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Osteodencytometric Diagnostics in Women with Oophorectomy

Hikmatov Bakhtiyor Alisherovich[1], Makhmonov Lutfullo Saydullaevich[2], Kholikulov Bahodir Erkulovich[3], Madasheva Anajan Gazkhanovna[4]
[1]*Traumatologist-Orthopaedist, Samarkand Regional Multi-Profile Medical Centre*
[2]*PhD, Head of the Haematology Course, Samarkand State Medical University*
[3]*Head of the Diagnostic Consultation Centre, Samarkand Regional Multi-Profile Medical Centre*
[4]*PhD, Senior Lecturer, Department of Haematology, Samarkand State Medical University*

Abstract: Oophorectomy, particularly bilateral, is associated with a significant risk of bone mineral density (BMD) loss due to abrupt oestrogen deficiency. This study aimed to assess the effectiveness of osteodensitometric diagnostics in detecting early post-oophorectomy bone demineralisation in women. A total of 62 women aged 35–60 years who had undergone unilateral or bilateral oophorectomy were evaluated using dual-energy X-ray absorptiometry (DEXA). The results showed that 45.2% had osteopenia and 24.2% had osteoporosis, with more severe BMD loss observed in those with bilateral oophorectomy and greater time elapsed since surgery. The lumbar spine showed the most significant decline. A negative correlation was found between BMD and both the time since oophorectomy and serum oestradiol levels. These findings highlight the importance of early DEXA screening and long-term monitoring in surgically menopausal women, particularly in those without hormone replacement therapy, to prevent osteoporosis and its complications.
Keywords: Oophorectomy, osteodensitometry, osteoporosis, osteopenia, bone mineral density, DEXA, surgical menopause.

I. INTRODUCTION

Oophorectomy, the surgical removal of one or both ovaries, is a common gynaecological procedure performed in women for a range of benign and malignant conditions, including ovarian cysts, endometriosis, and cancer prevention in high-risk groups. However, the removal of ovaries, especially in premenopausal women, induces a sudden decline in circulating oestrogen levels, which plays a critical role in maintaining bone homeostasis. As a result, women who undergo oophorectomy, particularly bilateral procedures, are at significantly increased risk of developing decreased bone mineral density (BMD), osteopenia, and premature osteoporosis [4, 9].

Oestrogen deficiency following oophorectomy leads to an acceleration of bone resorption due to increased osteoclastic activity, while osteoblastic bone formation remains unchanged or reduced. This hormonal imbalance contributes to trabecular bone loss, particularly in the spine and proximal femur, increasing the risk of fragility fractures. The decline in BMD may be rapid and often asymptomatic in the early stages, which makes early detection and regular monitoring vital for effective prevention and intervention strategies [3, 10].

Osteodensitometry, particularly dual-energy X-ray absorptiometry (DEXA), is considered the gold standard for the quantitative assessment of BMD and diagnosing osteopenia and osteoporosis. It is a non-invasive, highly sensitive method that allows early identification of individuals at risk and enables clinicians to monitor the efficacy of hormone replacement therapy (HRT), lifestyle interventions, or antiresorptive medications. Despite the proven effectiveness of osteodensitometric screening, it remains underutilised in post-oophorectomy follow-up care, especially in women without cancer history or in those who underwent the procedure at a younger age [6, 12].This study aims to evaluate changes in bone mineral density in women who have undergone oophorectomy and to determine the role and diagnostic value of osteodensitometry in the early identification of post-surgical bone loss. By correlating BMD levels with the duration since oophorectomy, age at the time of surgery, and hormonal status, the study seeks to strengthen the clinical rationale for routine osteodensitometric monitoring in this at-risk population.

II. METHOD

1) Study Design and Participants

This was a prospective observational study conducted at the Radiology and Endocrinology Departments of the Samarkand Regional Multi-Profile Medical Centre between January 2024 – December 2024.

The study included 62 women aged between 35 and 60 years who had undergone unilateral or bilateral oophorectomy at least 6 months prior to enrolment. All participants provided written informed consent prior to inclusion in the study.

Patients were recruited through gynaecological follow-up clinics. Inclusion criteria were: (1) confirmed history of oophorectomy; (2) absence of hormone replacement therapy (HRT) in the last 6 months; (3) no known history of metabolic bone disorders prior to surgery. Exclusion criteria included: (1) concurrent thyroid or parathyroid dysfunction, (2) chronic corticosteroid therapy, (3) rheumatoid arthritis or other autoimmune diseases affecting bone metabolism, and (4) malignancies involving bone metastases.

2) Ethical Approval

The study protocol was reviewed and approved by the Institutional Ethics Committee of the Samarkand State Medical University. All procedures were conducted in accordance with the Declaration of Helsinki.

3) Osteodensitometric Assessment

Bone mineral density (BMD) was measured using dual-energy X-ray absorptiometry (DEXA) on a certified Hologic Discovery™ scanner. Scans were performed at two standard skeletal sites: lumbar spine (L1–L4) and proximal femur (total hip and femoral neck). Each participant was positioned according to the manufacturer's guidelines, and all scans were interpreted by a single radiologist specialised in densitometry to minimise interobserver variability.

