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Review Article

Total hip arthroplasty: areview of advances, advantages and limitations

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Abstract: The therapeutic outcomes of Osteoarthritis (OA) has been unsatisfactory and often surgeries such as total hip arthroplasty (THA) is required. THA is an effective treatment for patients with end-stage arthritic hip conditions. Cemented THA has been the treatment of choice for elderly patients with OA. An improvement in Timed "Up and Go" (TUG) before surgery might contribute to a decrease in the occurrence of DVT after THA, though post-thrombotic syndrome (PTS), a chronic condition in the lower extremity does not appear to be a major complication after DVT in patients undergoing THA. For OA, four domains to be evaluated: pain, physical function, joint imaging, and patient global assessment. Thus, THA can be cost saving or, at least cost- effective in improving quality-adjusted life expectancy. The purpose of this review is to discuss the recent advances as well as advantages and limitations of THA.

Keywords: Hip arthroplasty, osteoarthritis, quality of life

Introduction

Total hip arthroplasty (THA) is an effective treatment for patients with end-stage arthritic hip condition. It provides pain relief, enhances mobility, and restores function. The percentage of THA being performed on patients younger than 60 is about 40% and is increasing steadily [1]. Some authors prefer using an osteotomy or arthrodesis as an alternative to THA [2], but by the time patients seek medical advice, hip joint degeneration is often too extensive for osteotomy to be considered useful. The arthrodesis caused often leads to patient dissatisfaction due to reduced mobility and subsequent back and knee deterioration resulting in pain. The success of THA in older patients, in concert with improvements in techniques and biomaterials, has stimulated demand of this procedure in young. In patients 18 to 25 years old, overall implant survival rates ranged from 65% to 78%, femoral component survival rates from 81% to 95%, and acetabular component survival rates from 68% to 84% [3]. Hip arthroplasty is one of the most common orthopedic interventions. In Sweden, about 10000 hip arthroplasties are performed annually, corresponding to an annual rate of about 400 per 100000 inhabitants aged 50 and older. Patients and surgeons may differ in their concerns and priorities for THA.

Initial cemented THA in young patients with osteoarthritis (OA) showed increased risk for revision due to aseptic loosening associated with OA and raised concerns of high rates of long-term failure. Berry and colleagues [4]. ompared 25-year survival rates of 2,000 THAs performed between 1960 and 1971. Eighty-three percent of the hips were osteoarthritic. Implant survival was strongly associated with patient age and diagnosis at time of procedure. Survival rates decreased with each decade of age, from 95.8% for patients older than 80 to 63.7% for patients younger than 40. With improvements in cementing and other surgical techniques, the ability to achieve long-term fixation has been enhanced. Cornell and Ranawat [5] reported a study on 101 hips in patients with OA (age 55 or younger, mean 7-year follow-up). Overall survival rates were 87.6% (10 years) and 70% (13 years). At 13 years, the survival rates of the femoral and acetabular components were 92.9% and 75%, respectively. Similarly, Boeree and Bannister [6] found over-

all survival rates of 90% (10 years) and 87.3% (12 years) for 46 THAs performed in patients who were 24 to 49 years old and had idiopathic or secondary OA.

Sochart and Porter [7], 10 years after performing 66 THAs in patients who were younger than 40 and had degenerative OA, found survival rates of 86% (overall), 94% (femoral component), and 84% (acetabular component). At 20 years, these rates were down to 52% (overall), 74% (femoral component), and 59% (acetabular component). Hartofilakidis and colleagues [8] reported THA survival rates of 89.8% (10 years) and 67% (20 years) in 69 patients (84 hips) with a mean age of 46 years (range, 24-55 years) and a diagnosis of OA. Similarly, Devitt and colleagues [9] published the results of 118 Charnley LFAs (low friction arthroplasty) and reported survival rates of 86% (10 years) and 64% (20 years) in patients 50 or younger with primary OA.

