Influence of Age at Menarche on Bone Mineral Density of Rural Women

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ABSTRACT *The primary estrogen, estradiol plays a crucial role in bone formation and after the onset of menarche in girls influences the bone growth and is the base for determining the peak bone mass in late adolescence years. Thus the onset of menarche is crucial in determining the bone health status of women in later years. In this regard, the present study is focused to test the influence of age at menarche in the life of adulthood. Rural women with age range of 35 to 74 years (n=260) are selected and evaluated for the influence of age at menarche by considering menarche nature in terms of age at menarche as early, ideal and late . The present study results have demonstrated the late menarche is the major detrimental factor for poor bone mass. Early and ideal menarche conditions are associated significantly with greater retention of bone density among adults.*

Introduction

Bone health presents an opportunity to say something positive about menstruation and give the menstrual cycle due respect. Teenage girls have an early warning sign of estrogen deficiency with irregular or delayed menstrual cycle. Regular menses are a sign that the ovaries are working normally in their endocrine capacity as a source of estradiol. Estradiol, the major natural human estrogen, plays a critical role in building bone mass. Remarkably, this is true even for men. Men lacking the estradiol alpha receptor or the ability to synthesize estradiol because of aromatase deficiency develop osteoporosis in spite of having normal serum testosterone levels. Thus, estradiol is important to achieving peak bone mass for both men and women. Epidemiological studies have provided indirect evidence that late menarche decreases peak bone mass and is a risk factor for osteoporosis. [1]

The menstrual cycle is a vital sign of bone health. Many anthropologic accounts stress the importance of menarche as a sign of a girl's transition into woman hood, physical maturity and fertility. Transition into womanhood is accompanied by remarkable skeletal growth. The teen years are a critical time for building bone; peak volumetric bone, mineral density and bone size are almost fully attained during late adolescence. It has been said that osteoporosis is a pediatric disease with geriatric outcome. Bone density can be compared as bank account. One need to take care of it when young and it is there to take care of it at old age. [2]

The existing literature thus well demonstrates the importance of menstruation not only at adolescence period but also exhibits greater impact in the adulthood ages. Extensive studies are essential to lay down scientific base and arrive at exact influence of menarche on bone health of women. For this purpose, 260 adult rural women are purposively selected in the age range of 35 to 74 years. Bone health status is evaluated by bone mineral density (BMD) T-score measured by Quantitative Ultra-Sound (QUS) bone densitometry measured at heel bone. The relationship between age at menarche and BMD is studied to evaluate the influence of menarche on bone health status of women.

Methods

Chittoor district of Andhra Pradesh is purposively selected as the study area. Out of 61 mandals, five mandals viz., Chandragiri, Renigunta, Puttur, Srikalahasthi and Tirupati rural are purposively selected. From each mandal, three villages i.e., a total of fifteen villages are chosen as the major area of the study. The women between the ages of 35 to 74 years (n=260) who voluntarily attended the BMD campaigns to undergo BMD measurements are included in the study. The information on age at menarche is obtained from the participants orally and noted down.

The influence of age at menarche is derived statistically through least significant differences for the mean differences of BMD T-scores among early, ideal and late menarche women. SPSS 11.5 version is used to arrive at statistical inferences.

Results and discussion

Menarche is the onset of menstruation and it is one of the most significant milestones in a woman's life. The age at menarche is known to be sensitive indicator in achieving optimal peak bone mass in adolescent years. Based on the age at menarche, women are categorized into early menarche, if age at menarche is below 12 years, ideal between 12 to 14 years and late if it is above 14 years.

The association between age at menarche and bone mineral density is estimated by considering the extent of bone mineral density levels in terms of BMD T-scores in early, ideal and late menarche women. Least significant differences in the BMD T-scores among early, ideal and late menarche individuals are evaluated to test the influence of age at menarche on bone health of women.

The frequency and percent distribution of women based on menarche nature are presented in table no-1. The data indicated majority of women attained menarche between the ages of 12 to 14 years at an ideal age. More than half of the rural women had ideal menarche age around 69 percent. The important observation need to be that considerable number of rural women experienced the late menarche problem to the extent of 17 percent. The mean age at menarche found to be 13.27 years, though fall un-

der ideal menarche category, compared to the healthy communities, the menarche in rural women noticed to be slightly higher.

The results on the influence of age at menarche calculated as the least significant differences of BMD T-scores in the different menarche categories of rural women are presented in the table no-2. The results from the table revealed that better bone retention is maintained in the women who experienced either early or ideal menarche age. The striking feature to consider is that the women who reported with late menarche found to suffer from very poor bone mass condition with mean BMD T-Score (-2.74) value fall in the range of osteoporosis of < -2.5 BMD T-score.

