# GEORGIAN MEDICAL NEWS

ISSN 1512-0112

NO 4 (373) Апрель 2026

ТБИЛИСИ - NEW YORK


ЕЖЕМЕСЯЧНЫЙ НАУЧНЫЙ ЖУРНАЛ

**Медицинские новости Грузии**

საქართველოს სამედიცინო სიახლენი

**GEORGIAN MEDICAL NEWS**

Monthly Georgia-US joint scientific journal published both in electronic and paper formats of the Agency of Medical Information of the Georgian Association of Business Press. Published since 1994. Distributed in NIS, EU and USA.

**GMN: Georgian Medical News** is peer-reviewed, published monthly journal committed to promoting the science and art of medicine and the betterment of public health, published by the GMN Editorial Board since 1994. GMN carries original scientific articles on medicine, biology and pharmacy, which are of experimental, theoretical and practical character; publishes original research, reviews, commentaries, editorials, essays, medical news, and correspondence in English and Russian.

GMN is indexed in MEDLINE, SCOPUS, PubMed and VINITI Russian Academy of Sciences. The full text content is available through EBSCO databases.

**GMN: Медицинские новости Грузии -** ежемесячный рецензируемый научный журнал, издаётся Редакционной коллегией с 1994 года на русском и английском языках в целях поддержки медицинской науки и улучшения здравоохранения. В журнале публикуются оригинальные научные статьи в области медицины, биологии и фармации, статьи обзорного характера, научные сообщения, новости медицины и здравоохранения. Журнал индексируется в MEDLINE, отражён в базе данных SCOPUS, PubMed и ВИНИТИ РАН. Полнотекстовые статьи журнала доступны через БД EBSCO.

**GMN: Georgian Medical News –** საქართველოს სამედიცინო სიახლენი – არის ყოველთვიური სამეცნიერო სამედიცინო რეცენზირებადი ჟურნალი, გამოიცემა 1994 წლიდან, წარმოადგენს სარედაქციო კოლეგიისა და აშშ-ის მეცნიერების, განათლების, ინდუსტრიის, ხელოვნებისა და ბუნებისმეტყველების საერთაშორისო აკადემიის ერთობლივ გამოცემას. GMN-ში რუსულ და ინგლისურ ენებზე ქვეყნდება ექსპერიმენტული, თეორიული და პრაქტიკული ხასიათის ორიგინალური სამეცნიერო სტატიები მედიცინის, ბიოლოგიისა და ფარმაციის სფეროში, მიმოხილვითი ხასიათის სტატიები.

ჟურნალი ინდექსირებულია MEDLINE-ის საერთაშორისო სისტემაში, ასახულია SCOPUS-ის, PubMed-ის და ВИНИТИ РАН-ის მონაცემთა ბაზებში. სტატიების სრული ტექსტი ხელმისაწვდომია EBSCO-ს მონაცემთა ბაზებიდან.

**WEBSITE**

www.geomednews.com

## К СВЕДЕНИЮ АВТОРОВ!

При направлении статьи в редакцию необходимо соблюдать следующие правила:

1. Статья должна быть представлена в двух экземплярах, на русском или английском языках, напечатанная через **полтора интервала на одной стороне стандартного листа с шириной левого поля в три сантиметра**. Используемый компьютерный шрифт для текста на русском и английском языках - **Times New Roman** (**Кириллица**), для текста на грузинском языке следует использовать **AcadNusx.** Размер шрифта - **12**. К рукописи, напечатанной на компьютере, должен быть приложен CD со статьей.

2. Размер статьи должен быть не менее десяти и не более двадцати страниц машинописи, включая указатель литературы и резюме на английском, русском и грузинском языках.

3. В статье должны быть освещены актуальность данного материала, методы и результаты исследования и их обсуждение.

При представлении в печать научных экспериментальных работ авторы должны указывать вид и количество экспериментальных животных, применявшиеся методы обезболивания и усыпления (в ходе острых опытов).

4. К статье должны быть приложены краткое (на полстраницы) резюме на английском, русском и грузинском языках (включающее следующие разделы: цель исследования, материал и методы, результаты и заключение) и список ключевых слов (key words).

5. Таблицы необходимо представлять в печатной форме. Фотокопии не принимаются. **Все цифровые, итоговые и процентные данные в таблицах должны соответствовать таковым в тексте статьи**. Таблицы и графики должны быть озаглавлены.

