

Impact of Obesity on Complications following Primary Hip Joint Arthroplasty Surgery for Osteoarthritis

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Abstract

Objective: To describe the most common forms of hip replacement complications that can prevail post-operatively and how obesity can impact the extent and severity of these complications.

Methods: Relevant literature and research evidence concerning complications that occur after primary joint hip arthroplasty or joint replacement surgery, plus those that discussed issues of obesity in this context were sought and reviewed.

Results: Data embedded in the PubMed, Scopus, Science Citation and Web of Science data bases over the last twenty years describe several forms of complications that can occur after hip replacement surgery. A considerable number of reports imply obesity can adversely impact several of these complications.

Conclusions: Excess body weight raises the risk for complications after hip joint surgery. Comprehensive efforts to identify and effectively treat obese people prior to and after receiving hip replacement appears warranted.

Keywords: Hip osteoarthritis; Hip replacement surgery; Obesity; Post-operative complications; Total hip arthroplasty

Introduction

Hip joint osteoarthritis, a prevalent debilitating medical condition, causes considerable distress and chronic disability among community-dwelling adults in all countries [1]. Predicted to arise in one in four adults in his or her lifetime [2], hip osteoarthritis, the most common cause of hip joint deterioration, does not always respond adequately to conservative treatments. Primary total hip joint arthroplasty or joint replacement, a surgical procedure involving the replacement of the diseased hip joint components with artificial components called prostheses significantly improves the health, well-being and life quality of patients diagnosed as having painful disabling end stage arthritis of one or more joints, such as the hip joint [3-5]. Key reasons why adults undergo primary total hip replacement surgery are the presence of unmanageable pain and disability. However, this form of treatment is not without complications [6-9], even when new generation prostheses are employed [10].

Common technical complications occurring after primary hip joint replacement surgery are aseptic loosening of the metal inserts commonly used to replace defective bone [11], and periprosthetic osteolysis or damage to the bone around the prosthetic device [12]. Other problems requiring rehospitalization following primary hip replacement surgery are prosthetic infection, a major complication that can adversely affect the anticipated favorable outcome of this surgical procedure [13]. Others include periprosthetic fracture [14], a failed arthroplasty, prosthetic dislocation [15], stem breakage, cup malpositioning [16,17] and a variety of mechanical factors associated with the characteristic properties of the prosthesis, along with fixation methods employed [10,11,18-20]. Others are extrinsic surgical factors, intrinsic 'patient' or biological related factors including age [21,22], gender [23-26], race, medical comorbidity [27-29], and preoperative functional status. In addition to these factors, excess body mass [4,11] is a reported risk factor for adverse events post hip arthroplasty surgery, such as excess wear or loosening of the prosthesis, implant dislocation, periprosthetic fracture, and infection of the surgical site [30,31].

Given that the total number of primary total hip arthroplasties to be carried out globally within the next two decades, is likely to exceed 2 million [4], and that dealing with technical complications post-operatively is extremely costly to the patient, hospital and society [32], it seems imperative to examine the degree to which some or all of these complications can be obviated, minimized, or prevented. Since a considerable volume of literature implies obesity can heighten post-operative complication risk after total hip replacement surgery among most candidates regardless of age, gender, surgical technology, and approach, and obesity is present in epidemic proportions, regardless of location, a review focusing on the role of obesity and its possible implications for those who perform surgical procedures, as well those undergoing these procedures seems timely [33].

Aims

The present work consequently aimed to review and detail the key technical complications reported to arise among patients with disabling end stage hip osteoarthritis hospitalized for purposes of primary replacement surgery. It specifically aimed to examine if one or more of these possible complications appears to be consistently predicted in part, by the presence of excess body mass, rather than surgical or hospital-related factors. To this end, the article examines the current literature to discern: 1) If overweight or obesity is a prevalent health correlate among osteoarthritis cases undergoing

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hip replacement surgery; 2) the predominant technical and/or other surgical complications found to occur after this form of surgery; and 3) evidence linking one or more of these complications to the presence of excess body weight. The overall goal was to provide clinicians and researchers with an updated understanding of the potential influence of excess body mass on common complications that continue to occur after total Hip replacement, despite considerable advances in the field. In examining the prevailing literature, it was hoped this information would provide support for the idea that efforts to evaluate the weight status of the patient prior to surgery and to plan operative and post-operative interventions accordingly might improve the outcomes and reduce the immense monetary and human costs of complications associated with primary total Hip replacement surgery.

