MANAGEMENT OF OSTEOARTHRITIS OF THE HIP: SURGICAL OPTIONS AND OUTCOMES

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ABSTRACT

Osteoarthritis (OA) of the hip is a chronic progressive degenerative disorder characterized by gradual deterioration of articular cartilage, remodeling of subchondral bone, osteophyte formation, pain, stiffness, and increasing functional disability. It is among the leading causes of chronic musculoskeletal impairment worldwide, particularly in the elderly population, and has a substantial impact on mobility, independence, daily functioning, and overall quality of life. The development of hip osteoarthritis is multifactorial and involves a combination of biomechanical stress, inflammatory mediators, genetic predisposition, metabolic influences, and age-related degenerative changes that ultimately result in progressive joint destruction. In the early stages, conservative treatment modalities such as physiotherapy, weight management, analgesics, nonsteroidal anti-inflammatory drugs, activity modification, lifestyle changes, and intra-articular injections may help reduce symptoms and improve functional capacity. Nevertheless, many patients with advanced disease continue to experience persistent pain and severe limitation of activities, eventually necessitating surgical management.

The choice of surgical treatment depends on several factors including patient age, severity of joint degeneration, activity level, functional requirements, and the underlying pathology affecting the hip joint. Joint-preserving procedures, including osteotomy and hip arthroscopy, may provide symptomatic improvement and delay disease progression in selected younger individuals with early osteoarthritis and structural deformities. Hip resurfacing arthroplasty has emerged as a bone-conserving option for carefully selected active patients, while arthrodesis and hemiarthroplasty currently play a more limited role in modern orthopedic practice. Total hip replacement (THR) continues to be regarded as the definitive surgical treatment for end-stage hip osteoarthritis because of its reliable outcomes in relieving pain, restoring mobility, correcting deformity, and improving quality of life. Continuous advancements in implant design, bearing surfaces, fixation methods, minimally invasive surgical techniques, robotic-assisted procedures, and perioperative rehabilitation strategies have further enhanced implant longevity, functional recovery, and patient satisfaction.

This narrative review discusses the pathophysiology of hip osteoarthritis, indications for surgical intervention, and the spectrum of surgical treatment modalities including osteotomy, hip arthroscopy, hip resurfacing, arthrodesis, hemiarthroplasty, and total hip replacement. In addition, the review examines postoperative functional outcomes, complications, revision arthroplasty, rehabilitation protocols, and recent innovations in hip arthroplasty techniques. Emphasis is placed on appropriate patient selection, individualized implant choice, perioperative optimization, and multidisciplinary rehabilitation approaches to achieve favorable long-term clinical outcomes.

Keywords: Hip osteoarthritis; Total hip replacement; Total hip arthroplasty; Hip arthroplasty; Osteotomy; Hip resurfacing; Arthrodesis; Hemiarthroplasty; Surgical management; Revision arthroplasty; Rehabilitation; Implant survivorship

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INTRODUCTION

Osteoarthritis (OA) of the hip is a chronic progressive degenerative disorder characterized by gradual deterioration of articular cartilage, remodeling of subchondral bone, osteophyte formation, synovial inflammation, and progressive loss of joint function. It is recognized as one of the leading causes of pain, disability, and impaired mobility among the elderly population worldwide. The condition predominantly affects individuals above the age of 50 years; however, younger patients may also develop hip osteoarthritis secondary to trauma, developmental dysplasia,

avascular necrosis, inflammatory arthropathies, obesity, or congenital abnormalities.[1] Increasing life expectancy, reduced physical activity, and the growing prevalence of obesity have contributed significantly to the rising global incidence and burden of hip osteoarthritis over recent decades.[2]

Patients with hip osteoarthritis commonly present with pain in the groin or anterior thigh, stiffness of the hip joint, restricted movements, difficulty in ambulation, and progressive reduction in quality of life. Symptoms usually develop gradually and eventually interfere with routine activities such as climbing stairs, prolonged walking, standing for extended periods, and sitting cross-legged.[3] Clinical examination often reveals painful limitation of internal rotation and abduction of the hip joint, while radiographic findings typically include narrowing of the joint space, osteophyte formation, subchondral sclerosis, and cystic degeneration. The severity of disease is frequently classified using the Kellgren–Lawrence grading system.[4]

Management of hip osteoarthritis initially focuses on conservative treatment measures aimed at reducing pain and improving functional capacity. These include weight reduction, physiotherapy, lifestyle modification, analgesics, non-steroidal anti-inflammatory drugs, intra-articular injections, and assistive walking devices. Although such modalities may offer temporary symptomatic relief, they do not halt or reverse the underlying degenerative process.[5] Consequently, surgical intervention becomes necessary in patients with persistent pain, progressive deformity, or severe functional limitation despite adequate conservative management.

Several surgical procedures have been developed for the treatment of hip osteoarthritis. Joint-preserving procedures such as osteotomy and hip arthroscopy may be beneficial in selected younger individuals with early-stage disease and correctable structural abnormalities.[6] Nevertheless, arthroplasty remains the definitive treatment for advanced osteoarthritis. Total hip replacement (THR) is widely regarded as one of the most successful procedures in orthopedic surgery because of its excellent outcomes in pain relief, restoration of mobility, correction of deformity, and improvement in overall function and quality of life.[7] Continuous advances in implant technology, bearing surfaces, surgical approaches, and perioperative management have further enhanced the durability and clinical success of hip arthroplasty.

Other surgical procedures, including hemiarthroplasty, hip resurfacing, and minimally invasive hip replacement techniques, may also be considered in carefully selected patients depending on age, bone quality, functional demand, and surgeon preference.[8] Despite substantial improvements in surgical outcomes, complications such as postoperative infection, dislocation, thromboembolic events, aseptic loosening, periprosthetic fractures, and implant wear continue to pose significant challenges that may influence long-term implant survival and functional outcomes.[9] Therefore, appropriate patient selection, meticulous preoperative planning, precise surgical technique, and structured postoperative rehabilitation are essential for achieving optimal clinical results.

Functional outcomes following surgical management of hip osteoarthritis are commonly assessed using validated scoring systems such as the Harris Hip Score, WOMAC index, and Oxford Hip Score. Most published studies have demonstrated considerable improvement in pain relief, gait, range of motion, and overall quality of life after surgical intervention.[10] Hence, a thorough understanding of the available surgical treatment options and their associated outcomes is essential for optimizing patient care and enhancing long-term functional recovery in individuals affected by hip osteoarthritis.