6. Фотографии должны быть контрастными, фотокопии с рентгенограмм - в позитивном изображении. Рисунки, чертежи и диаграммы следует озаглавить, пронумеровать и вставить в соответствующее место текста **в tiff формате**.

В подписях к микрофотографиям следует указывать степень увеличения через окуляр или объектив и метод окраски или импрегнации срезов.

7. Фамилии отечественных авторов приводятся в оригинальной транскрипции.

8. При оформлении и направлении статей в журнал МНГ просим авторов соблюдать правила, изложенные в «Единых требованиях к рукописям, представляемым в биомедицинские журналы», принятых Международным комитетом редакторов медицинских журналов - http://www.spinesurgery.ru/files/publish.pdf и http://www.nlm.nih.gov/bsd/uniform_requirements.html
В конце каждой оригинальной статьи приводится библиографический список. В список литературы включаются все материалы, на которые имеются ссылки в тексте. Список составляется в алфавитном порядке и нумеруется. Литературный источник приводится на языке оригинала. В списке литературы сначала приводятся работы, написанные знаками грузинского алфавита, затем кириллицей и латиницей. Ссылки на цитируемые работы в тексте статьи даются в квадратных скобках в виде номера, соответствующего номеру данной работы в списке литературы. Большинство цитированных источников должны быть за последние 5-7 лет.

9. Для получения права на публикацию статья должна иметь от руководителя работы или учреждения визу и сопроводительное отношение, написанные или напечатанные на бланке и заверенные подписью и печатью.

10. В конце статьи должны быть подписи всех авторов, полностью приведены их фамилии, имена и отчества, указаны служебный и домашний номера телефонов и адреса или иные координаты. Количество авторов (соавторов) не должно превышать пяти человек.

11. Редакция оставляет за собой право сокращать и исправлять статьи. Корректура авторам не высылается, вся работа и сверка проводится по авторскому оригиналу.

12. Недопустимо направление в редакцию работ, представленных к печати в иных издательствах или опубликованных в других изданиях.

**При нарушении указанных правил статьи не рассматриваются**.

## REQUIREMENTS

Please note, materials submitted to the Editorial Office Staff are supposed to meet the following requirements:

1. Articles must be provided with a double copy, in English or Russian languages and typed or compu-ter-printed on a single side of standard typing paper, with the left margin of **3** centimeters width, and **1.5** spacing between the lines, typeface - **Times New Roman** (**Cyrillic**), print size - **12** (referring to Georgian and Russian materials). With computer-printed texts please enclose a CD carrying the same file titled with Latin symbols.

2. Size of the article, including index and resume in English, Russian and Georgian languages must be at least 10 pages and not exceed the limit of 20 pages of typed or computer-printed text.

3. Submitted material must include a coverage of a topical subject, research methods, results, and review.

Authors of the scientific-research works must indicate the number of experimental biological species drawn in, list the employed methods of anesthetization and soporific means used during acute tests.

4. Articles must have a short (half page) abstract in English, Russian and Georgian (including the following sections: aim of study, material and methods, results and conclusions) and a list of key words.

5. Tables must be presented in an original typed or computer-printed form, instead of a photocopied version. **Numbers, totals, percentile data on the tables must coincide with those in the texts of the articles.** Tables and graphs must be headed.

6. Photographs are required to be contrasted and must be submitted with doubles. Please number each photograph with a pencil on its back, indicate author's name, title of the article (short version), and mark out its top and bottom parts. Drawings must be accurate, drafts and diagrams drawn in Indian ink (or black ink). Photocopies of the X-ray photographs must be presented in a positive image in **tiff format**.

Accurately numbered subtitles for each illustration must be listed on a separate sheet of paper. In the subtitles for the microphotographs please indicate the ocular and objective lens magnification power, method of coloring or impregnation of the microscopic sections (preparations).

7. Please indicate last names, first and middle initials of the native authors, present names and initials of the foreign authors in the transcription of the original language, enclose in parenthesis corresponding number under which the author is listed in the reference materials.