Based on prior work, it was hypothesized that high body mass index, an important proxy for health status, as well as low bone mineral density, is likely to raise the risk of incurring hip osteoarthritis [32], as well as infections and possible stability and osseointegration problems in instances of cementless total hip arthroplasty [22] and other forms of primary hip replacement surgery. To this end the impact of excess body mass was specifically examined because this variable is one which is potentially modifiable, although argueably comorbidity level, years of disability, and numbers of affected joints may clearly all predict hip arthroplasty outcomes more strongly than weight status [5].

Reported are data embedded in the relevant English language literature in the PubMed, Scopus, Science Citation and Web of Science data bases over the last twenty years using the terms hip arthroplasty, complications, hip osteoarthritis, obesity, and outcomes alone or in combination. All relevant articles retrieved had to focus on hip osteoarthritis, obesity, and some aspect of hip arthroplasty surgery. All articles retrieved were read carefully to examine the types of technical complications that commonly occur after total hip replacement surgery, as well the key risk factors for these complications. To establish if obesity, a potential risk factor for post-operative hip arthroplasty complications, is a predominant feature of end-stage hip osteoarthritis, data on obesity and its association with Hip joint osteoarthritis were reviewed as well. Excluded were: articles on hemi arthroplasty surgery, which is similar to total hip arthroplasty in terms of local tissue trauma, but is generally less intense and used for hip fracture repair; factors associated with rheumatoid arthritis surgery of the hip joint; outcomes of hip arthroplasty surgery that did not discuss technical post-operative complications; technical articles; articles discussing weight loss before surgery; and articles that did not focus solely on hip osteoarthritis cases or sub-groups. The findings are described in narrative form as the data do not lend themselves to meta-analyses given the diverse body of research topics, approaches, and samples, and the exploratory nature of the present research question.

Results

Search strategy results and numbers of publications are listed below in Table 1.

Key Post-Operative Complications

The key technical complications or failure points outlined in the literature in the context of total hip replacement for people with hip osteoarthritis include infection, periprosthetic fractures, dislocations, and/or loosening or fatigue of one or more of the prosthetic components.

Infection

Although occurring in only approximately 0.4-1.5% of patients

[7], prosthetic joint infection is often a costly, devastating outcome of joint replacement surgery [31,32,34,35]. Frequently requiring re-hospitalization, implant removal or exchange, and/or the prolonged use of potentially toxic and antimicrobial resistance-encouraging antibiotic [6], this outcome is extremely disabling [31], and despite many advances that have been made to reduce post-operative infection rates, Asaid et al. [31] note that infections continue to occur.

Dale et al. [34] who assessed the incidence of and risk factors for infection post hip arthroplasty in a Norwegian context using three national health registries found risk factors for total hip arthroplasty infection were advanced age, and being male. Although the superficial surgical site infections were potentially different from the risk of infection after primary total hip arthroplasty, the numbers of possible risk factors examined were small, and obesity was not found to be a significant factor.

Other causes include infections in other parts of the body [28] any time after surgery, or in proximity to surgery [8]. Of interest to this article is the finding by Dowsey et al. [30] that obesity is an independent risk factor for acute infection after primary total hip arthroplasty. Jameson et al. [36] found that obese classes 2 and 3 patients who had smaller overall health benefits, had a greater risk of wound complications, readmission, and reoperation rates.

Periprosthetic fractures

Periprosthetic fractures or fracture of the bone surrounding a prosthesis at the hip joint is an important painful disabling post-operative complication of hip arthroplasty surgery, commonly requiring additional surgery. Occurring commonly among elderly patients with osteoporosis, or young physically active patients suffering from congenital dysfunction of the hip joint [37], Katz et al. [38] state we can expect an increased frequency of this complication in the future, especially among those with prior knee or revision total hip replacements [38]. Unfortunately, periprosthetic fractures, which are associated with high morbidity and mortality rates [39], are increasing in number and severity [40]. Although this could reflect the increasing numbers of total hip replacements occurring worldwide, or poor bone health, the role of excess body weight, which can influence falling, as well as bone health and muscle function negatively, is not well described in the prevailing literature, and might be relevant in explaining the presence of periprosthetic fractures in the absence of significant trauma [41].

