

Advancing Hip Fracture Management in the Elderly: The Role of the Shizuoka Hip Fracture Prognostic Score (SHiPS)

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ABSTRACT

With the aging of populations worldwide, hip fractures among older people emerge as a significant public health dilemma, substantially impairing mobility, diminishing life quality, and leading to increased mortality and healthcare expenditure. To address this, the Shizuoka Hip Fracture Prognostic Score (SHiPS) has been formulated to predict long-term mortality within Japan's aging demographic. Analyzing data from 43,529 cases across 8.5 years, SHiPS assesses crucial factors, including sex, age, comorbidities, and ADL levels, categorizing mortality risk into four distinct levels, with ROC-AUC values surpassing 0.7, confirming its predictive accuracy. SHiPS notably uncovers marked sex-based disparities in mortality rates, with males exhibiting a heightened death risk over females, and delves into the varied impacts of diseases on these rates. Beyond guiding therapeutic and clinical management strategies and offering insights into both surgical and non-surgical options, SHiPS stresses the need for individualized treatment and optimal resource allocation in managing hip fractures. This review further details SHiPS, advocating for personalized care and highlighting the urgent requirement for continued research into treatment efficacies and sex-specific risk elements in elder hip fracture management.

Keywords: Hip fracture; Prognostic factors; Long-term mortality; Preoperative scoring system; Sex-specific disease risks

INTRODUCTION

In light of the globally aging population, hip fractures among the elderly have become a critical public health issue [1]. These fractures result in a significant reduction in independent mobility and quality of life, frequently requiring many survivors to transition to long-term care facilities. It is noteworthy that the mortality rate following a hip fracture significantly increases in comparison to other medical conditions [2,3]. Consequently, the treatment and recovery from hip fractures involve considerable expenses, including surgery, extensive rehabilitation, and caregiving services. These costs impose a heavy burden not only on the affected individuals and their families but also on healthcare systems and social security frameworks. Comprehending the factors influencing hip fracture prognosis and identifying high-risk individuals is crucial for delivering

tailored medical care and management aligned with prognostic risks. This approach is essential for the early recovery of patients and the efficient allocation of medical resources.

Although previous studies have identified several prognostic factors-including sex, age, BMI, comorbidities, medications, fracture type, and independent mobility [4,5], the significance of examining these predictors using Japanese data is particularly noteworthy. Japan, with its rapidly aging population, presents a unique demographic profile distinct from Western countries, where many existing studies have been conducted. Physiological, cultural, and healthcare system differences may influence the prognosis of hip fractures and the effectiveness of current predictive models.

The Shizuoka Hip Fracture Prognostic Score (SHiPS), a scoring system we developed based on preoperative prognostic factors,

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aims to predict long-term mortality in Japan's elderly population following a hip fracture [6]. This review will outline the SHiPS scoring system and introduce some intriguing preliminary findings encountered during its development.

LITERATURE REVIEW

Development of the SHiPS scoring system

Over 8.5 years, using data from the Japanese claims database (April 2012-September 2020), we analyzed 43,529 cases in first-time hip fracture patients aged 65 and older, with 34,499 being women (79.3%). During this period, 43% of the patients died. In our analysis using the Cox regression model, we identified crucial prognostic factors affecting mortality, including sex (male), advanced age, fracture site, care-need certification indicative of Activities of Daily Living (ADL) levels, and comorbidities like malignant and metastatic solid tumors, renal diseases, congestive heart failure, chronic pulmonary diseases, liver diseases, and deficiency anemias. These factors were evaluated and integrated into SHiPS, using scoring points to categorize the 5-year post-fracture mortality risk into four levels. The predictive accuracy of SHiPS for 1,3 and 5-year mortality demonstrated satisfactory performance, with ROC-AUC values exceeding 0.7. For instance, the predicted 1-year survival rate was 96% in the lowest-risk group and 63% in the highest-risk group. The 5-year survival rates were estimated to be 81% for the lowest-risk and 13% for the highest-risk groups, respectively.

While numerous prognostic models exist, many depend on laboratory values to primarily forecast short-term mortality within the first year after a fracture [7,8]. Furthermore, these models predominantly focus on patients receiving surgical treatment for hip fractures. In contrast, the SHiPS uses information obtainable during the incident to predict long-term mortality for up to five years. Moreover, the SHiPS can be adapted to patients who, for a variety of reasons, choose conservative treatment over surgery. Rapid and accurate prognostic risk assessment during fracture can affect immediate treatment and clinical management and assist in planning long-term strategies, including rehabilitation and managing comorbid conditions.

Importance of sex differences on prognosis

A significant observation during the SHiPS development was that, although women comprise approximately 80% of hip fracture incidents, men displayed a notably higher mortality rate, evidenced by a hazard ratio of 2.09 (95% CI: 2.01-2.18), suggesting that men have twice the likelihood of mortality compared to women. Although our study did not ascertain a direct cause of death, this discovery emphasizes sex as a crucial risk factor, aligning with outcomes reported in previous research [1,3-5,7,9-12]. According to previous research, men may face a higher risk of infections (such as pneumonia, influenza, and sepsis) and heart failure as postoperative complications, potentially contributing to elevated mortality rates following hip fractures [11,12]. Moreover, reports indicate that the use of anti-osteoporotic medications, linked to better outcomes after hip fractures, is less prevalent among men compared to women

[1,13]. (A subsequent section will elaborate on the association between post-hip fracture care and anti-osteoporotic medication use.) However, the underlying causes of the observed disparity in mortality rates between men and women are still not fully understood.