8. Please follow guidance offered to authors by The International Committee of Medical Journal Editors guidance in its Uniform Requirements for Manuscripts Submitted to Biomedical Journals publication available online at: http://www.nlm.nih.gov/bsd/uniform_requirements.html
http://www.icmje.org/urm_full.pdf
In GMN style for each work cited in the text, a bibliographic reference is given, and this is located at the end of the article under the title "References". All references cited in the text must be listed. The list of references should be arranged alphabetically and then numbered. References are numbered in the text [numbers in square brackets] and in the reference list and numbers are repeated throughout the text as needed. The bibliographic description is given in the language of publication (citations in Georgian script are followed by Cyrillic and Latin).

9. To obtain the rights of publication articles must be accompanied by a visa from the project instructor or the establishment, where the work has been performed, and a reference letter, both written or typed on a special signed form, certified by a stamp or a seal.

10. Articles must be signed by all of the authors at the end, and they must be provided with a list of full names, office and home phone numbers and addresses or other non-office locations where the authors could be reached. The number of the authors (co-authors) must not exceed the limit of 5 people.

11. Editorial Staff reserves the rights to cut down in size and correct the articles. Proof-sheets are not sent out to the authors. The entire editorial and collation work is performed according to the author's original text.

12. Sending in the works that have already been assigned to the press by other Editorial Staffs or have been printed by other publishers is not permissible.

**Articles that Fail to Meet the Aforementioned Requirements are not Assigned to be Reviewed.**

## ავტორთა საყურადღებოდ!

რედაქციაში სტატიის წარმოდგენისას საჭიროა დავიცვათ შემდეგი წესები:

1. სტატია უნდა წარმოადგინოთ 2 ცალად, რუსულ ან ინგლისურ ენებზე,დაბეჭდილი სტანდარტული ფურცლის 1 გვერდზე, 3 სმ სიგანის მარცხენა ველისა და სტრიქონებს შორის 1,5 ინტერვალის დაცვით. გამოყენებული კომპიუტერული შრიფტი რუსულ და ინგლისურენოვან ტექსტებში - **Times New Roman (Кириллица)**, ხოლო ქართულენოვან ტექსტში საჭიროა გამოვიყენოთ **AcadNusx.** შრიფტის ზომა – 12. სტატიას თან უნდა ახლდეს CD სტატიით.

2. სტატიის მოცულობა არ უნდა შეადგენდეს 10 გვერდზე ნაკლებს და 20 გვერდზე მეტს ლიტერატურის სიის და რეზიუმეების (ინგლისურ, რუსულ და ქართულ ენებზე) ჩათვლით.

3. სტატიაში საჭიროა გაშუქდეს: საკითხის აქტუალობა; კვლევის მიზანი; საკვლევი მასალა და გამოყენებული მეთოდები; მიღებული შედეგები და მათი განსჯა. ექსპერიმენტული ხასიათის სტატიების წარმოდგენისას ავტორებმა უნდა მიუთითონ საექსპერიმენტო ცხოველების სახეობა და რაოდენობა; გაუტკივარებისა და დაძინების მეთოდები (მწვავე ცდების პირობებში).

4. სტატიას თან უნდა ახლდეს რეზიუმე ინგლისურ, რუსულ და ქართულ ენებზე არანაკლებ ნახევარი გვერდის მოცულობისა (სათაურის, ავტორების, დაწესებულების მითითებით და უნდა შეიცავდეს შემდეგ განყოფილებებს: მიზანი, მასალა და მეთოდები, შედეგები და დასკვნები; ტექსტუალური ნაწილი არ უნდა იყოს 15 სტრიქონზე ნაკლები) და საკვანძო სიტყვების ჩამონათვალი (key words).

5. ცხრილები საჭიროა წარმოადგინოთ ნაბეჭდი სახით. ყველა ციფრული, შემაჯამებელი და პროცენტული მონაცემები უნდა შეესაბამებოდეს ტექსტში მოყვანილს.

6. ფოტოსურათები უნდა იყოს კონტრასტული; სურათები, ნახაზები, დიაგრამები - დასათაურებული, დანომრილი და სათანადო ადგილას ჩასმული. რენტგენოგრამების ფოტოასლები წარმოადგინეთ პოზიტიური გამოსახულებით **tiff** ფორმატში. მიკროფოტოსურათების წარწერებში საჭიროა მიუთითოთ ოკულარის ან ობიექტივის საშუალებით გადიდების ხარისხი, ანათალების შეღებვის ან იმპრეგნაციის მეთოდი და აღნიშნოთ სურათის ზედა და ქვედა ნაწილები.

7. სამამულო ავტორების გვარები სტატიაში აღინიშნება ინიციალების თანდართვით, უცხოურისა – უცხოური ტრანსკრიპციით.