Dislocations

Single or repetitive dislocations of the prosthetic hip occur in less than 2% of patients [42], but are important because they account for up to 30% of the indications for revision surgery. Influenced by both operation specific and patient dependent factors, 50% are thought to occur within the first 3 months after initial hip replacement surgery, suggesting a high percentage are due to operative-specific or related perioperative factors. However, the treatment of prosthetic dislocations continues to be associated with high failure rates and repeated dislocations even after fixation or second surgeries [8]. Although not

	Data Source [1995-2015]		
	PubMed	Scopus	Web of Science
Obesity and hip osteoarthritis:	294	659	580
Obesity + hip joint replacement:	194	319	217
Obesity + hip joint replacement complications:	121	134	63

Table 1: Search strategy.

well studied, these problems are more than to be likely emotionally traumatizing [43] especially problematic in the patient with health challenges [44], and in those who are overweight and/or debilitated [8], as well as very frustrating for the patient and surgeon to deal with [45].

Mechanical failure

With the exception possibly of newer prostheses, the wear and tear of daily usage of a prosthetic device frequently results in implant wear and loosening [8]. In young physically active patients, this may occur more rapidly than in older and/or more sedentary individuals.

If the patient's immune system responds to the presence of wear particles which the body views as foreign material, the bone around the prosthesis may be destroyed, and the replaced hip components may loosen [8]. The daily wear and tear of a prosthesis leading to loosening is common and the most frequent form of mechanical failure. More rarely, the actual prosthetic device may fracture or break [8]. As well, even though metal-on-metal prostheses are increasingly and widely used in total hip arthroplasty, and offer particular benefit to patients with Osteoarthritis, adverse effects related to the release of metal ions (such as cytotoxicity, genotoxicity, carcinogenicity and metal allergy) remain common concerns [46].

Factors influencing post-operative complications

A large number of factors are responsible for increasing the risk of complications after primary hip joint arthroplasty. These include but are not limited to: leg length changes, joint stiffening caused by extra

bone formation in some soft tissues around the hip [7], neurologic injury, vascular injury, and thromboembolism [9].

Other factors are the nature of the actions of daily living pursued after total Hip replacement [47], non-traumatic dislocations [48] and/or obesity or morbid obesity [49].

Risk for revision of total hip replacement is specifically increased by young age [50,51], advanced age and comorbid conditions [52], body weight [53], type of implant [18,54], gender [29], and preoperative anemia [55]. Other predictors of total hip replacement outcomes are weight gain and overweight from early adulthood [56], body mass index [57] and high bone mass [58].

In terms of examining these risk factors, the present literature reviews focused on examining the role of body weight in the context of end stage hip osteoarthritis, as this a possible modifiable factor. The literature was reviewed first to determine whether a sizeable percentage of primary hip arthroplasty cases are indeed likely to be overweight or obese. This review revealed a number of recent reports indicating a fair proportion of populations requiring total hip arthroplasty today are likely to be overweight or obese. This is of concern, because as outlined in Table 3, the majority of available prospective studies support the view that high body weights may increase the rates of selected complications after total hip replacement surgery quite predictably and significantly (Tables 2 and 3).

