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RESEARCH ARTICLE

Natural menopausal age: Correlation with body mass index and various reproductive factors in postmenopausal women

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ABSTRACT

Background: Natural menopause can be defined as cessation of menstruation in which women have experienced 12 consecutive months of amenorrhea that results from loss of ovarian follicular activity. Usually, women attain menopause between the ages of 48 and 52 years (years). Age at menopause may be altered by various reproductive factors and body mass index (BMI). **Aims and Objectives:** The present study was designed to find an association of age at menopause with certain reproductive factors and BMI. **Materials and Methods:** This prospective observational study was conducted in the tertiary care hospital for a period of 4 months (September 2017-December 2017) after the approval of Institutional Ethical committee. **Results:** A total of 230 postmenopausal women were included in this study. The mean age at menopause was found to be 49 years. The mean and standard deviation values of various factors along with correlation value were assessed. Statistically, significant correlation was found between age at menopause and other factors such as BMI, age at first and last delivery. No significant differences in the age at menopause were found between regularity of periods and nature of delivery. **Conclusion:** The results of this study suggest that every woman should maintain their BMI within the normal range, adopt healthy lifestyle, and moreover, woman need to plan for pregnancy at her right age will be helpful in avoiding either early or late menopause.

KEY WORDS: Age at Menopause; Correlation; Reproductive Factors; Body Mass Index

INTRODUCTION

Menopause is a universal phenomenon among women. Women attain menopause either naturally or surgically. Natural menopause can be defined as cessation of menstruation in which women have experienced 12 consecutive months of amenorrhea without any obvious pathological or physiological cause, that results from loss of ovarian follicular activity. Mostly natural menopause occurs between 50 and 53 years of age.[1,2] Caucasian women attain menopause at the average age of 51.5 years whereas Latin, Hispanic, Chinese, Japanese, and African-American women attain menopause a little earlier.[3,4] A complex interaction between hypothalamus, pituitary, and ovary results in natural menopause.[5] Basically, the ovarian follicle consists of two components: An outer thecal layer and an inner granulose cell layer. Outer thecal layer initiates androgens which serve as an antecedent for the formation of estrogens by granulose cells through aromatization.[6] The ovulatory cycle starts with the recruitment of many follicles. Some of these follicles become dominant and leads to ovulation. Though 200,000 follicles are produced during the reproductive life span, only 500 follicles will yield mature oocytes through ovulation.[7] Earlier and late age of natural menopause implicate many chronic health problems in older ages. Early age of menopause can lead to high risk of cardiovascular diseases, osteoporosis, venereal

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cancers, and onset of Alzheimer's disease. Late menopause may increase the risk of breast cancers, endometrial cancers. [8] The age of natural menopause may be affected by genetic, socioeconomic, lifestyle, environment, race, ethnic, reproductive, and geographic factors. A woman living in developing countries, rural areas and higher altitudes may undergo natural menopause earlier than those living in developed countries, urban areas, and lower altitudes.[9] It is estimated that women whose menstrual cycle length are fewer than 26 days at the age of 20–35 years may attain natural menopause 1.4 years earlier than women with a cycle length of 26–32 days. Late natural menopause was seen in women with the cycle length of 33 days or longer.[10] Women who smoke may experience premature natural menopause than nonsmokers.[11] In addition, hormonal changes are associated with physical activity. Hormonal level will be low in women at rest or low physical activity than physically active women. [12] Hormonal instability occurs during menopausal transition which results in increased follicles stimulating hormone (FSH) and decreased estradiol. Elevated FSH and luteinizing hormone, low estradiol and progesterone; furthermore, well-preserved levels of testosterone are seen in postmenopausal state.[13,14] Estrone is an utmost circulating form of estrogen in postmenopausal state. The level of estrone is found to be higher in obese than lean women. Due to this, obese women are at greater risk of developing estrogen-related malignancies such as breast and endometrial cancer.[14] On account of these hormonal changes in postmenopausal women, they experience various symptoms. The most commonly seen symptoms are hot flushes, night sweats, vaginal dryness, and dyspareunia. [15] Age at menopause will be influenced by body mass index (BMI) and various reproductive factors such as age at menarche, age at parity, irregular periods, and breastfeeding. [16] Hence, this study was designed to find an association for age at menopause with certain reproductive factors and BMI.

MATERIALS AND METHODS

This prospective observational study was conducted in the tertiary care hospital for a period of 4 months (September 2017-December 2017). The study protocol was approved by the Institutional Ethical Committee (IEC/RVSIMS/2017/05). Consent from the hospital authorities was obtained before accessing data from the patients. Patients who fulfilled the inclusion criterion were documented from the case sheets and recorded in a separately designed case report form. Written informed consents were obtained after explaining the study protocol to each individual patient.

Study Participants

This study comprises a total of 230 postmenopausal women who attained menopause naturally. Women who underwent bilateral oophorectomy (surgical menopause), on chemotherapy, nulliparous women and mentally challenged were excluded from the study.