8. სტატიას თან უნდა ახლდეს ავტორის მიერ გამოყენებული სამამულო და უცხოური შრომების ბიბლიოგრაფიული სია (ბოლო 5-8 წლის სიღრმით). ანბანური წყობით წარმოდგენილ ბიბლიოგრაფიულ სიაში მიუთითეთ ჯერ სამამულო, შემდეგ უცხოელი ავტორები (გვარი, ინიციალები, სტატიის სათაური, ჟურნალის დასახელება, გამოცემის ადგილი, წელი, ჟურნალის №, პირველი და ბოლო გვერდები). მონოგრაფიის შემთხვევაში მიუთითეთ გამოცემის წელი, ადგილი და გვერდების საერთო რაოდენობა. ტექსტში კვადრატულ ფჩხილებში უნდა მიუთითოთ ავტორის შესაბამისი N ლიტერატურის სიის მიხედვით. მიზანშეწონილია, რომ ციტირებული წყაროების უმეტესი ნაწილი იყოს 5-6 წლის სიღრმის.

9. სტატიას თან უნდა ახლდეს: ა) დაწესებულების ან სამეცნიერო ხელმძღვანელის წარდგინება, დამოწმებული ხელმოწერითა და ბეჭდით; ბ) დარგის სპეციალისტის დამოწმებული რეცენზია, რომელშიც მითითებული იქნება საკითხის აქტუალობა, მასალის საკმაობა, მეთოდის სანდოობა, შედეგების სამეცნიერო-პრაქტიკული მნიშვნელობა.

10. სტატიის ბოლოს საჭიროა ყველა ავტორის ხელმოწერა, რომელთა რაოდენობა არ უნდა აღემატებოდეს 5-ს.

11. რედაქცია იტოვებს უფლებას შეასწოროს სტატია. ტექსტზე მუშაობა და შეჯერება ხდება საავტორო ორიგინალის მიხედვით.

12. დაუშვებელია რედაქციაში ისეთი სტატიის წარდგენა, რომელიც დასაბეჭდად წარდგენილი იყო სხვა რედაქციაში ან გამოქვეყნებული იყო სხვა გამოცემებში.

აღნიშნული წესების დარღვევის შემთხვევაში სტატიები არ განიხილება.

*GEORGIAN MEDICAL NEWS*
*NO 4 (373) 2026*

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*GEORGIAN MEDICAL NEWS*
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# ASSESSMENT OF CARDIOVASCULAR DISEASE RISK USING ANKLE-BRACHIAL INDEX IN EMERGENCY PHYSICIANS WORKING 24-HOUR DUTIES: A CROSS-SECTIONAL STUDY

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## Abstract.

**Aim:** This study aimed to evaluate the likelihood of CVD development among emergency physicians in Khartoum State by employing the ankle-brachial index (ABI), a simple and non-invasive method for detecting peripheral arterial disease and cardiovascular risk.

**Methods:** A cross-sectional study was carried out over two months. Systolic blood pressure was measured at the brachial and ankle arteries using a handheld Doppler device, and the ankle-brachial index (ABI) was calculated. ABI values were classified as follows: <0.90 (increased cardiovascular risk), 0.91–0.99 (borderline), and ≥1.00 (normal). Data were analyzed using the Statistical Package for the Social Sciences (SPSS), version 26.0. Statistical significance was set at $p < 0.05$.

**Results:** The study included 60 emergency physicians (52% female, mean age 29 ± 3.8 years). ABI results showed 15% had high CVD risk profile (ABI < 0.90), while 36.7% were borderline, with a mean ABI of 1.01 ± 0.09. Male physicians exhibited significantly higher brachial systolic BP and lower ABI than females, indicating greater cardiovascular risk. Overall, physicians working 24-hour shifts demonstrated a distribution of ABI values suggestive of increased cardiovascular risk.

**Conclusion:** Emergency physicians working 24-hour shifts demonstrated lower ankle-brachial index (ABI) values and elevated systolic blood pressure, particularly among male physicians, suggesting a heightened risk of cardiovascular complications. These findings reflect the importance of early screening and the implementation of targeted preventive measures to mitigate occupational health risks in this population.

