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RESEARCH ARTICLE

Determination of Serum Estrogen levels and its Relationship with Risk of Osteoporosis among Women in Mangalore.

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Abstract

Aims and Objectives:-To estimate the risk of osteoporosis among pre and post menopausal women and determine the serum estrogen level and its relationship with risk of osteoporosis.

Background:-Osteoporosis is considered to be one of the most prevalent health prevailing problems in India, posing a huge economic burden on our country. According to a startling survey by the arthritis foundation of India, it is estimated that by 2050, half of the world's fractures will occur in India and the total affected population with osteoporosis could be around 25 million.

Design:-Descriptive co relational design.

Methods:-The study was conducted in a tertiary care hospital at KSHEMA, Mangalore in the year 2015. 50 pre menopausal women aged 25-45 years and 50 post menopausal women aged 46-65 years were selected by purposive sampling. Baseline data and the risk of osteoporosis were assessed in both the groups using the osteoporosis risk assessment tool and those at risk were assessed for the serum estrogen levels.

Results:-Majority of the post menopausal women were at moderate risk of osteoporosis and had decreased serum estrogen levels compared to the pre menopausal women. A negative relation was found between the risk of osteoporosis and serum estrogen level. The risk of osteoporosis was twice more among the women with serum estrogen level <45pg/ml.

Conclusions:-The risk of osteoporosis increases with decreased serum estrogen levels. Hence creating awareness regarding importance of screening for osteoporosis and importance of diet during post-menopausal period is an essential step to prevent further complications.

Introduction:-

Musculoskeletal system forms a pivotal part of the human body. Loss of bone density can cause bone weakness and eventually lead to fractures. According to Lane, JM et al.(2006), Osteoporosis is a widespread metabolic bone disease characterized by decreased bone mass and poor bone quality. It leads to an increased frequency of fractures of the hip, spine, and wrist. Osteoporosis is a global public health problem currently affecting more than 200 million women worldwide.**1**

The WHO survey states that Osteoporosis is estimated to affect approximately one-tenth of women aged 60, one-fifth of women aged 70, two-fifths of women aged 80 and two-thirds of women aged 90. For the year 2000, there were an estimated 9 million new osteoporotic fractures, of which 1.6 million were at the hip, 1.7 million were at the forearm and 1.4 million were clinical vertebral fractures. Europe and the Americas accounted for 51% of all these

fractures, while most of the remainder occurred in the Western Pacific region and South East Asia. It is said that by 2050, the worldwide incidence of hip fracture in men is projected to increase by 310% and 240% in women.**2**

According to the World Health Organization (WHO) and the International Osteoporosis Foundation (IOF), osteoporosis is second only to cardiovascular disease, as a global healthcare problem. About 300 million people in India suffer from osteoporosis and it is speculated that in the next decade as much as 50% of the Indian population will be victim to this condition. Osteoporosis is also three times as common in Indian males as compared to their counterparts anywhere else in the world.**3**

This disease is referred to as silent disease that which remains often asymptomatic until bone fracture occurs. Despite high prevalence and serious medical consequences of osteoporosis, many at risk patients are inadequately screened and diagnosed before symptoms occur. Despite of prevalence and deleterious consequences of bone loss and fractures, patients with osteoporosis continue to be under diagnosed and under treated. It is important for the health care professionals to identify the high risk of osteoporosis and to implement preventive strategies. The health care professionals are in a unique position to improve diagnosis and management of this clinical condition when they implement a holistic and multi factorial approach.

Methods:-

Study design and settings:-

A descriptive co relational design was carried in a 1200 bedded tertiary care teaching hospital to estimate the risk of osteoporosis among pre and post menopausal women and determine the serum estrogen level and its relationship with risk of osteoporosis. The study was approved by institutional ethical committee (Ref No. NUINS/ CON/ NU/ IEC/2012-2013 dated 21/09/2011). Written permission was obtained from the Medical superintendent of the selected hospital Informed consent was obtained from the participants after proper explanation about the purpose and usefulness of the study. Confidentiality was assured to the participants.

