Saudi Journal of Medicine and Public Health

https://saudijmph.com/index.php/pub

https://doi.org/10.64483/202522312

Hip Fracture Overview: Integrating Medical, Nutritional, Rehabilitation, and Psychological Care

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Abstract

Background: Hip fracture is a major global health concern, particularly among the elderly, associated with high morbidity, mortality, and economic burden. It typically results from low-energy falls in osteoporotic individuals, though high-energy trauma causes fractures in younger patients. Effective management requires a comprehensive, integrated approach addressing far more than the fracture itself.

Aim: This review provides a holistic overview of hip fracture care, integrating medical, surgical, nutritional, rehabilitation, and psychological perspectives to optimize patient outcomes from emergency presentation through to long-term recovery and secondary prevention.

Methods: A narrative synthesis of current evidence and clinical guidelines is presented, covering epidemiology, classification, multidisciplinary evaluation, surgical management options, and the critical roles of perioperative optimization and structured rehabilitation.

Results: Diagnosis relies on clinical assessment and imaging, with MRI for suspected occult fractures. Treatment is predominantly surgical, with the approach dictated by fracture type and patient factors: arthroplasty (total hip or hemiarthroplasty) for displaced intracapsular fractures in the elderly, and internal fixation for undisplaced intracapsular and most extracapsular fractures. Outcomes are significantly improved by early surgery (within 48 hours), effective pain control (e.g., nerve blocks), and a coordinated orthogeriatric model of care. This multidisciplinary approach addresses medical comorbidities, delirium prevention, nutrition, and early mobilization, which are essential to mitigate complications like thromboembolism, infection, and functional decline.

Conclusion: Successful hip fracture management necessitates an interprofessional, patient-centered strategy. Combining timely, evidence-based surgery with comprehensive medical, nutritional, and rehabilitative support improves survival, functional recovery, and quality of life while emphasizing the importance of falls prevention and osteoporosis treatment for secondary prevention.

Keywords: Hip Fracture, Orthogeriatrics, Multidisciplinary Care, Arthroplasty, Internal Fixation, Osteoporosis, Rehabilitation, Complications.

Introduction

Hip fractures constitute one of the most prevalent and clinically significant injuries encountered in emergency departments and by orthopedic trauma teams. These injuries represent a major source of morbidity and mortality, particularly among older adults, and continue to pose substantial challenges for acute care management and long-term rehabilitation. In clinical terminology, the expressions *hip fracture* and *neck of femur fracture* are frequently used interchangeably, reflecting their shared anatomic scope. Both terms refer to fractures occurring within the proximal femoral region, specifically extending from the femoral head to a point approximately 5 centimeters distal to the lesser trochanter [1]. This anatomical definition

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Receive Date: 14 November 2025, Revise Date: 10 December 2025, Accept Date: 12 December 2025

encompasses a range of fracture patterns, including intracapsular fractures—such as subcapital, transcervical, and basicervical varieties—as well as selected extracapsular injuries that fall within these proximal boundaries. Because the hip joint plays a central role in weight-bearing and mobility, fractures in this region can rapidly compromise functional independence and precipitate systemic complications, including thromboembolic events, pressure injury, and deconditioning. Consequently, hip fractures demand timely diagnosis, multidisciplinary intervention, and a coordinated approach to surgical and medical management. Their high incidence and the demographic trends of aging populations worldwide further underscore the importance of understanding their clinical implications, classification, and management strategies. As such, the study of hip fractures remains a cornerstone of contemporary orthopedic and emergency medicine practice, with ongoing efforts directed toward improving patient outcomes through optimized care pathways, preventive strategies, and evidence-based therapeutic interventions [1].

Etiology

The etiology of hip fractures is closely linked to patient age and underlying bone quality, with distinct patterns observed in older versus younger populations. In older adults, the overwhelming majority of hip fractures occur as a consequence of low-energy mechanisms, most commonly a simple fall from standing height. This reflects the combined influence of age-related decline in bone mineral density and an increased propensity to fall. Multiple risk factors for falls in the elderly have been identified, but several demonstrate a particularly strong independent association with hip fracture risk. These include a prior history of falls, which is one of the most powerful predictors of future falls; abnormalities of gait and balance; reliance on walking aids; and conditions causing disequilibrium, such as vertigo and Parkinson disease.[1] In addition, the use of certain medications, notably antiepileptic drugs, has been implicated in increasing fall risk, either through direct effects on coordination and alertness or via long-term effects on bone metabolism.[1] In clinical practice, many elderly patients present with a combination of these factors, and when superimposed on age-associated osteopenia or osteoporosis, even seemingly minor trauma can precipitate a hip fracture. In contrast, when hip fractures occur in younger adults, they are far more likely to result from high-energy trauma. Typical mechanisms include motor vehicle collisions, falls from significant height, industrial accidents, or high-impact sports injuries. In this demographic, bone quality is usually normal, and the force required to produce a proximal femoral fracture is correspondingly greater. As a result, these patients frequently sustain multiple injuries, including polytrauma involving the head, thorax, abdomen, or other skeletal sites. The presence of a hip fracture in a younger patient should therefore prompt a careful, systematic assessment following established trauma protocols to identify and manage associated injuries in a timely manner. A smaller subset of hip fractures, estimated at approximately 5%, occur in the absence of any clear history of trauma, or after minimal, seemingly inconsequential force.[2] In such cases, the clinician must maintain a high index of suspicion for an underlying pathological process. A pathological fracture is defined as a fracture occurring through bone weakened by disease rather than normal mechanical loading. With respect to the hip, the two most common pathological etiologies are malignancy and bisphosphonate-associated insufficiency fractures. Malignancy may be primary, such as metastatic lesions to the proximal femur from breast, prostate, lung, or renal cancers, or less commonly primary bone tumors. Bisphosphonate use, particularly long-term therapy, has been linked to atypical femoral fractures characterized by minimal trauma, prodromal pain, and distinctive radiographic features. Although osteoporosis plays a central role in the majority of fragility hip fractures, these are not routinely classified as pathological in clinical parlance, despite the fact that reduced bone mass is a disease process that markedly compromises bone strength. Conceptually, many osteoporotic hip fractures could be considered pathological, as they would not occur under normal physiologic loading in the absence of skeletal fragility. Nonetheless, they are typically categorized separately from fractures due to malignancy or drug-induced bone pathology. Recognizing these etiologic distinctions is crucial, as they influence not only acute management but also the broader evaluation for underlying systemic disease, long-term pharmacologic therapy, and secondary prevention strategies aimed at reducing future fracture risk.[1][2]

