



THE HIDDEN EPIDEMIC: UNRAVELLING SARCOPENIA'S INFLUENCE ON RECOVERY AND REHABILITATION IN ORTHOPAEDIC SURGERY

Orthopaedics

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ABSTRACT

Sarcopenia, defined by a progressive loss of muscle mass and strength, is emerging as a critical factor influencing postoperative recovery and long-term functional outcomes in orthopaedic surgery. This systematic review explores the multifaceted impact of sarcopenia on recovery trajectories, rehabilitation effectiveness, and complication rates following common orthopaedic procedures such as total hip and knee arthroplasties and spinal surgeries. Special emphasis is placed on the challenges associated with preoperative identification of sarcopenia and its frequent coexistence with osteoporosis—both of which are underdiagnosed in routine clinical practice. Given the demographic shift toward an aging population, particularly in countries like India, the prevalence of sarcopenia and osteoporosis is rising rapidly. The review highlights the importance of integrating muscle and bone health assessments into pre-surgical planning. It advocates for proactive strategies including nutritional optimization, physiotherapy-led prehabilitation, and pharmacologic interventions such as denosumab for bone strengthening. These approaches can significantly reduce postoperative complications, enhance functional recovery, and restore patient independence. By drawing from current evidence and contextualizing it within resource-constrained healthcare systems, this review underscores the urgent need for a multidisciplinary, preventive care model. Early detection and personalized rehabilitation plans are essential in improving outcomes in sarcopenic patients undergoing orthopaedic surgery.

KEYWORDS

Sarcopenia, postoperative recovery, osteoporosis, rehabilitation, orthopaedic surgery.

INTRODUCTION

As the global population ages, orthopaedic surgeries such as total hip arthroplasty (THA), total knee arthroplasty (TKA), and spinal surgeries are becoming more prevalent. Among the various factors affecting postoperative recovery, sarcopenia has emerged as a key concern. Defined by a decline in muscle mass and function, sarcopenia contributes to frailty and diminished physical capabilities, posing a significant risk to surgical outcomes in elderly patients. It adversely affects recovery times, rehabilitation effectiveness, and overall functional recovery (Su et al., 2024; Tanaka et al., 2024).

With the aging population, the prevalence of sarcopenia is expected to increase, highlighting the need to better understand its impact on recovery following orthopaedic surgeries. This review aims to consolidate existing evidence on how sarcopenia influences recovery, complications, and rehabilitation outcomes in individuals undergoing hip replacements, knee arthroplasties, spine surgeries and trauma surgeries.

The Impact Of Sarcopenia On Orthopaedic Surgery Outcomes Impact On Recovery And Rehabilitation

Sarcopenia, a condition characterized by the progressive loss of muscle mass and function, significantly impacts postoperative recovery, particularly in orthopaedic patients. In sarcopenic individuals, recovery from surgeries such as total hip arthroplasty (THA), total knee arthroplasty (TKA), and spinal procedures is often delayed, with slower regain of functional mobility. This delay is attributed to muscle atrophy and the consequent loss of strength, which severely hinders rehabilitation efforts. Sarcopenic patients are more susceptible to complications such as infections, falls, delayed wound healing, and prolonged hospital stays (Longo et al., 2023). For example, patients undergoing THA and TKA with sarcopenia often experience prolonged functional recovery, with a reduced ability to walk independently and a diminished overall quality of life (Su et al., 2024; Chang et al., 2023).

A key factor contributing to delayed recovery is the difficulty in performing rehabilitation exercises due to muscle weakness. As muscle mass declines, the patient's capacity for physical therapy and rehabilitation activities is diminished, further extending recovery times (Brzeszczyński et al., 2021). Additionally, these patients require more extended hospitalizations to manage complications and to provide intensive physical therapy, leading to increased healthcare costs and burden on healthcare systems (Tanaka et al., 2024).

For example, a study by Nanri et al. (2024) highlighted that sarcopenia substantially affects walking independence in elderly patients

undergoing total joint arthroplasty. Sarcopenic patients, in this case, had a significantly lower chance of achieving independent ambulation post-surgery, which is a critical component of recovery. Similarly, sarcopenic individuals undergoing THA are at heightened risk for prolonged recovery periods and greater reliance on assistive devices, including walkers and canes, even after being discharged from the hospital (Knoedler et al., 2023).