Discussion

Osteoarthritis of the hip is a very painful disabling disease with

Authors	Study Procedures and Sample	Key Results
Changulani et al. [59]	Studied the relationship between obesity and age among 1025 patients undergoing total hip replacements. Five groups based on their <i>body mass index</i> (normal, overweight, moderately obese, severely obese and morbidly obese) were studied.	Those who were morbidly obese were 10 years younger on average than those with a normal body mass
De Guia et al. [110]	An analysis from the Canadian Joint Replacement Registry was conducted using <i>body mass index</i> measures to estimate the relationship between overweight and rates of joint replacement for hip and knee osteoarthritis in Canada between 2003-2004	Among hip replacement patients (n = 7,538), 73% were classified as overweight or obese at the time of surgery Obese cases were over three times as likely and overweight persons were one and a half times more likely to undergo joint replacement surgery
*Flugsrud et al. [60]	Studied 9 years of data on 50,034 participants from cardiovascular screening using <i>body mass index and weight data</i>	There were dose-response associations between body mass indices, body weight, level of physical activity at work and total hip replacement for primary osteoarthritis of the hip
Guenther et al. [122]	Examined all patients with a <i>body mass index</i> greater than 25 over a two year period between 2011 and 2013 retrospectively 64% of those receiving either a hip or knee prosthesis had a body mass index of 25 or higher	Higher body mass index is linked to the earlier requirement for hip replacement surgery, and a lower functional level among these patients is seen Primary implantation is significantly affected by level of obesity
Harms et al. [61]	Retrospective review of medical charts of patients 18-59 years old, who underwent knee or hip replacement from January 2002-December 2004	Obesity as measured by <i>body mass index</i> category, greater than 30, was significantly associated with the need for both forms of surgery compared to age matched healthy controls
*Jacobsen and Holm [62]	This prospective study investigated the relationships among hip osteoarthritis and body mass among other factors among 4151 subjects from 1976-2003	The risk of total hip replacement was predicted only by <i>body mass indices</i> at baseline
Järnholm et al. [63]	This study examined the need for total hip replacement in relation to normal range and high <i>body mass indices</i> among 320, 192 male construction workers	Body mass is an important predictor of osteoarthritis, especially osteoarthritis of the hip
Jiang et al. [64]	Conducted a systematic review and meta-analysis to assess the strength of associations between <i>body mass index</i> and hip osteoarthritis risk	Increased body mass contributes to the positive susceptibility to hip osteoarthritis, regardless of gender
Karlsom et al. [109]	Examined 568 women from the Nurses' Health Study who reported hip replacement due to primary hip osteoarthritis over the time periods of 1990-1996	Findings showed that higher <i>body mass index</i> and older age were significant risk factors for total hip replacement due to osteoarthritis. Younger age at hip arthroplasty was related to higher body weight, as was hip contact stress and resultant force
Recnik et al. [96]	Examined 50 subjects undergoing hip replacement surgery due to osteoarthritis, correlates were conducted between <i>body weight, body mass index</i> and radiographs	Obesity or increased weight produces unfavorable pelvic loading conditions

*prospective studies

Table 2: Selected studies revealing a positive relationship between obesity as measured by body mass index, end-stage hip joint osteoarthritis and total hip arthroplasty.