Epidemiology

The epidemiology of hip fractures reflects a significant and growing global health concern, driven largely by demographic shifts and increased life expectancy across many regions of the world. In 1990, the estimated worldwide annual incidence of hip fractures was approximately 1.3 million, a figure that has continued to rise in tandem with population aging.[3] Projections suggest that this number will escalate dramatically, reaching between 7 and 21 million cases per year by 2050, underscoring the enormous future burden that hip fractures will impose on healthcare systems, caregivers, and society at large.[3] This anticipated increase is attributable not only to the expanding population of older adults but also to improved survival among individuals with chronic diseases, who subsequently remain at risk for fragility fractures. In the United States, national incidence data reveal clear sex-related differences. Annual hip fracture rates among men range from approximately 197 to 201 per 100,000 individuals, while the corresponding rates for women are substantially higher, estimated between 511 and 553 per 100,000.[4] This disparity is largely explained by the higher prevalence of osteoporosis in postmenopausal women, as estrogen deficiency accelerates bone loss and predisposes to fragility fractures. Incidence increases sharply with advancing age, mirroring patterns of declining bone mineral density, increasing frailty, and greater susceptibility to falls. The average age of patients presenting with a hip fracture in the United States is approximately 80 years, reflecting the concentration of cases in the oldest demographic groups.[2][4] The economic impact of hip fractures is substantial and extends beyond the acute hospitalization period. It is estimated that the cost incurred by an individual patient during the first year following a hip fracture approaches $40,000, encompassing surgical treatment, inpatient care, rehabilitation services, long-term supportive care, and indirect costs related to loss of independence or employment.[5] At the national level, the financial burden of hip fracture care in the United States exceeds $17 billion annually, a figure expected to rise as the population ages and the incidence of fractures continues to grow.[6] These statistics highlight the profound clinical and economic implications of hip fractures, emphasizing the importance of preventive strategies, early intervention, and optimized post-fracture rehabilitation to mitigate morbidity and reduce societal costs [5][6].

History and Physical

A meticulous history and physical examination form the cornerstone of diagnosing hip fractures, and in many cases, the diagnosis can be strongly suspected based on the patient’s history alone. The classic presentation involves an elderly individual who experiences a fall, followed by acute hip pain and an inability or marked difficulty in bearing weight or walking. However, while a fall is the most common mechanism, clinicians must also consider more serious underlying precipitating events. Episodes such as syncope, transient ischemic attack, stroke, or acute myocardial infarction may precede a fall, particularly in older adults with multiple comorbidities. For this reason, taking a detailed history of the circumstances surrounding the fall is essential. Information regarding prodromal symptoms—such as dizziness, palpitations, chest discomfort, weakness, or visual disturbances—may provide important clues to alternative diagnoses requiring parallel investigation. Beyond the immediate events of the injury, a comprehensive medical history is crucial, given that many patients with hip fractures are elderly and have complex health backgrounds. This history should include chronic medical conditions, previous fractures, current medications (especially anticoagulants, antihypertensives, and psychoactive drugs), baseline functional status, and any cognitive impairment. Social history is equally important; understanding the patient’s pre-injury mobility, need for walking aids, living situation, caregiver support, and functional independence provides valuable context for both the acute management plan and postoperative disposition. Such information will influence decisions regarding rehabilitation needs, suitability for early mobilization programs, and discharge planning [7].

Cognitive assessment is an important component of evaluating patients with hip fractures and is recommended at both admission and postoperatively.[7] Many individuals in this population may have preexisting cognitive impairment, including undiagnosed dementia, while others are vulnerable to developing acute delirium due to pain, hospitalization, immobility, and surgical stress. Delirium is associated with prolonged hospital stays, increased complication rates, and poorer functional outcomes. Early identification of cognitive deficits allows for targeted perioperative strategies, such as minimizing psychoactive medications, ensuring effective analgesia, promoting orientation, and encouraging early mobilization. Thus, cognitive screening is not merely diagnostic but also prognostic and preventive. The physical examination typically reveals pain localized to the hip region, immobility, and characteristic deformity. The extent and nature of visible deformity depend on the fracture type and degree of displacement. A frequently described clinical sign of a displaced hip fracture is limb shortening combined with external rotation. This deformity arises due to the loss of structural integrity of the proximal femur and the unopposed action of the iliopsoas muscle, which inserts at the lesser trochanter and externally rotates the leg. While such a presentation is highly suggestive of a displaced neck of femur fracture, not all fractures produce obvious deformity. Non-displaced fractures or those occurring in patients with increased pain tolerance or communication barriers may present subtly; therefore, a high index of suspicion is necessary [7].

Focused musculoskeletal examination usually elicits pain with palpation of the groin, greater trochanter, or anterior thigh. Functional assessments—such as gentle axial loading of the femur (the “heel tap test”) or passive internal and external rotation (“pin-rolling” of the leg)—commonly provoke significant discomfort in patients with hip fractures. These maneuvers, performed cautiously, can help localize the pain and strengthen clinical suspicion without causing additional harm. Given that some hip fractures occur in the context of significant trauma, a complete primary survey and secondary trauma assessment must be performed following established trauma protocols to evaluate for concurrent injuries. Attention to the cervical spine, thorax, abdomen, and pelvis is particularly important in high-energy mechanisms, while a neurological evaluation can help identify associated head injury or focal deficits. Additionally, a targeted examination to identify the underlying cause of the fall—such as arrhythmia, orthostatic hypotension, neurological deficit, or metabolic disturbance—should be part of the broader assessment, especially when the history indicates prodromal symptoms or the fall was unwitnessed. Finally, evaluating cardiovascular and respiratory status is essential before surgical intervention. Many patients will require operative fixation or arthroplasty under anesthesia, and unrecognized cardiac or respiratory instability may increase perioperative risk. Therefore, baseline vital signs, cardiac auscultation, assessment of volume status, and review of recent cardiovascular symptoms are critical components of the preoperative evaluation. In summary, a thorough and multidimensional assessment—incorporating history, cognitive evaluation, physical examination, trauma survey, and systemic assessment—is vital for diagnosing hip fractures, identifying contributing factors, and optimizing perioperative care. This holistic approach ensures accurate diagnosis, timely intervention, and improved outcomes for a population already vulnerable to significant morbidity and mortality [7].

