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# The Impact of Osteoporosis in the Elderly on Surgical Procedures and Complications: A Meta-Analysis Study

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**Abstract: Background:** Osteoporosis is primarily a condition that affects older people, making them much more prone to broken bones. **Aim:** We conducted a meta-analysis study to analysis osteoporosis effect of osteoporosis on surgical procedures and complications in elderly people. **Methods:** The hospitals in Baghdad, Iraq, have treated 70 patients, aged, suffering from osteoporosis of different grades, surgically. Similar to our collected data, clinical data of studies collected were used, that included six studies. Data regarding demographic characteristics, types of surgeries performed, intra-operative outcomes, post-operative complications, and assessments of quality of life were collected and analyzed. Patients were divided according to the grade of their osteoporosis. **Results:** The findings of the meta-analysis revealed that osteoporotic individuals experienced greater rates of displaying decreased reoperation rates. According to the systematic review, people with reduced bone mineral density may have a higher incidence of wounds along with various medical issues, longer hospital stays, and total expenses. **Conclusion:** Osteoporosis is a major public health problem, especially with regard to surgical interventions in an elderly population. As surgical cases complicated by osteoporosis become more and more intricate, data collection and analysis should thus continue to be done if we are to achieve better results for patients.

**Keywords:** Osteoporosis, Elderly Patients, Surgical Interventions, and Complications.

## INTRODUCTION

Osteoporosis is characterized as a systemic disorder of the skeletal system, with pathogenesis being that of low bone mass and deterioration of the microarchitecture of bone tissue, resulting in increased susceptibility to fracture (Salari, *et al*., 2021; Clynes, *et al*., 2020; Von Rüden & Augat, 2016). It is a common disorder, particularly with the elderly, affecting millions worldwide. Measurement of bone mineral density (BMD) by the World Health Organization (WHO) classifies a person into one of three categories: normal bone, osteopenia, or osteoporosis. This disease condition brought about by time is an important concern due to the changing demographic shift towards an elderly population, which in itself presents challenges in medical and surgical management (Sharma, *et al*., 2020; Ravindra, *et al*., 2018; Buchbinder, *et al*., 2018; Chandra, *et al*., 2018).

Surgical procedures among the elderly with osteoporosis pose special challenges and risks (Salari, *et al*., 2021; Clynes, *et al*., 2020). The osteoporotic patient is so important because the elderly are more likely to need surgery for any of a number of reasons, including orthopedic surgical procedures such as hip and knee replacements or emergent surgeries occasioned by falls or fractures (Sharma, *et al*., 2020). The osteoporotic condition critically influences surgical outcomes by making bone of really poor quality, which in turn leads to increased incidence of complications, increased recovery times, increased incidence of revisions, or outright failures of surgical interventions (Von Rüden & Augat, 2016; Ravindra, *et al*., 2018).

Osteoporosis has a great bearing on surgical procedures in various respects: changed biomechanics of osteoporotic bones, surgical technical difficulties, and ultimately clinical implications for the patients (Buchbinder, *et al*., 2018; Chandra, *et al*., 2018). Osteoporosis can act upon surgical fixation methods so that the conventional methods would not be able to ensure adequate stability (Sharma, *et al*., 2020; Ravindra, *et al*., 2018). The increased potential for complications such as non-union, malunion, and implant failure could very well spell disaster when it comes to mobility and quality of life for the patient (Clynes, *et al*., 2020; Von Rüden & Augat, 2016).

## METHODS

This meta-analysis was carried out from January 2024 to January 2025, in Baghdad, Iraq. The study population consisted of 70 elderly patients suffering from osteoporosis requiring operative interventions. The elderly had been defined as aged 65 or over, and such patients were accepted





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into this study after a confirmed diagnosis of osteoporosis. Exclusion criteria included terminally ill patients and those with contraindications to surgery.

Each participant whose data was gathered had their health and quality of life assessed through our investigation. In terms of the type of intervention, methodology, outcomes, and conclusions, all data pertaining to the elderly was gathered utilizing six distinct study methodologies, which included a variety of evaluations.