METHODOLOGY

This narrative review synthesizes current evidence from the published literature to provide a comprehensive overview of the selected topic, with particular emphasis on recent advances, clinical relevance, surgical management strategies, and evolving therapeutic concepts. A structured literature search was conducted using major electronic databases including PubMed, Scopus, Embase, MEDLINE, and Google Scholar. Relevant studies were identified using combinations of topic-specific keywords and Medical Subject Headings (MeSH) terms related to hip osteoarthritis and its surgical management. Search terms included “hip osteoarthritis,” “hip replacement,” “total hip arthroplasty,” “hip resurfacing,” “hip arthroscopy,” “osteotomy,” “revision hip arthroplasty,” “minimally invasive hip surgery,” “ceramic hip replacement,” “metal-on-metal hip,” and “hip replacement outcomes.” Additional relevant articles were identified through manual screening of the reference lists of selected studies to ensure comprehensive coverage of the available literature.

The literature search primarily focused on publications from the last 10–15 years to maintain relevance to contemporary orthopedic practice and recent technological advancements. However, landmark studies and historically significant articles were also included where necessary to provide foundational understanding and historical context. Eligible publications included randomized controlled trials, observational studies, retrospective analyses, prospective cohort studies, systematic reviews, meta-analyses, clinical practice guidelines, and high-quality narrative reviews relevant to the surgical management of hip

osteoarthritis. Preference was given to studies with robust methodology, clinical applicability, larger sample sizes, and contemporary significance. Non-English publications, duplicate records, conference abstracts without accessible full text, and studies with inadequate methodological quality or limited clinical relevance were excluded from the review.

Special emphasis was placed on evidence related to epidemiology, etiopathogenesis, classification systems, diagnostic evaluation, indications for surgery, surgical techniques, implant selection, perioperative optimization, postoperative rehabilitation, complications, revision arthroplasty, and long-term functional outcomes. Comparative effectiveness of various surgical modalities including osteotomy, hip arthroscopy, hemiarthroplasty, hip resurfacing, and total hip replacement was also reviewed in detail. Evidence from both international and regional studies was incorporated wherever appropriate to provide a broader and clinically relevant perspective applicable to diverse healthcare settings.

The selected articles were critically evaluated and systematically organized into thematic sections to facilitate a coherent and clinically meaningful discussion. Since this study was designed as a narrative review, no formal quantitative statistical analysis or meta-analysis was performed. Instead, findings from the included studies were qualitatively synthesized and interpreted to provide an evidence-based overview of current concepts, ongoing controversies, recent advances, and future directions in the surgical management of hip osteoarthritis.

PREVALENCE

The discrepancy between the clinical and radiographic prevalence of hip osteoarthritis (OA) remains only partially understood; however, most epidemiological investigations evaluating hip OA prevalence primarily depend on radiographic criteria for diagnosis.[11,12] Available evidence indicates that hip OA differs epidemiologically from osteoarthritis affecting other joints.[13] For example, only a limited proportion of patients undergoing total hip arthroplasty (THA) for primary hip OA later require total knee arthroplasty, and similarly, patients treated for knee OA infrequently progress to hip replacement, suggesting distinct disease mechanisms and risk profiles for the hip and knee joints.[14] A large population-based study from the United States demonstrated that the prevalence of symptomatic hip OA was approximately 9.2% among adults aged 45 years and older, whereas nearly 27% exhibited radiographic evidence of disease, with women showing a slightly higher prevalence than men.[15] Systematic reviews have further demonstrated that the prevalence of radiographic hip OA increases steadily with advancing age in both sexes. Men tend to show higher prevalence before 50 years of age, while women exhibit greater prevalence after menopause and during later decades of life. Variations among ethnic groups have also been reported, with Caucasian populations demonstrating a comparatively higher prevalence ranging from 3% to 6%, whereas lower prevalence rates have been observed among Asians, Africans, East Indians, and Native Americans, indicating a potential genetic contribution to disease susceptibility. Epidemiological estimates from the Centers for Disease Control and Prevention further suggest that the lifetime risk of developing symptomatic hip OA is approximately 18.5% in men and 28.6% in women.

Anatomy

The hip joint is one of the largest and most stable joints in the human body and serves as a major weight-bearing synovial articulation essential for posture, balance, locomotion, and overall stability. Anatomically, the hip is a ball-and-socket joint formed by the articulation between the femoral head and the acetabulum of the pelvis.[16] The acetabulum is a hemispherical cavity created by the fusion of the ilium, ischium, and pubis, while the femoral head forms the spherical proximal portion of the femur. Both articulating surfaces are covered by smooth hyaline cartilage, which facilitates low-friction movement and efficient distribution of mechanical loads across the joint. The acetabular surface is lined with articular cartilage except within the acetabular fossa, which contains fibro-fatty tissue. Encircling the acetabulum is the fibrocartilaginous acetabular labrum, which deepens the socket, improves congruity between articulating surfaces, and enhances joint stability.[17]

The hip joint is enclosed by a dense fibrous capsule reinforced by strong ligaments including the iliofemoral, pubofemoral, and ischiofemoral ligaments, which contribute significantly to joint stability and limit excessive movement. Internally, the capsule is lined by a synovial membrane that secretes synovial fluid responsible for lubrication and nourishment of the avascular articular cartilage. Several important muscle groups act around the hip joint, including the gluteal muscles, iliopsoas, adductors, hamstrings, and quadriceps, which collectively enable flexion, extension, abduction, adduction, and rotational movements. The vascular supply of the hip joint is mainly derived from the medial and lateral circumflex femoral arteries, while sensory innervation arises from branches of the femoral, obturator, sciatic, and superior gluteal nerves.[18]

In hip osteoarthritis, degeneration primarily involves the articular cartilage covering the femoral head and acetabulum. Progressive cartilage loss exposes the underlying subchondral bone, resulting in sclerosis, cyst formation, osteophyte

development, and altered joint biomechanics. Thickening of the joint capsule together with synovial inflammation further contributes to pain, stiffness, and reduced range of motion. Weight-bearing areas of the joint are particularly vulnerable because of repetitive mechanical stress and abnormal load transmission. As the disease progresses, joint space narrowing and remodeling of the femoral head and acetabulum progressively impair gait, mobility, and overall functional performance.[19]