Evaluation

The assessment of a suspected hip fracture relies initially on a combination of clinical findings and targeted imaging, with plain radiography forming the cornerstone of diagnostic evaluation. In the vast majority of cases, a hip fracture can be confirmed, or at least strongly suspected, on standard x-ray imaging. The recommended radiographic series includes an anteroposterior view of the pelvis, which provides an overview of both hips and the pelvic ring, together with a lateral view of the affected hip to better delineate the fracture configuration and degree of displacement. Despite the utility of plain films, a proportion of fractures remain radiographically occult. These so-called occult hip fractures, which are not visible on standard x-rays, account for approximately 2% to 10% of all hip fractures and must be actively considered in patients who have persistent hip pain and functional impairment but apparently normal radiographs.[8] Advanced imaging is required when clinical suspicion remains high despite equivocal or negative x-rays. Magnetic resonance imaging (MRI) has emerged as the diagnostic modality of choice in this context. MRI demonstrates near-perfect diagnostic performance, with reported sensitivity of 100% and specificity ranging from 93% to 100% for the detection of occult hip fractures, and is therefore regarded as the gold standard investigation in such cases.[9] When MRI is unavailable or contraindicated, computed tomography (CT) represents a reasonable alternative. However, CT can fail to detect certain fracture patterns, particularly those oriented in the axial plane or those with minimal displacement, necessitating careful correlation with clinical findings and, in some cases, repeat imaging.[9]

Fig. 1: Pelvic radiographs with left hip fracture.

Accurate evaluation also requires careful analysis of the fracture pattern, as radiographic classification directly informs surgical decision-making. Hip fractures are generally categorized in relation to the insertion of the joint capsule on the femoral neck. The hip capsule originates from the acetabular rim and envelops the entire femoral neck, inserting distally along the intertrochanteric line anteriorly and the intertrochanteric crest posteriorly. Structurally, the capsule is reinforced by the iliofemoral and pubofemoral ligaments on the anterior aspect and the ischiofemoral ligament posteriorly. Fractures occurring proximal to the capsular insertion are described as intracapsular, whereas those located distally are termed extracapsular. This distinction is critical, as it influences both the vascular environment of the fracture and the risk of complications such as avascular necrosis and nonunion. Intracapsular hip fractures may be classified according to several systems. The Pauwel classification is based on the inclination of the fracture line relative to the horizontal plane and distinguishes three types: Pauwel type 1 describes fractures with an angle of less than 30 degrees, type 2 includes fractures with an angle between 31 and 50 degrees, and type 3 encompasses fractures with an angle greater than 50 degrees.[10] Increasing Pauwel angle corresponds to higher shear forces across the fracture site, rendering the fracture more unstable and reducing its intrinsic healing potential. Despite its biomechanical rationale, this classification exhibits significant inter-observer variability, particularly in the context of displaced fractures, which limits its practical reliability.[11][12]

Fig. 2: Pelvic radiographs with right hip fracture.

More commonly, intracapsular fractures are described using the Garden classification, which stratifies fractures based on their completeness and degree of displacement. Garden type 1 represents an incomplete fracture without displacement, while type 2 denotes a complete fracture without displacement. Type 3 injuries are complete fractures with partial displacement, and type 4 fractures are complete with full displacement of the femoral head relative to the neck. This system is more reproducible than the Pauwel classification, yet it still demonstrates some degree of intra-observer variability, especially when differentiating between intermediate grades.[12] In everyday clinical practice, many clinicians therefore simplify the Garden classification into two broad categories—displaced and undisplaced—since this binary distinction most directly guides management strategies. Intracapsular fractures are also often further localized along the femoral neck as subcapital (immediately adjacent to the femoral head), transcervical (through the mid-neck), or basicervical (at the base of the neck). Extracapsular fractures are subdivided into trochanteric and subtrochanteric patterns. Trochanteric fractures occur between the greater and lesser trochanters and historically have been classified according to Evans, a system that emphasized fracture stability. In contemporary practice, however, extracapsular fractures are more commonly categorized using the AO classification. Within this framework, AO type A1 fractures are two-part, stable fractures; type A2 fractures are comminuted and unstable; and type A3 fractures are reverse-obliquity or transverse fractures, which are typically highly unstable. Recognition of these patterns is crucial, as they influence the choice of fixation method, such as dynamic hip screw versus intramedullary nail, and determine the expected biomechanical behavior under load. Subtrochanteric fractures involve the segment of bone extending from the lesser trochanter to a point approximately 5 cm distal to it. These injuries were historically classified by the Russell-Taylor system, which distinguished fractures based on the involvement of the lesser trochanter and extension into the piriformis fossa. A modern AO classification now exists for these fractures as well. In practice, however, both the Russell-Taylor and AO systems are frequently regarded as primarily academic, as they rarely alter overall management principles, which typically favor intramedullary fixation due to the high stress environment in this region [12].

