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EFFECT OF BISPHOSPHONATE THERAPY ON FUNCTIONAL OUTCOMES AND FRACTURE HEALING IN OSTEOPOROTIC HIP FRACTURES: A PROSPECTIVE OBSERVATIONAL STUDY

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Abstract

Background: Osteoporosis-related hip fractures represent a major burden in orthopedic practice. While bisphosphonates are established in preventing secondary fractures, their effect on fracture healing and postoperative outcomes remains debated.

Objective: To evaluate the role of early bisphosphonate therapy on radiological union, functional recovery, and prevention of subsequent fractures in elderly patients with osteoporotic hip fractures.

Methods: A prospective study was conducted on 120 patients (>60 years) with low-energy osteoporotic hip fractures treated surgically. Patients were divided into two groups: Group A (n=60) received standard care plus bisphosphonate therapy (oral alendronate 70 mg/week or IV zoledronic acid 5 mg yearly), while Group B (n=60) received standard care only. Outcomes assessed included time to radiological union, Harris Hip Score (HHS), pain score (VAS), and incidence of new fragility fractures at 12 months.

Results: Mean union time was comparable (Group A: 15.8 ± 2.1 weeks; Group B: 16.2 ± 2.4 weeks; p=0.41). Functional outcomes were superior in Group A with higher HHS at 6 months (78.5 ± 8.2 vs 72.3 ± 9.1, p=0.02) and 12 months (85.4 ± 7.5 vs 79.1 ± 8.7, p=0.01). New fragility fractures occurred in 3.3% of Group A vs 13.3% of Group B (p=0.04). No significant increase in delayed union or nonunion was observed with bisphosphonate therapy.

Conclusion: Early initiation of bisphosphonate therapy following osteoporotic hip fracture surgery improves functional recovery and reduces the risk of subsequent fractures without adversely affecting fracture healing.

Introduction

Osteoporotic hip fractures constitute a major challenge in orthopedics, associated with high morbidity, mortality, and socioeconomic burden (1,2). Pharmacological management is essential to prevent secondary fractures, with bisphosphonates being the first-line therapy due to their potent antiresorptive properties (3). However, controversy exists regarding their effect on fracture healing.

Some animal studies suggest delayed callus remodeling, while clinical data remain inconsistent (4,5). This study evaluates the impact of early bisphosphonate therapy on fracture healing, functional recovery, and prevention of subsequent fractures in elderly patients with osteoporotic hip fractures.

Materials and Methods

Study Design: A prospective observational study conducted at a tertiary care hospital between January 2022 and December 2023. Inclusion Criteria: Age ≥60 years; Low-energy osteoporotic hip fracture (confirmed on DEXA, T-score ≤ –2.5); Treated surgically with hemiarthroplasty or internal fixation.

Exclusion Criteria: Pathological fractures (except osteoporosis); Severe renal impairment (eGFR <30 mL/min); Prior bisphosphonate therapy; Malignancy or metabolic bone disease.

Intervention: Patients were divided into two groups: Group A (Bisphosphonate group, n=60): received either oral alendronate 70 mg weekly or IV zoledronic acid 5 mg annually within 2 weeks post-surgery. Group B (Control group, n=60): standard postoperative care without bisphosphonates. Both groups received calcium (1000 mg/day) and vitamin D (800 IU/day).

Outcome Measures: Radiological union (bridging of 3 of 4 cortices), Harris Hip Score (HHS) at 6 and 12 months, Pain relief (VAS), Incidence of new fragility fractures within 12 months.

Statistical Analysis: Continuous variables analyzed using Student's t-test; categorical variables with Chi-square test. $p < 0.05$ considered significant.

Results

Baseline Characteristics: Both groups were comparable in terms of age, sex distribution, comorbidities, and type of surgical fixation.

Fracture Healing: Mean union time: Group A (15.8 ± 2.1 weeks) vs Group B (16.2 ± 2.4 weeks), $p = 0.41$. No significant difference in delayed union/nonunion.

Functional Outcome (HHS): At 6 months: Group A (78.5 ± 8.2) vs Group B (72.3 ± 9.1), $p = 0.02$. At 12 months: Group A (85.4 ± 7.5) vs Group B (79.1 ± 8.7), $p = 0.01$.

Pain Scores (VAS): Significant reduction in Group A at 6 months (2.3 ± 1.1 vs 3.1 ± 1.4, $p = 0.03$).

Secondary Fractures: Group A: 2/60 (3.3%) developed new fractures. Group B: 8/60 (13.3%), $p = 0.04$.

Discussion

The present study demonstrates that early bisphosphonate therapy post-hip fracture surgery significantly improves functional recovery and reduces secondary fractures without delaying radiological union. Our findings are consistent with Eriksen et al. (6), who reported no adverse impact on fracture healing with bisphosphonates. In contrast, some animal models suggested inhibition of remodeling due to suppressed osteoclast activity (7). However, clinical trials such as the HORIZON Recurrent Fracture Trial (8) support early initiation to reduce subsequent fracture risk.

The improvement in Harris Hip Score and pain reduction in Group A can be attributed to enhanced bone mineral density and reduction in microfractures, providing greater skeletal stability. The reduced incidence of secondary fractures aligns with previous large-scale studies demonstrating a 40–70% reduction in vertebral fractures and 20–50% reduction in hip fractures with bisphosphonates (9,10).

Concerns about long-term therapy include atypical femoral fractures and osteonecrosis of the jaw (11). However, in our study (1-year follow-up), no such adverse events were observed. A "drug

holiday" approach after 3–5 years remains a widely accepted strategy to balance efficacy and safety (12).

Overall, the integration of bisphosphonate therapy into postoperative management of osteoporotic fractures supports a multidisciplinary approach involving orthopedics, geriatrics, and endocrinology.

Conclusion

Early initiation of bisphosphonate therapy after osteoporotic hip fracture surgery is safe, enhances functional recovery, and prevents secondary fragility fractures without impairing fracture healing. Routine incorporation into fracture liaison services can significantly reduce the burden of osteoporosis-related morbidity.

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