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Effect of Age on Resting Blood Pressure in Pregnancy

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Abstract

Pregnancy is a physiological condition associated with profound adaptive changes in the maternal hemodynamics and cardiovascular system. Autonomic nervous system plays a central role in this adaptation to the various needs of pregnancy. Several studies suggest that there are evidences of an age-related increase of cardiovascular sympathetic nervous system activity and a reduction of cardiac parasympathetic nervous system activity. Older age is associated with a gradual loss of vascular compliance, which subsequently leads to a higher afterload. Thus, increased sympathetic activity with maternal age, decreased baroreceptor sensitivity, and loss of vascular compliance all together contributes to increase in blood pressure. The study was conducted among 225 pregnant womenfrom 7 weeks of gestation and they were divided in different age groups (18–23 years, 24–29 years, 30–35 years). Older maternal age was associated with higher blood pressure having the mean systolic blood pressure 102.90 ± 11.95, 103.23 ± 12.58, 113.2 ± 12.53 mm Hg and diastolic blood pressure 63.90 ± 9.20, 65.78, 71.33 and mmHg respectively in different age groups. Women aged 30–35 years had the highest blood pressure, but the steepest increase was observed in those aged 35 years. Thus, changes in sympatho-adrenal function with advancing age may have a number of important physiological and pathophysiological consequences for human health and may lead to gestational hypertensive disorders.

Keywords: Sympathetic nervous system; Vascular compliance; Gestational hypertensive disorders.

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Introduction

Pregnancy is a physiological condition associated with profound adaptive changes in the maternal hemodynamics and cardiovascular system. Autonomic nervous system plays a central role in this adaptation to the various needs of pregnancy.[1]

Over the past three decades the changes in sympathoadrenal function that occur with age in healthy adult humans have been systematically studied using a combination of neurochemical, neurophysiological and haemodynamic experimental approaches. The available experimental evidence indicates that tonic whole-

body sympathetic nervous system (SNS) activity increases with age. The elevations in SNS activity appear to be region specific mainly targeting skeletal muscle and the gut.[2]

Both arterial and cardiopulmonary baroreflexes tonically inhibit central sympathetic nervous system outflow in humans.[3] With advancing age, this tonic inhibition lessens thus allowing progressively greater levels of sympathetic nervous system activity to peripheral tissues.[4]

Reduced neuronal reuptake or systemic plasma clearance of noradrenaline, both of which have been reported to occur with age would result in greaterplasma noradrenaline (PNA) concentrations in response to a particular stress-evoked increase in sympathetic nervous systemactivity.[5] Thus, sympathetic nervous system tone of the heart is increased, although this appears to be due to reduced neuronal reuptake of noradrenaline (norepinephrine).[6]

It was suggested that there is evidence of an age-related increase of cardiovascular sympathetic nervous system activity and a reduction of cardiac parasympathetic nervous system activity. These findings are consistent with the hypothesis that there is sympathetic nervous system and parasympathetic nervous system compensation of cardiovascular function in response to an age-related decrease in baroreceptor sensitivity.[7]

According to some studies the differences in blood pressure levels between younger and older women might be part of the underlying mechanism explaining the association between advanced maternal age and hypertensive complications in pregnancy.[8–11] A different process occurs with ageing. Older age is associated with a gradual loss of vascular compliance, which subsequently leads to a higher afterload.[12]

These changes in sympathoadrenal function with advancing age may have a number of important physiological and pathophysiological consequences for human health and disease. Differences in hemodynamic adaptations related to pregnancy and ageing might be associated with differences in blood pressure levels during pregnancy.[13]

Therefore, we assessed in a population-based prospective cohort study among 225 pregnant women, the associations of maternal age with systolic and diastolic blood pressure in first trimester of pregnancy and may lead to the development of gestational hypertensive disorders.

Material and Methods

The study was conducted in the Department of Physiology, Uttar Pradesh University of Medical Sciences (UPUMS), Saifai, Etawah, India, in association with Department of Obstetrics and Gynaecology. After clearance from institutional ethical committee, informed written consent from each participant.The pregnant females between age of 18 to 35 years in first trimesters reporting to the Out-Patient Department (OPD) of Obstetrics and Gynaecology were included in the study.

A detailed history was taken from each participant and subjects having multiple pregnancy, history of smoking, subjects taking drugs such as hypnotics or autonomic blockers, and previous history of hypertension, cardiovascular disease, diabetes mellitus, renal disease, obesity, liver diseases, thyrotoxicosis; were excluded from the study'

Patients were divided into three groups. 18–23 years, 24–29 years, and 30 to 35 years. The subjects were requested to sit in peace for 10 minutes. After 10 minutes of rest, baseline systolic and diastolicblood pressure was recorded by auscultatory method using mercurial sphygmomanometer.

