ClinicoEconomics and Outcomes Research

Dovepress

open access to scientific and medical research

Open Access Full Text Article

ORIGINAL RESEARCH

Body mass characteristics of hip osteoarthritis patients experiencing aseptic loosening, periprosthetic fractures, dislocation, and infections after total hip replacement

This article was published in the following Dove Press journal:
ClinicoEconomics and Outcomes Research
13 May 2009
Number of times this article has been viewed

Ray Marks

City University of New York and Columbia University, New York, NY, USA

Abstract: This work assessed the body mass characteristics of a cohort of community dwelling adults requiring surgery for complications related to primary hip arthroplasty, among other factors. The specific aim was to identify the extent to which high body mass prevailed in the cohort as a whole, to identify a role for subnormal body mass in the pathogenesis of post-operative complications following hip joint arthroplasty, and to identify whether different complication types could be differentiated on the basis of body mass profiles. The subjects were males and females drawn from a representative sample of 1,040 hip osteoarthritis patients between the ages of 30–89 years hospitalized for purposes of primary hip arthroplasty or complications related to prior replacement surgery. An analysis of their medical records showed: 1) Approximately 20% of the present cohort was constituted by patients with various complications related to prior arthroplasties, or to general deterioration of their condition; 2) The most common reasons for their re-hospitalization were aseptic prosthetic loosening followed by infection, prosthetic dislocations, prosthetic and periprosthetic fractures, and second surgeries on the opposite hip; 3) The presence of a high body mass index differentiated those presenting with aseptic prosthetic loosening, periprosthetic fractures, and those with infected hips ($p < 0.007$). Those with infection diagnoses were significantly heavier on average than those with no infection, regardless of diagnosis, and more cases with a dislocation history were underweight, rather than overweight ($p < 0.05$). It is concluded, a small but clinically relevant proportion of obese or underweight adults with hip osteoarthritis who undergo primary total hip replacement may experience complications at higher rates than cases with normal body weight, despite the generally successful outcomes experienced by the majority of hip arthroplasty patients.

Keywords: body mass, hip joint, osteoarthritis, replacement surgery

Introduction

Aseptic loosening and periprosthetic osteolysis are the most common complications observed after total hip arthroplasty,[1] a surgical procedure that significantly improves the health and well-being of patients diagnosed as having painful disabling end-stage hip osteoarthritis.[2] Other problems that often require re-hospitalization after total hip replacement surgery are prosthetic infection, a major complication that can adversely affect the outcome of this surgical procedure.[3] Other reported problems include periprosthetic fracture, a failed arthroplasty, nonunion of an intertrochanteric fracture,[4] and prosthetic dislocation.[5] While mechanical factors due to the characteristics of the metal prostheses and fixation mechanisms used for this form of surgery can influence total hip arthroplasty outcomes differentially,[6] it is possible other factors explain why some hip arthroplasty cases are more vulnerable to complications than others.

Correspondence: Ray Marks
Box 114, Columbia University, 525W 120th Street, New York, NY 10027, USA
Tel +1 212 678 3445
Fax +1 212 678 8259
Email rm226@columbia.edu

Some of these risk factors include, age, disease duration, and comorbid status. In addition, some evidence suggests body mass may influence prosthesis longevity, and/or the proclivity to dislocation, fracture, inactivity, and infection, which often necessitates surgical relocation, prosthetic removal, and reimplantation, differentially.[7] But there is less than universal consensus on this issue.

A further body of research shows that being overweight, as well as underweight, may be quite prevalent among adults of both genders undergoing total hip replacement,[8–11] and that as shown in Table 1, there is both an increasing incidence of obesity in the population, and among patients undergoing primary Charnley hip replacement. Hence, given that total hip replacement surgery is the most common intervention for disabling hip osteoarthritis, but that dealing with complications post-operatively is extremely costly to the patient as well as the hospital and society as a whole, it seemed reasonable to investigate whether there is likely to be any possible post-operative risk to total hip replacement surgery related to body weight distribution, and if so, what are possible implications of this for those who perform and require total hip replacement.[12]

Study aims

The first study aim was to examine whether patients with post-surgical complications are likely to constitute a sizeable proportion of patients with disabling hip joint osteoarthritis hospitalized at any point in time for hip joint surgery. A second aim was to examine the nature of these complications and their frequency of occurrence. A third aim was to examine if these complications would be likely to vary by age, numbers of prevailing comorbidities, and body mass among other factors. That is, the study sought to provide a better understanding of the potential influence of age, body mass and health status with respect to complications that can occur after total hip replacement, and their expected frequency of occurrence.

It was anticipated that by carefully examining the extent of this problem, and by identifying salient factors that might explain or place community dwelling elders at risk for complications after primary total hip replacement surgery, some insight into opportunities worthy of further study in the context of improving the clinical outcomes and reducing the costs of complications after primary total hip replacement surgery might be forthcoming. Based on an in-depth literature review, it was anticipated a sizeable volume of the present cases would be overweight, rather than underweight or of normal body weight, regardless of sub-group diagnosis. It was also anticipated that those hospitalized with complications from previous surgery would exhibit higher rates of subnormal body mass characteristics than those without complications, and that this could differ depending on the type of complication identified.