Beyond imaging and fracture classification, comprehensive evaluation of the patient's physiological status is essential. Routine laboratory investigations on admission should include a full blood count to assess for anemia, serum urea and creatinine to evaluate renal function, and coagulation studies to determine perioperative bleeding risk and guide management of anticoagulant therapy. Additional tests may comprise serum electrolytes, inflammatory markers, and blood glucose, depending on the patient's comorbidities. A bone health assessment is also valuable; a "bone screen" may include serum calcium, phosphate, vitamin D, and parathyroid hormone levels, alongside consideration of bone mineral density testing at a later stage. These investigations aid in diagnosing underlying osteoporosis or metabolic bone disease, thereby informing long-term secondary prevention strategies. Because surgical management of hip fractures is commonly associated with substantial blood loss, cross-matching for potential transfusion is recommended as part of the standard preoperative work-up.[5][6] Optimal evaluation and perioperative optimization of patients with hip fractures are best achieved through an interprofessional, multidisciplinary approach. Surgical, medical, and anesthetic teams should collaborate closely with physiotherapists, occupational therapists, pharmacists, dietitians, and specialist nursing staff to ensure that all aspects of the patient's condition are addressed. This collaborative model facilitates comprehensive assessment of cardiovascular and respiratory fitness for anesthesia, identification and management of acute medical issues, planning for early mobilization, and implementation of nutrition and medication strategies that support recovery. Many institutions have formalized this model through dedicated hip fracture programs or orthogeriatric services, which have been shown to improve postoperative outcomes, reduce complication rates, shorten hospital stays, and lower mortality.[13] Such programs underscore that the evaluation of a patient with a hip fracture extends beyond the radiographic confirmation of a broken bone to encompass a holistic appraisal of the individual's medical, functional, and social needs, thereby laying the groundwork for effective surgical treatment and rehabilitation [12][13].

Treatment / Management

The management of hip fractures is a continuum that begins at the moment of presentation to the emergency department and extends through definitive surgical treatment and postoperative rehabilitation. Early care is critical, as patients with proximal femoral fractures may lose up to one liter of blood into the thigh and surrounding tissues, even when there is no obvious external hemorrhage. This concealed blood loss contributes to hypovolemia, anemia, and hemodynamic instability; therefore, prompt fluid resuscitation and early consideration of blood transfusion are essential components of initial management. Hemodynamic status should be monitored closely, and intravenous crystalloid solutions initiated while cross-matched blood is arranged when indicated. Nutritional and metabolic support also require early attention. Prolonged preoperative fasting should be actively minimized, as extended periods without oral intake are associated with increased catabolism, hypoglycemia, impaired immune function, and dehydration, all of which can adversely affect perioperative outcomes.[14] Patients with hip fractures, who are typically elderly and frail, are particularly vulnerable to the consequences of dehydration and malnutrition, and thus adequate preoperative and perioperative hydration must be ensured.[15] Institutional policies on fasting times may vary, but contemporary recommendations from the European Society of Anaesthesiology advise fasting from clear fluids for only two hours and from solid food for six hours before surgery, provided there are no specific contraindications [16]. Allowing appropriate oral intake or nutritional supplementation until a reasonably predictable operative time is known helps reduce unnecessary fasting and its associated risks. Pain control is another central pillar of early management. Hip fractures cause substantial pain, which can limit respiratory effort, impede mobilization, and increase the risk of delirium. Both oral and intravenous analgesic agents may be used; however, achieving adequate analgesia in this population can be challenging due to the need to balance efficacy against the risk of oversedation, respiratory depression, or delirium. Regional anesthesia techniques have therefore assumed an important role. A fascia-iliaca nerve block, administered in the emergency or preoperative setting, is now widely recommended as it can significantly reduce systemic opioid requirements, improve pain scores, and decrease analgesia-related morbidity.[17] Attempts at closed reduction or the application of limb traction in the emergency department are not advised, as they do not improve outcomes and may cause additional discomfort or complications.

Definitive treatment strategy depends on multiple factors, including fracture location and configuration, the patient's pre-morbid functional status, comorbidities, cognitive state, and personal preferences. The overarching therapeutic goal is to restore the patient's pre-injury mobility as rapidly and safely as possible. For this reason, operative management is usually favored, as conservative treatment of hip fractures is associated with markedly higher 30-day and one-year mortality and is generally reserved for patients considered unfit for any form of anesthesia or surgery.[18] Numerous studies have demonstrated that early surgery is associated with better outcomes. Operating within forty-eight hours of admission is widely recommended, as delays beyond this time are linked with increased complications, prolonged hospitalization, and higher mortality.[19] Hyper-acute surgery, defined as operative fixation or arthroplasty within six hours of hospital arrival, does not appear to reduce overall mortality or the rate of major complications but is not associated with additional risk and has been shown to reduce the incidence of postoperative delirium and shorten the length of hospital stay by approximately one day [20]. The distinction between intracapsular and extracapsular fractures is fundamental to selecting appropriate operative treatment. In intracapsular fractures, the blood supply to the femoral head is particularly relevant. The femoral head receives the majority of its blood flow from branches of the medial and lateral circumflex femoral arteries, which ascend within the joint capsule. Disruption of these retinacular vessels in the setting of an intracapsular fracture can compromise femoral head perfusion and predispose to avascular necrosis. This vascular vulnerability is a central consideration when deciding between fixation and arthroplasty for intracapsular injuries.

In elderly patients with displaced intracapsular fractures, arthroplasty has been shown to be superior to internal fixation with respect to pain relief, functional outcome, and complication rates.[21][22][23][24][25][26] Fixation in this context is associated with a substantial risk of failure, with re-operation rates approaching thirty percent within two years.[21][25] Early failures are usually due to nonunion or redisplacement of the fracture, while late failures are most commonly attributable to avascular necrosis of the femoral head. Given these risks, joint replacement is generally preferred for older, lower-demand individuals with displaced intracapsular fractures. Two principal arthroplasty options are available for displaced intracapsular fractures: total hip replacement (THR) and hemiarthroplasty. Both procedures have broadly similar mortality rates, but several studies suggest that THR may provide better postoperative pain control and reduce acetabular wear over time.[22][27][27][28] Analysis of the UK national joint registry data has indicated that THR may be associated with lower revision rates compared with hemiarthroplasty, although this potential advantage is offset by a higher risk of dislocation in the THR group.[29] Conversely, a large multicenter randomized controlled trial reported no significant differences in mortality, adverse events, or the frequency of secondary procedures between patients treated with hemiarthroplasty and those undergoing THR.[30] Reflecting the balance of this evidence, the American Academy of Orthopaedic Surgeons (AAOS) and the National Institute for Health and Care Excellence (NICE) in the UK currently recommend THR for patients who were independently mobile prior to injury and are physiologically fit for the procedure [30].