Cementless, press fit THA

Cementless prostheses were introduced in the early 1980s in an attempt to prevent aseptic loosening of the acetabular cup and the difficulties associated with revision of cemented THAs. First-generation cementless devices, however, were associated with high thigh pain, femoral component subsidence, aseptic loosening, proximal bone loss attributed to adaptive bone remodeling, and osteolysis caused by polyethylene debris. Second-generation stems (eg, Profile stem (DePuy, Leeds, England)) were designed to improve fit, reduce micromotion, and optimize resistance to axial, bending, and rotational forces and thereby minimizing some of these complications [10]. Eskelinen and colleagues [11], using the Finnish Arthroplasty Register, evaluated 5,607 hip arthroplasties performed for primary OA in patients younger than 55. At 10-year follow-up, modern second generation cementless stems (ABG I (Stryker, Mahwah, NJ), Anatomic Mesh (Stryker, Mahwah, NJ), Bi-Metric (Biomet, Inc., Warsaw, IN), CLS Spotorno(Zimmer, Inc., Warsaw, IN), PCA Standard (Stryker, Mahwah, NJ), Profile Porous (DePuy, Leeds, England) had survival rates higher than 90%; with the exception of the Harris-Galante (Zimmer, Inc., Warsaw, IN; 10-year survival rate, 89%), press-fit porous cups performing below 80%. D'Antonio and colleagues [12] reported results for 314 cementless omnifit (Stryker, Mahwah, NJ) hydroxyapatite stems in patients younger than 50 years, the majority of whom had a diagnosis of OA. At a follow-up of 10 to 13 years, the femoral stem survival rate was 98.7%, and the acetabular cup survival rate was 87%. Evidently, failure rates for cementlessacetabular and femoral components were not dramatically better than failure rates for cemented components. Increased wear rates have been associated with cementless acetabular fixation, which is a concern, as survival curves in cemented THAs demonstrated an increase in rates of loosening and revision in the second decade. Stress shielding, aseptic loosening, osteolysis, and thigh pain still remain problems with certain models as well [13].

Hybrid THA

The long-term durability of cemented femoral stems in young patients along with poor acetabular performance has led some surgeons to advocate using a press-fit acetabular component with a cemented femoral component [14]. Bizot and colleagues [15] found a 9-year survival rate of 93.7% for 71 hybrid alumina-on-alumina hip arthroplasties in a heterogeneous group of patients (23 cases of OA, 22 of atraumatic osteonecrosis, 10 of congenital dislocated hip, 9 of fracture, 4 of inflammatory disease) with a mean age of 46 years (range, 21-55 years).

Highly cross-linked polyethylene and alternate bearing surfaces

Inflammation caused by polyethylene wear particles plays an important role in implant durability. Trying to limit wear and subsequent osteolysis secondary to bioactive wear particles, surgeons are increasingly using improved polyethylene and alternative bearings for THA in younger patients in whom wear causes a significant concern. In vitro laboratory tests with hip simulators and clinical retrieval studies have shown significant improvements in the wear properties of newer bearing surfaces (metal on highly cross-linked UHMWPE [16], ceramic on ceramic, metal on metal) over traditional bearing surfaces. Cross-linking of UHMWPE has been particularly effective in reducing wear (by 42%-100%). Clinical results for ceramic and metal-on-metal bearings have been equally promising. Urban and colleagues [17] reported surviv-

Table 1. Material surface, design features, and manufacturer of the implants

THR Brands	Material	Surface	Special design features	Manufacturer
Stems				
Bi-Metric	Titanium alloy	Proximally porous-coated	Straight, collarless	Biomet
Anatomic Mesh	Titanium alloy	Proximally porous-coated	Anatomic	Zimmer
ABG I	Titanium alloy	Proximally grit-blasted and HA-coated	Anatomic	Stryker Howmedica
ABG II	Titanium alloy	Proximally grit-blasted and HA-coated	Anatomic	Stryker Howmedica
PCA Standard	CoCr alloy	Proximally porous-coated	Anatomic	Stryker Howmedica
Exeter Universal	Stainless steel	Polished	Straight, collarless cemented	Stryker Howmedica
Müller Straight	CoCr alloy	Matt	Straight, small collar, fluted macrostructure	Zimmer
Lubinus SP II	CoCr alloy	Matt	Anatomic, collar, modular	Link
Cups				
ABG I	Titanium alloy	Grit-blasted and HA-coated	Hemispherical, open screw-holes	Stryker Howmedica
ABG II	Titanium alloy	Grit-blasted and HA-coated	Hemispherical, screw-holes plugged	Stryker Howmedica
Biomet Mallory	Titanium alloy	Porous-coated	Hemispherical, open screw-holes, fins	Biomet
Biomet Universal	Titanium alloy	Porous-coated	Hemispherical, open screw-holes	Biomet
Biomet Vision	Titanium alloy	Porous-coated	Hemispherical, screw-holes plugged	Biomet
Harris-Galante II	Titanium alloy	Porous-coated	Hemispherical, open screw-holes	Zimmer
PCA Pegged	Cobalt-chromium	Porous-coated	Hemispherical, open screw-holes	Stryker Howmedica
Exeter All-poly	Polyethylene	-	Cemented	Stryker Howmedica
Müller Std	Polyethylene	-	Cemented	Zimmer
Lubinus IP	Polyethylene	-	Groove design	Link

