



Retrospective Evaluation of the Impact of Menopausal Status on the Recovery of Orthopedic Injuries

Gauri rani¹, Avinash Kumar²

¹Senior Resident, Department of Obst& Gynaecology, MGM Medical College and LSK Hospital Kishanganj Bihar

²Senior Resident, Department of Orthopaedic, MGM Medical College and LSK Hospital Kishanganj Bihar

Corresponding Author- Avinash Kumar

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Abstract

Background: Oestrogen levels diminish throughout menopause, affecting bone health and other biological processes. Oestrogen levels diminish during menopause, which increases bone resorption, lowers bone density, and may slow orthopaedic injury healing. To establish effective treatment regimens for postmenopausal women, one must understand how menopause affects orthopaedic injury healing.

Methods: MGM Medical College and LSK Hospital Kishanganj researchers conducted this retrospective cohort analysis. The study included 180 women with damaged bones, ligaments, and joint replacements conducted between April 2021 to March 2022. Participants were divided into premenopausal and postmenopausal groups by menopause status. Medical record data on functional outcomes, recovery timelines, and complication rates was analysed using Kaplan-Meier survival curves and Cox proportional hazards regression models.

Results: Study reveals postmenopausal women recover at 14.3 weeks, much longer than premenopausal women (10.2 weeks, $p < 0.01$). Additionally, postmenopausal women had a 35% higher complication rate than premenopausal women (20%, $p < 0.05$). The Kaplan-Meier survival curves showed that postmenopausal women recovered slower and had a reduced likelihood of full recovery by 16 weeks.

Conclusion: Orthopaedic injuries take longer and are harder to heal for postmenopausal women. These findings suggest that postmenopausal women need osteoporosis screening, tailored medications, and customised rehabilitation.

Introduction

Joint, muscle, bone, and soft tissue injuries affect patients' independence, happiness, and capacity to work, making them a major concern for healthcare practitioners. The recovery process from these injuries can be lengthy and complicated depending on the severity, patient health, and comorbidities [1]. Menopause is important but often disregarded by women.

Menopause, a normal biological process with physiological changes, ends reproductive years. The loss of muscle, bone, body composition, and connective tissues can impede orthopaedic injury healing. Postmenopausal women fracture and heal slowly from osteoporosis [2]. Hormonal changes during menopause may affect the body's inflammatory response and tissue healing, slowing recuperation.



Figure 1 Orthopedic injuries (Source:[3])



Rationale

This study fills a gap in menopause-related orthopaedic injury repair knowledge. Menopause and recovery study is crucial due to the ageing population and menopausal musculoskeletal problems. Understanding women's particular challenges during menopause and the years leading up to it helps doctors build more effective, tailored treatment regimens. This study addressed the need for scientific orthopaedic injury management in menopausal women. Because hormonal changes can affect bone and tissue health throughout this period of life, understanding how they affect recovery is vital. This study may also influence therapeutic guidelines and treatments to reduce menopause's impact on orthopaedic healing.

Objectives

1. The main goal is to compare premenopausal and postmenopausal orthopaedic injury repair.
2. To determine if comorbidities, injury type, and therapy mediate menopausal state and recovery.
3. To assess if menopause affects healing issues.
4. Based on the data, offer therapeutic practice adjustments to help postmenopausal women recuperate.

Hormonal Changes During Menopause

Oestrogen levels plummet during menopause, affecting various body systems. Oestrogen regulates bone density, healing, and damage response. Osteoporosis and fractures are more likely in postmenopausal women who don't have enough oestrogen because their bodies resorb bone faster and manufacture less [4]. Lower bone density makes orthopaedic injuries more likely and severe in women.

Effects of Menopause on Bone Health and Healing

Menopausal oestrogen deficiency slows fracture healing. Oestrogen affects bone remodelling through osteoblasts and osteoclasts, according to [5]. As oestrogen levels drop during menopause, bone resorption increases. This imbalance reduces bone mineral density and slows fracture repair. According to [6], postmenopausal women with osteoporosis have decreased bone strength and worse cellular repair processes, slowing fracture recovery.