Study Sample:-

Fifty premenopausal women between the age of 25- 45 years and fifty postmenopausal women between 46 -65 years were selected through purposive sampling technique. The inclusion criteria were: Post menopausal women aged more than 45 years and less than 65years; Premenopausal women above 25 years and below 45 years; those women willing to participate in the study. The exclusion criteria were as follows: Women with existing osteoporosis; On HRT or Oral contraceptives; pregnant women; women with fracture or existing osteoporosis.

Data collection:-

Pilot study was conducted from 1st September to 31st October 2014

The following instruments were used for the collection of the data: A demographic proforma consisting of 7 questions including age in years, educational status, occupation, monthly income, food habits, and source of information; an Osteoporosis Risk Assessment tool consisting of 14 questions pertaining to the risk factors that can lead to osteoporosis and the total score ranged between 0-23. The scores were further arbitrarily classified as: No risk- 0; Low risk- 1-7; Moderate risk- 8-14 and High risk- 15-23.An Estradiol kit was used to measure the serum Estrogen levels of those women who were at risk of osteoporosis

Data analysis:-

SPSS version XVI was used to analyze the data. The demographic variables and the level of risk of osteoporosis were analyzed using frequency and percentage. Comparison of the level of risk of osteoporosis between the pre and post menopausal women was analyzed using 'independent t test'. The relationship between the level of risk of osteoporosis and the estrogen level was assessed using Karl Pearson's correlation co efficient. To ensure the content validity, the tools along with the problem statement, objectives, hypothesis, operational definitions and criteria checklist were submitted to five experts from the field of Medical Surgical Nursing and the doctors from the Orthopaedic Department. The final data were translated by verbatim from English to Kannada by language experts.

Results:-

Section 1: Description of sample characteristics

The frequency and percentage of women according to their demographic characteristics are presented in **Table 1**:

Table 1: Frequency and Percentage distribution of Pre and Postmenopausal women according to their demographic characteristics.

n=100

SLNo.	Sample characteristics	Pre menopausal		Post menopausal		
1.	**AGE IN YEARS**	**f**	**%**	**AGE IN YEARS**	**f**	**%**
	25-30	1	2	45-50	16	32
	31-35	7	14	51-55	9	18
	36-40	32	64	56-60	14	28
	41-45	10	20	61-65	11	22
2.	**EDUCATIONAL STATUS**					
	Illiterate	4	8		24	48
	Primary education	26	52		16	32
	Higher primary	11	22		2	4
	Graduation	6	12		5	10
	Others	3	6		3	6
3.	**OCCUPATION**					
	Sedentary	43	86		40	80
	Active	7	14		10	20
4.	**FOOD HABITS**					
	Vegetarian	5	10		8	16
	Mixed	45	90		42	84
5.	**INCOME (in rupees)**					
	< 5000	24	48		28	56
	5001 -10,000	15	30		14	28
	10001 – 15,000	6	12		8	16
	>15,000	5	10		0	0
6.	**SOURCE OF INFORMATION**					
	Mass media	27	54		31	62
	Academic education	9	18		4	8
	Contact with health personnel	8	16		10	20
	Others	6	12		5	10

Table -1 above shows that majority of the pre menopausal women 32 (64%) were in the age group of 36- 40 years and 16 (32%) of the post menopausal women were in the age group of 45- 50 years. Distribution of samples based on food habits revealed that majority of the pre and post menopausal 45(90%) and 42(84%) were consuming mixed diet respectively whereas 5(10%) and 8(16%) were vegetarian respectively.

Section 2: Risk of osteoporosis among the pre and post menopausal women

Osteoporosis risk assessment tool was used to assess the risk status of the pre and post menopausal women for osteoporosis (**Table -2**)