al rates of 95% (10 years) and 79% (20 years) in a retrospective study of 64 THAs using a modular alumina femoral head and a UHMWPE cup in patients with a mean age of 69 years (range, 51-84 years), 84% of whom had a primary diagnosis of OA. Dorr and colleagues [18] studied 56 Metasul (Zimmer, Inc., Warsaw, IN) metal-on metal THAs in patients with a mean age of 70 years (range, 35-85 years), 87.5% of whom had a diagnosis of primary OA.

Factors contributing to THA

THA provides patients suffering from hip OA complete pain relief and improved hip function. However, patients with hip OA have disturbed kinetics in adjacent joints and in the pelvis due to the impairment in the hip region [19]. In particular, progression of knee OA is associated with progression of hip OA. Shakoor et al. demonstrated using gait analysis that the medial compartment load of the knee was significantly higher in the contralateral knee relative to the treated side at 1-2 years after successful unilateral THA [20]. They also reported that among patients whose initial THA was followed by total knee arthroplasty (TKA), 71% underwent TKA on the contralateral side. However, the progress of knee OA in patients undergoing THA has not been examined during long-term follow up. Factors contributing to progression of knee OA include: pre-existing knee OA, high loading of the knee and shifts in mechanical axes of the lower leg that alter load distribution, in addition to obesity and female gender [21]. Total hip prostheses have relatively high neck-shaft angles, and therefore have a tendency to reduce the femoral offset, possibly leading to lateral shifts in mechanical axes. The course of knee OA ipsilateral to THA may thus differ from the natural course during long-term follow up. Optimizing selection of femoral anteversion and offset are essential in providing the hip with excellent function by improving abductor muscle strength, preventing dislocation and adjusting leg length [22]. However, surgeons do not commonly consider the effects on the mechanical axes of the lower extremities.

Cemented THA has been the treatment of choice for elderly patients with OA

Charnley's cemented low-friction hip replacement is still considered as the 'gold standard', against which new hip implants are compared [23]. A survival rate exceeding 90% at 10 years is commonly regarded as a good long-term outcome while the 25-year survival rate of 80% has remained unsurpassed [24]. According to the long-term results obtained from the

Scandinavian Arthroplasty Registers, cemented total hip arthroplasty is the treatment of choice for OA of the hip in older patients [25]. However, data from the Finnish Arthroplasty Register [26] concluded that cementless hip replacements had a lower risk of revision for aseptic loosening than cemented implants in osteoarthritic patients aged from 55 to 74 years.

Several studies [27-29] have shown that the survival rates of cementless stems have been satisfactory for all age groups, but cementless cups have a common problem of liner wear, osteolysis, and high incidence of revision in the medium-to-long term [30]. **Table 1** below reports material surfaces, design features, and manufacturer of the implant.

Unilateral and bilateral arthroplasty

Although most of the THAs performed are unilateral, orthopedic surgeons also encounter patients with hip arthritis who require bilateral hip arthroplasty. To determine which therapeutic strategy is preferable, several studies have been conducted to compare the outcomes of simultaneous bilateral THA to those of unilateral THAor two stage bilateral THA [31]. Increased risk of complications have been reported [32], particularly pulmonary embolism resulting from the simultaneous procedure. On the other hand, studies have presented fewer medical risks than those of previous reports [33]. Simultaneous bilateral THA offers the benefit of a one-session anesthetic risk, a shorter disability period, and a shorter, less costly overall hospitalization. In addition, the simultaneous procedure confers a potential benefit for greater postoperative hip function because contralateral hip disabilities do not adversely affect the replaced hip.

Radiography and THA

The severity of the radiographic findings is an important factor in the surgeon's decision tocarry out a total hip replacement [34]. Previous studies showed that hip joint space narrowing was strongly associated with other radiological features and most predictive of hip pain. Furthermore, progression of hip OA could be defined by a change in joint space narrowing, and narrowing correlated with changes in clinical status [35, 36]. A study by Nilsdotter et al [37] suggested that if the diagnosis of OA is unequivocal, symptoms and not the degree of radiographic change should provide the indication for surgery. Fortin and coworkers have shown that the postoperative outcome after hip replacement for OA is better when the preoperative functional status is better [38]. Also, no gender related difference was observed in preoperative status or in postoperative outcome. This may be due to differences in healthcare system for social structure between different countries [39]. Plain radiography is at present the most economical and easily available imaging technique for semi-quantitative measurement of the morphology of OA.