**Key words.** Emergency physicians, cardiovascular disease, ankle-brachial index, systolic blood pressure.

## Introduction.

Stress and long working hours are common during medical training and clinical practice and they are associated with increased risk of cardiovascular diseases (CVDs) [1]. Emergency situations that require extended working shifts for more than eight hours frequently happen in medical field and have been of much concern due to their adverse effects on doctor's health, training and patient care [2, 3].

Global studies among resident physicians have demonstrated that long working hours are linked to poor physical and mental health outcomes [4]. However, the exact mechanism that explains this relation needs further investigation. For example, a two-month cross-sectional study in India found that the incidence of cardiovascular diseases (CVD) and stroke was more than doubled among physicians in India, compared to the general population. This risk was explained by stress, dyslipidemia and low-grade inflammation [5]. Another explanation could be a disruption of circadian rhythm and sleep cycle that are associated with workload and stress [6]. On the other hand, debate continues among scientific experts regarding the degree and nature of working hours and health risks, especially with the increasing evidence of a link to heart disease [7].

To our knowledge, there have been no studies conducted in Sudan that examine the association between long duty hours and physicians' cardiovascular health of physicians. This is of concern, especially as there are repeated reports of cardiac deaths among young doctors during or immediately after long duty periods [8].

In Khartoum State, several indicators reflect the intense workload and stress faced by physicians, particularly those performing continuous 24-hour duties. One such indicator is the doctor-to-population ratio, which is recommended to be at least 1:1,000 [9]. According to the World Bank (2021), Sudan faces a critical shortage of healthcare workers, with only 0.2 physicians and 0.3 nurses per 1,000 population as of 2019, far below the WHO recommended threshold of 4.5 healthcare workers per 1,000 population. This shortage is significantly lower than the average in low- and middle-income countries, which have 1.3 physicians and 2.6 nurses per 1,000 population, respectively [10].

According to the annual statistical report of the federal ministry of health of Sudan in 2018, the total number of populations in Khartoum state was 7,993,900 and the total number of physicians in the state was 2040, in average of 28.5 physicians per 100,000 population (Including specialists, registrars, medical officers, and house officers) [11]. Another measure that can reflect the workload and stress on the physicians is the number of patients that are presented to the Emergency room per year. Khartoum state receives about 3 million patients per year skewed toward the large tertiary level and teaching hospitals in the state [11].

The ABI is calculated as the ratio of systolic blood pressure measured at the ankle to that at the brachial artery [12,13]. It was initially developed to detect peripheral artery disease (PAD), but then became recognized as a broader marker of systemic atherosclerosis and cardiovascular risk [14]. Most studies use a Doppler device to calculate ABI, with a value below 0.90 considered diagnostic for PAD [15]. Several researches have shown that low ABI values are strongly associated with multiple cardiovascular risk factors [14,16,17]. These include hypertension, diabetes mellitus, dyslipidemia, smoking, and emerging biomarkers such as C-reactive protein, interleukin-6, homocysteine, and chronic kidney disease [18]. The ABI can

serve as a predictive marker not only in patients with established CVD but also in asymptomatic individuals [19]. Studies have shown that the prevalence of coronary artery disease among PAD patients is high, reflecting the systemic nature of atherosclerosis [20]. In contrast, there have been relatively few studies on the significance of high ABI values (above 1.40), which could be indicative of vascular stiffening and calcification and have been linked with risks of stroke and congestive heart failure, especially in male patients with diabetes or hypertension [21].

The purpose of this study is to examine the risk of cardiovascular 24-hour duties in Khartoum State of Sudan, an understudied worker, despite reports of sudden deaths during or after such long duties [8]. The study utilized the ankle-brachial index (ABI), a simple and non-invasive screening tool, to assess potential atherosclerotic burden and estimate the risk of future cardiovascular events.

## Materials and Methods.

### Study Design:

A cross-sectional analytical study was conducted among 60 Emergency Medicine Registrars working 24-hour duties in the emergency departments of three tertiary level hospitals in Khartoum State: Ibrahim Malik Teaching Hospital, Bahry Teaching Hospital, and Omdurman Teaching Hospital. Data was collected from December 2021 to January 2022. Ethical clearance was obtained from the Research Ethics Committee of Al-Neelain University (Number: REC-PH-32/2021) and approval letters were obtained from the State Ministry of Health (SMoH). Written informed consent was obtained from all participants, and all data was used solely for research purposes.