Table-2 Frequency and percentage distribution of Pre and Postmenopausal women based on their risk factors

n=100

Risk factors	Pre menopausal		Post menopausal	
	f	%	f	%
Age				
I am under 40 years old	40	80	-	-
I am 40 years old or older	10	20	50	100
Family history of osteoporosis				
Yes	14	28	19	38
No	36	72	31	62
Menopause				
Not gone through menopause	50	100	-	-
Gone through menopause after the age of 45 years	-	-	35	70
Gone through menopause before the age of 45 years	-	-	15	30
End of menstruation other than menopause				
I have not stopped menstruating	50	100	-	-
I have stopped menstruating normally	-	-	38	76
I have stopped menstruating for other reasons(removal of ovaries)	-	-	12	24
Hormonal variations				
My periods are / were regular	31	62	40	80
My periods are / were irregular	19	38	10	20
Smoking				
I never smoke	49	98	49	98
Yes, I smoke	1	2	1	2
Alcohol				
No, I do not drink alcohol	45	90	48	96
I, Drink alcohol occasionally	4	8	2	4
I, Drink excessively	1	2	-	-
Dietary habits				
My food includes milk and vegetables	37	74	37	74
My food don't include milk and vegetables	13	26	13	26
Gastro- intestinal disorders				
I do not have symptoms of gastritis	42	84	40	82
I do have symptoms of gastritis	8	16	10	18
Exercise				
I exercise regularly	22	44	24	48
I exercise occasionally	19	38	18	36
I get little or no exercise	9	18	8	16
Immobility				
Not had any periods of immobility	25	50	22	44
Had periods of immobility	25	50	28	56
Medications				
I don't take drugs which would increase risk of osteoporosis	40	80	39	78
Yes, I take drugs which would increase risk of osteoporosis	10	20	11	21
Chronic disease				

I don't have any of the chronic diseases	31	62	29	58
Yes, I have chronic disease	19	38	21	42
Hyperthyroidism				
I have been diagnosed with hyperthyroidism	2	4	4	8
No, I don't have hyperthyroidism	48	96	46	94
Hyperparathyroidism				
I have been diagnosed with hyperparathyroidism	-	-	6	12
No, I don't have hyperparathyroidism	50	100	44	88
Caffeine drink				
I mostly drink beverages with no caffeine	37	74	36	72
Yes, I drink lot of caffeine, colas, coffee etc	13	26	14	28
Height				
I have not lost my height after the age of 40 years	50	100	47	94
I have lost my height of 3 cms after the age of 40 years	-	-	3	6
Sunlight exposure				
I spend outdoors more than 10 minutes	29	58	30	60
I spend outdoors less than 10 minutes	11	22	12	24
I do not spend time outdoors	10	20	8	16

Table- 2 above shows that 14(28%) of the pre menopausal and 19(38%) of the post menopausal had family history of osteoporosis. It is also observed that 38(76%) of the post menopausal women attained menopause through normal process were as 12(24%) of them due to the removal of ovaries. 22 (44%) of the pre menopausal and 24(48%) of the post menopausal women exercised regularly, 2 (4%) of the pre menopausal and 4(8%) of the post menopausal had hyperthyroidism. 6(12%) the post menopausal had hyperparathyroidism.

Majority of the pre and post menopausal women 37 (74%) and 36(72%) respectively did not consume excessive caffeine and beverages nor majority 49(98%) had the habit of smoking.