Menopausal Status and Orthopedic Injury Recovery

Postmenopausal women heal slower and have more consequences from orthopaedic injuries. [7] found that postmenopausal women had longer hip fracture healing and comorbidities. Postmenopausal women may benefit

from preventative osteoporosis treatment. [8] found that menopause-related orthopaedic injuries are harder to heal. A cross-sectional study found that postmenopausal women had shorter recovery and functional limitations. [9] found that postmenopausal women had worse knee surgery outcomes and recuperation times. Menopausal hormone fluctuations hinder recovery and require personalised treatment regimens.

Clinical Implications of Menopausal Status on Orthopedic Recovery

These studies show that women who have gone through menopause need special care for hip injuries in order to deal with the problems they face. Knowing how menopause affects bone healing after menopause can help women who have gone through menopause use osteoporosis drugs, physical therapy, and hormonal treatments to keep their bones healthy and speed up their recovery [10]. The study offers several ways to look at how menopause impacts the healing of orthopaedic injuries. [11] proposed studying tailored hormone replacement treatment and advanced physical rehabilitation for postmenopausal women's recovery. Future study should examine the benefits of combined orthopaedic injury treatment in this population and the involvement of specific oestrogen receptors in bone recovery. According to prospective and retrospective research, oestrogen shortage during menopause lowers bone density, slows fracture healing, and increases morbidity [12]. The study emphasises the clinical significance of menopausal status in orthopaedic care and suggests more research on how to quantify targeted treatment efficacy and molecular causes. This detailed evaluation supports the study's purpose of studying menopausal changes on orthopaedic recovery.

Methods

Study Design

This retrospective cohort study examines menopause and orthopaedic injury repair. Retrospective studies use past data to detect trends and effects. This methodology allows for long-term study of therapy-treated patients' recovery trajectories.

Setting

The study was conducted at MGM Medical College Kishanganj and a tertiary care hospital with orthopaedic



services. The hospital's diverse patient population is ideal for studying menopause's effects on orthopaedic healing.

Sample Size

The study comprised 180 female orthopaedic injury patients at MGM Medical College and LSK Hospital Kishanganj.

Inclusion Criteria

- Female patients aged 40-70 years.
- Patients who sustained orthopedic injuries and completed the treatment and recovery process at the hospital.
- Availability of complete medical records, including menopausal status and recovery outcomes.

Exclusion Criteria

- Male patients.
- Female patients outside the age range of 40-70 years.
- Patients with incomplete medical records or lost to follow-up.
- Patients with concurrent severe medical conditions that could independently impact recovery (e.g., advanced cancer, severe cardiovascular disease).

Data Collection

The data was painstakingly retrieved from MGM Medical College and LSK Hospital Kishanganj EMRs. Each patient's demographics, damage data, treatment techniques, and recovery results must be extracted. Demographic data included age, menopause status, and comorbidities. The kind, severity, date, and treatment type of orthopaedic injuries were listed. To measure recovery,

we looked at how long it took patients to recover from injury to full function, any issues that arose during healing. We also collected treatment details, including drug use and physical therapy, to better understand each patient's healing process.

Statistical Analysis

We searched our data for patterns and relationships using SPSS 26.0. Descriptive statistics described the study population's demographics, injuries, and recovery results. T-tests were used to compare premenopausal and postmenopausal women's typical recovery times, and chi-square tests were utilised to determine if menopause was associated with issues. We performed multivariate regression analysis to identify factors that affected recovery duration and results, including age, comorbidities, and injury type. Survival analysis, including log-rank tests and Kaplan-Meier curves, compared the two groups' recovery times. Because all analyses had a p-value below 0.05, the study's conclusions were reliable. Our rigorous statistical analysis sought to understand how menopausal status affects orthopaedic injury recovery to improve patient care and educate professionals.

Results

Participant Characteristics

180 female orthopaedic injury patients at MGM Medical College and LSK Hospital Kishanganj were assessed. The average participant age was 55.6 years, and they ranged from 40 to 70. Ninety women were premenopausal or postmenopausal. Table 1 shows baseline data such as age distribution, comorbidities, and injury type.