### Participants:

The study sample included 60 adult Emergency Medicine registrars actively working 24-hour shifts in the emergency departments of tertiary level hospitals in Khartoum State. Inclusion criteria required participants to be current Emergency Medicine registrars of either sex. Exclusion criteria included registrars from other specialties, specialists, medical officers, house officers, nurses, smokers, individuals with a prior diagnosis of cardiovascular disease or chronic medical illness, those receiving anti-hypertensive medications, and those who had been enrolled in the Emergency Medicine training program for less than six months.

### Methods:

A data collection form was used to gather information on demographic characteristics, medical history, list of medication and usage and outcomes of participant assessments. Measurements were performed according to a standardized protocol to maintain accuracy and ensure consistency in data collection, including the measurement of systolic blood pressure at both the brachial and ankle arteries.

### Measurement of Systolic Blood Pressure at Brachial and Ankle Sites:

Systolic blood pressure was measured using a handheld Doppler device at the brachial arteries and at both the dorsalis pedis and posterior tibial arteries. All measurements were performed under standardized conditions. Participants were allowed to rest for 5–10 minutes in a supine position prior to measurements. A constant room temperature was maintained throughout the procedure, and appropriately sized blood pressure cuffs were used for both the upper arm and the lower limb (just above the ankle) to ensure accuracy and consistency of measurements.

### Ankle-Brachial Index calculation:

The ankle-brachial index (ABI) is a validated measure for assessing peripheral vascular health and cardiovascular risk. It was calculated for each participant using the following formula: (ABI = Ankle systolic blood pressure (highest) / Brachial systolic blood pressure (highest). [22] An ABI value of less than 0.90 was considered indicative of increased cardiovascular risk, while values between 0.91 and 0.99 were classified as borderline. Mean arterial blood pressure was determined by adding one-third of the difference between systolic and diastolic blood pressure (pulse pressure) to the diastolic blood pressure.

### Statistical Analysis and Interpretation of the Test Results:

Data was analyzed using the Statistical Package for the Social Sciences (SPSS), version 26.0. Descriptive statistics were used to summarize the data, and categorical variables were presented in frequency tables. Normality was assessed using Shapiro–Wilk test; non-normally distributed variables were analyzed using Mann–Whitney U test. ABI results were interpreted by classifying the values into three categories: increased risk of CVD (ABI $< 0.90$), borderline (ABI between 0.91 and 0.99), and normal (ABI $\geq 1.00$), based on standard cutoff points.

## Results.

Table 1 displays the age and sex distribution of the 60 Emergency Medicine registrars included in the study. The majority of participants (70%) were between 25 and 30 years of age, followed by 23.3% in the 31–35 age group, and 6.7% in the 36–40 age group. The overall sample included 29 males (48.3%) and 31 females (51.7%), with a similar distribution across age categories.

Table 2 presents the mean systolic blood pressure (SBP), diastolic blood pressure (DBP), and mean arterial pressure (MAP) in both the brachial and ankle regions among male and female participants. Males showed higher mean systolic (120.3 mmHg) and arterial pressures (93.3 mmHg) compared to females (114.5 mmHg and 88.5 mmHg, respectively). These findings suggest that male participants may have a slightly higher cardiovascular risk profile compared to female participants. Statistical analysis revealed a statistically significant difference in brachial systolic BP ($p \approx 0.03$), with males showing higher values. However, the differences in diastolic BP, mean arterial pressure, and ankle systolic BP did not reach statistical significance ($p > 0.05$), indicating similar values across genders in these measures.

The Kolmogorov-Smirnov and Shapiro-Wilk tests of normality, along with the Levene test of homogeneity, indicated that systolic blood pressure values were not normally distributed in both male and female groups ($p < 0.05$). Therefore, the Mann-Whitney U test was applied and showed no statistically significant difference in systolic blood pressure between males and females ($p = 0.052$). However, the p-value was close to the threshold for statistical significance, suggesting a possible trend

***Table 1.*** *Age and Gender Distribution of Study Participants.*

| Age (year) | Frequency | | Total | Percent |
|---|---|---|---|---|
| | Male | Female | | |
| 25-30 | 20 | 22 | 42 | 70% |
| 31-35 | 6 | 8 | 14 | 23.3% |
| 36-40 | 3 | 1 | 4 | 6.7% |
| Total | 29 | 31 | 60 | 100% |