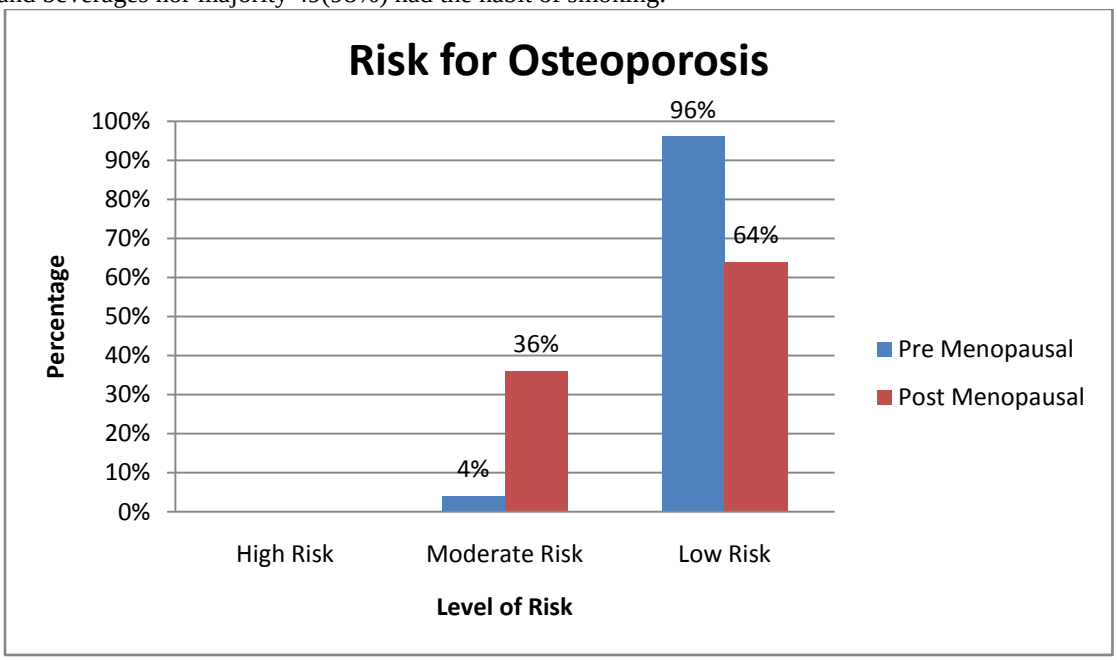

Fig 1: Bar Diagram depicting distribution of women based on level of risk for osteoporosis

Fig 1- above shows that out of 100 pre and post menopausal women, majority of the premenopausal 48 (96%) were at low risk when compared to the post menopausal women where 18(36%) were at moderate risk of getting osteoporosis.

Table (3a): Comparison of the serum estrogen level in pre and post menopausal women

n =50+50

Group	Mean	S.D	Mean difference	df	t Value	p value
Pre-menopausal	51.72	16.44	12.23	98	4.321	0.001
Post -menopausal	39.48	11.43				

$t_{(tab)}(98) = 1.984, p<0.005$

Table- 3a) shows that the mean score of the pre menopausal estrogen level is 51.72 pg/ml ±16.44 and mean of post menopausal estrogen level is 39.48 pg/ml ±11.43 and the mean difference is 12.23. There was a significant difference in the estrogen level between the pre and post menopausal women (p<.001)

Table -3b) Comparison of the serum estrogen level with respect to risk of osteoporosis

n=100

Group	Mean	S.D	Mean difference	df	t Value	p value
Low risk	46.67	16.18				
Moderate risk	41.30	10.84	5.361	98	1.772	0.08

$t_{(tab)}(98) = 1.984, p>0.05$

Table -3b) shows that the mean score of the estrogen level of low risk group of the pre and post-menopausal women level is 46.67pg/ml±16.18 and mean of estrogen level of moderate risk group of pre and post-menopausal women is 41.30pg/ml±10.84 and the mean difference is 5.361. There was no significant difference in the estrogen level and the risk of osteoporosis among the pre and post menopausal women (p>.005).

Table 4a): Correlation between the level of risk and the serum estrogen level

n=50+50

SI No:	Variables	Pearson correlation	p value
1.	Level of risk and serum estrogen levels	- 0.254	0.011

Table 4a) above reveals a negative relation between the level of risk and serum estrogen level.

Table 4(b): Odds ratio for the serum estrogen levels of post-menopausal women with the level of risk

SI No:	Categorized scores of serum estrogen level	Low risk	Moderate risk	OR	95% CI
1.	<45 pg/ml	12	6	1.5 6	0.357-4.038
2	>45 pg/ml	20	12		

]

The odds ratio in **Table 4b)** above shows that though there is no statistical significance the risk of getting osteoporosis is almost two times more among the women with serum estrogen level <45pg/ml comparable to the women with serum estrogen level > 45pg/ml. However it can be inferred that as the serum estrogen level decreases the chance of getting osteoporosis increases.