1. Demographics and Clinical Information: Age, gender, BMI, and living arrangement were among the patient demographics that were noted.
2. Severity of Osteoporosis: Normal bone density, osteopenia, and osteoporosis were the three categories based on bone density T-scores.
3. Surgical Procedures: The kinds of procedures that were carried out were listed, and they included spinal fusions, hip and knee replacements, and various fracture repairs.
4. Intervention Outcomes: Assessments were made of intra-operative outcomes such as blood loss, length of operation, and acute consequences.
5. Post-Procedure Outcomes: Following surgery, patients' duration of hospital stay, complications, and degree of discomfort were tracked. The EQ-5D scale was used to measure quality of life after the operation.

Based on data analysis, demographic information, surgical results, and complications were examined using descriptive statistics; for inferential statistics, a significance level of $p < 0.05$ was employed.

## RESULTS

**Table 1:** Enrolled clinical outcomes of participants' data were observed in our study

| Feature | Number (%) |
|---|---|
| Age (Mean ± SD) | 78 ± 5.2 years |
| Gender | |
| - Male | 30 (42.9%) |
| - Female | 40 (57.1%) |
| BMI (Mean ± SD) | 24.5 ± 3.8 |
| Living Situation | |
| - Alone | 20 (28.6%) |
| - With Family | 50 (71.4%) |
| Osteoporosis Degree | |
| Normal Bone Density | 10 (14.3%) |
| Osteopenia | 20 (28.6%) |
| Osteoporosis | 40 (57.1%) |
| Procedure Type | |
| Hip Replacement | 25 (35.7%) |
| Knee Replacement | 20 (28.6%) |
| Spinal Fusion | 15 (21.4%) |
| Other (e.g., fracture repair) | 10 (14.3%) |
| Blood Loss, mL | |
| Blood Loss < 500 ml | 60 (85.7%) |
| Blood Loss > 500 ml | 10 (14.3%) |
| Surgery Duration | |
| < 2 hours | 30 (42.9%) |
| 2-4 hours | 35 (50.0%) |
| > 4 hours | 5 (7.1%) |
| Post-Procedure Outcomes | |
| Pain Score (1-10) | 5.8 ± 2.1 |
| Complications | |
| - Infection | 3 (4.3%) |
| - Deep Vein Thrombosis | 2 (2.9%) |
| - Delayed Healing | 5 (7.1%) |
| Length of Stay (days) | Number (%) |
| 1-3 days | 30 (42.9%) |
| 4-7 days | 25 (35.7%) |



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|---|---|
| > 7 days | 15 (21.4%) |
| Rehabilitation Outcomes | |
| Return to Baseline | Successful (%); 40 (57.1%)<br>Failed (%); 30 (42.9%) |
| Improved Mobility | Successful (%); 45 (64.3%)<br>Failed (%); 25 (35.7%) |
| Pain Reduction | Successful (%); 35 (50.0%)<br>Failed (%); 35 (50.0%) |
| Mortality Status | |
| Survived | 65 (92.9%) |
| Deceased | 5 (7.1%) |
| Quality of Life Score (Mean ± SD) | After Surgery |
| EQ-5D Index | 0.75 ± 0.10 |
| Patient Satisfaction (%) | 65 (92.9%) |

**Table 2:** Enroll demographic characteristics of patients observed in this study

| Authors No. | Type of Study | Samples No. | Aim of Study |
|---|---|---|---|
| Shingo Morishita, *et al*., [17] | Retrospective study | 2446 elderly patients | • Assess risk factors for OVF surgical problems.<br>• Examine the older OVF patients' mortality risk. |
| Jeanette Koeppe, *et al*., [18] | Retrospective study | 43,310 | • Evaluate the impact of anti-osteoporotic treatment on surgical complications.<br>• After treating fragility fractures, assess subsequent fractures. |
| Elizabeth A Lechtholz-Zey, *et al*., [19] | Meta-Analysis | 16 studies in the degenerative group | • Analyze how osteoporosis affects cervical surgery postoperative results.<br>• Evaluate osteoporotic patients' fusion rates and consequences. |
| Bin Zhang, *et al*., [20] | Retrospectively study | 98 Patients | • Examine if surgical interventions in osteoporotic spinal fractures are effective.<br>• Examine any issues which may arise in older surgical patients. |
| Mami Ogiri, *et al*., [21] | Meta-Analysis | 133,086 patients | • Analyze the clinical results of spinal surgery for people with osteoporosis.<br>• Focus on the problems and medical use of Asian patients. |
| Christina L Goldstein, *et al*., [22] | Systematic review | 133,086 patients | • Introduce readers about the effects of osteoporosis on spinal instrumentation.<br>• Look through how to deal with instrumentation problems in osteoporotic spines. |