Authors	Study procedures and Sample	Results	Conclusion
Azodi et al. [65]	A cohort of 2106 male patients who underwent total hip replacement between 1997 and 2004 were identified	53 developed dislocation within 3 years of follow-up, and these cases were more likely to be overweight or obese	Greater attention should be given to high body mass as a risk factor for dislocation following total hip replacement
Arsoy et al. [101]	Studied outcomes of 42 total hip arthroplasty cases in the super obese range	24 of these cases had at least one complication, and when compared to a control group this risk was significantly increased	Caution should be employed when carrying out primary total hip arthroplasty surgery in cases where the body mass index exceeds 50
Bozic et al. [48]	40, 919 patients who underwent total hip arthroplasty between 1998 and 2007 were studied	The impact of 29 comorbid conditions on periprosthetic infection and mortality was examined	In order of significance, rheumatologic disease, obesity, and coagulopathy were associated with an increased adjusted rate of periprosthetic joint infection, information deemed important when counseling elderly patients concerning the risk of the studied conditions following total hip arthroplasty
Choong et al. [66]	The authors analyzed the association between patient-related and surgical factors and the risk of infection associated with hip prosthetic surgery in the acute stage among 14 patients of 819 seen between 1998 and 2004	There was a correlation between having a body mass index greater than 30 as well as 2 co-morbidities	Diabetes and high body mass are possible risk factors and the incidence of early infection
Davis et al. [94]	Examined the impact of body mass index on the outcome of total hip replacement in a group of 1617 cases followed for five years	Those with body mass indices greater or equal to 35 had a 4.42 times higher rate of dislocation than those with a body mass index of 25 or lower. Increasing body mass was associated with increased infection rates even when adjusting for comorbidities, age, gender, and surgeon, among other factors.	Adverse outcomes are influenced by excess body mass in the short term, and may become more prominent if longer time periods of study are implemented
Dowsey and Choong [30]	Reviewed consecutive primary hip arthroplasties according to 4 categories of body weight	There was evidence obesity was an independent risk factor for acute periprosthetic infection after primary hip arthroplasty	Obesity is a risk factor for acute periprosthetic infection independent of patient comorbidities such as diabetes
Elkins et al. [47]	The obesity effect on total hip arthroplasty was explored using a validated finite element model comprising implant hardware and periarticular soft tissue	Thigh soft tissue impingement lowered resistance to dislocation in those with body mass indices equal to or greater than 40	Excessive obesity creates conditions that compromise the stability of a total hip replacement
Font-Vincera et al. [92]	Studied patients undergoing total hip arthroplasty from 2007-2011 to examine prosthetic joint infection rates within the first three months after surgery	Body mass index was the only host feature that was related to having a positive intraoperative culture the rate of infection in patients with a body mass index below 35 was 2.7%; it was 25% in those with higher body mass indices	A body mass index of 35 or higher is associated with a higher risk of having a positive intraoperative culture during hip arthroplasty and following this procedure
Houdek et al. [100]	Studied the effect of morbid obesity as a risk factor for failure of two-stage revision total hip arthroplasty using medical records of 653 cases treated for periprosthetic joint infection over a 20 year period	Compared with nonobese cases, morbidly obese cases had higher reinfection, revision, and reoperation rates,	Morbidly obese patients have increased risk of severe post-operative complications after revision total hip arthroplasty than nonobese patients
Jameson et al. [36]	This group studied the impact of body mass on complications and other outcomes following primary hip arthroplasty	In comparing outcomes by body mass group categories, obese class 1-III patients had a higher risk of wound complications those in obese class II and III had higher rates of readmission and reoperation	Complication rates are higher in obese patients than nonobese patients body mass indices 19.0-29.9kg.m ²
Joshi et al. [86]	51 patients with bilateral total hip arthroplasties were examined as regards wear behavior of the socket over a mean of 14.7 years	The mean wear rate was .071 mm/year for the left hip and .081 mm/year for the right hip	Linear wear was increased in patients with high body weights
Kessler and Käer [67]	67 total hip replacement patients of varying weights were assessed 10 days and 3 months after surgery	There was no significant impact on hospital duration or early outcome based on weight	Body weight should not be justification for withholding surgery from over weight or obese patients
Kim et al. [68]	Studied the outcomes of revision total hip arthroplasty in a matched cohort of obese and non-obese patients	Seven patients in obese group underwent revision surgery, six of whom underwent additional reoperations to treat recurrent postoperative dislocation	Obese patients should be counseled about the increased risk of dislocation that can occur after revision total hip arthroplasty
Koenig et al. [52]	Studied a cohort of 306 patients in 3 age groups, < 65 years, 65-79 years, and > 80 years	90 day rates of major adverse events were 9%, 19%, and 34% respectively	Age and comorbidity, but not body mass index, gender, or revision type predicated outcome
Lakstein et al. [121]	6 patients with a mid-stem fracture in a modular revision hip arthroplasty system were studied	Patients with a fractured stem had significantly higher body mass indices than patients without a stem fracture	Risk factors for fractures of the modular junction of a prosthesis include excessive body weight
Lubbeke et al. [69]	A hospital-based cohort who underwent total hip replacement or revision total hip arthroplasty was assessed	Patients under-going revision were older, more often obese, and had more medical and orthopedic comorbidities	Patients and physicians should acknowledge risks that prevail for total hip arthroplasty revision if they are obese
Melloh et al. [91]	Examined consecutive records of 4372 cemented and uncemented primary total hip arthroplasties conducted in Europe between 1981 and 2003	Regarding body mass index, the odds of cemented stem loosening increased by #% for each additional body mass index unit of 25kg.m ⁻¹	Higher body mass index is a risk factor of early stem loosening after total hip arthroplasty