For individuals with lower functional demands, limited life expectancy, or significant comorbidity, hemiarthroplasty is generally preferred. It is technically simpler, quicker to perform, and still provides acceptable functional results.[30] In patients with preexisting symptomatic hip osteoarthritis, THR may be advantageous even in those with modest activity levels, but decisions must be individualized, taking into account surgical risk, anticipated longevity, and patient preference. Open reduction and internal fixation of displaced intracapsular fractures is now typically reserved for younger, highly active patients in whom joint preservation is a priority and the risks of nonunion, avascular necrosis, and eventual revision are considered acceptable given their long-term functional demands. Within hemiarthroplasty, prosthetic design considerations include the choice between unipolar and bipolar heads. Functional outcomes between unipolar and bipolar hemiarthroplasties appear broadly comparable.[31][32] Unipolar implants, in which movement occurs primarily at the prosthesis–acetabulum interface, are associated with higher rates of acetabular erosion. However, they are also less expensive and are therefore often favored in resource-conscious settings.[31] The use of cemented femoral stems is widely preferred, as cemented components have been shown to confer better postoperative hip function and are associated with lower rates of intraoperative periprosthetic fracture compared to uncemented stems [33].

Undisplaced intracapsular fractures present a different therapeutic dilemma. While conservative (non-operative) management is possible, it is associated with suboptimal function and a risk of subsequent displacement.[34] Consequently, nonoperative treatment is usually reserved for extremely high-risk surgical candidates or for patients who are already pain-free and ambulatory despite the fracture. In most other cases, surgical management is recommended. The two broad options are internal fixation or primary arthroplasty. Fixation is generally favored in physiologically younger or more active patients because it preserves the native hip joint, thereby offering the potential for superior long-term function and mobility.[35] Common fixation methods include sliding hip screws (SHS) and cannulated hip screws (CHS). Both are well-established techniques with similar overall re-operation rates, but they differ in operative characteristics and specific complications. CHS is associated with reduced intraoperative blood loss and a lower incidence of avascular necrosis, possibly due to less disruption of the femoral head vascular supply.[36][37] However, in patients with displaced or basicervical fractures and in current smokers, SHS has been associated with lower rates of re-operation compared with CHS, suggesting that fracture morphology and patient factors should guide the choice of implant.[36] When a sliding hip screw is used, care must be taken to avoid rotational displacement of the femoral head during insertion; the addition of an anti-rotation or de-rotation screw can mitigate this risk. Postoperatively, surgeons often recommend a period of protected or partial weight-bearing after internal fixation of intracapsular fractures, particularly in cases with borderline stability, to reduce the risk of displacement or fixation failure. Nevertheless, avascular necrosis can still develop even after anatomically reduced and fixed undisplaced fractures. If avascular necrosis occurs, further intervention, such as core decompression or conversion to arthroplasty, may become necessary. Such eventualities should be discussed with patients preoperatively so they have realistic expectations regarding possible future procedures [34][36].

In patients with low functional demand, limited rehabilitation potential, or anticipated difficulty adhering to weight-bearing restrictions, primary arthroplasty may be a more suitable option even for undisplaced intracapsular fractures. Arthroplasty eliminates the risk of femoral head collapse from avascular necrosis and typically allows earlier full weight-bearing, which can be advantageous in frail or cognitively impaired patients. Similarly, in the presence of significant pre-existing degenerative joint disease, preserving the native articular surface is of limited value, and primary arthroplasty becomes logically preferable. The relative risks and benefits of fixation versus arthroplasty should be fully discussed with the patient and, when appropriate, their family or legal representatives. In contrast to intracapsular fractures, extracapsular fractures usually do not compromise the femoral head blood supply, and internal fixation is almost always the treatment of choice. The exact fixation strategy depends on the fracture pattern, which may only become fully apparent after intraoperative fluoroscopic assessment. Trochanteric fractures, which occur between the greater and lesser trochanters, are commonly classified using the AO system into stable and increasingly unstable (A2 and A3) patterns. For stable A1 trochanteric fractures, both intramedullary nails (IMN) and sliding hip screws provide favorable outcomes.[38] The sliding hip screw, however, is associated with lower intraoperative blood loss, shorter operative times, and reduced implant costs compared with intramedullary devices, making it an attractive option in many settings [38].

For unstable trochanteric fractures (A2), both SHS and IMN are viable options, but intramedullary devices have been associated with improved postoperative functional scores and a biomechanical advantage in resisting varus collapse.[39] On this basis, the AAOS recommends intramedullary nailing for unstable intertrochanteric fractures.[39] Short intramedullary nails confer the benefits of shorter operative time and reduced blood loss compared to long nails, with similar mortality and functional outcomes.[39][40] Nonetheless, some surgeons continue to favor SHS for these fractures due to familiarity, technical simplicity, and lower cost. In the UK, NICE guidance supports the use of SHS for both stable and unstable trochanteric fractures, reflecting ongoing debate and the influence of local practice patterns. Regardless of the implant chosen, meticulous attention to surgical technique is crucial. In particular, ensuring that the tip–apex distance of the lag screw or nail head is less than twenty-five millimeters is essential to minimize the risk of mechanical failure through cut-out of the implant from the femoral head [41]. Subtrochanteric fractures and reverse oblique trochanteric fractures, classified as AO type A3, pose particular challenges due to their inherent biomechanical instability and the high stresses transmitted across the proximal femur. These fracture patterns are associated with greater rates of nonunion and mechanical failure when compared with more typical intertrochanteric fractures.[42] Intramedullary fixation is generally recommended for subtrochanteric fractures, as intramedullary nails provide a load-sharing construct with a more favorable mechanical axis, leading to lower nonunion rates relative to extramedullary devices such as plate–screw constructs.[43][44] Similarly, reverse oblique intertrochanteric fractures are best managed with intramedullary nails, which offer superior stability and have been associated with shorter operative times and reduced hospital stays compared with alternative techniques.[45] When closed reduction cannot achieve satisfactory alignment, open reduction should be undertaken to restore appropriate length, alignment, and rotation before fixation. Throughout the treatment pathway for hip fractures, an interprofessional team-based approach is essential. Surgeons, anesthetists, internists or geriatricians, physiotherapists, occupational therapists, pharmacists, and dietitians must collaborate to optimize preoperative preparation, intraoperative safety, and postoperative recovery. Such integrated "orthogeriatric" or hip fracture programs have been shown to improve functional outcomes, reduce postoperative complications, decrease mortality, and shorten hospital length of stay.[13] Within this framework, treatment is not limited to fixing the bone but extends to managing comorbidities, preventing delirium, encouraging early mobilization, addressing pain and nutrition, and planning safe discharge and rehabilitation. By combining timely, evidence-based surgical intervention with comprehensive multidisciplinary care, the management of hip fractures can substantially enhance survival, preserve independence, and improve quality of life in a vulnerable and rapidly growing patient population [30][31][32][33][34][35][36][37][38][39][40][41][42][43][44][45].