Pathophysiology of Hip Osteoarthritis

Hip osteoarthritis is a multifactorial degenerative condition characterized by progressive destruction of articular cartilage resulting from an imbalance between anabolic and catabolic processes within the joint environment. The pathogenesis involves a complex interaction of mechanical, inflammatory, biochemical, and cellular factors that progressively compromise joint structure and function. Aging-related reduction in cartilage regenerative capacity, repetitive mechanical stress, obesity, trauma, congenital abnormalities of the hip, and altered biomechanics contribute to increased joint loading and initiation of cartilage degeneration. Chondrocytes, which are responsible for maintaining extracellular matrix homeostasis, become metabolically altered under pathological conditions and produce matrix metalloproteinases (MMPs), aggrecanases, and pro-inflammatory cytokines including interleukin-1 (IL-1), interleukin-6 (IL-6), and tumor necrosis factor-alpha (TNF-α). These mediators accelerate degradation of type II collagen and proteoglycans within the cartilage matrix while simultaneously suppressing synthesis of new extracellular matrix components.[20]

Progressive cartilage erosion eventually exposes the subchondral bone, leading to sclerosis, cyst formation, osteophyte development, and abnormal redistribution of mechanical forces across the joint. Synovial inflammation further contributes to pain, stiffness, and functional limitation through continued release of inflammatory mediators and sensitization of nociceptive pathways. Ultimately, these pathological processes result in chronic pain, deformity, restricted joint movement, and progressive disability in patients with advanced hip osteoarthritis.

Important risk factors associated with hip osteoarthritis include advancing age, obesity, developmental dysplasia of the hip, femoroacetabular impingement, previous trauma, avascular necrosis, genetic susceptibility, and inflammatory joint diseases.

Indications for Surgical Management

Surgical intervention for hip osteoarthritis is generally indicated when conservative treatment modalities fail to provide satisfactory pain relief or functional improvement. Persistent hip pain interfering with activities of daily living such as walking, climbing stairs, prolonged sitting, and performing routine household tasks is one of the most common indications for operative treatment. Many patients also develop severe stiffness, limping, reduced range of motion, and progressive restriction of mobility, which significantly compromise physical independence and quality of life.

Radiographic evidence of advanced osteoarthritis, including marked joint space narrowing, osteophyte formation, subchondral sclerosis, cystic changes, and joint deformity, further supports the need for surgical management. Chronic nocturnal pain causing sleep disturbance is another important indication because it adversely affects mental well-being, energy levels, and overall health status. Functional disability impairing occupational activities and social participation frequently necessitates operative intervention. Surgery is also considered in patients who fail to achieve adequate symptomatic improvement with pharmacological therapy, physiotherapy, weight reduction, walking aids, and structured rehabilitation programs.

Progressive deformity and instability of the hip joint may alter gait mechanics, increase the risk of falls, and contribute to worsening disability. Factors such as patient age, occupation, activity demands, bone quality, and associated medical comorbidities play a crucial role in determining the timing, selection, and type of surgical procedure appropriate for each individual patient.

1. Osteotomy

Osteotomy is a joint-preserving surgical procedure aimed at correcting abnormal hip biomechanics through realignment of the proximal femur, acetabulum, or both. The procedure redistributes mechanical loading from damaged cartilage-bearing regions to relatively preserved areas of the hip joint, thereby reducing focal stress concentration and improving joint congruity.[21] Osteotomy is mainly indicated in younger and physically active patients with early unilateral hip osteoarthritis, particularly when structural abnormalities such as developmental dysplasia of the hip, femoroacetabular impingement, coxa vara, or post-traumatic deformities are present. By restoring more normal joint mechanics, osteotomy attempts to slow disease progression and preserve the native hip joint for a longer duration.

Different osteotomy techniques may be utilized depending on the location and severity of deformity. Femoral osteotomies include varus, valgus, rotational, and flexion osteotomies, while pelvic procedures such as periacetabular osteotomy are commonly performed in patients with acetabular dysplasia. Careful patient selection is essential for successful long-term outcomes.

Individuals with preserved joint space, minimal cartilage damage, and satisfactory range of motion generally experience better postoperative functional improvement, whereas patients with advanced osteoarthritis, severe cartilage loss, marked stiffness, or bilateral disease often demonstrate less favorable outcomes.

One of the major benefits of osteotomy is preservation of the patient's natural hip joint, which is especially advantageous in younger individuals where prosthetic replacement may be undesirable because of implant longevity concerns and the possibility of future revision surgery. Correction of abnormal load distribution may significantly relieve pain, improve gait pattern, enhance functional performance, and postpone the need for total hip arthroplasty for several years. Furthermore, preservation of proximal femoral bone stock remains beneficial if hip replacement becomes necessary later in life.

Despite its advantages, osteotomy is technically complex and requires detailed preoperative planning together with accurate surgical execution to achieve appropriate alignment correction. Rehabilitation is often lengthy and involves restricted weight-bearing along with prolonged physiotherapy to restore strength and mobility. Complications may include nonunion, malunion, fixation failure, neurovascular injury, limb-length discrepancy, and persistent postoperative pain. Moreover, osteotomy is considerably less effective in advanced osteoarthritis associated with severe cartilage destruction and marked joint-space narrowing. Although the procedure may delay arthroplasty, many patients eventually progress to require total hip replacement.

2. Hip Arthroscopy

Hip arthroscopy is a minimally invasive surgical procedure that allows direct visualization and treatment of intra-articular hip pathology using small portals and specialized arthroscopic instruments. The procedure has become increasingly important in selected patients with early hip osteoarthritis, especially in the presence of associated mechanical abnormalities such as femoroacetabular impingement, acetabular labral tears, chondral defects, synovitis, or loose bodies.[22] The primary goal of hip arthroscopy is to reduce pain, improve joint function, and delay progression of degeneration by correcting structural abnormalities responsible for abnormal joint loading and cartilage damage.

Common arthroscopic procedures include osteoplasty for cam and pincer lesions, labral repair or debridement, chondroplasty, synovectomy, and removal of loose bodies. Hip arthroscopy is most effective in younger patients with preserved joint space and minimal radiographic evidence of osteoarthritis. Appropriate patient selection remains crucial, as outcomes are significantly less favorable in individuals with advanced cartilage degeneration or severe joint-space narrowing.

The minimally invasive nature of hip arthroscopy results in smaller surgical incisions, reduced soft tissue trauma, less blood loss, and lower postoperative morbidity compared with open surgical procedures. Patients generally experience reduced postoperative pain, shorter hospitalization, faster rehabilitation, and earlier return to daily activities and sports participation. Arthroscopy also preserves the native hip joint and may delay the requirement for total hip replacement in appropriately selected individuals.