Mollan et al. [97]	Examined factors related to failure of the femoral component of Howse total hip arthroplasties	In male patients, time of failure was influenced by weight	There is a need for constant vigilance as the time after surgery increases
Münger et al. [70]	725 cases in a multinational sample collected over 25 years were studied to examine patient-related risk factors leading to aseptic stem loosening in total hip arthroplasty	Height and weight were not associated with loosening, but a higher body mass index was associated with an increased risk of stem loosening	High activity levels, coupled with high body mass indices heighten the risk of stem loosening within 10 years
Nambe et al. [120]	1071 total hip arthroplasty patients were examined prospectively	36% were obese and those with body mass indices of 35 or higher had 4.2 higher odds of acquiring an infection than those who were less heavy.	The increased risk of infection attributable to high body mass should be acknowledged by patient and surgeon
Pulido et al. [87]	Reviewed a database of 9245 patients undergoing hip or knee arthroplasty between January 2001 and April 2006	Prosthetic infections developed in 63 patients, and among the independent predictors was morbid obesity	Morbid obesity and other factors may predispose patients to periprosthetic joint infection
Pulos et al. [102]	Retrospectively examined 309 consecutive revisions of total hip arthroplasty from 2005-2009, and compared subgroup with body mass index greater than 35 to those with body mass indices below 35	At 36 months, there was a higher rate of re-operation in the obese group, especially for infection	Patients should be aware of their increased risk for post-surgical complications after total hip arthroplasty if they are obese
Rajgopal et al. [93]	Studied the complications and outcomes of total hip replacement in 30 super-obese patients with body mass indices greater than 50 over a four year period and compared these to individuals in the 30-34.9 and 18.5-24.9 body mass index range.	The super obese patients experienced more complications than the other groups	Superobese patients undergoing total hip replacement will experience significant increases in the risk of major post-operative complications
Traina et al. [53]	Examined 27,571 patients with primary arthritis retrospectively	Body weight is a predictor of survivorship of the arthroplasty in men	Body weight might be a useful indicator to examine in future research and clinical contexts
Wright et al. [51]	Used a case-control approach to study Medicare beneficiaries between 1985 and 1996 and 2009	Factors associated with higher odds of revision were age, weight, type of surgery predicated revision rates	Effects of age and body weight on revision risk should be discussed with potential total hip replacement candidate
Zhang et al. [95]	Evaluated 714 patients who underwent total hip replacement between March 1991 and April 2006 for 5-20 years. Patients were separated into 3 groups, underweight, normal, and obese	The preoperative scores were lower for the obese group and postoperative scores higher for the normal group when using the Harris hip score tool. A significantly higher complication rate occurred in the obese group and the underweight group	Patients with abnormal body mass indices may face higher complication rates and poorer clinical outcomes after total hip arthroplasty than those who are normal weight

Table 3: Prospective or controlled studies examining the role of obesity in the context of complications following total hip arthroplasty.

no known cure, often requiring surgery. Yet, even though total hip arthroplasty improves the hip osteoarthritis patient's well-being and is considered one of the most cost-effective [4] and successful interventions for treating end-stage hip osteoarthritis [14] this form of treatment is not without complications [6,70,71]. Hence even though excellent results have been achieved in the surgical management of hip osteoarthritis through total hip replacement surgery, with long-term survival rates of 90%, the potential and evidenced complications and their sequelae remain worthy of mention as recently outlined by Pivic et al. [4], by Mahomed et al. [72] for a United States Medicare population, and by Malchau et al. [73] for a Swedish population. Another related body of literature shows linear wear of the prosthesis is positively correlated with body weight, as was observed by McLaughlin and Lee [74] and Haverkamp et al. [75]. Although Effenberger et al. [76], found no clear body mass relations. Hips observed among that sample studied, as outlined in Table 3 and reported by Choong et al. [66] it is hard to dispel the observation that both percent body fat [77], and obesity or morbid obesity as measured using body mass index measures raises the risk for post-operative complications following total hip arthroplasty [78,79]. Obesity is also associated with increased infection and dislocation rates [80-83], increased rates of implant failure and revision, as well as recurrent dislocations [84-86].

In addition, although small in number, those admitted with a diagnosis of periprosthetic fractures, another costly complication of hip arthroplasty surgery, may be more likely to be obese or overweight than of normal weight [80]. While patient demographics, a variety of clinical characteristics, and the nature of the surgical procedures and underlying bone health [41,80] may explain both the need for revision

surgery plus this specific post-operative problem, it is possible that the interaction of microtrauma due to the impact of excess body weight on the surgical site, and the replacement of muscle mass by fat, along with low pain levels, may heighten the risk for this post-surgical complication, independently of other factors as outlined in Figure 1.

The distribution of load on a joint may also differ from the norm in the excessively overweight patient, thus raising the risk for complications, such as dislocation, even though a variety of technical factors have been shown to play a significant causative role in this regard [55]. Surgery may also be more problematic initially in the excessively overweight candidate if their surgical time is longer, even though a short-term study has suggested no impact of body mass on early outcome or hospital length of stay [66]. Many candidates who are extremely overweight who have poorer health outcomes than non-obese cases [85], are also likely to be in poor health in general due to the presence of one or more comorbid conditions such as diabetes and may consequently be more prone to implant failure and/or dislocation as a result as outlined by Joshi et al. [86] and Pulido et al. [87].