Data Collection

Data including the patient demographics (age, height, weight, BMI, marital status, occupation, food habit, substance abuse, and literacy background), allergy status, past medical history, obstetric, and gynecologic history (age at menarche, regularity of periods, nature of delivery, age at delivery, and age at menopause) were obtained by patient medical history interview and from medical records of the patients for both the groups.

Statistical Analysis

The collected data were analyzed using IBM SPSS 17 and GraphPad Prism 7.0. Descriptive statistics were used to exhibit demographic details of the study population. Unpaired *t*-test was used to analyze the difference in age at menopause based on the nature of delivery and regularity of periods. Wherever computed, $P < 0.05$ was considered significant since the confidence interval was maintained at 95%. Pearson's correlation was used to determine an association for age at menopause with BMI and various reproductive factors.

RESULTS

In total, 230 post-menopausal women were analyzed in this study. Table 1 presents baseline characteristics of the study population. Comorbidities observed in this population are shown in Figure 1.

The mean and standard deviation values of various factors along with correlation value assessed between various factors and age at menopause are described in Table 2. The graphs of factors which show significant correlation with age at menopause are demonstrated in Figures 2-4.

Here, we assessed the effect of two reproductive factors of age at menopause. No significant differences were found between the regularity of periods and nature of delivery which is shown in Table 3.

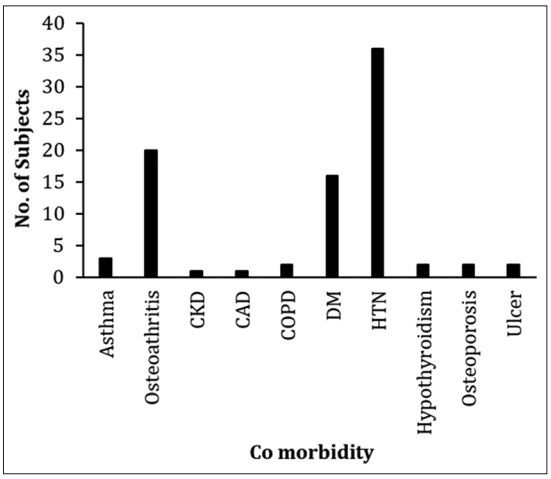

Figure 1: Comorbidity wise distribution. *DM: Diabetes mellitus, HTN: Hypertension, CKD: Chronic kidney disease, CAD: Coronary artery disease, COPD: Chronic obstructive pulmonary disease

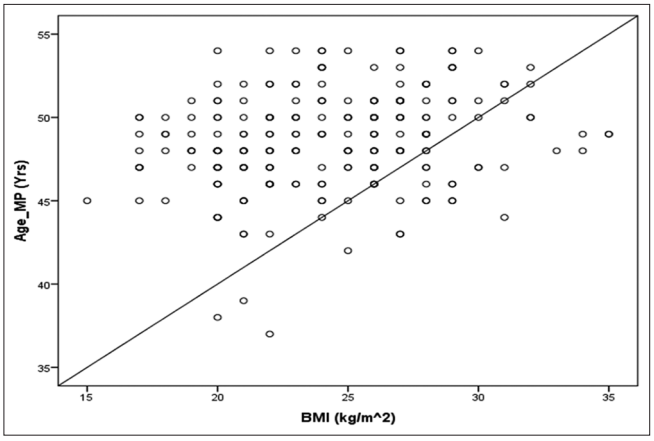

Figure 2: Correlation of body mass index with age at micronized progesterone in postmenopausal women y = 1* x + 20; r = 0.233

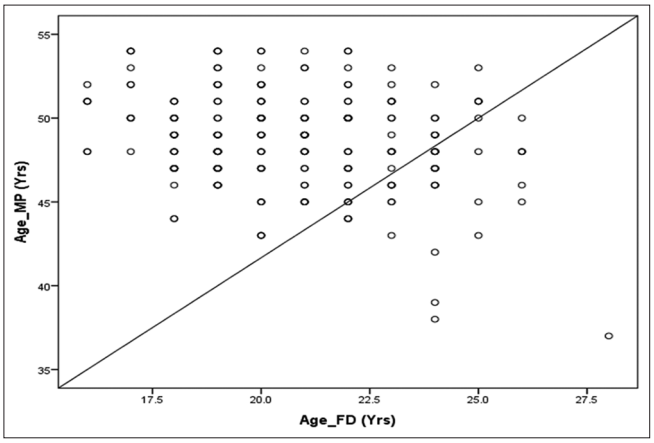

Figure 3: Correlation of age at FD with age at micronized progesterone in postmenopausal women y = 1.6667 * x + 8.3333; r = −0.263