The bone densities seemed to be at higher rate in women who attained menarche at an ideal age than compared to early menarche and late menarche aged women. The mean differences of BMD T-scores between early and ideal found to be not significant in rural women but at significant level (P < 0.05) in remaining groups of women. Whereas, the mean differences of BMD T-scores between early, ideal and late menarche women represent significant lower bone densities (P < 0.05) in late menarche women . The higher levels of bone densities in early and ideal menarche women is probably due to longer periods of estrogen exposure in a woman's life time resulting in restoration of more bone mass which reserves as a bank for women's bone density in the later years of adulthood. Thus the attainment of menarche before 14 years of age is mostly related to achieving the maximum peak bone mass at adolescence and thereby reducing the future risk of low bone mass and the onset of osteoporosis.

Epidemiological studies suggest that delayed puberty and late menarche may result in low peak bone mass and may be a risk factor of osteoporosis. Studies have shown that menarche occurs at a later age in girls from Low Socio Economic Stratum (LSES) as compared to those of high socio economic stratum (HSES). A longitudinal study conducted in girls of Istanbul demonstrated that the mean age of menarche was significantly earlier in HSES girls (12.5 years) as compared to LSES girls (13.4 years). Thus, there is a need to study bone mass accrual in relation to stages of puberty, especially in underprivileged girls[3] The present rural women mean menarche age found to closer to the LSES girls indicating much proneness to poor bone mass condition of osteoporosis.

The investigation on the relationship of reproductive factors with bone mineral density was studied. The results indicated long reproductive period, early menarche, and late menopause are associated with high BMD. In premenopausal women, there was a significant relationship between early menarche and high BMD. The results reveal that age at menarche may have a strong association with peak bone mass, as suggested by the positive correlation of early menarche with high BMD observed in the study. This is truly observed with the present findings with better retention of bone mass in early and ideal menarche women.

One of the conducted noticed no significant relationship between menarche age and osteoporosis. However, the study findings referred that the late menarche is associated with increased osteoporosis risk in Fujian, Chinese. The current study findings also support that late menarche is associated with poor bone mass and is factor for later osteoporosis.

The retrospective and analytical cross-sectional study was conducted in 243 Mexican postmenopausal women. The bone mineral density was measured with X-ray dual absorptiometry in the distal forearm. Age at menarche was collected from the women and identified that an age greater to 13 years of menarche age was related as a risk factor for osteoporosis.[4] The results of the present study results also confirm that the late menarche after the age of 13 years is associated with the risk of osteoporosis.

The cross sectional research was carried out in a cohort of 100 girls in Delhi (India) and analyzed the nutritional status and recalled age at menarche. The results indicate that age at menarche is strongly influenced by nutritional status in adolescence and notably the level of stunting at adolescence is highly dependent on the level of stunting in early childhood. A 'late menarche' due to stunting may be detrimental for reproductive health in case of early marriage and early child bearing because of association between height and pelvic size.[5] Thus improving the nutritional status during early childhood and in preadolescent and adolescent periods is one among the best modifiable strategies to bring menarche period earlier and to initiate bone formation earlier for building maximum peak bone mass during late adolescent period and to restore maximum bone mass in the later adulthood. Balanced nutrition with quality proteins and associated minerals improve better growth including better growth hormone production and utilization of full growth potential obtained by hereditary processes.

Table no 1: Frequency, percent distribution of women based on menarche nature and mean age at menarche

S.No	Menarche nature	Subjects (n)	Percentage (%)	Mean Age at Menarche (Years)
1.	Early (<12 years)	37	14.23	11.71
2.	Ideal (12-13 years)	180	69.23	12.98
3.	Late (≥ 14 years)	43	16.54	15.12
Total sample		260	100.00	13.27

Table no 2: Relationship between age at menarche of select women groups: Least significant differences in BMD T-scores and level of significance

Menarche nature	Mean BMD T-Score	Age at menarche nature (years) -Least significant differences			BMD T-Score at 95% confidence	
		Late (≥ 14)	Ideal (12-13)	Early (< 12)	Lower bound	Upper bound
Early (n = 37)	-1.69 ± (0.73)	1.45*	-0.24	-	-1.62	-0.97
Ideal (n = 180)	-1.53 ± (1.08)	1.21*	-	0.24	-1.68	-1.37
Late (n = 43) -2.74 ± (0.95)		-	-1.21*	-1.45*	-2.46	-1.69

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