The impact of sarcopenia is not limited to elective orthopaedic surgeries. In post-operative trauma patients, such as those recovering from hip fractures or spinal injuries, sarcopenia also plays a crucial role in recovery outcomes. Trauma patients with sarcopenia face a greater risk of postoperative complications, including infections, delayed wound healing, and increased mortality rates (Knoedler et al., 2023). Sarcopenic trauma patients often experience a delayed return to baseline functional status, further compounding the physical and psychological challenges they face during recovery.

Impact On Complications And Mortality

Sarcopenia is associated with an increased incidence of postoperative complications, significantly impacting the outcomes of major orthopaedic surgeries. Patients with sarcopenia undergoing procedures such as total hip arthroplasty (THA) and total knee arthroplasty (TKA) face a higher risk of complications, including deep vein thrombosis (DVT), infection, and even mortality (Knoedler et al., 2023). The condition's negative effects are compounded by reduced muscle strength and function, which limit the body's ability to heal and recover efficiently. Furthermore, sarcopenic individuals often have multiple comorbidities, such as frailty, which further elevate the risk of adverse postoperative outcomes (Chiang et al., 2021).

A comprehensive meta-analysis by Knoedler et al. (2023) emphasized that sarcopenia notably increases the risk of surgical complications, including wound dehiscence and impaired functional recovery, in patients undergoing joint replacement surgeries like THA and TKA. The loss of muscle mass and strength diminishes the body's capacity to withstand the stress of surgery and hinders the healing process, leading to a higher likelihood of complications. Sarcopenic patients are also more prone to prolonged hospitalizations due to these complications, which further delays recovery and increases the overall healthcare burden.

In addition to these direct surgical complications, sarcopenia contributes to the development and exacerbation of frailty, a condition marked by weakness, slowness, and reduced physical activity. Frailty has a detrimental effect on postoperative recovery, significantly

complicating the rehabilitation process. Patients who are frail often experience longer hospital stays, require more intensive care, and are less likely to achieve full functional recovery (Bokshan et al., 2016). Frailty can also increase the risk of falls, further hindering recovery and leading to additional complications such as fractures or re-hospitalization. Sarcopenia's impact extends beyond elective surgeries; it is a particular concern in postoperative trauma patients, such as those recovering from hip fractures or spinal injuries. Trauma patients with sarcopenia face heightened risks of complications such as infection, delayed wound healing, and increased mortality rates. Sarcopenia further complicates recovery in trauma patients, as the loss of muscle mass impairs the ability to mobilize, increasing the likelihood of immobility-related complications, such as pressure ulcers and pneumonia. Moreover, sarcopenic trauma patients may have a more challenging time returning to baseline functional status, making long-term rehabilitation efforts more difficult.

Challenges In Preoperative Identification Of Sarcopenia

Although sarcopenia is now recognized as a major determinant of postoperative complications and delayed recovery in orthopaedic patients, its preoperative identification remains a significant clinical challenge. Despite the growing body of evidence supporting its role in influencing surgical outcomes, sarcopenia often goes undetected prior to orthopaedic interventions such as total hip arthroplasty (THA), total knee arthroplasty (TKA), and spinal procedures. This diagnostic gap is primarily due to the absence of universally accepted screening protocols and the variability in diagnostic definitions used across clinical settings and research studies (Koto et al., 2022).

The early stages of sarcopenia can be insidious, presenting without overt clinical signs, which makes it difficult to identify during routine preoperative assessments. Although advanced imaging modalities such as dual-energy X-ray absorptiometry (DXA) and computed tomography (CT) scans offer accurate evaluations of muscle mass and composition, they are not widely implemented in standard pre-surgical screening due to limitations in cost, accessibility, and resource allocation (Pegreff et al., 2024). These technologies, while effective, are frequently reserved for research settings or high-risk cases, leaving many sarcopenic patients unidentified until complications emerge postoperatively.

To circumvent these limitations, alternative screening tools such as the SARC-CalF method—which utilizes calf circumference as a surrogate marker for muscle mass—have been developed for easier implementation in routine clinical practice (Su et al., 2024). However, the reliability of these tools is still under scrutiny. Many lack the necessary sensitivity and specificity to be definitive, particularly in populations with comorbidities or varying body compositions. The inconsistency in screening results, coupled with a lack of consensus on threshold values, further complicates clinical decision-making and limits the utility of these tools in predicting outcomes (Brzezczynski et al., 2021).

Importantly, timely recognition of sarcopenia prior to surgery is essential, as it enables clinicians to initiate tailored interventions such as prehabilitation, targeted nutritional supplementation, and physical conditioning programs that are known to improve postoperative recovery trajectories (Longo et al., 2023). These preoperative strategies have the potential to enhance muscle strength and function, reduce the risk of complications, and ultimately improve surgical outcomes.

