

ORIGINAL ARTICLE

ANKLE BRACHIAL INDEX (PALPATORY METHOD)
IN FEMALE MIGRAINEURS

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Background: Migraine is a primary headache that affects females three times compared to men. Vascular nature of migraine has been suggested. Migraineurs are reported to be at higher risk of untoward vascular events. Ankle brachial index (ABI) is the ratio of ankle systolic arterial pressure to brachial systolic pressure. Its palpatory method is a simple non-invasive method, recommended to screen asymptomatic subjects. The present study was aimed to determine and compare ankle brachial index in female migraineurs and healthy controls and to determine if migraine alone affects peripheral blood vessels. **Methods:** Eighty-four women aged 20–50 years were divided into three groups of 28 subjects each. Group A and B comprised of migraineurs with history of migraine for less than and more than 10 years respectively. Group C, had healthy controls. Ankle Brachial Index was calculated after recording systolic pressures from brachial and dorsalis pedis arteries by palpatory method. **Results:** Migraineurs with history of migraine for more than 10 years had the highest number of cases with borderline ABI. Kruskal Wallis ANOVA compared values of ABI in the three groups. Statistically significant differences were seen ($p=0.046$) among the three groups. Comparison of group B and C showed significant difference ($p=0.01$). **Conclusion:** Group B had highest number of borderline cases. Statistically significant differences exist between healthy women and migraineurs with history of migraine for more than 10 years.

Keywords: Migraine, borderline, ankle brachial index, ABI

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INTRODUCTION

Migraine is defined by the International Classification of Headache Disorders beta version 2013 (ICHD III β) as recurring headache disorder manifesting in attacks lasting 4 to 72 hours.¹ It is typically unilateral, pulsating, moderate to severe in intensity and associated with nausea, vomiting, photophobia and/or phonophobia. Prevalence of migraine is 14.7% in the adult population worldwide. It is three times more common in females compared to males.² World Health Organization (WHO) report 2015 ranks migraine globally as the 4th leading cause of years lived with disability in women, whereas ranked 7th collectively in both sexes.³

The Ankle Brachial Index (ABI) is the ratio of the ankle systolic pressure to brachial systolic pressure. The ankle systolic pressure is slightly higher as compared to the brachial systolic pressure in the upright posture but if a person is lying supine and the arm is at the level of heart this ratio becomes 1 as differences are abolished. The ABI has gained significance from a simple index of Peripheral Arterial Disease (PAD) to a sensitive assessment for asymptomatic patients who are at risk for atherosclerosis and cardiovascular disease.⁴ Low ABI is an independent predictor for cardiovascular disease and stroke risk.⁵

According to the American College of Cardiology/American Heart Association guidelines 2016 for ABI interpretation, resting ABI results should be reported as abnormal ($ABI < 0.90$), borderline (ABI

$0.91-0.99$), normal ($1.00-1.40$), or non-compressible ($ABI > 1.40$).⁶ Along with low ABI, an already established criteria, borderline ABI a comparatively newly set criteria is associated with worse clinical outcomes.^{7,8}

The evidence for migraine as a cause of increased risk of cerebral, coronary, retinal, peripheral and dermal vascular involvement suggests that although headache begins and involves cerebral blood vessels, the changes that are taking place whether procoagulatory, atherosclerotic or related to vasomotion may be widespread.⁹ It is recommended to determine ABI as a tool for assessment of cardiovascular risk of asymptomatic adults.¹⁰ Because of sufficient evidence of its use and the ease with which it can be learned and applied with little expense in clinics, office, or a primary care setting, it is a must to perform where cardiovascular risk assessment is required. Most epidemiological studies measured ABI by hand-held Doppler ultrasound which is considered to be the gold standard method.⁹ A study of heart outcome prevention evaluation measured ABI by palpation and found the results comparable with Doppler.¹¹ Ranasinghe *et al*¹² reported ABI measured by palpation, as a reliable method for screening in resource poor conditions.

ABI measured by palpation provides a simple, clinical, quantitative, non-invasive, inexpensive and rapid method for PAD detection and vascular risk stratification in primary care setting.^{13,14}

Large prospective cohort studies were carried out on men and women.¹⁵ Women Health Study enrolled women with migraine 45 years and above. They were followed for a period of 12–15 years. An increased risk by 24% for myocardial infarction and stroke was observed in migraineurs.¹⁶ In Nurses' health study a large prospective cohort followed migraineurs for 20 years and it was seen that migraineurs have a 50% increased risk of having an ischemic event.¹⁷ This increased risk occurs with or without high Framingham risk scoring.¹⁵

Ambrose and Najafi¹⁸, report that time and resources spent to prevent and treat cardiovascular disease only reduce the actual risk by 2%. The changes in blood vessels start many years earlier. As migraineurs have an increased risk, these changes may start decades before the untoward event. Screening of individuals is rare under the age of 40 especially if the traditional risk factors are not present.