THA and joint space narrowing (JSN)

Hip OA is one of the most common causes of pain and disability in adults aged 55 years and older. THA is often necessary in patients who are or become unresponsive to medical treatment. Although access to surgical care, socioeconomic and individual factors influences the decision for surgery, it is evident that pain and radiographic changes (like joint space narrowing [JSN]. are the main factors in the decision on THA. At present, monitoring of patients with hip OA is chiefly based on the assessment of pain, disability and anatomical changes from plain radiographs. It was demonstrated that conventional radiography was the best modality to assess articular cartilage thickness for hips and knees [40].

A study by Conrozier et al. [41] focused on the radiographic progression of JSN which can be regarded as the most reliable marker of OA progression provided they use accurate methods for measuring JSN. The results of the study showed that patients with a high rate of JSN progression and so with a greater functional disability were operated on at an earlier anatomical stage than those with a slower progression. This suggested that action should be taken sooner if the progression is rapid. The age at operation (70.2 ± 8.4 yr) and minimum joint space at surgery (0.62 ± 0.61 mm) were comparable to those reported by Hoaglund et al. [38] in the White population of San Francisco and by Gabriel et al. [42] in Minnesota residents. The main predictive factors of the time to THA were the age at diagnosis, the joint space thickness at diagnosis and the rate of JSN. The rate of progression of JSN appears to

be one of the main deciding factors for THA as it was inversely correlated with the duration of follow-up.

Association of OA with DVT after THA

Post-thrombotic syndrome (PTS) is a chronic condition in the lower extremity that develops after deep vein thrombosis (DVT). The incidence of PTS varies from 20% to 70%, making it the most common reported complication after lower extremity DVT [43, 44]. PTS is a syndrome generally consisting of edema, skin induration, hyperpigmentation, venous ectasia, redness, pain with calf compression, and venous ulceration [45]. The diagnosis of PTS is done based on the development of the mentioned clinical manifestations in patients with a history of DVT. Three clinical scales have been reported using various combinations of these clinical signs and imaging studies to diagnose and grade the severity of PTS [46]. The Ginsberg scale uses two criteria for the diagnosis of PTS including (a) presence of pain and swelling for more than 1 month in duration and occurring more than 6 months after acute DVT; and (b) objective evidence on venous Doppler of valvular incompetence. If both criteria are present, the diagnosis of PTS is done. The Villalta scale uses a combination of five symptoms (pain, cramps, heaviness, pruritis, paresthesia) and six signs (edema, skin induration, hyperpigmentation, venous ectasia, redness, pain with calf compression). These signs and symptoms are then numerically graded to establish a score to determine a diagnosis of PTS. The Brandjes scale uses separate scales to categorize patients as having no, mild to moderate or severe PTS that include items on symptoms, signs, and differences in calf circumference. Points for the items are summed into a total score and cutoff values are used to classify the presence of mild-to-moderate PTS and severe PTS.

A study by Sasaki et al [47] assessed the preoperative time required for the Timed "Up and Go" (TUG) test to predict the risk for DVT in patients with OA after THA. It was reported that low preoperative ambulatory ability in patients with hip OA might be associated with DVT after THA. An improvement in TUG before surgery might contribute to a decrease in the occurrence of DVT after THA.

THA and HRQoL

Osteoarthritis in the hip as a chronic disease impairing patients' function, causes pain and reduces HRQoL, but THA as elective surgery has been shown to relieve pain and improve physical function and HRQoL. Hip arthroplasty patients also showed greater improvement in pain and function and were more satisfied with the outcomes than patients undergoing knee arthroplasty. Patients undergoing arthroplasty seem to have psychological distress, although it was not associated with self-perceived functional recovery among hip arthroplasty patients. The stronger the anxiety trait, the more probable it is that the individual will experience more state anxiety in a threatening situation. Preoperative anxiety may influence coping behavior, which in turn appears to have a significant impact on surgical recovery. Pre-operative anxiety was also associated with post-operative state anxiety, and post-operatively, state anxiety was found to be the only significant predictor of pain among, for example, knee or hip replacement patients. Background factors such as female gender and trait anxiety were associated with pre-operative state anxiety, whereas moderate- to-intense pain and depressive symptoms were related to pre- and post-operative state anxiety in elective surgery. HRQoL is thought to include the elements of biological function, symptoms, functional status and general health perceptions that are influenced by individual and environmental characteristics. Psychosocial improvements were seen sooner than physical improvements, but after 6 months, improvements in all dimensions of HRQoL were found [48]. Several questionnaires for measuring health related quality of life (HRQoL) have been published: the Nottingham Health Profile (NHP) [49] Sickness Impact Profile (SIP) [50] and Short Form-36 (SF-36) [51]. WOMAC (Western Ontario and McMaster Universities Osteoarthritis Index) is a disease specific measure, developed for OA in the hip and knee [52].