Subgroup analyses from our study hint at the potential for sex-specific risk factors influencing hip fracture mortality. Notably, chronic pulmonary diseases were more prevalent in men, while cerebrovascular diseases and myocardial infarctions were more common among women. Additionally, the effect of aging appeared more pronounced in men, but women seemed to be more adversely affected by liver diseases and solid tumors (unpublished data). Nevertheless, these findings alone cannot fully explain the significant differences in mortality between the sexes, suggesting the presence of other unidentified risk factors. Future research should aim to uncover these factors, emphasizing the need for sex-specific approaches in treatment and rehabilitation planning.

Mortality for hip fractures: Surgical vs. conservative approaches

It is widely accepted that early surgical intervention following a hip fracture contributes to improved outcomes [14,15]. Nevertheless, various reasons lead some patients to decline surgery, and research into the impact of conservative treatment on prognosis remains limited [16]. Our analysis revealed a greater inclination towards conservative treatment choices among our subjects compared to previous reports [7]. Individuals selecting conservative treatments exhibited marginally higher SHiPS scores, suggesting a tendency towards older males with reduced ADL levels and a greater number of comorbidities. While definitive causality related to surgery remains unclear, mortality rates were marginally lower in the group receiving surgical treatment. This observation underscores the necessity of carefully weighing the benefits of surgical intervention against its potential risks. As care transitions towards patients opting for surgery, addressing surgical-related complications, including infections and thrombosis, becomes crucial. Focusing on these complications and implementing effective prevention and early response strategies is vital for optimizing patient outcomes. Conversely, for patients foregoing surgery, the emphasis shifts to preventing and managing complications arising from prolonged bed rest, including muscle weakness, contractures, bedsores, and pneumonia. Thus, post-hip fracture decision-making process must extend beyond the binary choice of surgical or conservative treatments. It demands an integrative approach that accounts for the patient's overall health status, prognostic predictions, and quality of life preservation. This underscores the importance of devising personalized treatment strategies catering to the unique risks and advantages of each patient's condition.

Post-hip fracture care: Medication, rehabilitation and nutrition

In addition to treatment options like surgery, the significance of post-fracture care plays a pivotal role in determining patient prognosis [17]. Anti-osteoporotic medications, notably

bisphosphonates, significantly reduce mortality rates following hip fractures [1,13]. These benefits arise partly from the diminished risk of subsequent fractures, enhanced functional outcomes, and accelerated rehabilitation and recovery processes. Bisphosphonates help in cardiovascular health by reducing the risk of acute myocardial infarction and fatal arrhythmias and enhancing the immune response against serious infections along with vitamin D, potentially contributing to their prevention.

The early initiation of rehabilitation after fracture also plays an essential role in reducing post-fracture mortality, primarily by helping them return to or improve their pre-fracture level of function [18,19]. Effective rehabilitation aims to manage pain, restore muscle strength, enhance balance and coordination, and support independence in ADLs. Early mobilization through rehabilitation reduces the risk of complications such as pneumonia, thrombosis, and delirium, improves mental health by increasing self-esteem and self-efficacy, and facilitates social reintegration. Nonetheless, the realm of rehabilitation encounters considerable obstacles, such as restricted access to specialized services-particularly in rural and underserved areas-and the intricacies involved in transitioning from hospital to community-based care [18]. Coordination and resource allocation are additional challenges, along with the need for specialized interventions for patients with cognitive impairments such as dementia. Addressing these issues requires a concerted effort to standardize practices, enhance care access, and promote collaboration among healthcare providers to improve outcomes and quality of life for these patients.

DISCUSSION

Inadequate nutrition significantly elevates the risk of hip fractures in older people and adversely affects recovery outcomes, culminating in complications such as delirium, sepsis, bedsores, and heightened mortality [20]. Malnutrition, common among older people with hip fractures, often exacerbates post-fracture. Consequently, malnutrition post-fracture usually results in only partial recovery to pre-fracture levels of ADL independence. Implementing dietary strategies is straightforward, where providing adequate nutritional support after a fracture is vital for effective healing, recovery, and preventing further complications. For example, oral dietary supplements have demonstrated benefits for elderly patients with hip fractures by enhancing total energy, protein, and fluid intake, thereby reducing complications and preventing weight loss [20]. Considering the evident connection between malnutrition and its negative impact on health outcomes for elderly individuals with hip fractures, healthcare providers must give priority to nutritional support within the overall care strategy. Guaranteeing these patients receive personalized nutritional interventions can substantially enhance their overall recovery process, improve their quality of life, and possibly minimize the risk of long-term disabilities. Therefore, integrating effective dietary strategies should be considered a standard practice in managing hip fracture cases among older people.

CONCLUSION

The SHiPS scoring system marks a substantial breakthrough in managing hip fractures, offering a crucial tool for the prediction of long-term mortality and facilitating care that is personalized according to individual risk factors. The formulation of SHiPS, in conjunction with prior studies, highlights the multifaceted nature of factors influencing outcomes, such as sex disparities, options in treatment, and the pivotal roles of medication, rehabilitation, and nutrition in care after fractures. This accentuates the need for an integrated strategy that prioritizes immediate surgical interventions alongside comprehensive post-fracture management to improve recovery and life quality. Enhancing our comprehension of these elements, especially considering cultural and demographic variances, is crucial for delivering more precise and effective healthcare. Additionally, fostering multidisciplinary collaboration among clinicians, nurses, physical therapists, occupational therapists, pharmacists, dietitians, social workers, and mental health professionals is crucial. Addressing these challenges demands a unified effort from healthcare providers, researchers, and policymakers alike, aiming to reduce mortality rates, improve outcomes, and preserve independence in the elderly population suffering from hip fractures.

CONFLICTS OF INTEREST

None.

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