Clearly, because patients who have suffered a hip dislocation are predisposed to additional dislocations [8], revision surgery for this problem must be undertaken thoughtfully, and should allow for the adequate healing of the tissues around the revised hip [8]. Education about movements that are contraindicated and efforts to strengthen the surrounding musculature should be done under supervision at the outset, and hence assessing the degree to which nutrition education and exercise interventions are needed seems wise.

In addition, because being obese has been shown to impact the

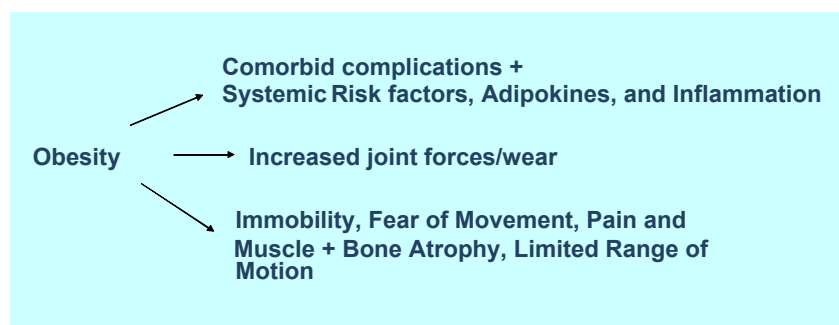


Figure 1: Schematic depicting possible role of obesity in mediating complications post-Hip replacement surgery among obese Hip Osteoarthritis patients.

success of hip replacement surgery in a negative way (Table 3), a careful initial analysis of the patient's body weight and related health practices, in light of their age and gender, followed by pre-surgical interventions which promote optimal dietary practices and the attainment of more optimal body weights relative to height, where these are clearly subnormal, may confer better long-term outcomes after total hip replacement procedures than those presently reported. That is, physicians and surgeons may want to either delay surgery, or at a minimum advise end-stage hip osteoarthritis patients who are extremely overweight about the risks of total hip replacement surgery complications they may face if body weight factors are not addressed at the outset. These include a reasonable risk of failure, dislocation or periprosthetic fracture or metalwork failure, plus prosthetic infection, and need for reoperation. To offset long-term risks, physicians and surgeons could also conduct regular radiological reviews of such cases postoperatively as proposed by Ikema et al. [19]. They or members of the rehabilitation team could monitor the patient's general health status, functional ability, bone health, muscular strength and range of motion status to more clearly predict whether their patients are likely to be at risk for premature or unwarranted secondary complications of this surgical procedure. This idea of the provision of better assessment followed by appropriate information, medical preparation, and tailored surgical approaches is not new and has been indicated to be of considerable import in increasing the chances of success [1], and mediating further successes of revision surgery by Lubbeke et al. [69]. Moreover, even though revision surgery at the hip may not be driven by weight factors per se [74], obesity was also found by Lubbeke et al. [69] to be strongly associated with unfavorable outcomes after revision, and since these complications are extremely costly and difficult to treat successfully, the implications of having a high body weight, which is often a proxy for other health conditions, should not be ignored. There may also be a decreased need for total hip replacement or the possibility of delaying this till later on in life through dietary and exercise intervention and this avenue warrants further study.

Hence, Proffen et al. [3] suggest that even though the potential complications and sequelae of total hip joint replacement surgery may only concern a fraction of numbers treated with this approach, careful preoperative planning, and informing the patient accurately about the chances of success, and discussing the patient's expectations are essential aspects of the treatment. To minimize dislocation, a common complication after reimplantation for infection [88], patients should receive specific precautions related to what movements are safe and what are unsafe after the surgery [7] and Leichtle et al. [71] advocate a stringent conservative treatment regime be implemented after any initial total hip arthroplasty dislocation. Preventing dislocation through adequate prognostic assessment of dislocation risk may reduce

dislocation in high risk patients as outlined by Meek et al. [89], as may preventing infection or excess weight among the obese [90,96].

Conclusion

Hip osteoarthritis is a disabling disease, frequently unresponsive to conservative treatments. While highly successful in restoring function and reducing pain, total hip replacement surgery [97] is not without complications. In addition to complications attributable to the surgery itself, certain patient-related characteristics may reduce the longevity of the implant or cause it to fail or become infected. These factors include age, the presence of comorbid diseases, and gender. While the role of body mass in predicting the risk of post-operative complications after total hip replacement remains equivocal, given that primary hip osteoarthritis cases are growing in number and these patients are more than likely to be overweight than of normal weight [80], this paper has focused on examining the role of body weight characteristics on outcomes of total hip replacement, regardless of type, or year studied. As outlined in Tables 2 and 3, and in most recent studies [98-103], with the exception of Tai et al. [104] whose data were extracted from the 2003 time period, it appears taking precautions to reduce body weight problems may not only help to delay surgery, thereby reducing the possible need for revision due to loosening, but also other complications such as infection, that remains a very serious and dangerous complication of total hip arthroplasty [105-107], and excess metal wear of the prosthesis [108]. That is, the risks of one or more technical complications occurring after total Hip replacement may be reduced if efforts to focus on measures to optimize body weight before and after surgery are forthcoming.