Discussion:-

Sample characteristics:-

In the present study majority of the post menopausal women 16 (32%) were in the age group of 45- 50 years. A study conducted by Aylin, Ozturk & Merdiye, Sendir (2011) to evaluate the osteoporosis knowledge and self-efficacy of female orthopaedic patients showed the mean age of the patients was59·6 ± 12·9 years.**4**

Similar findings were seen in a study conducted by Allali, F et al (2010) to assess educational level and osteoporosis risk in postmenopausal Moroccan women. Out of 356 women selected the mean age was 58.9±7.7 years.**5**

Majority of the premenopausal women 27(54%) and31 (62%) of postmenopausal women had information on osteoporosis through mass media, 9(18%) and4 (8%) through academic education, 8(16%) and 10(20%) from the health personnel's, 6(12%) and5 (10%) through other sources respectively. A study conducted at Malaysia showed similar findings where, 55.7% obtained information about Osteoporosis from newspapers and 46.4% from magazines.**6**

Section 2: Risk of osteoporosis among the pre and post menopausal women:-

Majority of the premenopausal 48 (96%) were at low risk and 2(4%) were at moderate risk when compared to the post menopausal women 32 (64%) were at low risk, 18(36%) were at moderate risk of getting osteoporosis.

Considering the risk factors, 14(28%) of the pre menopausal and 19(38%) of the post menopausal had family history of osteoporosis. In both the groups 13 (26%) of them consumed inadequate milk and vegetables, 9(18%) of pre and 8(16%) of post menopausal women got little or no exercise. 13(26%) of the pre and 14(28%) of the post menopausal women consumed excessive caffeine and beverages.

A study conducted at Malaysia by Swan, Sim Yeap et al (2010) showed similar finding with the above study, which identified 97.1% of the samples with low calcium intake, 87.8% with lack of exercise, 80.0% with family history of Osteoporosis, and 75.8% with postmenopausal status.**6**

A study conducted among the African-American and Hispanic women by S. E, Geller and R, Derman (2001) identified behaviors such as inadequate physical activity, inadequate calcium intake, cigarette smoking, and long-term steroid use as risk factors for osteoporosis.

Section 3: Serum estrogen level in women with and without menopause:-

The mean score of the pre menopausal estrogen level was 51.72 pg/ml ±16.44 and mean of post menopausal estrogen level was 39.48 pg/ml ±11.43. Though there was a significant difference in the estrogen level between the pre and post menopausal women, statistically there was no significant difference seen with the serum estrogen levels and risk for osteoporosis. Supportive to this finding a prospective study conducted in a cohort of 150 women by Henry, G. Burger et.al (2013) revealed decreasing estrogen levels and rising FSH levels (Follicular stimulating hormone) before 1-2 years of achieving menopause. The study concluded that there is no single reliable hormonal marker of menopausal status for an individual woman.

Section 4: Correlation between the level of risk and the serum estrogen levels:-

The present study findings revealed a negative relation between the risk of osteoporosis and serum estrogen levels**.** Similar findings were found in a study conducted by Bruce,Ettinger et al (2013)to evaluate the skeletal effects of endogenous serum estradiol, bone mineral density (BMD) at the calcaneus and radius (single photon absorptiometry) and at the hip and spine (dual x-ray absorptiometry) in 274 women aged 65 yr. Lateral radiographs of the thoracic and lumbar spine were also taken, and serum was assayed for estradiol. Those who had estradiol levels from 10–25 pg/mL had 4.9%, 9.6%, 7.3%, and 6.8% greater BMD at total hip, calcaneus, proximal radius, and spine than those with levels below 5 pg/mL.Vertebral deformities were less prevalent among women whose estradiol level exceeded 5 pg/mL. The study concluded that physiologically low estradiol has a salutary effect on the skeleton in elderly women, possibly by reducing skeletal remodeling.

Conclusion:-

Osteoporosis is a preventable and treatable condition. Hence, care should be aimed at providing strategies to prevent the disease and resulting injuries from the disease. The present study has revealed the importance of early screening and increasing awareness as the key to prevention and early detection of osteoporosis. Many individuals are unaware of the risk of osteoporosis or are uninformed of the preventive behaviors .Thus nurses who work in almost all settings like hospital, nursing homes, community etc. play an active role in promotion of health, preventing illness and disability of both individual and communities.

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Author contributions:-

The authors have contributed to the design of the study and the preparation and critical revision of the manuscript and agree to be accountable for all aspects of the study

Disclosure:-

The findings from this study are those of the author and do not reflect the views of the funding body. The authors reports no conflict of interests in this work

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