

Comparison of Serum Follicle-Stimulating Hormone and Bone Mineral Density Levels in Natural Menopause and Surgical Menopause Women

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Abstract

Introduction: Menopause is characterized by reduced levels of ovarian hormones, especially estradiol by 66%, and increased in follicle-stimulating hormone (FSH) due to negative feedback mechanism. While this reduction occurs gradually in women with natural menopause, it occurs suddenly in surgical menopause. Our study is aimed at comparing serum FSH levels and bone and mineral density (BMD) levels in women with surgical and natural menopause.

Materials and Methods: The study was conducted on 90 women, of whom 30 were healthy menstruating women in the age group of 20–30 years, who are taken as control group. Of 60 remaining, 30 women were taken who have attained their menopause naturally within the age of 42–58 years. The remaining are women who have attained their menopause surgically in the age group of 35–50 years. These study groups were selected randomly and their FSH levels and bone mineral density were measured and compared between these groups.

Results: The FSH levels were statistically significantly higher in natural menopause and surgical menopause groups when compared with control group. Significant difference was observed in the FSH levels of the natural and surgical menopause groups also. The bone mineral density was higher in control groups than the natural and surgical menopause groups and no significant difference between the natural and surgical menopause groups.

Conclusion: The raised levels of FSH and decreased levels of BMD suggest increased risk of osteoporotic changes in the persons who have been hysterectomized.

Key words: Bone mineral density, Follicle-stimulating hormone, Hysterectomy, Menopause, Osteoporosis

INTRODUCTION

Menopause is a term introduced by a French physician Charles Pierre Louis De Gardanne in 1821.^[1] Menopause is defined as the time of permanent cessation of menstrual cycles due to depletion of ovarian function characterized by no menstrual periods for 12 consecutive months.^[2] Natural or spontaneous menopause occurs without any pathological etiology due to depletion of ovarian oocytes with aging

between the ages of 42 and 58 years. On the other side, the menopause can also be induced prematurely through medical interventions such as bilateral oophorectomy with or without hysterectomy, chemotherapy, or radiation.^[3-5]

Hysterectomy is the surgical removal of the uterus for certain indications such as cervical or uterine cancer, fibroids, endometriosis, or a prolapsed uterus.^[6] Most of the women spend one-third of their lifetime in the postmenopausal period typically accompanied by diminished estrogen state.^[7]

Osteoporosis is an absolute reduction in the quantity of bone or the atrophy of skeletal tissue. It is a global health problem of postmenopausal bone loss which occurs secondary to alterations in the pituitary-bone axis, where the reduced estrogen production after menopause

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is viewed as the main pathogenesis for osteoporosis.^[8] Postmenopausal osteoporosis is the most common bone metabolic disease associated with low bone mineral density (BMD) and osteopathic fragility fractures, which has been associated with significant disability and mortality.^[9]

The follicle-stimulating hormone stimulates (FSH) ovarian folliculogenesis and estrogen synthesis. Based on the previous studies, it also plays an important role in reducing the bone mineral density in postmenopausal women than the estrogen. Direct evidence for FSH modulation of osteoclast differentiation has been provided in mouse and human cells, which have pointed out a role of FSH in the menopausal bone loss.^[10-12] The aim of the present study was to find out variation between the serum FSH levels and BMD levels in natural or spontaneous menopause women and in the women who had undergone hysterectomy or bilateral oophorectomy which was considered as surgical menopause.

MATERIALS AND METHODS

The study was conducted on 90 women in the following three groups: 30 were the healthy menstruating women in the age group of 20–30 years taken as control group, 30 women were attained their menopause naturally within the age of 42–58 years, and the remaining 30 women were attained their menopause surgically within the age group of 35–50 years. The women who have become pregnant in the age group of 20 years, the women who are taking calcium supplementation or hormone replacement therapy, and the women who are hysterectomized after menopause or positive history of thyroid disease were excluded from the study. All the participants were explained about the study and the signed informed consent was obtained before starting the study. These study groups are selected randomly and their serum FSH levels were measured and compared between these groups. Serum FSH levels were estimated using COBAS INTEGRA automatic analyzer to calculate analytic concentration of each sample. Bone mineral density was measured using bone density scanning or dual energy X-ray absorptiometry (DEXA) or bone densitometry. Body mass index (BMI) was calculated based on the height and weight of the women. The T-scores of the WHO criteria for osteoporosis in women are as follows - BMD >−1.0 below the young adult reference range was considered as normal. BMD −1.0–−2.5 SD below the young adult reference range was considered as low bone mass (osteopenia). BMD <−2.5 SD below the young adult reference range was taken as osteoporosis and BMD <−2.5 SD below the young adult reference range and the patient has one or more fractures as severe osteoporosis.

RESULTS

The average age of control group was 23.16 ± 2.22 years with the average BMI of 21.05 ± 3.30 . The average serum FSH levels were 9.5 ± 6.15 and the BMD was 0.23 ± 0.9 in control group. The mean and standard deviations of the serum FSH levels and BMD values were compared with natural menopause and surgical menopause groups which was tabulated in Table 1.

The FSH levels were higher in natural menopause and surgical menopause groups when compared with control group. Statistically significant difference was observed between the control group and natural menopause, and control group and surgical menopause. There was a significant difference between the natural and surgical menopause groups also [Table 2 and Figure 1].

The BMD was higher in control groups than the natural and surgical menopause groups, and no significant difference between the natural and surgical menopause groups was found. The mean bone mineral densities of the menopause groups were decreased largely when compared with control group with $P < 0.0001$, which was extremely statistically significant. The mean and SD of BMD of the natural and surgical menopause groups were very close to each other with $P < 0.1301$, which was not statistically significant [Table 3 and Figure 2].