This issue is even more critical in the context of trauma patients, particularly older adults recovering from hip fractures or spine injuries. These individuals often present emergently, leaving limited time for comprehensive preoperative evaluations. Nonetheless, the presence of sarcopenia in these patients significantly heightens the risk of adverse outcomes, including infection, immobility, prolonged hospitalization, and mortality. As trauma patients frequently overlap with the frail elderly demographic, rapid assessment tools and protocols for sarcopenia are urgently needed to better stratify risk and guide immediate postoperative care. From the author's perspective, grounded in both clinical experience and thorough review of current literature, there is a compelling need to advocate for routine preoperative evaluation of not only sarcopenia but also osteoporosis. These two conditions are interlinked and often coexist, particularly in the elderly population undergoing major orthopaedic procedures. Sarcopenia compromises muscle strength and mobility, while

osteoporosis increases the risk of fragility fractures and poor implant fixation. Ignoring either condition can severely compromise the surgical outcome.

Hence, it is imperative that osteoporosis assessment—ideally via DXA—and appropriate medical management be integrated into preoperative planning. Initiating treatment with anti-resorptive agents and osteoanabolic therapies such as bisphosphonates, denosumab, or teriparatide prior to surgery may significantly enhance bone quality, support prosthetic integration, and reduce complication rates. This holistic approach to musculoskeletal optimization not only aids in surgical decision-making and patient selection but also maximizes the likelihood of a successful functional recovery.

Overcoming the challenges in preoperative identification of sarcopenia and osteoporosis is essential to improving outcomes in orthopaedic surgery. The integration of cost-effective, standardized screening protocols and early therapeutic interventions can bridge the gap between diagnosis and optimized recovery. This review aims to highlight these needs and proposes that the future of orthopaedic surgical success must begin well before the first incision—with the comprehensive assessment and treatment of the aging musculoskeletal system.

Rehabilitation Strategies For Sarcopenic Patients

Rehabilitation is a cornerstone in the management of sarcopenic patients undergoing orthopaedic surgeries, with a growing body of evidence supporting structured pre- and postoperative interventions to enhance recovery. Prehabilitation—initiated before surgery—includes targeted resistance training, functional mobility exercises, and nutritional supplementation. Such programs have demonstrated improved surgical outcomes, particularly in elderly patients with sarcopenia undergoing procedures like total knee and hip arthroplasty (Pegreff et al., 2024). Strengthening key muscle groups before surgery enhances baseline physical function and prepares patients to cope with the physiological stress of surgery. Nutritional support, especially adequate protein intake along with vitamin D supplementation, plays a crucial role in maintaining muscle protein synthesis and preventing further muscle degradation (Nanri et al., 2024).

Postoperatively, rehabilitation strategies must be tailored to the reduced muscular capacity and increased frailty of sarcopenic patients. Low-impact aerobic activities, such as walking and cycling, along with progressive resistance training, are beneficial in gradually restoring muscle strength and functional mobility (Pegreff et al., 2024). Early mobilization and controlled physical therapy help reduce the risk of complications like deep vein thrombosis, pressure ulcers, and pneumonia. Importantly, rehabilitation should not be approached as a one-size-fits-all protocol; personalization based on the patient's preoperative functional level and nutritional status is essential.

Tanaka et al. (2024) highlighted that patients who underwent preoperative strengthening combined with structured postoperative rehabilitation achieved superior functional outcomes and faster return to independence following hip arthroplasty. These findings underscore the importance of continuity between pre- and postoperative care.

In trauma settings—especially in elderly patients presenting with fragility fractures such as hip fractures—the role of rehabilitation becomes even more critical. Sarcopenic trauma patients often begin rehabilitation from a lower functional baseline and are at higher risk for complications due to immobility and nutritional deficits. In such cases, rehabilitation must be initiated as early as possible, with a comprehensive plan focusing on functional restoration, nutritional replenishment, and psychological support.

From an Indian healthcare perspective, implementing such multidisciplinary rehabilitation programs presents unique challenges. Resource constraints, limited awareness about sarcopenia, and inadequate geriatric care infrastructure often hinder early identification and intervention. However, integrating the efforts of physiotherapists, orthopaedic surgeons, and clinical nutritionists is pivotal in optimizing patient care. Physiotherapists, in particular, serve as frontline caregivers in postoperative rehabilitation. Their close collaboration with orthopaedic surgeons ensures that rehabilitation plans are aligned with surgical outcomes and healing timelines, while nutritionists provide crucial guidance on dietary interventions to combat muscle loss.