Results

In total 225 pregnant women were enrolled during first trimester of pregnancy. For the present study, we included 132 patients in 18–23 years, 78 patients in 24–29 years, 15 patients in 30–35 years of age. Older maternal age was associated with higher blood pressure having the mean systolic blood pressure 102.90, 103.23, 113.2 and diastolic blood pressure 63.90, 65.78, 71.33 and mmHg respectively in different age groups (Table 1).

Table 1: Variation in blood pressure among different age groups.

Trimester	Age(years)	No. of patients	Mean Systolic Blood pressure (mmHg)	Mean Diastolic Blood pressure (mmHg)
1st	18–23	132	102.90 ± 11.95	63.90 ± 9.20
1st	24–29	78	103.23 ± 12.58	65.78 ± 10.92
1st	30–35	15	113.2 ± 12.53	71.33 ± 9.17

Discussion

As observed in the study there is an increase in both resting systolic and diastolic blood pressure in different age groups in first trimesters. In the analyses, we used maternal age as continuous variable and categorized in 3 groups: 132 patients in 18–23 years, 78 patients in 24–29 years and 15 patients in 30–35 years of age. A positive correlation is observed between maternal age and systolic and diastolic blood pressure in first trimester.

According to Romy Gaillard *et al.* (2011), available experimental evidence indicates that tonic whole-body sympathetic nervous system (SNS) activity increases with age.[2] Reduced neuronal reuptake or systemic plasma clearance of noradrenaline, both of which have been reported to occur with age would result in greater plasma noradrenaline (PNA) concentrations in response to a particular stress-evoked increase in sympathetic nervous system activity.[5]

Pfeifer MA *et al*. (1983) also suggested that there was evidence of an age-related increase of cardiovascular sympathetic nervous system activity and a reduction of cardiac parasympathetic nervous system activity. Normal baroreceptor sensitivity leads to increased parasympathetic activity and decreased sympathetic tone in response to increased blood pressure. Decreased baroreceptor sensitivity with age may be contribute to decreased parasympathetic activity and unopposed sympathetic activity (Fig. 1). These findings are consistent with the hypothesis that there is sympathetic nervous system and parasympathetic nervous system compensation of cardiovascular function in response to an age-related decrease in baroreceptor sensitivity.[7]

The mechanisms explaining the differences of age effect on systolic and diastolic blood pressure are not known. It has been suggested that with older age the vascular compliance declines, leading to a higher afterload.[12] This is contradictory to the hemodynamic adaptation during pregnancy, in which the afterload declines. Differences in blood pressure levels between younger and older women might be part of the underlying mechanism explaining the association between advanced maternal age and hypertensive complications in pregnancy.[13]

Conclusion

Study carried out is of interest from an etiological perspective rather than from an individual clinical perspective.Thus,increased sympathetic activity with maternal age, decreased baroreceptor sensitivity and decreased compliance all together contributes to increase in blood pressure. These changes in sympathoadrenal function with advancing age may have a number of important physiological and pathophysiological consequences for human health and disease. Our results suggest the association between maternal age and the rise in blood pressure which may lead to the risk of pregnancy-induced hypertension.

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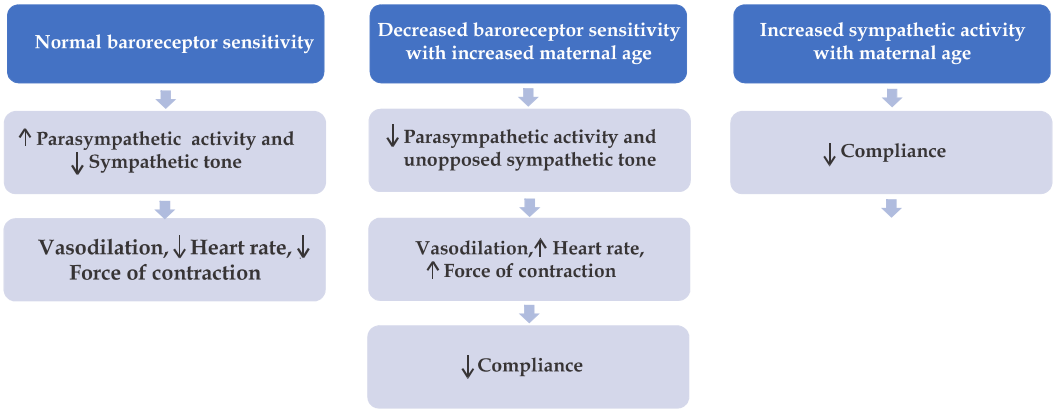

Fig 1: Factors responsible for increased blood pressure in advanced maternal age.

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