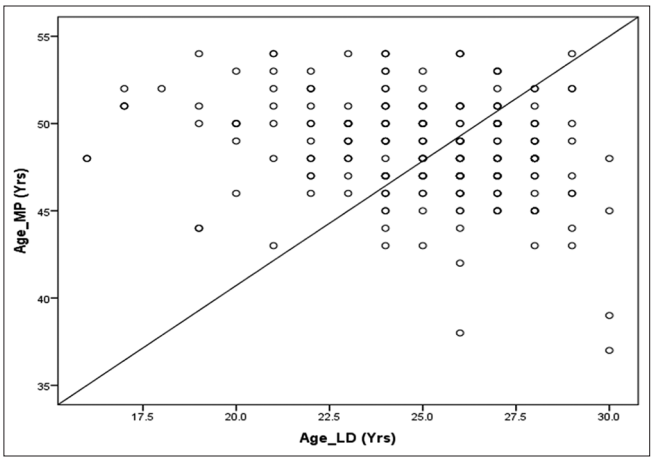

Figure 4: Correlation of age at LD with age at micronized progesterone in postmenopausal women y = 1.4286 *x + 12.1429; r = −0.257

Table 1: Baseline characteristics of study population

Characteristics	Mean±SD or *n* (%)
Age (years)	58.23±7.21
Height (ft)	5.18±0.23
Weight (kg)	59.89±8.13
BMI (kg/m^2)	24.28±4.16
Age at menopause	48.95±3.40
Marital status (%)	100 (100)
Literacy background	
Illiterate	147 (63.9)
Literate	83 (36.1)
Food habit	
Mixed	202 (87.8)
Veg	28 (12.2)
Substance abuse	
Betel nut	20 (8.6)
Nil	210 (91.4)
Occupation	
Housewife	156 (67.8)
Employee	37 (16.1)
Labor	37 (16.1)

BMI: Body mass index, SD: Standard deviation

Table 2: Correlation of age at menopause with BMI and reproductive variables

Variable	Mean ± SD	Correlation with age at menopause (r)
BMI	24.28 ± 4.16	0.233**
Age at menarche	13.22 ± 0.80	0.016
Age at first delivery	20.65 ± 2.77	−0.263**
Age at last delivery	24.92 ± 3.24	−0.257**

BMI: Body mass index, SD: Standard deviation **Positive correlation value

Table 3: Comparison of age at MP based on reproductive variables

Variable	*n* (%)	Mean ± SD	*P*
Regularity of periods			
Regular	198 (86.08)	48.88 ± 3.45	0.3898
Irregular	32 (13.92)	49.44 ± 3.08	
Nature of delivery			
Normal	202 (87.8)	49.10 ± 3.44	0.0880
Cesarean	28 (12.2)	47.93 ± 2.91	

MP: Micronized progesterone, SD: Standard deviation

DISCUSSION

Menopause is the cessation of the monthly menstrual cycle and the end of female fertility. It is a natural decline in reproductive hormones when a woman reaches her 40s or 50s.[17] Age at menopause will be effected by various factors. We have considered five reproductive factors and BMI in our study. In this study, mean age at menopause was 49 years. In another study, it was reported to be 49.6 years which complies with this study.[18] Comorbidities which were observed in this study population are hypertension, diabetes mellitus, osteoarthritis,

asthma, chronic kidney disease, ulcer, chronic obstructive pulmonary disease, coronary artery disease, hypothyroidism, and osteoporosis.[19] Increase in BMI is usually cause by an increase in body fat. Obesity and physical activity play a crucial role during menopause. Higher the body fat higher will be the amount of reproductive hormones thus disrupting the physiology of menopause. In this study, the statistically significant positive correlation was found between age at menopause and BMI ($r = 0.233$), similar to a study performed by Laxmi *et al.*[20] In addition, various reproductive factors established to have an impact on age at menopause but the exact mechanism is not clearly understood. Ozdemir and Cöl reported that earlier the age of menarche, earlier will be the age of menopause but the controversial report had been given by Hachul *et al.* study which described age at menarche was not associated with age at menopause.[21,22] Statistically, significant association between age at menopause and age at menarche was not found in this study ($r = 0.016$) which is similar to Hachul *et al.* study report. When the association between age at menopause and age at delivery (first and last) was evaluated, the statistically significant negative correlation found between these in this study ($r = -22120.263$ and -0.257) which is analogous to Shin *et al.* study report and controversial to Ayatollahi *et al.* report.[23,24] A study report of Magurský *et al.* suggested that women who have irregular menses attain natural menopause earlier than women with regular menses, but this study found no statistically significant difference between age at menopause of regular and irregular menstrual groups ($P = 0.3898$).[25] Shin *et al.* stated that there is an association between age at menopause and nature of delivery, i.e. normal and cesarean.[23] However, to the best of our knowledge, no study had been conducted to find an association between these two variables. In this study, statistically significance difference was not found between age at menopause of normal and cesarean delivery groups ($P = 0.0880$).

CONCLUSION

Age at menopause was significantly correlated with age at first and last delivery as well as BMI. The level of estrogen plays a key role in generating the complications associated with both early and late menopause. The results of this study suggest that every woman should maintain their BMI within the normal range, adopt healthy lifestyle, and moreover, woman need to plan for pregnancy at her right age will be helpful in avoiding either early or late menopause.

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