***Table 2.*** *Descriptive and Comparative Statistics of Brachial and Ankle Blood Pressure Measurements by Gender Among Emergency Participants.*

| Gender | N | Mean Systolic Brachial BP (mmHg) | Mean Diastolic Brachial BP (mmHg) | Mean Arterial Pressure Brachial (mmHg) |
|---|---|---|---|---|
| Male | 29 | 120.3±11.3 | 79.8±21.6 | 93.3±21.6 |
| Female | 31 | 114.5±10.7 | 75.5±22.3 | 88.5±22.3 |
| Gender | N | Mean Systolic Ankle BP (mmHg) | Mean Diastolic Ankle BP (mmHg) | Mean Arterial Pressure Ankle (mmHg) |
| Male | 29 | 118.1±16.1 | 78.3±21.6 | 91.6±21.6 |
| Female | 31 | 119.5±16.7 | 78.9±22.3 | 92.4±22.3 |
| Total | 60 | | | |

***Table 3.*** *Comparison of Systolic Blood Pressure Categories Between Male and Female Participants.*

| Variable | N | Normal (<120 mmHg) | Prehypertension (120- 139 mmHg) | Stage1 hypertension (140-159 mmHg) | Stage2 hypertension (>160 mmHg) | Mean Rank | P-value |
|---|---|---|---|---|---|---|---|
| Male | 29 | 18 (62.1%) | 8 (27.6%) | 3 (10.3%) | 0 | 34.98 | 0.052 |
| Female | 31 | 25 (80.6%) | 5 (16.1%) | 1 (3.2%) | 0 | 26.31 | |
| total | 60 | 43 | 13 | 4 | 0 | | |
| percent | N | 71% | 21.6% | 7.4% | | | |

***Table 4.*** *Distribution of Ankle-Brachial Index Classifications Among the Study Participants.*

| ABI Classification | Frequency (n) | Percentage (%) |
|---|---|---|
| Increased risk of CVD (≤0.9) | 9 | 15% |
| Borderline (0.91–1.00) | 22 | 36.7% |
| Normal (1.01–1.4) | 29 | 48.3% |
| Total | 60 | 100% |

***Table 5.*** *Comparison of Ankle-Brachial Index (ABI) Classifications and Mean Values Between Male and Female Participants.*

| Group | Normal (≥1.00) | Borderline (0.91- 0.99) | High risk (≤ 0.90) | Mean ± SD | P-Value |
|---|---|---|---|---|---|
| Male | 11(37.9%) | 12(41.4%) | 6(20.7%) | 0.99±0.098 | 0.032 |
| Female | 18(58.1%) | 10 (32.3%) | 3(9.7%) | 1.04±0.095 | |
| Total | 29 (48.3%) | 22 (36.7%) | 9 (15%) | 1.01±0.094 | |

toward higher systolic blood pressure among male participants (Table 3).

Table 4 shows the frequency and percentage of participants classified by Ankle-Brachial Index (ABI) categories, indicating their cardiovascular disease (CVD) risk levels. Notably, approximately 51.7% of participants fall into the 'Increased risk of CVD' (≤0.9) and 'Borderline' (0.91–1.00) categories, indicating a substantial proportion at risk for cardiovascular disease."

Table 5 compares the distribution of ABI classifications and mean ABI values between male and female participants. The Kolmogorov-Smirnov and Shapiro-Wilk tests confirm that ABI is normally distributed for both groups ($p > 0.05$). Levene's test of homogeneity also showed equal variance across both genders. Comparison between males and females showed a statistically significant difference in ABI mean values between males (0.99 ± 0.098) and females (1.04 ± 0.095), with a p-value of 0.032, indicating gender-based variability in cardiovascular risk. The comparison was found to be in favor of females, suggesting that males have a higher risk for cardiovascular diseases.