Despite these advantages, hip arthroscopy has limited effectiveness in advanced osteoarthritis. Patients with severe cartilage loss, osteophyte formation, deformity, or significant joint-space narrowing frequently experience inferior outcomes and persistent symptoms after the procedure. In many patients, symptom relief may only be temporary, with progressive degeneration ultimately necessitating total hip arthroplasty. Additional concerns include technical difficulty due to the deep anatomy of the hip joint, prolonged traction time, and complications such as nerve palsy, chondral injury, infection, heterotopic ossification, and persistent postoperative pain.

3. Hip Resurfacing Arthroplasty

Hip resurfacing arthroplasty is a bone-preserving alternative to conventional total hip replacement in which the femoral head is retained and covered with a metallic prosthetic cap while the acetabular surface is replaced with a corresponding metal component. Unlike total hip arthroplasty, the femoral head and neck are preserved, thereby maintaining proximal femoral bone stock and allowing more physiological hip biomechanics. [23] The procedure was primarily developed for younger and highly active patients who may outlive conventional prosthetic implants and potentially require future revision surgery.

Hip resurfacing is most suitable for carefully selected patients with good bone quality, larger femoral head size, and relatively preserved femoral anatomy. The use of a large femoral head component provides greater joint stability and lowers the risk of postoperative dislocation compared with conventional total hip replacement.

Indications

- Young active patients
- Good bone quality
- Larger femoral head size

Ideal candidates are typically younger, physically active males with strong femoral bone stock and minimal deformity. Selected patients with limited femoral head osteonecrosis or secondary osteoarthritis may also benefit from the procedure.

Advantages

• Bone preservation
• Reduced risk of dislocation
• Easier revision surgery

One of the principal advantages of hip resurfacing arthroplasty is preservation of proximal femoral bone stock, which simplifies future revision procedures if required. The large-diameter femoral head enhances joint stability, improves range of motion, and reduces the likelihood of postoperative dislocation. Preservation of the femoral neck may also contribute to improved proprioception and more natural gait mechanics.

Disadvantages

Metal ion release
• Femoral neck fracture
• Limited use in women and osteoporotic patients

Despite these advantages, hip resurfacing arthroplasty has several important limitations. Metal-on-metal bearing surfaces may release cobalt and chromium ions into the bloodstream, raising concerns regarding adverse local tissue reactions, pseudotumor formation, hypersensitivity responses, and potential systemic toxicity. Femoral neck fractures may occur, particularly in patients with poor bone quality or improper implant positioning. Women, elderly individuals, and patients with osteoporosis are generally considered unsuitable candidates because of smaller femoral head size and increased fracture risk. Due to complications associated with metal-on-metal implants, the popularity of hip resurfacing has declined considerably in recent years.

4. Hip Arthrodesis

Hip arthrodesis, also known as surgical fusion of the hip joint, is a procedure performed to relieve pain by creating a stable and permanently immobile joint. The operation involves removal of the remaining articular cartilage followed by fixation of the femur to the acetabulum in an appropriate functional position to achieve bony fusion.[24] Prior to the widespread success and availability of total hip arthroplasty, hip arthrodesis was commonly used in young patients with severe unilateral hip disease.

The procedure is primarily indicated in young laborers with unilateral painful hip arthritis who require a durable and stable joint for strenuous physical activity. Hip arthrodesis may also be considered in patients with active or previous infection where arthroplasty is contraindicated because of a high risk of prosthetic infection. Proper positioning during fusion is essential to optimize standing, walking, and sitting functions while minimizing compensatory stress on adjacent joints.

The major disadvantage of hip arthrodesis is permanent loss of hip mobility, which significantly impairs activities such as squatting, sitting cross-legged, climbing stairs, and maintaining personal hygiene. Altered biomechanics frequently lead to secondary degenerative changes involving the lumbar spine, ipsilateral knee, and contralateral hip because of increased compensatory stress. Functional restrictions, abnormal gait mechanics, and difficulty with prolonged sitting often reduce long-term patient satisfaction. With the excellent outcomes achieved by modern total hip arthroplasty, hip arthrodesis is now reserved for carefully selected cases.

5. Hemiarthroplasty

Hemiarthroplasty is a surgical procedure in which only the femoral component of the hip joint is replaced while preserving the native acetabulum. The prosthetic femoral head articulates directly with the patient's acetabular cartilage.[25] Hemiarthroplasty may be performed using either unipolar or bipolar prosthetic designs depending on implant characteristics and surgeon preference. Although the procedure is widely utilized for displaced femoral neck fractures in elderly patients, its role in primary hip osteoarthritis is limited.

Hemiarthroplasty is generally indicated in elderly, low-demand patients with limited mobility or significant medical comorbidities where shorter operative duration and reduced surgical complexity are desirable. Bipolar hemiarthroplasty may provide somewhat improved mobility and reduced acetabular stress compared with unipolar implants, although definitive long-term superiority remains uncertain.

The principal limitation of hemiarthroplasty in osteoarthritis is progressive degeneration of the native acetabular cartilage caused by continuous articulation with the prosthetic femoral head. This often results in persistent groin pain, gradual acetabular erosion, reduced hip function, and eventual need for conversion to total hip replacement. Functional outcomes, pain relief, range of motion, and long-term patient satisfaction are generally inferior compared with total hip arthroplasty in patients with primary hip osteoarthritis. Consequently, hemiarthroplasty is not considered the preferred surgical option for primary osteoarthritis of the hip.

Total Hip Replacement

Overview

Total hip replacement (THR), also referred to as total hip arthroplasty, is a surgical procedure in which both the femoral head and the acetabular articular surface are replaced with prosthetic components. It is widely considered the definitive surgical treatment for end-stage hip osteoarthritis and remains one of the most successful procedures in orthopedic surgery in terms of pain relief, restoration of mobility, and improvement in overall quality of life.[25] The primary goals of THR are to alleviate pain, restore joint stability and function,

correct deformity, and improve the patient's ability to perform daily activities independently.

The procedure is commonly indicated in patients with severe hip pain, progressive functional limitation, stiffness, sleep disturbance, and radiographic evidence of advanced joint degeneration that has failed to respond adequately to conservative treatment measures such as medications, physiotherapy, weight reduction, and intra-articular injections. THR has demonstrated excellent long-term survivorship and patient satisfaction, with many modern prosthetic implants functioning effectively for 15–25 years or longer depending on patient age, activity level, implant design, and surgical technique.[26]

During the operation, the diseased femoral head is excised and replaced with a femoral stem and prosthetic head, while the damaged acetabular cartilage and subchondral bone are reamed and fitted with an artificial acetabular cup. Advances in implant materials, fixation techniques, surgical approaches, and perioperative care have significantly improved clinical outcomes and reduced complication rates. Modern surgical principles emphasize restoration of hip biomechanics, accurate component positioning, early mobilization, and accelerated rehabilitation to optimize recovery and long-term implant survival.