In India, fostering awareness among orthopaedic teams about the implications of sarcopenia, and incorporating simple screening protocols during pre-surgical assessments, could significantly improve patient selection and outcome prediction. Furthermore, developing cost-effective community-based rehabilitation models can make these strategies more accessible across both urban and rural settings.

The rehabilitation of sarcopenic patients demands a coordinated, individualized, and multidisciplinary approach. By strengthening the collaboration between physiotherapists, orthopaedic surgeons, and nutritionists—especially in resource-limited settings like India—significant strides can be made in improving recovery outcomes and reducing the long-term impact of sarcopenia in orthopaedic populations.

The Role Of Nutrition And Supplements In Sarcopenia Management

Nutritional intervention is an essential pillar in the comprehensive management of sarcopenia, particularly during the perioperative period in orthopaedic patients. Sarcopenia, which compromises muscle mass and strength, can significantly delay postoperative recovery, and targeted nutrition can play a pivotal role in minimizing these adverse effects. Adequate protein intake is crucial for maintaining and rebuilding muscle tissue. Evidence shows that higher dietary protein, especially rich in essential amino acids like leucine, contributes to improved muscle protein synthesis and supports the recovery of sarcopenic patients following orthopaedic surgeries (Tanaka et al., 2024; Pegreffi et al., 2024).

In addition to protein, vitamin D plays a key role in muscle function and bone health. Its deficiency, which is common among elderly patients, particularly in regions with limited sun exposure or poor dietary habits, has been linked to worsening sarcopenia. Supplementation with vitamin D can improve muscle strength and reduce the risk of falls and fractures, which is particularly relevant for orthopaedic and post-trauma patients (Pegreffi et al., 2024). Moreover, omega-3 fatty acids have anti-inflammatory properties that aid muscle regeneration and reduce catabolic muscle loss, making them beneficial in the recovery phase.

In the Indian context, the challenges of malnutrition and underdiagnosed micronutrient deficiencies in elderly orthopaedic patients are considerable. Many patients from rural or socioeconomically weaker backgrounds present with chronic nutritional inadequacies that predispose them to sarcopenia, often undetected until a major fracture or joint replacement is required. Integrating nutritional assessment into preoperative planning, especially in trauma settings, is essential to optimize surgical readiness and reduce complications.

In trauma patients, such as those with hip fractures, the nutritional status is often acutely worsened due to immobility and systemic stress responses. Timely and individualized supplementation, including high-protein diets, vitamin D, and possibly omega-3 fatty acids, can support recovery and functional outcomes in this vulnerable group.

Incorporating a personalized nutritional strategy before and after orthopaedic surgery can significantly mitigate the impact of sarcopenia. For India, where nutritional deficiencies are prevalent, establishing multidisciplinary care involving orthopaedic surgeons, dietitians, and rehabilitation specialists is key to improving surgical success and patient quality of life.

CONCLUSION

Sarcopenia remains an often-overlooked yet critical determinant of postoperative recovery and long-term functional outcomes in orthopaedic surgery, particularly in the elderly. In the Indian healthcare setting—marked by a rapidly aging population, limited access to specialized geriatric care, and widespread nutritional deficiencies—this condition must be brought to the forefront of surgical planning and rehabilitation. Addressing sarcopenia should be a proactive, multidisciplinary effort involving orthopaedic surgeons, physiotherapists, and clinical nutritionists working in close coordination to identify at-risk patients, initiate prehabilitation programs, and implement tailored nutritional strategies.

frequently coexists with sarcopenia and significantly increases the risk of fragility fractures, poor implant fixation, and revision surgeries. Preoperative evaluation of bone mineral density using tools like DXA should be standardized in all elderly patients undergoing major orthopaedic procedures. The use of pharmacological agents, particularly newer therapies such as denosumab, which inhibits bone resorption and improves bone strength, has shown promise in enhancing skeletal health and surgical outcomes when initiated in the perioperative period.

In the Indian context, cost-effective screening tools, greater awareness, and structured musculoskeletal health policies are urgently needed to shift from a reactive to a preventive orthopaedic care model. The future lies in holistic, patient-centered approaches—identifying sarcopenia and osteoporosis early, strengthening patients preoperatively, and ensuring a smooth, functional recovery post-surgery. By embracing this integrative model, Indian orthopaedic care can ensure not just survival after surgery, but restoration of independence, mobility, and quality of life.

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Equally vital is the assessment and treatment of osteoporosis, which