Results were expressed as T-scores, in accordance with WHO classification criteria:

- Normal BMD: T-score ≥ -1.0
- Osteopenia: T-score between -1.0 and -2.5
- Osteoporosis: T-score ≤ -2.5

4) Data Collection and Variables

In addition to DEXA results, clinical data were collected from patient records and through structured interviews, including:

- Age at time of surgery
- Type of oophorectomy (unilateral or bilateral)
- Time since oophorectomy
- Body mass index (BMI)
- Menopausal status
- Serum oestradiol and calcium levels (where available)

Patients were grouped based on the duration since oophorectomy (<1 year, 1–3 years, >3 years) to evaluate time-dependent bone loss. Data on lifestyle factors (smoking, physical activity, calcium intake) were also recorded.

5) Statistical Analysis

All statistical analyses were performed using SPSS software, version 26.0. Continuous variables were presented as means ± standard deviation. Group comparisons were made using ANOVA for normally distributed data and the Kruskal–Wallis test for non-parametric variables. The relationship between BMD values and clinical factors (age, time since surgery, BMI) was assessed using Pearson's or Spearman's correlation coefficients, depending on data distribution. A *p*-value of <0.05 was considered statistically significant.

III. RESULTS

A total of 62 women who underwent oophorectomy were enrolled in the study. The mean age of participants was 48.3 ± 6.9 years, and the average time since surgery was 2.7 ± 1.4 years. Among them, 37 women (59.7%) had bilateral oophorectomy, while 25 women (40.3%) had undergone unilateral procedures. The average body mass index (BMI) was 26.4 ± 3.1 kg/m², with no significant differences in BMI between groups.

1) Bone Mineral Density Findings

DEXA scan results revealed the following BMD classifications across all participants:

- Normal BMD: 19 women (30.6%)
- Osteopenia: 28 women (45.2%)
- Osteoporosis: 15 women (24.2%)

Osteoporosis was more frequently observed in women who had bilateral oophorectomy compared to those with unilateral surgery (32.4% vs. 12.0%, $p = 0.03$). Additionally, the lumbar spine (L1–L4) showed greater BMD reduction than the femoral neck, with mean T-scores of -1.86 ± 0.72 and -1.48 ± 0.65, respectively.

2) Association with Time Since Surgery

A progressive decline in BMD was observed in relation to the time elapsed since oophorectomy:

- <1 year: Osteopenia in 36.4%, osteoporosis in 9.1%
- 1–3 years: Osteopenia in 50.0%, osteoporosis in 25.0%
- >3 years: Osteopenia in 47.6%, osteoporosis in 38.1%

There was a statistically significant negative correlation between time since oophorectomy and BMD T-scores at both the spine ($r = -0.48$, $p < 0.01$) and femoral neck ($r = -0.41$, $p < 0.01$).

3) Hormonal and Lifestyle Factors

Among women with osteoporosis, the majority (80%) had undetectable or significantly reduced serum oestradiol levels. These women also reported lower levels of physical activity and calcium intake. Smoking was more prevalent in the osteoporosis group (20%) than in the osteopenia and normal BMD groups (9% and 5%, respectively), although this trend did not reach statistical significance.

IV. DISCUSSION

The findings of this study confirm the significant risk of reduced bone mineral density (BMD) in women who have undergone oophorectomy, particularly bilateral oophorectomy. More than two-thirds of the participants demonstrated either osteopenia or osteoporosis, highlighting the early onset and silent nature of bone loss following surgical menopause. These results align with existing literature indicating that the abrupt cessation of oestrogen production after oophorectomy accelerates bone resorption, primarily due to the loss of the protective effect of oestrogen on osteoblastic activity and calcium homeostasis.

The strong correlation between time since oophorectomy and T-score decline suggests that bone demineralisation is a progressive process that intensifies with the duration of hypoestrogenism. Notably, the rate of bone loss was more pronounced in the lumbar spine than in the femoral neck, which is consistent with the understanding that trabecular bone—more prevalent in the spine—is metabolically more active and more sensitive to hormonal changes than cortical bone. This pattern has important clinical implications, as vertebral fractures are often the earliest indicators of osteoporosis and significantly affect quality of life.

A particularly noteworthy finding was the significantly higher rate of osteoporosis among women who underwent bilateral oophorectomy compared to those who had unilateral procedures. This reinforces the hypothesis that complete ovarian removal, especially at a premenopausal age, poses a greater risk for early skeletal demineralisation. The absence or marked reduction of oestradiol levels in the osteoporosis group provides a biological explanation for the observed bone loss. These hormonal disruptions should prompt clinicians to consider early hormonal or non-hormonal interventions in post-oophorectomy management strategies.

Despite well-established guidelines supporting BMD screening after surgical menopause, our study reflects a gap in routine follow-up care. Many women, especially those who undergo oophorectomy for non-malignant reasons, are not referred for densitometry until symptoms arise or fractures occur. This oversight may lead to delayed diagnosis and missed opportunities for early intervention. Given the high prevalence of asymptomatic osteopenia and silent osteoporosis detected in this study, routine osteodensitometric screening—ideally within the first year post-surgery—should be advocated, particularly in women not receiving hormone replacement therapy.