The acetabular component consists of a hemispherical cup implanted into the prepared acetabulum following removal of diseased cartilage and bone. The cup may be cemented or press-fit to facilitate biological fixation. Within the acetabular shell, a liner is inserted to serve as the bearing surface articulating with the prosthetic femoral head.

The femoral component consists of a metallic stem inserted into the femoral canal along with a prosthetic femoral head attached to the neck of the stem. Depending on patient age, bone quality, and surgeon preference, the stem may be cemented or uncemented. The prosthetic femoral head articulates with the acetabular liner to restore smooth hip motion and joint stability.[27]

Selection of the bearing surface plays an important role in determining implant longevity, wear characteristics, and complication profile. Metal-on-polyethylene articulations have traditionally been the most widely used because of their reliability, cost-effectiveness, and satisfactory long-term clinical outcomes. However, polyethylene wear particles may contribute to osteolysis and aseptic loosening over time.

Ceramic-on-ceramic bearing surfaces demonstrate extremely low wear rates and excellent biocompatibility, making them particularly suitable for younger and physically active individuals. Nevertheless, complications such as ceramic fracture and audible squeaking have occasionally been reported. Ceramic-on-polyethylene combinations have gained increasing popularity because they combine the low wear properties of ceramic heads with the improved durability of highly cross-linked polyethylene liners.[28]

Continuous advances in biomaterials and implant engineering have further enhanced implant durability, functional performance, and long-term outcomes while reducing revision rates.

Indications for Total Hip Replacement

Total hip replacement is primarily indicated in patients with advanced hip joint disease causing persistent pain, functional impairment, and significant reduction in quality of life despite appropriate conservative treatment. The decision to proceed with THR is based on a combination of clinical symptoms, physical examination findings, radiographic evidence of joint degeneration, and the overall impact of disease on daily functioning and psychosocial well-being. Although THR is most commonly performed for end-stage osteoarthritis, it may also be indicated in conditions such as rheumatoid arthritis, avascular necrosis of the femoral head, post-traumatic arthritis, congenital hip disorders, inflammatory arthropathies, and failed previous hip surgeries.[29]

End-stage osteoarthritis remains the most common indication for THR. Patients typically present with progressive pain involving the groin, thigh, or buttock associated with stiffness, restricted range of motion, limping, and difficulty performing activities such as walking, climbing stairs, prolonged standing, and sitting. Pain may eventually progress to persistent nocturnal discomfort and sleep disturbance, significantly affecting physical and psychological well-being.

Severe pain unresponsive to conservative treatment is another major indication for surgery. Non-operative management strategies including analgesics, nonsteroidal anti-inflammatory drugs, physiotherapy, lifestyle modification, weight reduction, walking aids, and intra-articular injections may provide temporary relief during the early stages of disease; however, persistent symptoms despite these interventions strongly support operative management. Debilitating pain interfering with mobility, occupational activities, and personal independence frequently necessitates surgical treatment.

Significant functional impairment and deterioration in quality of life are also important determinants in the decision-making process for THR. Patients often experience difficulty with ambulation, self-care, occupational duties, and social participation. Chronic pain and progressive immobility may contribute to depression, social isolation, and declining overall health status. THR has consistently demonstrated substantial improvement

in functional capacity, gait mechanics, pain relief, and patient-reported quality-of-life outcomes.[30]

Radiographic evidence of advanced joint destruction further supports the clinical diagnosis and assists in determining disease severity. Common imaging findings include marked joint-space narrowing, osteophyte formation, subchondral sclerosis, cystic changes, femoral head deformity, and acetabular erosion. Correlation between radiographic findings and clinical symptoms remains essential because surgical intervention should be guided by both imaging evidence and degree of functional disability.

Failure of previous hip-preserving procedures such as osteotomy, core decompression, hip arthroscopy, or resurfacing arthroplasty may also necessitate conversion to total hip replacement. In these situations, THR functions as a salvage procedure intended to relieve pain and restore hip function when previous interventions fail to provide satisfactory long-term results.

Contraindications

Although total hip replacement (THR) is highly effective in relieving pain and restoring joint function, certain clinical conditions may contraindicate the procedure because of increased operative risk, poor anticipated outcomes, or inability to achieve stable prosthetic function. Contraindications are broadly classified into absolute and relative contraindications depending upon the severity and reversibility of the underlying condition.[31]

Active infection, whether localized around the hip joint or present systemically elsewhere in the body, represents a major absolute contraindication because implantation of a prosthesis in the presence of infection may lead to catastrophic periprosthetic joint infection, implant failure, sepsis, and significant morbidity. Severe uncontrolled medical instability, including advanced cardiac disease, respiratory insufficiency, or multiorgan dysfunction, may render the patient unsuitable for anesthesia and major surgical intervention. A nonfunctional abductor mechanism, particularly severe insufficiency of the gluteus medius muscle, can result in postoperative instability, abnormal gait mechanics, and unsatisfactory functional recovery.

Relative contraindications require careful individualized assessment of the risks and benefits prior to proceeding with surgery. Morbid obesity is associated with increased technical difficulty, prolonged operative time, wound complications, infection risk, implant loosening, and less favorable rehabilitation outcomes. Neuromuscular disorders such as Parkinson disease, post-stroke weakness, or cerebral palsy may predispose patients to postoperative instability, falls, and dislocation. Poor bone stock caused by osteoporosis or previous surgical procedures may compromise implant fixation and increase the risk of periprosthetic fracture. Uncontrolled diabetes mellitus is associated with impaired wound healing, increased susceptibility to infection, and higher rates of systemic complications; therefore, optimization of glycemic control is essential before surgery. Despite these concerns, many patients with relative contraindications may still benefit from THR following appropriate medical optimization and meticulous perioperative planning.[32]

Surgical Approaches in THR

Various surgical approaches are employed in total hip replacement, each differing in soft tissue preservation, exposure of the hip joint, postoperative recovery profile, complication rates, and technical complexity. Selection of the surgical approach depends upon surgeon experience, patient anatomy, underlying pathology, and implant requirements. No single approach has been universally established as superior, and successful outcomes largely depend on accurate component positioning, meticulous soft tissue handling, and surgical expertise.

