

## Original Research Article

# Prevalence of premenopausal osteoporosis in hypothyroid patients

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### ABSTRACT

**Background:** Hypothyroidism alone is not a risk factor for osteoporosis but the patient on treatment with levothyroxine in chronic terms have the greater chances of osteoporosis. This study is to evaluate the role of chronic levo-thyroxine treatment on bone mineral density and the development of osteoporosis.

**Methods:** A cross sectional descriptive study in which patients with recently diagnosed as hypothyroidism were taken as the first group and the second group as those who were having hypothyroidism for more than 2 years plus on chronic treatment with levothyroxine. Healthy premenopausal women were the control group. TSH was measured in all and the T score were used to measure osteoporosis severity. T score of lumbar vertebra and neck of femur were used for comparison. The description of qualitative data was done in absolute frequencies and percentages. The description of quantitative data were done as the, mean standard deviation, median, minimum and maximum. In the comparison of qualitative data between groups, the Chi-square test and contingency tables was used by rearranging the percentages of several variables (TSH, t-score). The statistical significance was set  $p < 0.05$ .

**Results:** TSH levels in the first group were slightly different from rest of the groups. T score were significantly lesser in patients in the second group who are diagnosed with hypothyroidism and on treatment with levothyroxine.

**Conclusions:** The treatment for hypothyroidism with levo thyroxine reduces both TSH and bone mineral density in the study groups. Proper control of risk factors and avoidance of high dose thyroxine supplements are an effective way in prevention of osteoporosis.

**Keywords:** Levo thyroxine, Osteoporosis, Thyroid stimulating hormone, T-score

### INTRODUCTION

Thyroid hormone is one of the contributing factors for bone development, deficiency of which leads to poor bone growth, physical growth problems, immature growth and delayed bone age in children.<sup>1,2</sup>

In general Hypothyroidism leads to decreased bone turnover, bone formation and reabsorption.

Osteoporosis is a state of decreased mass per unit volume of normally mineralized bone, characterized by abnormally low mass and defects in bone structure, a

combination of which renders bone unusually fragile and at greater than normal risk of fracture.<sup>3</sup> Bone depletion may be brought by predominant bone resorption, decreased bone formation or combination of two. However, Hypothyroidism alone will not cause osteoporosis but the patient on treatment with levothyroxine in chronic terms have the greater chances of osteoporosis.<sup>3,4</sup>

Diagnostic criteria for premenopausal osteoporosis in hypothyroid women is not clear hence it is essential to evaluate the prevalence of osteoporosis.

## METHODS

### Study population

During the study period 150 participants entered the survey.

### Inclusion criteria

- Those willing to participate in the study, female aged from 35-45 years.

### Exclusion criteria

- Those with asthma, liver failure, renal failure, hyperparathyroidism, hypercalcemia, steroids consumption, chronic gastric pathology like malabsorption, crohn's disease, patient on treatment with calcium therapy, vitamin D, bisphosphonates.<sup>5</sup>

This is a retrospective cross-sectional descriptive study of patients admitted in tertiary care hospital. Total of 150 patients were selected from the in-patient medicine wards from our hospital for a period of 10 months from February 2018 to December 2018. Total of 150 patients separated to 3 groups. First group consisted of 50 patients who were recently diagnosed hypothyroid. Second group consists of 50 patients who already diagnosed hypothyroid and on treatment with levothyroxine for almost 3 years. Third group consisted of 50 peoples who were not having any signs of hypothyroidism.

Complete details obtained from the study population, which includes patient age, hypothyroid status, bone

mineral density, T score level of lumbar vertebra and neck of femur, serum calcium, phosphorous and alkaline phosphatase, vitamin D, TSH and duration of hypothyroidism.

### Laboratory investigation

In all cases the following variables were analyzed: Approximately 10ml blood sample collected level for TSH, T3 and T4 evaluated in all three groups. Serum calcium, phosphorous, alkaline phosphatase are normal measured. TSH normal range is 0.4- 4.0mU/L. The bone density based on lumbar vertebra and neck of femur, for densitometry DEXA scan were used. In this study, we used the definitions of osteopenia and osteoporosis established by the World Health Organization (WHO): Osteoporosis is a T-score  $\leq -2.5$  standard deviations (SDs), osteopenia (T-score between -1 and -2.5 SDs).

### Statistical analysis

The description of qualitative data was done in absolute frequencies and percentages. The description of the quantitative data was done as mean, standard deviation, median, minimum and maximum. In the comparison of qualitative data between groups, the Chi-square test and contingency tables was used by rearranging the percentages of several variables (TSH, t-score).

## RESULTS

This study shows that baseline TSH is completely different in the 3 groups ( $p < 0.001$ ) having elevated TSH in Group-1 than Group-2 and Group-3 which is due to the initiation of thyroxine replacement therapy.

