6(12%) patients by conservatively. Out of 23(46%) patient with ABPI less than 0.4 ,all 23(46%) managed by amputation.

TABLE.3: Amputation if cut off ABPI was <0.4

	>0.4(0.4-1.3)	<0.4
Amputation	2	23
Not amputated	25	0

All 23 patient under cutoff ABPI <0.4 were amputated and 2 patient with ABPI >0.4 were amputated.

TABLE.4: Amputation if cut off ABPI was <0.7

	>0.7(0.7-1.3)	< 0.7
Amputation	0	25
Not amputated	19	6

25 patients out of 31 patients under cutoff ABPI <0.7 were amputated and zero patient with ABPI >0.7 were amputated.

TABLE.5: Amputation if cut off ABPI was <0.9

	>0.9(0.9-1.3)	<0.9
Amputation	0	25
Not amputated	13	12

25 patients out of 37 patients under cutoff ABPI <0.4 were amputated and zero patient with ABPI >0.9(normal ABPI) were amputated.

DISCUSSION: Foot ulceration is one of the leading causes of hospital admission in DM and is the most common non-traumatic cause of lower limb amputation. The presence of peripheral neuropathy and peripheral vascular disease are important causative factors for development of diabetic foot ulcers and the presence of lower limb ischemia and reduced vascularity are most important prognostic factors in diabetic foot.

Males accounted to 74% of participants which could be due to the higher prevalence of DM among males in our setting. Ankle-brachial index (ABI) is the ratio of systolic blood pressure to the ankle with the arm. This examination is measured by the patient in the supine position using a vascular Doppler and sphygmomanometer. Systolic pressure is measured on both arms of the brachial artery and in the posterior tibialis artery and dorsal pedis in the respective limbs. ABI examination aims to assess circulation function in the leg arteries. In this study Out of 19 amputated patient,zero patient with normal ABPI 0.9-1.3, 7 patients (36.8%) have ABPI <0.4 , 10 patients(52.6%) have ABPI 0.4-0.69 and 2 patient(10.5%) has ABPI 0.7-0.89 .

In this study, prediction of amputation was 100%(23 out of 23 patients) if ABPI cut off for amputation was <0.4 , prediction 80.64%(25 out of 31 patients) if ABPI cut off was <0.7 and prediction was 67.56%(25 out of 37 patients) if ABPI cut off was <0.9 . In this study lower ABPI is associated with amputation and delayed wound healing.

Hence, we recommend a careful history, physical examination with ABPI in the poor socioeconomic strata or angiography in affording patients. ABPI is a valuable tool for predicting the outcomes and amputaion in patients with diabetic foot.

CONCLUSION: ABPI can be used as a routine tool in all patients with diabetic foot ulcers for screening peripheral arterial disease so that the decision for amputation can be made early during diabetic foot as lower ABPI is associated with risk of amputation.

REFERENCES:
[1]. https://www.who.int/news-room/fact-sheets/detail/diabetes the who "global report on diabetes" 2020
[2]. Arun kumar, manish k goel, ram bilas jain, pardeep khanna, and vikas chaudhary india towards diabetes control 10.4066/amj.2013.1791

[3]. Seema abhijeet kaveeshwar and jon cornwall the current state of diabetes mellitus in india 10.4066/amj.2013.1979

[4]. H B Chandalia , d singh, v kapoor, s h chandalia, p s lamba footwear and foot care knowledge as risk factors for foot problems in indian diabetics 2008 oct;28(4):109-13

[5]. Norman s. williams ms frcs fmed sci professor of surgery and centre lead, centre for academic surgery, bailey and love's short practice of surgery bailey & love's 25thedition page 538,

[6]. Andrew j.m. boulton, md, frcp1 2, david g. armstrong, dpm, phd3, stephen f. albert, dpm, cped4, robert g. Comprehensive foot examination and risk assessment , diabetes care 2008 aug; 31(8): 1679-1685.

[7]. Swezey rn, bsn, cwocn, cws, faccws diabetic foot - risk factors and prevention pendsey, s. understanding diabetic foot. int j diabetes dev ctries. 2010; 30(2): 75-79 april 19th, 2013

[8]. Awad mohamed ahmed 24.07 najran university history of diabetes mellitus october 2019 saudi medical journal 23(4):375-378

[9]. Pathak anuj kumar 1 , sinha praveen kumar 2 and sharma janardan department of pharmacology, rajendra institute of medical sciences, ranchi, jharkhand diabetes – a historical review. jan 2013

[10]. Hongyan zhang , jingxian ni , changshen yu , yanan wu , jingyan li , jie liu , jun tu , xianjia ning , qing he and jinghua wang sex-based di_erences in diabetes prevalenceand risk factors: a population-based cross-sectional study among low-income adults in chinaendocrinol., 25 september 2019 /00658

[11]. Ritu lakhtakia,department of pathology, college of medicine & health sciences, sultan qaboos university, muscat, oman, the history of diabetes mellitussultan qaboos univ med j. 2013 aug; 13(3): 368–37/ doi.org/10.12816/0003257

[12]. Charles m. tipton, susruta of india, an unrecognized contributor to the history of exercise physiology 01 jun 2008 // https://doi.org/10.1152/japplphysiol.00925.2 007

[13]. Marianna karamanou, athanase protogerou, and e_e poulakou-rebelakou milestones in the history of diabetes mellitus: the main contributors world j diabetes. 2016 jan 10; 7(1): 1–7.published online 2016 jan 10. doi: 10.4239/wjd.v7.i1.1

[14]. Allen, frederick m., stillman, edgar, and fitz, reginald: total dietary regulation in the treatment of diabetes. new york, the rockefeller institute for medical research, monograph no. 11, 1919. pages 14–20 john rollodiabetes 1956 jul; 5(4): 325-327.https://doi.org/10.2337/diab.5.4.325

[15]. Marianna karamanou,1 michael koutsilieris,2 konstantinos laios,1 filio marineli,1 university of athens; athens, Greece george androutsos1 apollinaire bouchardat (1806-1886): founder of modern diabetology hormones 2014, 13(2):296-300

[16]. Edward crw,baird jp,frier bm,shephard j,toft ad .endocrine and metabolic diseases including diabetes mellitus. davidson's principles and practice of medicine 23rd edition.churchill livingstone,728-730

[17]. American diabetes association classification and diagnosis of diabetes: standards of medical care in diabetes—2020 diabetes care 2020 jan; 43(supplement 1): s14-s31. https://doi.org/10.2337/dc20-s002

[18]. World health organization classification and diagnosis of diabetesn department for management of noncommunicable diseases, disability, violence and injury preventionhttps://www.who.int/health-topics/diabetes

[19]. Alberto pugliese, diabetes research institute, university of miami miller school of medicine, miami, fl, usa insulitis in the pathogenesis of type 1 diabetes pediatr diabetes. 2016 jul; 17(suppl suppl 22): 31–36.

[20]. Alvin c. powers; kevin d. niswender; carmella evans-molina diabetes mellitus j. larry jameson, anthony s. fauci, dennis l. kasper, stephen l. hauser, dan l. longo, joseph loscalzo diagnosis, classification, and pathophysiology harrison's principles of internal medicine, 20th edition 2166-2178

[21]. Ahola, A. J. et al. 2010. Health-related quality of life in patients with type 1 diabetes – association with diabetic complications (the FinnDiane Study). Nephrol Dial Transplant 25, pp. 1903–1908.