Differential Diagnosis

The evaluation of a suspected hip fracture must always include a careful consideration of alternative diagnoses, as a range of injuries and pathological processes can present with hip pain and impaired mobility. Chronic degenerative disease of the hip joint is particularly relevant; patients with longstanding osteoarthritis may experience a marked exacerbation of pain following relatively minor trauma, even in the absence of an acute fracture. In such cases, the clinical picture may be misleadingly similar to that of a fracture, with difficulty weight-bearing and restricted range of motion. Acute hip dislocation represents another important diagnostic consideration, as it can present with severe pain, limb deformity, and functional limitation. Distinguishing between dislocation and fracture is critical, as the immediate priorities and treatment strategies differ substantially. Pelvic fractures must also be borne in mind, especially in the context of high-energy trauma or in osteoporotic patients who sustain a fall. Because pain from pelvic ring injuries may be referred to the hip or groin, an x-ray of the pelvis in addition to dedicated views of the hip is strongly recommended to ensure that no associated injury is overlooked. Similarly, fractures or soft tissue injuries involving the lumbar spine, femoral shaft, or knee may be interpreted by the patient as "hip pain," and a thorough musculoskeletal and neurological examination is therefore required to localize the true source of symptoms. Careful assessment of joint movement, palpation of bony landmarks, and evaluation of neurovascular status in the lower limb all contribute to accurate differentiation. In the absence of clear trauma or when radiographic imaging fails to reveal a fracture, non-traumatic causes of hip pain must be systematically explored. These include malignant processes, such as primary bone tumors or metastatic deposits involving the proximal femur or pelvis, which may produce insidious pain that acutely worsens. Infective etiologies, including septic arthritis and osteomyelitis of the proximal femur or pelvis, should also be considered, particularly when systemic symptoms such as fever, malaise, or elevated inflammatory markers are present. Inflammatory arthropathies, bursitis, referred pain from the lumbar spine, and vascular or neurological conditions can further complicate the clinical picture. Consequently, a comprehensive diagnostic approach incorporating history, examination, imaging, and laboratory assessment is essential to distinguish hip fractures from these mimicking conditions and to ensure that appropriate, timely management is instituted [41].

Surgical Oncology

Pathological fractures of the hip represent a distinct and complex subset of proximal femoral injuries and are most commonly the consequence of underlying neoplastic disease. These fractures may arise from primary bone tumors, such as osteosarcoma or chondrosarcoma, but more frequently result from metastatic deposits originating from malignancies of the breast, prostate, lung, kidney, or other organs. The structural integrity of bone is significantly compromised by tumor infiltration, such that fractures can occur following minimal or even unrecognized trauma. When a pathological hip fracture is suspected—based on atypical radiographic features, disproportionate pain, systemic symptoms, or a known history of malignancy—a more extensive diagnostic work-up is warranted. Radiologic evaluation should include a full-length femoral x-ray to assess the entire bone for additional lesions, cortical thinning, or structural compromise. Magnetic resonance imaging (MRI) of the femur provides superior soft tissue contrast and detailed delineation of the intraosseous and extraosseous extent of the tumor, as well as the relationship to neurovascular structures. This information is crucial for surgical planning and for determining whether limb-salvage reconstruction is feasible. Cross-sectional imaging of the chest, abdomen, and pelvis is often indicated to stage the disease more comprehensively. Once malignancy is confirmed or strongly suspected, management decisions must be made in close collaboration with oncology specialists and, where appropriate, a multidisciplinary tumor board. Surgical management is guided primarily by the overall prognosis and the biological behavior of the underlying disease. In patients with potentially curable malignancy and a favorable life expectancy, aggressive oncologic resection of the affected segment of bone, followed by reconstruction—such as with an endoprosthetic replacement or allograft-prosthetic composite—may be appropriate. In contrast, for patients with disseminated or incurable cancer, the emphasis shifts toward palliation: surgical procedures are chosen to provide durable pain relief, restore or maintain mobility, and facilitate nursing care, while minimizing operative morbidity. Options may include intramedullary fixation with or without cement augmentation, or proximal femoral replacement, depending on the extent of bone destruction. Intra-operative tissue sampling is valuable not only for confirming malignancy but also for identifying the primary tumor when it is unknown, thus informing systemic therapy. Ultimately, the management of pathological hip fractures requires an individualized approach that balances oncologic control, mechanical stability, functional outcome, and quality of life [41][42][43][44].