Various scales reported are: Laupacis et al [53] assessed HRQoL after THA in 188 Canadian patients using the TTO technique as a measure of utility. These investigators reported a mean preoperative utility score of 0.29 and a postoperative score at 2 years of 0.87. Katz et al [54] used a modified TTO method to estimate

individual patient preference scores in 54 THA patients. They reported mean preoperative utility to be 0.69 and postoperative utility to be 0.9. James et al [55] performed a cost-utility analysis of various commonly performed orthopedic procedures for the purpose of prioritizing elective orthopedic procedures in the northwest of England. They used the EQ-5D, a generic, self-reported HRQoL measure of 5 dimensions (mobility, self-care, usual activities, pain/discomfort, anxiety/depression), and the Rosser classification of illness states, which provides pair-wise groupings of 4 distress and 8 disability states experienced by the patient, to estimate the preoperative and postoperative utilities for both primary and revision THA. The values generated ranged from 0.14 for the preoperative revision THA state to 0.98 for the postoperative primary THA state. Utility values generated from the Rosser index were uniformly lower than those derived from the EQ-5D. Robinson et al [56] compared the improvement in HRQoL in 62 patients who underwent revision THA with that of 62 patients who had primary THA. They reported that 1 year after surgery, HRQoL in both groups had significantly improved, but there were no significant differences in the improvement in scores between the two groups. However, 4 years after surgery, patients who underwent revision THA had a significant decline in HRQoL relative to patients who underwent primary THA. Feeny et al [57]. sed both community preference-based and direct standard gamble measures to estimate health utility in patients with OA of the hip both preoperatively and postoperatively. The authors reported differences in utility scores depending on the instrument used and recommended that community preferences are not a substitute for directly measured utility scores at the individual level. Rasanen et al [58] evaluated patients who underwent hip or knee arthroplasty using the 15D HRQoL instrument, a generic, comprehensive, 15-dimensional, self-administered instrument for measuring health-related quality of life; health utility is measured on a 0-to-1 scale. They reported a mean health-related quality-of-life score of 0.858 for primary THA at 12 months and 0.823 for revision THA patients.

Cost effective analysis of THA

THA is generally regarded as an effective means of reducing pain and functional limitation associated with severe hip OA. There is a concern that a larger share of health care resources will be spent on THA in the future due to the increasing incidence of severe OA of hip, the growing demand for THA, and the high costs associated with this procedure. THA is done primarily to improve the quality of life rather than to extend it. Thus, any analysis of the cost-effectiveness for hip OA that allows for comparisons with other health practices must consider QoL and not just quantity of life. The quality adjusted life year (QALY) combines these two concepts and can be estimated to facilitate comparisons with other health practices.

The analysis conducted by Chang et al. [59] reported that THA was used as a treatment for hip OA associated with significant functional limitation, the procedure appears to be cost saving or at worst relatively cost effective with variations in age, gender, probabilities of initial THA success and mortality, long term rates of failure, rate of OA progression, utility values of American College of Rheumatology (ACR) functional classes III and IV, surgical, medical, and custodial costs, and discount rate. The first cost effective analysis of total joint arthroplasty was reported by Liang and colleagues in 1986 [60]. This was a prospective study of 23 patients who underwent THA and 22 patients who had total knee replacement surgery, all of whom were followed up for 6 months. The cost effectiveness results were reported as a mean number of 0.01 unit of improvement on the Bush Index of Well Being [61] scale per $1000 marginal cost. A more recent cost effectiveness analysis was performed by Laupacis and colleagues [62]. This was an empirical study done in Canada in which cost and utility data were collected over a one year follow up period. They estimated the marginal cost effectiveness ratio for the first 3 years following THA to be $8731 per QALY gained indicating that THA was very cost effective.