Table 1 Demographic and Baseline Characteristics of Participants

Characteristic	Premenopausal (n=90)	Postmenopausal (n=90)	Total (n=180)
Mean Age (years)	48.2 ± 3.1	63.0 ± 4.5	55.6 ± 7.8
Comorbidities	45 (50%)	65 (72%)	110 (61%)
Type of Injury			
Fractures	50 (56%)	60 (67%)	110 (61%)
Dislocations	20 (22%)	15 (17%)	35 (19%)
Soft Tissue Injuries	20 (22%)	15 (17%)	35 (19%)
Treatment Received			
Surgical	60 (67%)	70 (78%)	130 (72%)
Non-Surgical	30 (33%)	20 (22%)	50 (28%)



Main Findings

The study found substantial differences in recovery outcomes for premenopausal and postmenopausal women. The average recovery time for postmenopausal women was 14.3 weeks, substantially longer than

premenopausal women's 10.2 weeks ($p < 0.01$). Additionally, postmenopausal women had higher rates of infections and delayed healing (35% vs. 20%, $p < 0.05$) during the healing process. Postmenopausal women also reported poorer functional recovery scores on the SF-36 and WOMAC.

Table 2 Recovery Outcomes Based on Menopausal Status

Outcome	Premenopausal (n=90)	Postmenopausal (n=90)	p-value
Mean Recovery Time (weeks)	10.2 ± 2.5	14.3 ± 3.0	< 0.01
Complications (%)	18 (20%)	32 (35%)	< 0.05
SF-36 Score (mean ± SD)	75.4 ± 10.2	68.1 ± 11.5	< 0.01
WOMAC Score (mean ± SD)	25.8 ± 5.7	30.2 ± 6.3	< 0.05

Statistical Analysis

The statistical investigation showed that menopause greatly impacts recovery. Significant differences ($p < 0.01$) were seen in the t-tests comparing the groups' mean recovery times and SF-36 scores. Chi-square testing revealed a significant association between menopausal

state and problems ($p < 0.05$). Regression study that accounted for age, comorbidities, and injury type found postmenopausal status to predict longer recovery time and more complications. Log-rank tests indicated statistical significance ($p < 0.01$), whereas Kaplan-Meier survival curves revealed varying recovery times.

Table 3 Kaplan-Meier Survival Analysis for Time to Recovery by Menopausal Status

Time (weeks)	Number at Risk (Premenopausal)	Number at Risk (Postmenopausal)	Number of Events (Premenopausal)	Number of Events (Postmenopausal)	Survival Probability (Premenopausal)	Survival Probability (Postmenopausal)
0	90	90	0	0	1.000	1.000
2	85	82	5	8	0.944	0.911
4	75	70	10	12	0.833	0.778
6	65	60	10	10	0.722	0.667
8	50	45	15	15	0.556	0.500
10	35	30	15	15	0.389	0.333
12	20	15	15	15	0.222	0.167
14	10	5	10	10	0.111	0.056
16	5	0	5	5	0.056	

Kaplan-Meier survival analysis shows different recovery trajectories for premenopausal and postmenopausal women. Both groups had a 1.000 survival probability when the study began (0 weeks in) because no participants had recovered. As weeks pass, the postmenopausal group loses more at-risk individuals (those still mending) than the premenopausal group. 85 premenopausal and 82 postmenopausal women are remained at risk at 2 weeks with survival probabilities of 0.944 and 0.911. The groups

remain divided, but this trend persists. At 8 weeks, only 50 premenopausal and 45 postmenopausal women are recovering with survival probabilities of 0.556 and 0.500. At 14 weeks, ten premenopausal women (survival probability 0.111) and five postmenopausal women (survival probability 0.056) are still recovering. After 16 weeks, all postmenopausal women are safe and recovered. Only five premenopausal women are recovering, and their survival chance is 0.056. Postmenopausal women recover



slower than premenopausal women, according to Kaplan-Meier survival curves. Longer healing and faster risk and survival reductions are shown in postmenopausal women. These findings show that menopausal state greatly impacts orthopaedic injury recovery and suggest that postmenopausal women need customised treatment regimens to recover faster. Postmenopausal women had longer recovery times, higher complication rates, and lower functional outcomes after orthopaedic injuries, demonstrating that menopause status affects recovery. These findings emphasise the need for personalised treatment regimens to help postmenopausal women recover.

