



**PREVALENCE AND COINCIDENCE OF HYPERTENSION AND ORTHOSTATIC
HYPOTENSION IN PREAND CENTENARIANS AND THEIR EFFECT ON
MORTALITY: PRELIMINARY RESULTS**

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Abstract.

Objective. To estimate the prevalence and impact on mortality of arterial hypertension (HTN) and orthostatic hypotension (OH) in centenarians (95 years and older). Design and methods. The study participants were 82 super-long-livers aged 95 years and older (minimum age of 95 years, maximum 105 years), who underwent a comprehensive geriatric assessment at home by a multidisciplinary team (geriatrician, nurse and social worker). The following prospective observation lasted for three years (36 months).

Results.

Past medical history of HTN was noted in 78%. The mean systolic blood pressure (SBP) in the supine position was $151 \pm 27,9$ mm Hg (100–216 mm Hg), and the diastolic blood pressure (DBP) $74 \pm 12,8$ mm Hg (44–197 mm Hg). OH was detected in 31% of 61 long-livers who was able to perform an orthostatic test. The presence of OH was not associated with the higher intake of antihypertensive drugs. Within three years, 44 study participants died. The level of blood pressure (BP), history of HTN, and the presence of OH did not affect mortality ($p > 0,05$).

Conclusions. Centenarians have a wide range of SBP and DBP, high prevalence of HTN and OH. BP level, presence of HTN and OH did not affect mortality over 3 year period. Further investigation is needed to understand better the health status of long-livers and factors affecting the prognosis.

Key words: geriatrics, centenarians, orthostatic hypotension, hypertension

**РАСПРОСТРАНЕННОСТЬ АРТЕРИАЛЬНОЙ ГИПЕРТЕНЗИИ И
ОРТОСТАТИЧЕСКОЙ ГИПОТОНИИ У СУПЕРДОЛГОЖИТЕЛЕЙ:
ПРЕДВАРИТЕЛЬНЫЕ РЕЗУЛЬТАТЫ**

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Резюме



Цель исследования — оценить распространенность и влияние на смертность артериальной гипертензии (АГ) и ортостатической гипотонии (ОГ) у супердолгожителей (95 лет и старше).

Материалы и методы. Участниками исследования стали 82 супердолго-жителя в возрасте от 95 лет и старше (минимальный возраст 95 лет, максимальный — 105 лет), которым на дому была выполнена комплексная гериатрическая оценка мультидисциплинарной командой (врач-гериатр, медицинская сестра и социальный работник). Проспективное наблюдение составило 3 года (36 месяцев).

Результаты: Анамнез АГ отмечено у 78%. Среднее систолическое артериальное давление (САД) в положении лежа составило $151 \pm 27,9$ мм рт. ст. (от 100 до 216 мм рт. ст.), а диастолическое артериальное давление (ДАД) $74 \pm 12,8$ мм рт. ст. (от 44 до 197 мм рт. ст.). ОГ выявлена у 31% из 61 долгожителя, выполнившего ортостатическую пробу. Наличие ОГ не было ассоциировано с большим приемом антигипертензивных препаратов. В течение 3 лет умерли 44 участника исследования. Уровень артериального давления (АД), анамнез АГ и наличие ОГ не влияли на смертность ($p > 0,05$). **Выводы:** У супердолгожителей выявляются широкий диапазон САД и ДАД, высокая распространенность АГ и ОГ. Уровень АД, наличие АГ и ОГ не влияли на смертность в течение 3 лет. Необходимо проведение дополнительных исследований для лучшего понимания состояния здоровья долгожителей и факторов, влияющих на прогноз.

Ключевые слова: гериатрия, долгожители, ортостатическая гипотония, артериальная гипертензия.

Relevance of the Topic

Arterial hypertension (AH) is one of the most widespread diseases, reducing life expectancy and impairing quality of life. Its global prevalence increased from 600 million in 1980 to 1 billion in 2008, which is associated both with population growth and increased life expectancy [1]. The prevalence of AH rises with age. According to a meta-analysis of national databases from the United Kingdom (2006), Canada (2007–2010), and the United States of America (2007–2009), the prevalence of AH among the elderly (aged 60–80 years) is on average twice as high as in middle-aged individuals (40–59 years), ranging from 53.2% to 63.7% in the older age group and from 18.4% to 31.1% in the middle-aged group [2].

The prevalence of orthostatic hypotension (OH) also increases with age and is observed in 23% of people over 60 years old [3]. OH may explain the phenomenon of blood pressure (BP) variability in elderly patients and is обусловлена high arterial stiffness, impaired baroreflex function, and decreased renal function [4]. Studies have shown that the presence of OH is an independent unfavorable prognostic factor for the development of cardiovascular complications, cognitive impairment and dementia, decline in functional status, loss of autonomy, and increased all-cause mortality [5]. OH is often associated with AH [6]. Most studies addressing AH and OH have not included patients from the long-lived population (95 years and older).

The aim of our study was to assess the prevalence of arterial hypertension (AH) and orthostatic hypotension (OH) among individuals approaching or exceeding the age of 100 years (95 years and older), as well as to evaluate their impact on survival during a 3-year prospective follow-up.



Materials and Methods

Informed consent for participation in the examination could be signed by the long-lived individual or by a relative/guardian. Home visits to the long-lived participants were conducted in the presence of an assigned social worker. The study included 82 long-lived individuals aged 95 years and older (mean age 98 years; minimum 95 years, maximum 105 years; standard deviation (SD) 1.9), of whom 87.8% were women (Table 1).