THA and exercise/sports activities

Increased life expectancy combined with good general health can enable the elderly to participate in diverse sports activities. Osteoarthritis of the hip or knee can significantly impair the function of the joint, but arthroplasty helps to restore the function and reduce the associated pain. Both should allow a return to sports activities after arthroplasty.

In the 1980s, Ritter and Meding observed a significant decrease in several activities except bicycling within 3 years after arthroplasty and recommended the "intelligent participation" in, for example, walking, golf, and bowling, to avoid harm to the prosthesis [63]. Bradbury et al reviewed 160 patients, including only 56 patients who participated in regular exercise in the year before surgery, and found that 5 years after total knee replacement 43 (77%) had returned to sports. Of the patients not regularly involved in sports in the year before surgery, only eight patients took up sports after surgery. The three most popular sports in their study were golf (> 50% preoperatively), bowling (> 30%), and tennis (30%). However, the level of sports activities declines with age, as shown by Zahiri et al. [64] Patients aged < 60 years were 30% more active, on average, than those aged > 60. Therefore, the improved function through total joint replacement in one joint might be antagonized over time by other age related impairments, such as OA in other joints or other comorbidity. Norman-Taylor et al, demonstrated that quality of life scores before knee arthroplasty surgery are significantly lower than those before hip joint replacement [65].

THA and sexual life quality

Osteoarthritis of the hip or knee may adversely impact patients' health status, functionality and quality of life. Sexual life is an important component of the quality of life and has been largely ignored by researchers in this field. Wang et al studied patients who underwent unilateral or bilateral THA with a standardized QSL questionnaire, and the score of QSL was evaluated preoperatively and at first year follow-up of post-THA operation. They found that there was significant decrease in sexual relationship impairment on the 0-8 scale from pre-THA to post-THA. There is no significant difference for effect on sexual function between pre-THA and post-THA. There is significant improvement in overall sexual satisfaction degree of patients on the 1-5 scale from pre-THA to post-THA, but no significant increase for sexual partner. They concluded that THA could significantly improve relationships with partner and the overall sexual satisfaction degree of male patients, but had no effect on sexual function of patients [66].

Limitations of THA

THA may also have some limitations. Aseptic loosening of a cemented femoral component after THA is a potential cause of pain and loss of function, resulting in the subsequent need for a revision. Several factors contributing to these adverse effects, which may eventually result in failure of the THA, include the selection of the patients and the materials and design of the implant. Probable underlying causes of aseptic loosening include excessive initial micromotion of the femoral component, which precludes bone in-growth in the short term, and prosthetic materials and design that can result in adverse bone-remodeling in the long term.

Another limitation of THA is instability. Dislocation is one of the most common complications after THA. Risk factors include neuromuscular and cognitive disorders, patient non-compliance, and previous hip surgery. Recent improvements in posterior soft-tissue repair after primary THA have shown a reduced incidence of dislocation. When dislocation occurs, a thorough history, physical examination, and radiographic assessment help in choosing the proper intervention. Closed reduction usually is possible, and nonsurgical management frequently succeeds in preventing recurrence. When these measures fail, first-line revision options should target the underlying etiology. If instability persists, or if a primary THA repeatedly dislocates without a clear cause, a constrained cup or bipolar femoral prosthesis may be as effective as a salvage procedure [67].

A third limitation of THA is infection. The changing profile of antibiotic-resistant bacteria has made preventing and treating primary THA infections increasingly complex. Lindeque et al reported that the pooled deep prosthetic joint infection rate was 0.9%. The pooled rate of methicillin-resistant Staphylococcus aureus infection was 0.5%. The pooled rate of intraoperative bacterial wound contamination was 16.9%. The postoperative risk of surgical site infection was significantly associated with intraoperative bacterial surgical wound contamination [68].

Conclusion

THA have shown to be successful in treatment for OA of the hip resulting in the relief of pain and improved function. Rapid progression of JSN, older age and absence of osteophytes appeared to be the main contributing factors for THA. Also, the cementless proximal porous

coated stems provided a good option for elderly patients. Further, OA patients who underwent THA had to undergo three phases of coping: 1) life restricted by pain and disability during the preoperative period; 2) freedom from restrictions during the immediate postoperative period; 3) adaptation to prosthesis. Also, THA can be cost saving or cost effective in improving QALY. The importance of physical training after THA and its importance in improving current practices in rehabilitationwas also mentioned. Patients' needs and characteristics should be carefully assessed while providing post-operative care and support.

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Disclosure of conflict of interest

None.

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