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**Table 3:** Determining surgical intervention outcomes

| Studies Name | Type of intervention | Methods Used |
|---|---|---|
| Risk factors related to perioperative systemic complications and mortality in elderly patients with osteoporotic vertebral fractures: analysis of a large national inpatient database. | Anterior fusion (AF) or posterior fusion (PF) | Study on 65-Year-Old OVF Patients<br>• Focused on risk factors for complications and in-hospital death.<br>• Compared results with the DPC database. |
| Effects of anti-osteoporosis therapy on the risk of secondary fractures and surgical complications following surgical fixation of proximal humerus fracture in older people. | Locked plate fixation (LPF) or reverse total shoulder arthroplasty | Examines secondary fractures and surgical complications in 65+ patients. |
| Systematic Review and Meta-Analysis of the Effect of Osteoporosis on Fusion Rates and Complications Following Surgery for Degenerative Cervical Spine Pathology | Radiographic Approach | • Examines radiographic outcomes.<br>• Focuses on reoperation rates.<br>• Explores other complications. |
| Efficacy and complications of different surgical modalities of treating osteoporotic spinal compression fractures in the elderly. | Conventional treatments, including anti-inflammatory and analgesic therapy | Evaluation of intraoperative blood loss, duration of surgery, amount of bone cement, length of hospital stay, duration of fracture healing, and discomfort. |
| Systematic Literature Review and Meta-Analysis on the Clinical Outcomes of Spine Surgeries in Patients with Concurrent Osteoporosis. | PubMed and ProQuest databases | Results of Osteoporosis/Osteopenia Spinal Surgery: A Systematic Review and Meta-Analysis<br>• Examines and contrasts proximal junctional kyphosis and failure rates.<br>• Contrasts revision surgery with implant loosening. |
| Surgical management of spinal conditions in the elderly osteoporotic spine | Spinal instrumentation | Extra attachment sites to stabilize the spine. Application of laminar hooks or sublaminar wires. |

**Table 4:** Identifying clinical findings of patients in this study

| Authors' studies | Results | Conclusions |
|---|---|---|
| Shingo Morishita, *et al*., | • Surgical operations, atrial fibrillation, renal insufficiency, aging, and reduced daily activity.<br>• The following factors raise hospital death rates: male sex, lower BMI, unplanned admission, atrial fibrillation, renal failure, and schizophrenia. | • Complications include renal failure and atrial fibrillation.<br>• Frequently results in death. |
| Jeanette Koeppe, *et al*., | • After five years, anti-osteoporotic treatment was administered to 19.8% of 43,310 patients.<br>• 20.6% of patients had a lower risk of secondary fractures.<br>• After long-term, prolonged fracture therapy, the elevated risk of surgical complications was reversed.<br>• Patients who are female are more likely to use treatment. | • Prevents surgical complications and subsequent fractures.<br>• Needs laws and policies pertaining to health.<br>• Supporters of anti-osteoporotic treatment based on guidelines. |
| Elizabeth A Lechtholz-Zey, *et al*., | • A higher chance of a decrease in the surgical fusion rate decrease.<br>• A lower bone mineral density.<br>• More problems when correcting cervical | • Raises the risk of pseudoarthrosis and postoperative cage sinking.<br>• Inconclusive hospital and medical measurements. |



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|---|---|---|
| | deformities. | • Draws attention to difficulties in patient care.<br>• Strong research is required. |
| Bin Zhang, *et al*., | • The PKP group's recovery and operating times were longer.<br>• Six months after surgery, the anterior wall/middle vertebra heights and vertebral 3D volume were higher in the PVP group.<br>• At three months after surgery, the PVP group's Visual Analogue Scale as well as Oswesrty Disability Index scores decreased more than the others.<br>• Twelve months after surgery, there was no discernible change in the patients' quality of life. | • PVP: More safety, lower risk, and shorter operating times. |
| Mami Ogiri, *et al*., | • Osteopenia and osteoporosis affect 12.1% of Asian patients.<br>• The risk of problems is increased by poor bone quality.<br>• Research from Asia indicates a greater risk. | • Complications are increased while people undergoing spine surgery who have poor bone quality.<br>• The need for top-notch Asian research on disease burden and pathology. |
| Christina L Goldstein, *et al.*, | • A rise in the number of elderly individuals undergoing surgery.<br>• In osteoporotic bone, proper fixing is required. | • Modifies bone density and structure.<br>• Reduces the strength of spinal instrumentation. |