**Table 1: Results based on t-score and TSH values among the groups in the present study.**

Variable	Group-1	Group-2	Group-3	p	
Age	35-45	35-45	35-45		
Hypothyroid status	+	+	-		
TSH	11.0(3.6-23)	0.6(0.1-2.1)	2.2(1.1-6.7)	0.001	
T score	Lumbar vertebrae	-1.83±0.83	-2.48±1.39	-1.87±1.16	0.01
	Neck of femur	-0.88±1.13	-0.66±0.91	-0.98±1.11	0.28

**Table 2: Results of bone mineral density among the groups in the study.**

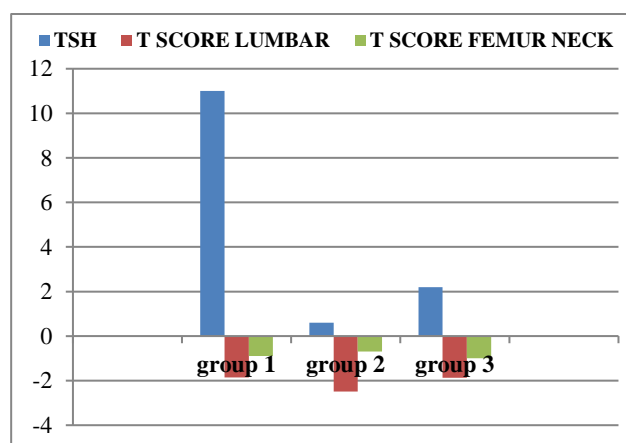
BMD category	Group-1	Group-2	Group-3	p	
Lumbar vertebra	Normal	10(18)	5(14)	14(30)	0.01
	Osteopenia	25(50)	16(32)	18(36)	
	Osteoporosis	15(30)	29(58)	18(36)	
Neck of femur	Normal	25(54)	33(68)	23(44)	0.12
	Osteopenia	22(44)	16(33)	21(42)	
	Osteoporosis	3(6)	1(2)	6(12)	

BMD is Bone Mineral Density (kruskalwallis test used), N(% of patients in each group), Group-1: recently diagnosed hypothyroid, Group-2: hypothyroid and on treatment with levothyroxine for 3 years, Group-3: healthy individuals

Prevalence of osteoporosis in Group-2 is 55%. The variance of T score at lumbar vertebrae between Group-2 and Group-3 ( $p=0.027$ ) and between Group-1 and Group-2 ( $p=0.034$ ) were significantly different. Mean TSH and Mean T score in Group-2 at lumbar vertebrae was lower than other Groups in the study.

The result from our study shows the T score value is significantly lesser in patient with second group who are diagnosed with hypothyroidism and also on chronic treatment with levothyroxine, when compared is statistically significant to other groups in the study.

Table 1 shows results based on t-score and tsh values among the groups. Average TSH value of (11) which is maximum in group-1 patients, when compared to TSH value (0.6) in group-2 and TSH value (2.2) in group-3, which shows the difference in the thyroid status among these groups. The comparison of the t score values in neck of femur where similar in all the three groups and did not show any statistical significance. But the t score values measured in the lumbar vertebrae is different in the various groups, group-1 showed a t score of (-0.83) measured, t score of (-2.48) in group-2 and t score of (-1.87) in group-3 showed statistical significance with a p value  $<0.01$ .



**Figure 1: Bone mineral density in relation with t score observed among the groups in the study.**

## DISCUSSION

Osteoporosis is a condition in which the bone becomes fragile and decrease in mass. Thyroid hormone is one of the causative factor for osteoporosis. However hyperthyroid states which usually cause a decrease in BMD in these population but hypothyroid status alone and its relation with osteoporosis is still questionable. But the patients with hypothyroid condition and on treatment with levothyroxine shows changes in bone mass and increase chance of vertebral fractures and neck of femur and other fractures.<sup>6</sup> The prevalence of osteoporosis in premenopausal women is comparatively lesser than post-menopausal women.<sup>7</sup> This study shows hypothyroid patients who are treated with levothyroxine more than 3 years shows no improvement in BMD than normal TSH, but their bone density is lesser in

lumbar spine when compared to healthy individuals and newly diagnosed hypothyroid.<sup>8,9</sup>

According to the present study, the chronic treatment of thyroid reduces TSH and BMD. The patients who receiving high dose of levothyroxine were high probable cases for osteoporosis.<sup>10,11</sup> Hence proper control of risk factors and avoiding high dose of levothyroxine are effective in preventing osteoporosis and its related fracture.

## CONCLUSION

Most pre-menopausal women with trivial trauma fracture should be worked up as a secondary case of osteoporosis. Women who presented with low energy fractures or with decreased bone mass should evaluated to rule out the causes for the same. Hypothyroid in recently diagnosed and healthy individuals seem to have no abnormality with TSH, bone mineral density, but patient with chronic hypothyroidism and levothyroxine supplement on long term basis or in high dose cause difference in bone density and recurrent trivial fractures. So appropriate monitoring is mandatory about hormone replacement and bone mass. Replacement of levothyroxine can be avoided if there is no clear benefit and is generally better as long as excessive administration is avoided. Moreover, patient should be monitored regularly by serum levels of TSH to prevent the onset of osteoporosis and recurrent fractures, which seems to be more common in this subgroup of patients.

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