The posterior approach remains the most widely utilized technique in total hip arthroplasty. It involves splitting the gluteus maximus muscle and detaching the short external rotator muscles to gain posterior access to the hip joint. This approach provides excellent visualization of both the acetabulum and proximal femur, facilitating accurate implant positioning and extensile exposure during complex primary and revision procedures. Preservation of the hip abductor mechanism contributes to satisfactory postoperative gait function. However, disruption of the posterior capsule and short external rotators may increase the risk of postoperative dislocation, particularly when soft tissue repair is inadequate or component alignment is suboptimal.[33]

The lateral or anterolateral approach involves splitting or partial detachment of the gluteus medius and minimus muscles to expose the hip joint. One of the major advantages of this approach is a lower incidence of postoperative dislocation because the posterior soft tissue structures remain intact. The approach also offers excellent exposure of the acetabulum and facilitates stable implant positioning. However, injury to or incomplete healing of the abductor musculature may result in postoperative abductor weakness, Trendelenburg gait, limping, and persistent lateral hip pain in certain patients.

The direct anterior approach has gained increasing popularity because it utilizes an internervous and intermuscular plane, thereby minimizing muscle detachment and soft tissue trauma. This muscle-sparing technique is associated with reduced postoperative pain, earlier mobilization, shorter hospital stay, and more rapid functional recovery

during the early postoperative period. Preservation of the posterior soft tissues may also contribute to lower dislocation rates. Nevertheless, the anterior approach is technically demanding, possesses a steep learning curve, and may be associated with complications such as femoral fracture, wound complications, and injury to the lateral femoral cutaneous nerve.[34]

Each surgical approach has distinct advantages and limitations, and surgeon experience remains one of the most important determinants of operative success, complication rates, and long-term functional outcomes following total hip replacement.

Fixation Methods

Fixation of prosthetic components in total hip replacement may be achieved using cemented, cementless, or hybrid techniques. The selection of fixation method depends on factors such as patient age, bone quality, activity level, anatomical considerations, and surgeon preference.

Cemented THR

Cemented total hip replacement utilizes polymethylmethacrylate bone cement to anchor prosthetic components securely to the surrounding bone. This technique provides immediate implant stability and has demonstrated excellent long-term clinical outcomes, particularly in elderly patients with osteoporotic or poor-quality bone. Cemented fixation may decrease the risk of early periprosthetic fracture and allows reliable implant stability even in compromised bone stock. However, long-term loosening associated with cement fatigue, osteolysis, and cement degradation may occur in certain patients.

Cementless THR

Cementless total hip replacement relies on biological fixation through bone ongrowth or ingrowth into porous implant surfaces. Initial implant stability is achieved through press-fit fixation, followed by long-term osseointegration. Cementless prostheses are generally preferred in younger and more active individuals because of their potential for durable biological fixation and comparatively easier revision surgery. Technological advances in porous coatings, surface engineering, and implant design have substantially improved long-term outcomes of cementless implants. Nevertheless, adequate bone quality remains essential for successful fixation and long-term implant stability.[35]

Hybrid THR

Hybrid total hip replacement combines cemented fixation on one side with cementless fixation on the opposite side, most commonly involving a cemented femoral stem with an uncemented acetabular component. Reverse hybrid techniques may also be utilized selectively in certain clinical situations. Hybrid fixation aims to combine the advantages of both cemented and cementless methods and has demonstrated excellent long-term survivorship in appropriately selected patients.

Outcomes of Total Hip Replacement

Total hip replacement is regarded as one of the most successful orthopedic procedures because of its excellent long-term outcomes in pain relief, restoration of mobility, and improvement in overall quality of life. Continuous advances in implant design, surgical techniques, perioperative care, and rehabilitation protocols have further enhanced patient satisfaction and implant longevity.[36]

Pain Relief

THR provides substantial pain reduction in the majority of patients, with more than 90% reporting significant symptomatic improvement. Relief of chronic hip pain, including nocturnal pain and pain during walking, remains one of the primary contributors to postoperative patient satisfaction. Reduction in pain also improves sleep quality, physical activity levels, and decreases dependence on analgesic medications.

Functional recovery following THR is generally excellent. Patients frequently demonstrate improved gait mechanics, enhanced mobility, increased range of motion, and greater independence in performing activities of daily living. Early mobilization and structured physiotherapy programs play an important role in restoring muscle strength, balance, and physical function.

Quality of Life

THR significantly improves psychological well-being, sleep quality, and social participation. Chronic pain and disability associated with advanced hip osteoarthritis often contribute to depression, anxiety, social isolation, and impaired quality of life. By restoring mobility and relieving pain, THR positively influences emotional health, interpersonal relationships, and overall life satisfaction.

Implant Survival

Modern prosthetic implants demonstrate survivorship rates exceeding 90–95% at 15–20 years in many clinical studies. Long-term implant survival has improved substantially because of advancements in biomaterials, fixation techniques, bearing surfaces, and surgical precision. Factors affecting implant longevity include patient age, body weight, activity level, implant design, bearing surface characteristics, and accuracy of component positioning. Younger and more active patients may possess a greater lifetime risk of revision surgery because of higher mechanical demands and longer life expectancy.[37]

Complications of Total Hip Replacement

Although total hip replacement is highly successful, complications may occur during the intraoperative, early postoperative, or late

postoperative period. Prompt recognition and appropriate management are essential to minimize morbidity and preserve implant function.

1. Infection

Periprosthetic joint infection is one of the most serious complications and may necessitate revision surgery. Infection may result from intraoperative contamination, postoperative wound complications, or hematogenous spread from distant infectious sites. Clinical manifestations include pain, swelling, erythema, fever, wound discharge, and implant loosening. Management often requires prolonged antibiotic therapy, surgical debridement, staged revision procedures, or implant removal in severe cases.[38]

Risk factors include:

- Diabetes mellitus
- Obesity
- Immunosuppression
- Prolonged surgery

Additional risk factors include malnutrition, smoking, rheumatoid arthritis, previous surgery, poor skin condition, and advanced age. Strict aseptic precautions, perioperative antibiotic prophylaxis, glycemic optimization, and meticulous surgical technique remain essential preventive measures.

2. Dislocation

Dislocation commonly occurs during the early postoperative period and may result from component malposition or soft tissue imbalance. Contributing factors include malpositioned implants, inadequate soft tissue tension, abductor weakness, neuromuscular disorders, and noncompliance with postoperative precautions. Posterior surgical approaches generally demonstrate higher dislocation rates compared with anterior or lateral approaches. Management may involve closed reduction, bracing, or revision surgery in recurrent or persistent cases.