Lifestyle factors, while not reaching statistical significance, still showed important clinical trends. Women with osteoporosis were more likely to lead sedentary lifestyles, have lower dietary calcium intake, and report higher smoking rates. These risk factors are modifiable and should be part of a comprehensive bone health management plan, along with pharmacological options. Educational efforts are needed to improve awareness among both patients and providers regarding these risks and the benefits of early preventive strategies.Although the study presents clinically meaningful insights, it is not without limitations. The relatively small sample size and the single-centre design may limit generalisability. Moreover, serum oestradiol measurements were not available for all participants, and bone turnover markers were not assessed, which could have provided additional insights into the dynamics of bone remodelling post-oophorectomy. Future longitudinal studies incorporating hormonal profiles and treatment outcomes would be valuable in determining the long-term trajectory of BMD in this population.

In conclusion, this study reinforces the importance of osteodensitometric diagnostics as a key component in the follow-up of women undergoing oophorectomy. Given the strong association between surgical menopause and accelerated bone loss, routine BMD screening should be considered essential, particularly for those with bilateral oophorectomy and without hormone replacement therapy. Early detection through DEXA scans can significantly improve outcomes by facilitating timely preventive and therapeutic interventions aimed at preserving bone health and reducing fracture risk.

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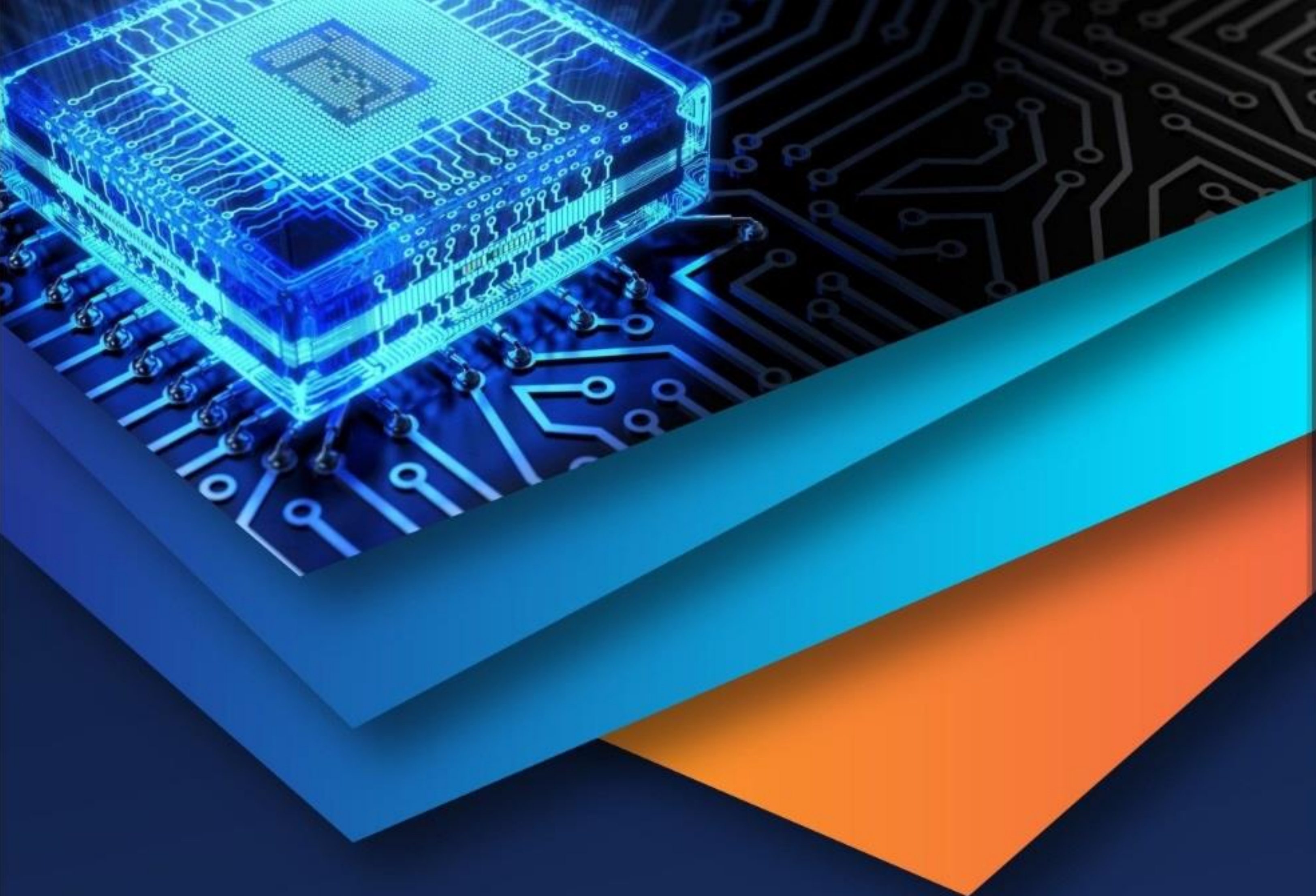

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