This is supported by Vasahelyi et al. [49] who noted obese hip osteoarthritis patients have the potential to pose several challenges for arthroplasty surgeons from the standpoint of the adverse influence obesity on surgical time, peri-operative medical management, and the increased rate of intra- and post-operative complications. Other data show outcomes after total hip replacement may be less advantageous for those who are obese than those who are normal weight [109].

Consequently even though age, neuro-musculoskeletal and health related factors, developmental hip problems, having a hip fracture history, steroid usage that undermines bone and immune system status, plus gender specific differences in risk do influence the risk of postoperative complications after total hip replacement to avert unwarranted complications, the importance of excess body weight, especially morbid obesity should not be ignored [110]. In addition, since several studies clearly show hip replacement surgery is increasingly being applied to younger and younger patients, as well as to the older frail adult, and since these surgeries are clearly not without

complications [50], those who are overweight, who may be at high risk for post-operative complications, such as dislocations [65,68], should receive further attention as well, especially as they are likely to suffer from one or more comorbid health problems, a major risk factor for post-operative complications. Since complications after surgery are the strongest predictors for 30-day readmissions following total joint arthroplasty [111], increased efforts to allay complications after total hip replacement attributable to obesity appear essential. Treating any associated health condition and depression that can increase obesity, is especially indicated in this respect [109]. In all cases, the intensity and type of intervention both in the hospital and the community should be tailored to the age, needs, physical capacity, bone health status, neuromuscular status, the presence of other affected arthritic joints, pain and exercise tolerance, mental health status, and type of surgery. Careful pre-operative analysis, followed by appropriately structured and designed peri-operative care prior to discharge followed by carefully designed and staged post-hospital rehabilitation strategies is also indicated.

To promote adherence to recommendations, asking patients to keep a journal, periodic re-evaluation, ensuring patients understand and can confidently carry out required self-care recommendations, helping them to maintain an optimal health status, allaying their fears, and providing direct supervision along with efforts to involve the family of friends in the recovery process, is likely to be found beneficial, as well. Accommodations for occupational activities, as well as social activities, and desirable environmental adaptations, such as high chairs, versus low chairs, should be understood as well, and efforts to facilitate acquisition of appropriate assistive devices or home or workplace adaptations as assessed by an occupational therapist should form a standard part of the rehabilitation effort. The limitations of the prosthesis as far as forceful impact activities or excessive stretching in certain directions should be explained at the outset by the attending physician or rehabilitation specialist, especially in the case of obese patients, prone to dislocation and periprosthetic fractures [80].

To supplement the above care regimen, and to reduce the high rates of total hip replacement predicted in the future [2], findings from Table 2 and others [112-114] imply more emphasis be placed on the importance of weight management as a preventive strategy. In contrast uncontrolled obesity after total hip replacement surgery is likely to worsen prevailing comorbidities along with excessive health care costs in the long term [115]. Those with major complications can expect to experience significantly greater mortality rates following total joint replacement than those with no complications [113], and obese patients are also more likely to return to the theatre within 90 days, especially if they are younger than 40 years of age [116], or super-obese [117].

To provide empirical support for one or more of these aforementioned suggestions, which have been advocated, in part, by Paxton et al. [118], and in line with compelling evidence from a recent meta-analysis of prospective studies linking obesity to increases in complication rates after primary total hip arthroplasty [119], more robust longitudinal studies over more extensive time periods with well-defined samples, and measures that are more definitive obesity indicators than body mass index, such as body fat percentage, should be pursued to better solidify the present findings. Identifying if education and more careful planning can play a key role in this effort should be examined further in well-designed prospective studies. As well, Pivc et al. [4] note, new bearing surfaces introduced to prevent the problems of some metal-on-metal bearings need to monitor carefully before it can be assumed they are better than traditional bearings.

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