Participants were examined at home by a mobile geriatric team consisting of a geriatrician, a nurse, and a social worker, in the presence of relatives/guardians and/or caregivers. During the visit, the physician performed a physical examination, including measurement of blood pressure (BP) and heart rate. BP was measured using the auscultatory method with a mechanical sphygmomanometer that had undergone metrological certification in accordance with current regulations.

Measurements were performed in the supine position (in participants with severely limited physical activity who were bedridden) or in the sitting position, and then at 1 and 3 minutes after standing. Orthostatic hypotension (OH) was defined as a decrease in systolic BP (SBP) of 20 mmHg or more and/or diastolic BP (DBP) of 10 mmHg or more within 3 minutes after standing [7].

A history of arterial hypertension (AH) was verified using available medical documentation. Information on current medication use was collected by interviewing the long-lived individuals themselves, their relatives, caregivers, and social workers who assisted with obtaining medications. Information on vital status at 3 years was obtained through telephone contact with the participants, relatives/guardians, or by inquiry to the relevant social service center.

Statistical analysis was performed using GraphPad Prism Version 8.1.1. Results are presented as mean values (\pm standard deviation, $M \pm SD$). Categorical variables were compared using the χ^2 (chi-square) test. Survival was assessed using Kaplan–Meier survival curve analysis. Differences were considered statistically significant at $p < 0.05$.

Prevalence of arterial hypertension (AH).

A history of AH was identified in 64 of the 82 study participants (78%). Among those examined, 53 individuals (72.8%) were receiving antihypertensive therapy at the time of assessment. Eight participants (14%) were on combination antihypertensive therapy (three or more drugs), while 27 individuals (42.2%) were taking only one antihypertensive agent. Angiotensin-converting enzyme inhibitors and beta-blockers were the most commonly used drug classes, with usage rates of 35.9% and 32.8%, respectively. Medications from other classes were used less frequently by the elderly patients: calcium channel blockers in 23% of cases and diuretics in 20%. None of the participants received centrally acting antihypertensive agents and/or alpha-adrenergic blockers.

The mean systolic blood pressure (SBP) was 151.4 ± 27.9 mmHg, and the mean diastolic blood pressure (DBP) was 74 ± 12 mmHg (Table 2). At the time of examination, 30% of participants had SBP below 140 mmHg, while 17.8% had SBP above 180 mmHg.



The orthostatic test was performed in 61 long-lived individuals (14 refused, and 7 were unable to assume an upright position). The mean decrease in SBP and DBP was 8.5 ± 17.3 mmHg (maximum decrease 50 mmHg) and -0.7 ± 11.5 mmHg (maximum decrease 36 mmHg), respectively. Orthostatic hypotension (OH) was identified in 19 participants (31.1%).

No differences in the prevalence of OH were found between individuals with and without AH: OH was observed in 15 long-lived participants (34.1%) with AH and in 4 (23.5%) without AH ($p > 0.54$). The number of antihypertensive drugs taken by participants with and without OH did not differ significantly: 1.6 ± 1.1 versus 1.1 ± 1.1 , respectively ($p = 0.08$).

After 3 years, data on vital status were obtained for 69 participants: 25 long-lived individuals (36.2%) were alive and 44 (63.8%) had died. Among survivors, SBP and DBP at baseline were 156.8 ± 24.7 mmHg and 78.6 ± 13.4 mmHg, respectively; AH was present in 72% and OH in 31.6%. Among those who died, AH was present in 84.1% and OH in 32.3%, while baseline SBP and DBP were 145.9 ± 25.2 mmHg and 72.2 ± 13.9 mmHg, respectively.

Kaplan–Meier survival analysis did not reveal an association between mortality and SBP or DBP levels, or the presence of AH or OH.

Discussion: The number of people reaching the age of 90–100 years is growing progressively every year. According to foreign publications, approximately 15% of women and 12% of men born in 1950 will live to be 90 years old, and more than 50% of those born in 2000 will be able to celebrate their 100th birthday [8]. The increase in life expectancy is explained primarily by improved quality of medical care. At the same time, it is known that in people who live to such an advanced age, the development of age-associated diseases does not occur or occurs significantly later in life [11]. This phenomenon is sometimes called "negligible aging" [10]. Another feature of very elderly patients is that traditional risk factors (hyperlipidemia, hyperglycemia) may not affect life prognosis, or the relationship with them may be inverse compared to younger people (for example, high total cholesterol is associated with lower mortality in people 85 years and older) [12, 13]. A J-shaped relationship has been described for BP level and the risk of death in elderly patients; studies conducted in the USA (war veterans over 80 years old) and Europe (INVEST) demonstrated that in groups with SBP above 139 mmHg and DBP above 89 mmHg, survival was higher than in groups with more stringent BP control [14, 15]. In our study, a history of hypertension did not affect 3-year survival. We also found no effect of OH on survival, unlike the Honolulu Heart Program study, which noted an increase in mortality in men aged 71 to 93 years with OH [5]. These differences in results may be explained by the older age of the patients included in our study, as well as the relatively small proportion of men in our sample ($n = 10$, 12.2%). Supercentenarians have not been included in most multicenter studies investigating modifiable risk factors affecting survival. It is currently known that hypertension and OH are common in this age group. International studies have demonstrated that some known risk factors cannot be used for this age group [12, 13]. Due to the resulting difficulty in applying standard prognostic factors and the uniqueness of a cohort of centenarians, further research is needed to develop algorithms for a personalized approach.

Conclusion



Supercentenarians exhibit a wide range of systolic and diastolic blood pressure, and a high prevalence of hypertension and OH. According to our study, blood pressure level, the presence of hypertension and OH do not affect mortality in the group of supercentenarians over 3 years. Further research is needed to better understand the health status of centenarians and the factors influencing prognosis.

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