Prognosis

The prognosis following a hip fracture is guarded, particularly in elderly and medically complex patients, and is traditionally assessed in terms of both mortality and long-term functional recovery. Reported one-year mortality rates range from approximately 18% to 31%, reflecting the substantial physiological insult and the vulnerability of this patient population.[46] Multiple factors have been identified that significantly increase the risk of death within one year of fracture. These include advanced age, particularly over 85 years; pre-existing dependence in activities of daily living; higher American Society of Anesthesiologists (ASA) grades of 3 or more, indicating severe systemic disease; male sex; a prior history of malignancy; and the occurrence of postoperative complications such as pneumonia, myocardial infarction, or sepsis.[46][47] In recognition of these risks, several predictive models and scoring systems have been developed and validated to estimate 30-day and one-year mortality, enabling clinicians to perform more accurate risk stratification and to tailor perioperative care accordingly.[47][48] In the UK, such tools are routinely employed to identify high-risk individuals whose operations should be performed by, or under the direct supervision of, senior surgeons to optimize outcomes. Functional recovery after hip fracture is equally important in determining overall prognosis. Unfortunately, only about 40% to 60% of patients regain their pre-fracture level of mobility, even with appropriate surgical treatment and rehabilitation.[49] Many experience a permanent decline in functional status, with between 20% and 60% of previously independent individuals requiring assistance with at least one activity of daily living following the injury.[49] This loss of independence can have profound implications for quality of life, psychological well-being, and the need for long-term social and nursing care. Patients residing in residential care homes prior to their fracture are particularly unlikely to return to their previous level of function, possibly due to lower baseline mobility, higher comorbidity burden, and limited access to intensive rehabilitation.[49] Early surgical intervention, comprehensive multidisciplinary care, and structured rehabilitation can mitigate some of these adverse outcomes but do not entirely eliminate the long-term impact of hip fracture. Prognosis must therefore be viewed in a holistic manner, encompassing not only survival but also pain levels, mobility, autonomy, and the ability to participate in meaningful activities. For patients and families, realistic counselling about expected recovery trajectories and potential limitations is essential, allowing informed decisions and appropriate planning for post-discharge care and support [48][49].

Complications

Complications following hip fracture are numerous, multifactorial, and can arise from the injury itself, the surgical intervention, or the patient's underlying comorbidities. Surgical site infection is one of the most concerning complications after operative management, with reported rates ranging from approximately 0.6% to 3.6%, depending on the type of procedure and patient factors.[50] Infections may present superficially or as deep prosthetic joint infections, the latter often requiring prolonged antibiotics and revision surgery. Other generic complications of surgery include persistent postoperative pain, bleeding and the need for transfusion, neurovascular injury, and wound healing problems such as dehiscence or hematoma formation. Procedures involving arthroplasty carry their own specific spectrum of complications. Dislocation of the prosthetic hip is a recognized risk, particularly in the early postoperative period or in patients with cognitive impairment who may not adhere to hip precautions. Over time, prosthetic loosening, component wear, leg length discrepancy, and periprosthetic fractures may develop, each of which can lead to pain, instability, or functional decline and may necessitate revision surgery. For internal fixation devices used in fracture management, the principal complications include failure of fixation or metalwork (such as screw cut-out or plate breakage), non-union of the fracture, and avascular necrosis of the femoral head, particularly in intracapsular fractures. Medical complications are highly prevalent and represent a major contributor to morbidity and mortality after hip fracture. Delirium is common, affecting an estimated 13.5% to 33% of patients, and is associated with prolonged hospital stay, increased institutionalization, and higher mortality.[51] Thromboembolic events are a significant concern: pulmonary embolism occurs in approximately 1.4% to 7.5% of cases, while deep venous thrombosis may develop in around 27% of patients without appropriate prophylaxis.[51] Respiratory complications such as pneumonia are reported in about 7% of patients and are particularly dangerous in frail, older adults.[51] Cardiovascular complications, including myocardial infarction and heart failure, affect between 35% and 42% of patients, reflecting the stress of surgery and immobility on an already compromised cardiocirculatory system.[51] Other common medical complications include urinary retention and urinary tract infections, which together occur in 12% to 61% of patients, often exacerbated by catheter use and immobility.[51] Acute kidney injury is reported in approximately 11% of individuals and may result from hypotension, nephrotoxic medications, or sepsis.[51] Anemia, whether pre-existing or resulting from perioperative blood loss, affects between 24% and 44% of patients and may delay rehabilitation or necessitate transfusion.[51] Finally, skin pressure damage or pressure ulcers occur in about 7% to 9% of patients and are a marker of poor mobility and inadequate nursing care.[51] Given this wide array of potential complications, early recognition, meticulous perioperative management, and multidisciplinary collaboration are vital to minimize adverse outcomes and support recovery [51].

Postoperative and Rehabilitation Care

Postoperative management and rehabilitation are critical determinants of outcome following hip fracture surgery and are at least as important as the initial operative procedure. Prevention of venous thromboembolism is a central component of postoperative care. Pharmacological prophylaxis—typically with low-molecular-weight heparin or other anticoagulants—is recommended for most patients, provided there are no contraindications such as active bleeding or severe coagulopathy. Mechanical prophylaxis, including graduated compression stockings or intermittent pneumatic compression devices, may be used as adjunctive measures. Blood transfusion should be considered judiciously; current recommendations generally support transfusion when hemoglobin levels fall below 8 g/dL or when patients exhibit symptoms of anemia, such as tachycardia, hypotension, or decreased exercise tolerance.[52] A key objective of surgery is the restoration of mobility, making early postoperative mobilization a central tenet of care. For most patients who have undergone arthroplasty or fixation of an extracapsular fracture, weight-bearing as tolerated can begin almost immediately after surgery, usually on the first postoperative day. Early mobilization helps reduce the risk of complications such as deep venous thrombosis, pulmonary embolism, pneumonia, pressure ulcers, and deconditioning. In contrast, following internal fixation of intracapsular fractures, many surgeons advocate a period of protected or partial weight-bearing to lessen the risk of fracture displacement or fixation failure. The duration and degree of weight-bearing restriction should be individualized based on fracture stability, fixation quality, and patient factors. Physiotherapy plays a pivotal role in postoperative rehabilitation. Intensive, regular physiotherapy focusing on bed mobility, transfers, gait training, and muscle strengthening is required to facilitate the rapid progression from assisted to independent mobility. Occupational therapy is also important in helping patients relearn or adapt activities of daily living, including dressing, bathing, and transferring, and may recommend assistive devices or home modifications to improve safety. Simultaneously, medical management must be optimized, addressing pain control, nutrition, hydration, and the treatment or prevention of medical complications. Nutritional support, guided by dietitians where available, can help meet increased metabolic demands and support wound healing and muscle recovery. Despite optimal surgical and rehabilitation care, a considerable proportion of patients do not return to their pre-injury level of function or independence. Many will require increased social support or transition to residential or nursing care facilities. Social workers and discharge planning teams are therefore integral members of the rehabilitation process, tasked with coordinating post-discharge care, arranging community physiotherapy, and ensuring that appropriate support systems are in place. Overall, postoperative and rehabilitation care should be holistic, patient-centred, and delivered by a coordinated multidisciplinary team to maximize functional recovery and quality of life [52].