## Discussion.

The Ankle-Brachial Index (ABI) is a well-established, non-invasive tool for assessing peripheral arterial disease and serves as an indicator for systemic atherosclerosis and cardiovascular disease (CVD) risk stratification, particularly when ABI values are below 0.9, which are associated with an increased incidence of coronary events [23]. A low ABI is also known to be associated with several emerging cardiovascular risk factors, such as C-reactive protein, interleukin-6, homocysteine, and chronic kidney disease, in addition to traditional risk factors like hypertension, diabetes mellitus, dyslipidemia, and smoking history [24,25]. The present study assessed brachial and ankle blood pressure parameters among the participants. Males consistently exhibited higher mean brachial systolic blood pressure (SBP) (120.3 ± 11.3 mmHg) compared to females

(114.5 ± 10.7 mmHg), with this difference reaching statistical significance ($p \approx 0.03$). However, the differences in diastolic blood pressure, mean arterial pressure, and ankle systolic blood pressure between males and females were not statistically significant ($p > 0.05$). These findings suggest that while brachial SBP was notably higher in males, other blood pressure parameters did not differ significantly, though the overall pattern still reflects a trend toward a higher cardiovascular risk profile in males, which complements the ABI findings. Similar patterns of higher blood pressure in males have been reported in other occupational health studies, emphasizing the gender-based vulnerability to elevated cardiovascular risk factors [26,27].

The present study utilized ABI to evaluate the cardiovascular risk profile of emergency physicians routinely working 24-hour shifts. Our findings suggest that prolonged 24-hour duties in the emergency setting may be associated with adverse cardiovascular profiles. Specifically, 15% of the study participants were found to have a low ABI ($\leq 0.9$), which could be associated with high CVD risk profile, while an additional 36.7% were classified as borderline (0.91–1.00). These proportions underscore a considerable burden of subclinical atherosclerosis among this occupational group. Chronic occupational stress may contribute to autonomic imbalance, increased sympathetic tone, and endothelial dysfunction, which could be the early contributors to atherosclerosis. Our findings are supported by a study conducted in China, which found an elevated risk of subclinical atherosclerosis among shift workers compared to day workers [28]. However, a community-based study among African Americans reported no significant association between occupational factors, such as prolonged standing, and changes in ABI over time, suggesting that work-related exposures alone may not sufficiently contribute to lower limb atherosclerosis [29].

Moreover, gender-specific analysis demonstrated that male physicians had significantly lower mean ABI values compared to their female counterparts, suggesting a higher cardiovascular risk profile in males. This finding is consistent with the available epidemiological data that generally demonstrate higher prevalence of CVD and lower mean ABI values in men compared to women [30], which may be further intensified by lifestyle and workplace stress associated with emergency medical personnel [31].

In the current study, classifying the ABI showed that a significant number of participants are in the borderline and low ABI groups, suggesting strong association with a higher risk of heart disease within the cohort. Although our results were comparable to the findings reported in the literature [32], the lack of a matched control group precludes causal inferences.

The relatively high proportion of low ABI in this young population should be interpreted with caution. While the measurements were taken under controlled conditions, operator device-related limitations, and short-term physiological effects that include stress-induced vasoconstriction, may have influenced the blood pressure readings. Therefore, overestimation from measurement cannot be ruled out as measurement-related errors are possible. However, since 24-hour shift-working emergency physicians are exposed to high levels of stress, this may increase the risk of heart disease. Moreover, our results are consistent with an earlier cross-sectional study that reported more than double the risk of developing cardiovascular disease and stroke among physicians compared to the general population, with a higher risk observed among males (relative risk 2.38 in men versus 1.78 in women) [33]. Collectively, these observations highlight the occupational health challenges faced by emergency medical personnel and suggest a potential contribution to early vascular changes and an increased burden of cardiovascular disease [34].

## Limitations.

The main limitation of this study is the small sample size which may affect the generalizability of the results and the possibility of conducting subgroup analyses. Further, lack of an age-matched control group restricts the ability to make reliable comparisons, and therefore, the results should be viewed with caution. Furthermore, other cardiovascular risk factors, such as detailed smoking history, body mass index, blood cholesterol, and family history were not measured, which may influence the results. Additionally, while the ABI was measured in a standardized manner, there may be some degree of measurement variability due to operator problems, device performance, or physiological variability. Finally, the cross-sectional nature of the study makes it impossible to establish any causal relationship.

## Conclusion.

The Ankle-Brachial Index (ABI) of emergency doctors who are on 24-hour shifts showed significantly lower levels, indicating strong association with higher risk of developing cardiovascular diseases. The elevated systolic blood pressure and reduced ABI in male physicians suggest that they may have greater cardiovascular risk than women physicians. This study highlights the possibility of co-existence of vascular dysfunction and elevated blood pressure among this population group, indicating the importance of cardiovascular risk profile assessment among health care workers with extended work hours.

## Financial support and sponsorship.

Nil.

## Conflict of Interest.

The author declares no conflict of interest.

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