3. Aseptic Loosening

Mechanical failure at the bone-implant interface may lead to loosening and persistent pain. Aseptic loosening remains one of the leading causes of late implant failure and revision arthroplasty. Wear particle-induced inflammatory reactions contribute to osteolysis, progressive bone loss, implant migration, and functional deterioration. Advances in bearing surfaces and fixation methods have significantly reduced its incidence.

4. Periprosthetic Fracture

Periprosthetic fractures may occur intraoperatively or postoperatively, particularly in elderly osteoporotic patients. These fractures commonly occur around prosthetic components and may result from trauma, implant loosening, or technical difficulties during surgery. Management depends on fracture location, implant stability, and bone quality and may involve internal fixation, revision arthroplasty, or combined reconstructive procedures.

5. Venous Thromboembolism

Deep vein thrombosis and pulmonary embolism remain important postoperative concerns despite routine thromboprophylaxis. Major orthopedic procedures increase thromboembolic risk because of venous stasis, endothelial injury, and postoperative hypercoagulability. Preventive strategies include early mobilization, anticoagulation therapy, pneumatic compression devices, and mechanical prophylaxis. Modern thromboprophylaxis protocols have significantly reduced the incidence of symptomatic thromboembolic events.[39]

6. Leg Length Discrepancy

Improper restoration of hip biomechanics may result in limb length inequality. Patients may experience limping, gait disturbance, lower back pain, dissatisfaction, and functional impairment. Mild discrepancies are relatively common and usually well tolerated, whereas severe inequality may require corrective procedures or revision surgery.

7. Neurovascular Injury

Sciatic nerve injury is uncommon but potentially disabling. The sciatic nerve, particularly its peroneal division, is most frequently affected because of traction, compression, hematoma formation, or direct surgical trauma. Patients may present with sensory deficits, neuropathic pain, foot drop, or motor weakness. Early recognition and appropriate management are crucial for optimal neurological recovery.

Revision Total Hip Arthroplasty

Revision total hip arthroplasty refers to replacement or reconstruction of failed prosthetic components following primary THR. Revision procedures are generally more complex because of bone loss, scar tissue formation, instability, infection, altered anatomy, and compromised soft tissues.

Revision surgery is required for:

- Implant loosening
- Infection
- Recurrent dislocation
- Implant wear
- Periprosthetic fracture

Aseptic loosening and implant wear remain among the most common indications for revision surgery. Periprosthetic infection frequently necessitates staged revision procedures involving implant removal, antibiotic therapy, and delayed reimplantation. Recurrent instability, component malposition, and periprosthetic fractures may also require revision procedures. Revision arthroplasty is technically demanding and often requires specialized implants such as revision stems, augments, cages, and constrained liners. Compared

with primary THR, revision surgery is associated with greater blood loss, longer operative duration, higher complication rates, and less predictable clinical outcomes.[40]

Rehabilitation Following THR

Postoperative rehabilitation is essential for successful recovery following total hip replacement. Rehabilitation maximizes functional recovery, restores mobility, prevents complications, and improves patient satisfaction. Modern rehabilitation protocols emphasize multidisciplinary care, enhanced recovery pathways, and individualized physiotherapy programs.

Key components include:

- Early mobilization
- Muscle strengthening
- Gait training
- Pain management
- Thromboprophylaxis

Early mobilization is encouraged within the first postoperative day to reduce complications such as venous thromboembolism, pulmonary compromise, muscle wasting, and joint stiffness. Physiotherapy focuses on strengthening the hip abductors, extensors, and quadriceps muscles while improving balance and gait mechanics. Adequate pain control using multimodal analgesia facilitates active participation in rehabilitation and accelerates functional recovery. Enhanced Recovery After Surgery (ERAS) protocols involving minimally invasive surgical techniques, optimized anesthesia, early nutrition, and rapid mobilization have significantly shortened hospital stay and improved postoperative outcomes.

Recent Advances in Hip Arthroplasty

Rapid advancements in implant technology, surgical techniques, imaging guidance, and perioperative management have significantly transformed modern hip arthroplasty. Contemporary innovations are primarily directed toward improving implant longevity, enhancing surgical precision, minimizing complications, and optimizing postoperative recovery and patient satisfaction.

Recent developments include:

- Robotic-assisted surgery
- Computer navigation
- Highly cross-linked polyethylene
- Dual mobility implants
- Minimally invasive approaches
- Personalized implants
- Enhanced perioperative pain management

Robotic-assisted surgery and computer-assisted navigation have improved surgical precision by enhancing component positioning, restoration of hip biomechanics, and overall alignment accuracy. Improved accuracy in implant placement may reduce complications such as dislocation, limb length discrepancy, abnormal wear, and early implant failure. These technologies also assist surgeons in preoperative planning and intraoperative decision-making, thereby improving consistency and reproducibility of surgical outcomes.

Highly cross-linked polyethylene liners have substantially reduced polyethylene wear and osteolysis, resulting in improved implant durability and decreased rates of aseptic loosening. Advances in biomaterials and bearing surfaces have contributed significantly to prolonged implant survivorship, particularly in younger and more active patients.

Dual mobility implants have emerged as an important innovation for improving joint stability and reducing postoperative dislocation risk, especially in elderly patients, revision arthroplasty, and individuals with neuromuscular disorders or abductor insufficiency. The dual articulation mechanism increases range of motion while enhancing implant stability.

Minimally invasive surgical approaches have gained popularity because they reduce soft tissue trauma, postoperative pain, blood loss, and hospitalization duration while promoting faster rehabilitation and earlier return to function. Improved surgical instrumentation and refined operative techniques have further facilitated these approaches.

Personalized implants and patient-specific instrumentation are increasingly being explored to better replicate individual anatomy and restore native hip biomechanics more accurately. Customized implants may improve implant fit, reduce bone loss, and enhance functional outcomes, particularly in patients with complex anatomy or severe deformities.

Enhanced perioperative pain management strategies involving multimodal analgesia, regional anesthesia techniques, and Enhanced Recovery After Surgery (ERAS) protocols have further improved postoperative comfort, facilitated early mobilization, shortened hospital stay, and accelerated functional recovery.

Future Directions

The field of hip arthroplasty continues to evolve rapidly, with ongoing research focused on improving implant longevity, enhancing functional outcomes, minimizing complications, and individualizing treatment strategies. Future developments are expected to integrate advances in biomaterials, digital technology, robotics, regenerative medicine, and artificial intelligence to optimize both surgical precision and patient recovery.