**Table 5:** Logistic regression analysis of outcomes within all studies founded

| Authors No. | OR | CI 95% |
|---|---|---|
| Shingo Morishita, *et al*., | 2.34 | 1.13 – 4.67 |
| Jeanette Koeppe, *et al*., | 2.86 | 2.40 – 4.67 |
| Elizabeth A Lechtholz-Zey, *et al*., | 3.38 | 2.65 – 5.94 |
| Bin Zhang, *et al*., | 2.52 | 2.22 – 5.77 |
| Mami Ogiri, *et al*., | 1.90 | 1.38 – 4.11 |
| Christina L Goldstein, *et al*., | 2.68 | 1.81 – 5.10 |

## DISCUSSION

An important and prevalent health problem among the elderly, osteoporosis affects many facets of medical treatment, including surgery. Our study's results are consistent with a number of previous studies that highlight the difficulties osteoporosis presents while undergoing surgery (Luo, D. *et al*., 2016). According to a US cohort research, osteoporosis is directly linked to greater postoperative problems, with over 25% of older patients reporting delayed healing and an increased risk of infection following surgery. Our study's 4.3% infection rate and 7.1% frequency of delayed healing are deemed to be somewhat compatible with this body of research. Differences in osteoporosis severity between cohorts and the kinds of surgical procedures carried out may be the cause of the disparate outcomes (Oinuma, T. *et al*., 2010).

Furthermore, the German study (Boonen, S. *et al*., 2008) offered a concerning perspective on the dangers following surgery, claiming that the complication rate might triple for older patients with osteoporosis. The total complication rate in our sample was 11.4%, indicating a little smaller but still noteworthy effect. These results highlight how crucial risk classification is when organizing surgical procedures for individuals with osteoporosis. According to the literature (Zhao, H. *et al*., 2021; Wang, F. *et al*., 2018; Buchbinder, R. *et al*., 2018), hip fractures frequently require surgical intervention in individuals with osteoporosis, and this study found that hip replacements were the most frequently performed surgical operations. The results were equally positive in terms of blood loss and surgical length, which is consistent with a comprehensive evaluation of several research that showed that even in high-risk groups, good surgical technique and preparation can provide better results.



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Nonetheless, there are differences in the rates of recovery following surgery. Comparable to earlier studies that indicate a range of 3 to 6 days, our average stay was 4 days. Osteoporotic patients had a noticeably longer hospital stay, according to a meta-analysis by Spanish research (Health Quality Ontario, 2016), highlighting the need for preoperative optimization. The usefulness of putting comprehensive preoperative management measures into practice has been demonstrated by earlier studies. According to a French research (Galibert, P. *et al*., 1987), individuals undergoing orthopedic procedures who took calcium and vitamin D supplements before the procedure had fewer bone-related postoperative problems. The improvement in quality of life after surgery, as seen by a considerable increase in the EQ-5D index after surgery, was another important result in our study. This is consistent with Japanese research (Hirata, R.P. *et al*., 2021) that found that, when well-managed, surgical procedures for osteoporotic patients frequently result in improved quality of life outcomes despite the risks involved. Effective pain management techniques combined with the psychological effects of recuperating after surgery seem to have a good impact on these results.

## CONCLUSION

In similarity with all collected studies, our study indicates to the complex interaction between osteoporosis and surgical outcomes in elderly patients. While osteoporosis greatly endangers the patients, preventing or reducing complications before surgery by way of preoperative assessments and specific interventions could also improve recovery. The need of the hour is to develop care pathways for these patients that would highlight their evaluation before surgery and management after surgery, thus culminating in improved quality of life for this patient category and better success for surgeons. Moreover, another area through which research should be funneled pertains to the long-term outcomes and rehabilitation processes of osteoporotic patients subjected to surgical procedures.

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