DISCUSSION

The prevalence rate of hysterectomies is increasing day by day in most of the states of India. In a recent study, it was reported that 17 in 1000 women had underwent

Table 1: The mean and SD of serum FSH and BMD values in all the three groups

Group	Serum FSH (mIU/ml)	BMD
Control	9.5±6.15	0.23±0.9
Natural menopause	95.51±43.83	-2.71±1.34
Surgical menopause	63.09±52.17	-2.809±0.73

FSH: Follicle-stimulating hormone, BMD: Bone and mineral density

Table 2: The variations in the FSH levels of all the three groups

Comparison between the groups	t value	P value	Level of significance
Control/natural menopause	10.644	0.0001	Extremely significant
Control/surgical menopause	5.5876	0.0001	Extremely significant
Natural menopause/surgical menopause	2.605	0.0116	Significant

FSH: Follicle-stimulating hormone

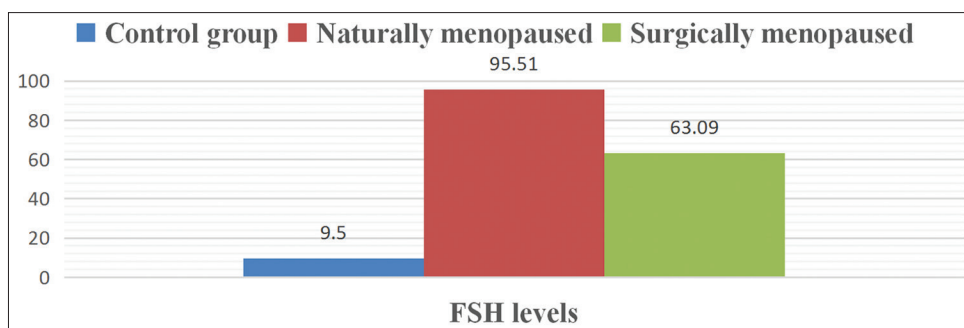


Figure 1: The variation in the follicle-stimulating hormone levels in all the three groups

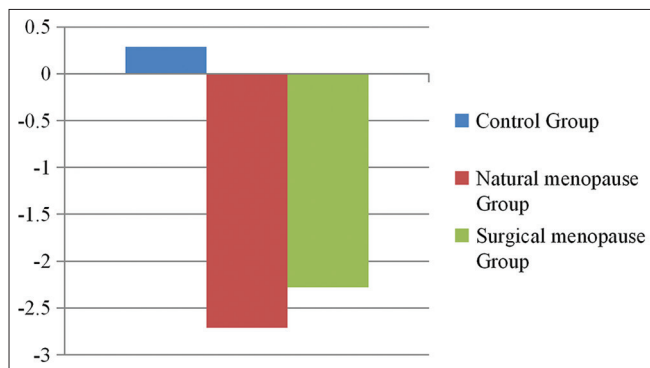


Figure 2: The variation in the bone and mineral density levels of all the three groups

Table 3: The variation in the BMD levels of all the three groups

Comparison between the groups	t value	P value	Level of significance
Control/natural menopause	9.9893	0.0001	Extremely significant
Control/surgical menopause	11.8277	0.0001	Extremely significant
Natural menopause/surgical menopause	1.5357	0.1301	Not statistically significant

BMD: Bone and mineral density

hysterectomy. The highest prevalence was reported in Andhra Pradesh where it was 63/1000 followed by Telangana and Karnataka where it was 55/1000 and 29/1000, respectively. Most of these hysterectomy surgeries are done at private hospitals and are attributed to the State Government’s Aarogyasri Health Insurance Scheme.^[13-16] The present study was conducted to find out the variations in serum FSH and BMD levels between the natural menopause and surgically induced menopause.

In the present study, the serum FSH levels were very high and BMD was very low in surgical menopausal women than the control and natural menopause women. FSH is a glycoprotein hormone which is secreted by the pituitary and is composed of two non-covalent α and β subunits. In females, the physiological function of FSH involves

the endometrial growth, ovulation, and the stimulation of follicular development. Serum FSH potentially up-regulates Rank, Mmp-9, Trap, and Cathepsin K mRNA expression in mature osteoclasts and plays an important role in osteoclast-mediated bone resorption. Wang *et al.* reported that the higher concentrations of serum FSH levels were the main factor for osteoporosis. In their study, they have compared the FSH levels in non-osteoporotic postmenopausal women and osteoporotic postmenopausal women and found that the serum FSH levels of osteoporotic postmenopausal women were ranging from 50.14 ± 4.92 to 58.95 ± 4.73 ml U/ml and of the non-osteoporotic postmenopausal women were ranging between 47.22 ± 4.32 and 55.13 ± 4.93 ml U/ml. The serum FSH levels were higher in osteoporotic postmenopausal women than the non-osteoporotic postmenopausal women.^[17] The present study results are coinciding with previous studies where they have found raised serum FSH levels and reduced BMD after surgical menopause which will be leading to osteoporosis in women at very early age.^[18,19]

CONCLUSION

The women who undergo hysterectomy with oophorectomy undergoes menopause earlier than the normal women. Early the menopause occurs, the serum FSH levels rise and the lower the BMD resulting in osteoporosis and its complications. Oophorectomy should be restricted to the life-threatening diseases in young women. Knowledge on the adverse health effects on their physical, reproductive, and socio-psycho health should be provided to the young women who are planning to undergo hysterectomy with oophorectomy. Health education should also be provided to keep a check on their hormonal levels. Early diagnosis of the osteoporosis or osteopenia can be treated by antiresorptive therapy which can minimise the incidence of morbidity and mortality due to osteoporosis.

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