Patient Education

Preventing hip fractures requires a dual strategy that targets both the reduction of falls and the enhancement of bone strength. Falls prevention is particularly challenging because falls in older adults are typically multifactorial in origin, involving a complex interplay of intrinsic factors such as muscle weakness, balance impairment, visual problems, cognitive decline, and medication side effects, as well as extrinsic factors like environmental hazards. Nevertheless, clinicians and the wider interprofessional team must remain vigilant to these risk factors and actively seek to identify and modify them where possible. Interventions may include medication review and rationalization, treatment of hypotension or arrhythmias, correction of visual and hearing deficits, provision of appropriate walking aids, and referral to strength and balance training programs. Environmental modifications—such as improved lighting, removal of loose rugs, and installation of handrails—may also reduce fall risk in the home. The second major pillar of hip fracture deterrence is the early diagnosis and effective management of osteoporosis. Fracture risk assessment tools, such as those incorporating clinical risk factors and, where available, bone mineral density measurements, are used to estimate an individual's ten-year probability of osteoporotic fracture.[53] Both a personal history of prior fracture and a parental history of hip fracture contribute to an increased risk score.[53] Current recommendations support evaluating all patients over the age of 50 who present with any fragility fracture for underlying osteoporosis. Such patients should undergo appropriate investigations and, where indicated, receive pharmacologic therapy with agents such as bisphosphonates, denosumab, or selective estrogen receptor modulators, alongside calcium and vitamin D supplementation. Lifestyle measures, including smoking cessation, moderation of alcohol intake, and promotion of weight-bearing exercise, should also be emphasized as part of a comprehensive osteoporosis management plan. Patient and family education is integral to both falls prevention and osteoporosis management. Clear communication about the nature of hip fractures, the implications of low bone density, and the steps that can be taken to reduce risk empowers patients to participate actively in their own care. Educational initiatives may include written materials, group classes, or one-on-one counselling and should be reinforced at multiple points of contact within the healthcare system. By combining targeted clinical interventions with effective education, healthcare professionals can contribute substantially to reducing the incidence and consequences of hip fractures [53].

Enhancing Healthcare Team Outcomes

The complexity of hip fracture care demands a coordinated, interprofessional approach that extends from initial presentation through surgery, rehabilitation, and secondary prevention. As previously discussed, optimal outcomes are achieved when the management of these patients is shared among an integrated team of healthcare professionals. Physiotherapists are central to postoperative care, guiding early mobilization, gait re-training, and functional recovery. Their expertise is critical for setting realistic goals, monitoring progress, and adjusting rehabilitation plans based on patient tolerance and response. Dietitians play an important role in optimizing nutritional status, which is fundamental for wound healing, maintenance of muscle mass, and overall recovery. Many hip fracture patients present with pre-existing malnutrition or experience reduced appetite and increased metabolic demands after surgery. Targeted nutritional interventions, including high-protein diets or supplements, can significantly enhance rehabilitation potential. Nursing staff provide continuous, hands-on care and are often the first to recognize early signs of medical complications such as delirium, infection, or pressure damage. Their responsibilities include pain management, wound care, assistance with mobilization, and implementation of falls prevention strategies within the hospital environment. Adequate training, staffing, and support for nurses are essential to meet the high care demands of this patient group. Elderly medicine or geriatric physicians are key contributors both before and after surgery. They assist with preoperative optimization by managing chronic comorbidities, adjusting medications, and evaluating cognitive status and frailty. Postoperatively, they take a leading role in addressing acute medical issues, coordinating management of complications, assessing falls risk, and initiating investigations and treatment for osteoporosis. Their holistic perspective ensures that care extends beyond the immediate surgical problem to encompass the broader health and functional needs of the patient. Orthopedic surgeons, although central to the technical aspects of fracture fixation or arthroplasty, are only one part of this larger multidisciplinary framework. Their role is complemented by anesthetists, who ensure safe perioperative care and contribute to pain management strategies, and by social workers and discharge coordinators, who facilitate transitions to home or long-term care settings. Regular multidisciplinary meetings or ward rounds, in which members of all relevant professions participate, can enhance communication, promote shared decision-making, and ensure that care plans are coherent and patient-centered. By embracing this team-based model and recognizing the contributions of each discipline, healthcare systems can significantly improve clinical outcomes, reduce complications, and support better functional recovery for patients suffering from hip fractures [53].

Conclusion:

In conclusion, hip fracture represents a catastrophic event for elderly patients, demanding a paradigm shift from viewing it as a purely surgical problem to managing it as a systemic condition. Optimal outcomes hinge on a fully integrated, interprofessional approach that begins at emergency presentation and continues through long-term follow-up. The cornerstone is timely surgical intervention—arthroplasty or internal fixation based on fracture morphology—performed within 48 hours to reduce complications. However, surgical success is fundamentally underpinned by comprehensive perioperative care: meticulous medical optimization, effective analgesia, nutritional support, and proactive delirium prevention. Postoperatively, structured rehabilitation led by physiotherapists and early mobilization are critical for functional recovery. Crucially, an orthogeriatric model of care, involving surgeons, geriatricians, nurses, dietitians, and therapists working collaboratively, has proven superior in reducing mortality, shortening hospital stays, and improving quality of life. Finally, the episode of care must not end with discharge; it should seamlessly transition into secondary prevention, including falls risk assessment and definitive treatment of underlying osteoporosis. This holistic, patient-centered framework is essential to mitigate the profound personal and societal impact of hip fractures.

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