Discussion

Comparison Table

Table 4 Comparison of the Present Study with Existing Studies

Study	Study Type	Sample Size	Findings
Present Study	Retrospective Cohort	180	Postmenopausal women had significantly longer recovery times (14.3 weeks vs. 10.2 weeks, $p < 0.01$) and higher complication rates (35% vs. 20%, $p < 0.05$). Functional recovery outcomes were poorer in postmenopausal women.
Study 1 [13]	Prospective Cohort	150	Found that postmenopausal women had longer recovery times and higher rates of complications after hip fractures. Emphasized the role of osteoporosis and hormonal changes.
Study 2 [14]	Cross-Sectional Study	200	Reported that postmenopausal women experienced more complications and had a higher incidence of delayed bone healing in orthopedic injuries compared to premenopausal women.
Study 3 [14]	Retrospective Cohort	120	Observed that postmenopausal women had significantly poorer functional outcomes and longer recovery periods after knee surgeries compared to premenopausal women.

As demonstrated in the comparison table, this study's findings on menopausal status and orthopaedic injury healing are consistent with and build on previous research. By including a wider range of orthopaedic injuries and a larger sample size, this study expands on previous findings that postmenopausal women have longer recovery times and higher complication rates. The present study found that postmenopausal women had significantly longer recovery periods and greater complication rates across diverse orthopaedic injuries, supporting study 1 focus on hip fractures and osteoporosis as important recovery delays. In a cross-sectional study, study 2 discovered that women who had gone through menopause had more problems and healed more slowly. Like this study, study 3 used a retrospective cohort method to show

This study shows that menopause affects orthopaedic injury rehabilitation. Postmenopausal women had lower recovery, morbidity, and functional outcomes. These findings complement prior research suggesting menopause-related hormonal changes, such as reduced oestrogen levels, harm tissue health, bone density, and muscle mass, making recovery harder and longer. Postmenopausal women recover slower due to osteoporosis and decreased bone repair. Furthermore, oestrogen influences immune responses and tissue healing, which is consistent with the higher occurrence of infections and delayed recovery. These findings support the study's main goal of examining menopausal state's impact on orthopaedic rehabilitation by highlighting postmenopausal women's specific challenges.

that women who had gone through menopause had worse functional outcomes and took longer to heal from knee surgery. The bigger sample size and more detailed approach of this study show that problems found in certain types of injuries or smaller samples are common across a wider range of orthopaedic problems. This study supports the idea that postmenopausal women need specialised care because their menopausal state has a big effect on their orthopaedic rehabilitation.

Implications

These findings have big effects on medicine. Doctors should be aware that postmenopausal women who hurt their bones have longer mending times and more problems. This group might gain from individualised care,



like hormone replacement therapy, intense physical rehabilitation, and starting to take bone-strengthening drugs early on. These results also show that women who have had orthopaedic injuries should get regular tests for osteoporosis and health issues related to menopause so that they can get better care faster.

Strengths and Limitations

This study is strong because it uses a big sample size and a lot of data from a tertiary care centre. These factors make sure that the results are reliable and useful. A retrospective cohort method made it possible to look at how menopause affected healing paths over time in a planned way. The study does have some flaws, though. Due to the flaws in medical records, retrospective studies may have wrong or missing data. Even though age and other health problems were taken into account in the study, healing may have been slowed by other factors.

Future Research

Prospective investigations are needed to validate these findings and understand how menopause affects orthopaedic injury rehabilitation. To understand targeted therapy, hormone function and bone and tissue healing must be studied. Moreover, longitudinal studies of postmenopausal women with orthopaedic injuries may help us learn how to maintain musculoskeletal health in this cohort. Hormone replacement therapy and specialist rehabilitation regimens may improve postmenopausal women's recovery. More research is needed. Filling these knowledge gaps will help create evidence-based clinical guidelines for menopausal women with orthopaedic recovery difficulties.

Conclusion

This study strongly suggests that menopause dramatically influences orthopaedic injury healing. Postmenopausal women had inferior functional outcomes, longer recovery times, and more comorbidities than premenopausal women. These findings confirm menopause's negative effects on bone health, tissue repair, and recovery. According to the study, orthopaedic clinicians should consider menopause. Preventative measures should include osteoporosis testing, early intervention, and individualised rehabilitation for postmenopausal women. The detailed data collection and huge sample size of this study provide strong insights on orthopaedic injury repair. However, the study was retrospective and may have contained confounding variables. This study highlights a

gap in orthopaedic care and the need for more research on postmenopausal women's healing and quality of life.

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