This study was designed to determine ABI in subjects having migraine for varying duration and to see the effect of longer history of migraine on peripheral blood vessels.

METHODOLOGY

It was a comparative cross-sectional study carried out at Postgraduate Medical Institute, Lahore, (Outpatient Department, Lahore General Hospital, Lahore) from August 2013 to August 2016. Permission from Ethical Committee Postgraduate Medical Institute was obtained. Protocol of the study was explained to each subject, and written informed consent was obtained.

Sample size was calculated using Power Analysis and sample size software (PASS 2008) keeping value of α at 5% and power of study as 90%.

A total of 84 women of age 20–50 years were enrolled and divided into 3 equal groups of 28 subjects each. Group A had migraineurs with history of migraine for less than ten years. Group B had migraineurs with history of migraine for more than ten years. Migraineurs were included in the study after taking a detailed history. Women having history of headaches other than migraine were excluded. Group C comprised of healthy women with no history of any primary headache. Known cases of diabetes, ischemic heart disease, hypertension, presence of acute or chronic inflammatory disease, pregnancy and menopause were also excluded from all groups. All subjects were non-smokers.

The subjects were asked to lie down supine for 5–10 minutes. Systolic pressures were recorded from brachial arteries of both arms using a mercury sphygmomanometer. Systolic pressures were recorded first by palpatory method and then by auscultatory method using the stethoscope. Limb with higher reading was selected as the index limb.⁶ Three

readings with interval of 5 minutes were recorded.¹⁹ Mean of the three readings was calculated.

For dorsalis pedis pressure, three fingers were placed between big toe and second toe and moved on the dorsum of foot. Pulse was located and marked (Figure-1). For posterior tibial, three fingers were placed posterior to the medial malleolus and slid upwards until the pulse was located. The pneumatic cuff was applied to the ankle above the medial malleolus (Figure-2). Cuff was inflated 30–35 mmHg above the systolic pressure. Released slowly and reading was taken as soon as pulse appeared. All four pulses were located (dorsalis pedis and posterior tibial from both feet). Limb with a higher systolic reading was selected.^{6,14} Three recordings were taken with an interval of 5 minutes each from the pulse which was best palpated. Mean of three readings was calculated. Ankle to brachial systolic pressure ratio was calculated.



Figure-1: Location of dorsalis pedis and posterior tibial artery marked on the foot



Figure-2: Recording systolic arterial pressure from the dorsalis pedis artery

Data were analysed using SPSS-17. The quantitative variables of the cases and controls were presented as Mean \pm SD and Median with inter quartile range. Statistical significance was calculated by using Kruskal Wallis ANOVA. Mann Whitney U test was used to calculate the differences between pairs of groups. Categorical variables were compared using Chi-square test and $p < 0.05$ was considered statistically significant.

RESULTS

This study was carried out on 84 women. A comparison of age, history of migraine duration in years, ankle systolic pressure, brachial systolic pressure and ankle brachial index among the three study groups is presented in Table-1 as Mean±SD and medians with interquartile range.

Table-2 presents results for ankle brachial index in the three study groups categorized as low (<0.9), borderline (0.91–0.99), and normal (1.00–1.40). No value for ABI was obtained in the high category in any of the three groups and only one case in each group had index value <0.9. However, the number of migraineurs

with borderline ABI was greater in group B (19, 67.9%) as compared to group A (16, 57.1%), whereas control group had only 7 (25%) subjects with borderline ABI. The categories in each group were compared with Chi-square test revealing statistical significance ($p=0.021$).

By comparing median ABI values among the three study groups using Kruskal Wallis ANOVA, a statistically significant difference was observed ($p=0.046$). Applying Mann Whitney U test, no statistical significance was seen between group A and B and also between group A and C. However, the comparison between Group B and C showed a statistically significant difference ($p=0.010$) (Table-3).