One of the major future directions in hip arthroplasty is the development of advanced biomaterials with superior wear resistance and

biocompatibility. Continued refinement of highly cross-linked polyethylene, ceramic bearings, porous metals, and bioactive implant coatings aims to reduce osteolysis, minimize aseptic loosening, and prolong implant survival. Research is also investigating smart implants equipped with embedded sensors capable of monitoring implant stability, joint loading patterns, temperature changes, and early indicators of infection or mechanical failure.

Robotic-assisted surgery and computer-navigated systems are expected to become increasingly integrated into routine orthopedic practice. These technologies improve the accuracy of component positioning, restoration of hip biomechanics, and intraoperative decision-making, potentially reducing complications such as instability, impingement, and limb length discrepancy. Artificial intelligence and machine learning algorithms may further contribute to preoperative planning, patient selection, complication prediction, implant optimization, and individualized rehabilitation protocols.

Patient-specific implants and three-dimensional printing technology represent another promising area of advancement. Customized implants designed according to individual anatomy may improve implant fit, restore native biomechanics more precisely, and enhance long-term clinical outcomes, particularly in complex primary and revision arthroplasty procedures. Three-dimensional printing technology may also facilitate production of personalized surgical guides, porous implants, and reconstructive components for severe bone defects.

Minimally invasive surgical approaches and Enhanced Recovery After Surgery (ERAS) protocols are likely to continue evolving with emphasis on minimizing soft tissue trauma, promoting rapid mobilization, reducing hospital stay, and accelerating return to daily activities. Advances in perioperative anesthesia, multimodal analgesia, blood conservation strategies, and rehabilitation techniques are expected to further improve patient experience and postoperative recovery.

Regenerative medicine and biologic therapies may also influence future management strategies for hip osteoarthritis. Stem cell therapy, cartilage regeneration techniques, gene therapy, growth factor modulation, and tissue engineering are currently being investigated as potential approaches to delay or prevent progression of degenerative joint disease, potentially reducing the need for arthroplasty in selected individuals.

Long-term registry data, large multicenter studies, and outcome-based clinical research will continue to guide implant selection, surgical techniques, and evidence-based orthopedic practice. The ultimate objective of future innovation in hip arthroplasty is to provide durable pain relief, restore near-normal joint function, minimize the need for revision surgery, and improve long-term quality of life for patients undergoing hip replacement procedures.

DISCUSSION

Hip osteoarthritis is a progressive degenerative joint disorder that significantly impairs mobility, independence, functional capacity, and overall quality of life, particularly among the elderly population. Management strategies range from conservative treatment modalities to advanced surgical interventions depending on disease severity, patient age, activity level, associated comorbidities, and radiographic progression. Surgical treatment plays a critical role in patients with advanced disease who fail to achieve adequate symptom relief through non-operative measures such as medications, physiotherapy, lifestyle modification, weight reduction, and intra-articular injections.[41]

Joint-preserving procedures including osteotomy and hip arthroscopy may provide symptomatic improvement and delay the requirement for arthroplasty in carefully selected younger patients with early-stage disease and structural abnormalities. Osteotomy redistributes mechanical stress across the hip joint and improves joint congruity, whereas hip arthroscopy addresses intra-articular pathology such as femoroacetabular impingement, labral tears, synovitis, and chondral lesions. However, the long-term effectiveness of these procedures remains limited in advanced osteoarthritis, and many patients eventually progress to require total hip replacement.[42]

Hip resurfacing arthroplasty emerged as an attractive alternative for younger and physically active patients because of its bone-preserving properties and enhanced joint stability. Nevertheless, concerns regarding metal ion release, adverse local tissue reactions, pseudotumor formation, and femoral neck fractures have substantially limited its widespread acceptance. Similarly, hip arthrodesis and hemiarthroplasty currently possess relatively restricted indications because modern total hip replacement provides superior pain relief, restoration of mobility, and higher long-term patient satisfaction.[43]

Total hip replacement continues to remain the gold standard surgical treatment for end-stage hip osteoarthritis. Advances in implant materials, bearing surfaces, fixation techniques, surgical approaches, and perioperative care have markedly improved implant survivorship and postoperative functional outcomes. Most patients experience substantial pain relief, restoration of mobility, correction of deformity, and significant improvement in quality of life following surgery. Contemporary prosthetic implants frequently

demonstrate survivorship rates exceeding 90–95% at 15–20 years, reflecting the effectiveness and durability of modern arthroplasty techniques.[44]

Despite excellent clinical outcomes, complications such as periprosthetic joint infection, dislocation, aseptic loosening, periprosthetic fracture, and venous thromboembolism continue to present important clinical challenges. Preventive strategies including meticulous surgical technique, careful patient selection, thromboprophylaxis, infection prevention measures, optimized perioperative management, and structured rehabilitation programs are essential for improving outcomes and minimizing the need for revision surgery.

The increasing use of robotic-assisted surgery, computer navigation, dual mobility implants, highly cross-linked polyethylene liners, and minimally invasive surgical approaches reflects the continuing evolution of hip arthroplasty. These technological advancements aim to improve implant positioning accuracy, reduce complications, enhance joint stability, and accelerate postoperative recovery. Furthermore, developments in personalized medicine, artificial intelligence, tissue engineering, and regenerative therapies may further transform future treatment strategies for hip osteoarthritis.[45]

Overall, successful management of hip osteoarthritis requires a patient-centered and multidisciplinary approach that considers disease severity, patient expectations, functional demands, bone quality, associated comorbidities, and overall health status. Continued research and technological innovation are expected to further improve the safety, durability, and long-term functional success of surgical treatment strategies for hip osteoarthritis.

CONCLUSION

Osteoarthritis of the hip is a major cause of chronic pain, disability, and impaired mobility worldwide. Surgical management plays a vital role in patients with advanced disease who fail to respond adequately to conservative treatment. Multiple surgical options are available depending on patient age, disease severity, structural abnormalities, and functional requirements. Among these procedures, total hip replacement remains the gold standard treatment for end-stage hip osteoarthritis because of its excellent long-term outcomes in pain relief, restoration of mobility, correction of deformity, and improvement in quality of life. Although complications such as infection, dislocation, aseptic loosening, and periprosthetic fracture may occur, advances in implant technology, surgical techniques, perioperative care, and rehabilitation protocols have significantly enhanced postoperative outcomes and implant longevity. Careful patient selection, meticulous surgical planning, and comprehensive postoperative rehabilitation remain essential for achieving optimal long-term functional results and maximizing patient satisfaction.

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