Table-1: Comparison of Age, migraine duration, ankle systolic pressure, brachial systolic pressure and ABI in groups

| Parameters | Group A (Migraine <10 years) | | | | Group B (Migraine >10 years) | | | | Group C (Controls) | | | |
|-----------------------------------|------------------------------|------|------|-----------|------------------------------|------|------|-----------|--------------------|------|------|-----------|
| | Median | Q1 | Q3 | Mean±SD | Median | Q1 | Q3 | Mean±SD | Median | Q1 | Q3 | Mean±SD |
| Age (Year) | 25 | 20.5 | 37.0 | 28.6±8.8 | 40.5 | 36.5 | 45.5 | 39.5±7.7 | 30.0 | 27.0 | 41.0 | 33.6±8.4 |
| Duration of migraine (Year) | 2.5 | 2.0 | 5.7 | 3.6±2.7 | 17 | 13 | 21.5 | 17.3±6.8 | - | - | - | - |
| Ankle systolic pressure (mmHg) | 109 | 103 | 121 | 112±10.4 | 111 | 105 | 116 | 112±6.61 | 111 | 104 | 115 | 111±6.6 |
| Brachial systolic pressure (mmHg) | 112 | 104 | 120 | 112±10.4 | 111 | 108 | 120 | 114±8.3 | 110 | 107 | 118 | 111±6.5 |
| Ankle brachial index | 0.99 | 0.96 | 1.01 | 0.99±0.05 | 0.99 | 0.99 | 1.02 | 0.98±0.05 | 1.01 | 0.99 | 1.02 | 1.00±0.04 |

Table-2: Comparison of ABI by categories among three study groups by using Chi-square test

| Group | Ankle Brachial Index | | | | | |
|-------|----------------------|-----|-------------------------|------|------------------|------|
| | <0.90 Low | | 0.91–0.99 Borderline | | 1–1.40 Normal | |
| | n | % | n | % | n | % |
| A | 1 | 3.6 | 16 | 57.1 | 11 | 39.3 |
| B | 1 | 3.6 | 19 | 67.9 | 8 | 28.6 |
| C | 1 | 3.6 | 7 | 25.0 | 20 | 71.4 |
| Total | 3 | 3.6 | 42 | 96.4 | 39 | 46.4 |

$\chi^2=11.57, p=0.021^*$

*Significant

Table-3: Comparison of ABI between the groups and pair-wise (n=28 each group)

| Kruskal Wallis ANOVA | | | (Mann Whitney U) | | | |
|----------------------|-----------|------------------|------------------|-------|--------|--------|
| Group | Mean rank | $\chi^2, df (p)$ | Groups | U | Z | p |
| A | 40.73 | 6.15, 2 (0.046*) | A vs B | 351.0 | -0.672 | 0.502 |
| B | 35.45 | | A vs C | 301.5 | -1.48 | 0.138 |
| C | 51.32 | | B vs C | 235.5 | -2.57 | 0.010* |

*Significant

DISCUSSION

Ankle Brachial Index, the ratio of the systolic pressures of dorsalis pedis/posterior tibial artery to that of brachial artery is a non-invasive technique used to assess the condition of the blood vessels. The group suffering from migraine for a longer time had the highest number of subjects with borderline ABI. Although the patients with history of migraine for less than 10 years were comparatively younger to the other two groups they had a significant number of subjects with borderline ABI values. Statistically significant differences were present between the migraineurs with history of longer duration of migraine and the controls. We had only one patient in each group having ABI in low category. Previously

considered normal, the borderline criteria is relatively new and the subjects are predisposed to a higher risk of atherosclerosis as compared to normal subjects.⁷

Our findings closely matched with those of Jurno *et al*²⁰. They used digital sphygmomanometer to record systolic pressures and observed lower ABI in migraineurs with a significant difference from controls. Mean ABI for both groups were in borderline range.

Pulse wave velocity and ABI were measured by Ikeda *et al*²¹ in migraineurs and controls with mean age higher than our subjects. They used oscillometric technique to determine ABI. Mean ABI in their study was 1.05±0.06 in migraineurs and 1.06±0.07 in controls. Significant differences in ABI were not observed between cases and controls of their study. Stam *et al*²² also conformed to the same findings, i.e., normal ABI with no statistically significant difference between controls and migraineurs.

CONCLUSION

The ABI in female migraineurs aged 20–50 years was in borderline range. Those with history of migraine for longer period of time have significantly lower ABI as compared to healthy females.

LIMITATIONS OF THE STUDY

Though a detailed history of the medication used by subjects for migraine was taken but the possible effects of the drugs on arterial pressure could not be studied due to insufficient evidence. Screening tests of vascular diseases are recommended for migraineurs of all ages even if the traditional risk factors are absent. Post-exercise ABI should be measured in migraineurs to see if the difference widens.

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