While various other risk factors for poor post-hip arthroplasty outcomes exist, body mass, an important proxy for health status was targeted given the prevailing support in the literature that this variable may be biomechanically and metabolically related to the development of complications post-hip arthroplasty. In particular, the impact of subnormal body mass indices as outlined in the literature[9,13] was specifically assessed because this variable

Table 1 Table depicting study findings as regards the role of body mass in the context of hip joint osteoarthritis in general

Authors	Study topic + sample	Findings
Changulani et al[40]	Studied the relationship between obesity and age of hip replacements	Those who were morbidly obese were 10 years younger on average than those with a normal body mass
Flugsrud et al[9]	Studied nine years of data on 50,034 participants from cardiovascular screening	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
Harms et al[10]	Retrospective review of medical charts of patients 18–59 years old, who underwent knee or hip replacement from January 2002–December 2004	Obesity was significantly associated with the need for both forms of surgery compared to age matched healthy controls
Jacobsen and Holm[8]	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 body mass indices at baseline
Järvholm et al[41]	This study examined the need for total hip replacement in relation to normal range and high body mass among 320,192 male construction workers	Body mass is an important predictor of osteoarthritis, especially osteoarthritis of the hip

is one which is potentially modifiable. Due to difficulties in conducting prospective studies in this area, a retrospective cross-sectional analysis was undertaken because of its descriptive value when exploring a phenomenon and formulating hypotheses.

Methods

All the available medical records charted over a 10 month period and drawn from a parent study of hip arthroplasty outcomes, but with no active patient involvement were examined to ensure the records were complete and patients had a diagnosis of osteoarthritis of one or both hips that required primary or secondary surgeries.

Study sample

The study cohort selected was a sample of 1,040 males and females between the ages of 23–89 years diagnosed as having definitive clinical and radiographic evidence of osteoarthritis of one or both hip joints. All were hospitalized for purposes of primary hip replacement (prosthetic) surgery or for complications related to prior prosthetic surgery or problems with one or both hips over a 10 month period in 2000.

Procedures

To obtain the desired information, data pertaining to the patient's were extracted by the researcher from the charts in a systematic way. These data included measures of the patients' body mass index (BMI), an indicator of fatness that represents the ratio of the subjects weight to the square of their height ($w.h^{-2}$), as well as pertinent demographic variables, including age, gender, reason for hospital admission, baseline functional status, and comorbid status were noted. In addition subjects were categorized as presenting for primary surgery or with a complication related to prior surgery. If a complication was identified, the specific complication noted on the chart, including infection, periprosthetic fracture, dislocation, and the term 'revision', which referred to the aseptic loosening of an arthroplasty cup, stem or both, and duration since first surgery, was recorded. These data were entered onto an Excel (Microsoft Corp., Redmond, WA) spreadsheet and were transposed thereafter into SPSS (version 16.0; SPSS Inc., Chicago, IL) files. SPSS programming was then used to describe the sample and to analyze differences in the age and body mass distributions and related variables among the observed subgroups of hip osteoarthritis surgical candidates using chi-square tests, cross-tabulations, and analysis of variance, as indicated. An *a priori* significance level of 0.05 was adopted.

Results

Demographic and clinical characteristics

The subjects studied were predominantly Caucasians, mean age 65.4 ± 13.0 years and 60% were women. Approximately 20% or 200% cases were hospitalized for purposes of primary hip joint surgeries on the contralateral side or because they had experienced ipsilateral complications related to prior primary total hip replacement surgeries. As shown in Table 2 depicting the six key reasons for re-hospitalization, the most common was some form of aseptic loosening of the initial prosthesis that required revision. Table 2 also shows that in addition to the differing rates of complications that were observed, the mean age of patients experiencing these problems tended to vary and was highest for those hospitalized due to prosthetic and periprosthetic fractures and contralateral hip surgery.

Body mass

In terms of body mass, and consistent with observations of several previously reported group characteristics, the hip osteoarthritis cases with no prior hospitalization history were predominantly overweight. Likewise, those with complications requiring re-hospitalization were generally overweight rather than of normal weight (60% vs 34%). Moreover, the mean BMIs of 29.8 ± 6.3 recorded for those with infection histories, regardless of diagnostic category, were significantly greater than the index of 26.7 ± 5.4 recorded for those with no infection ($p = 0.001$; equal variances assumed). As shown in Figure 1, the mean BMI of those hospitalized for infections warranting removal or reimplantation procedures was higher than that of the other subgroups and those with no surgical complications ($p = 0.004$).

The body mass indices defined as obese if this was greater or equal to 30 $kg.m^{-1}$; overweight if body mass indices were 25–29 $kg.m^{-1}$ or normal weight if less than 25 $kg.m^{-1}$ showed that consistent with others, those who experienced infections were more likely to be overweight or obese than of normal weight (81% vs 18%). Those with periprosthetic fractures were also more likely to be overweight or obese than those requiring primary surgery or revision hip arthroplasty who were moderately overweight on average. No subject classified as being underweight was being hospitalized for an infection-related problem.

Conversely, a higher proportion of patients undergoing revisions for dislocation and/or prosthetic relocations were likely to be underweight (BMI <20 $kg.m^{-1}$) when compared to those hospitalized for second surgeries, prosthetic reimplantation, removal and periprosthetic fractures ($p < 0.05$) (see Figure 2). The body mass indices for the nine

Table 2 Table depicting global rates and major categories and related sub-categories and rates of occurrence among these major diagnostic groups plus the mean age of each major group as observed among 1040 hospitalized patients with primary or secondary total hip replacement diagnoses showing different types of complications and reasons for hospitalization, as well as subtle differences in mean ages across conditions

Surgical category	N	Freq (%)	Mean age (Yrs)
Revision surgery	**132**	**12.7**	66.82 ± 14.45
Dislocations	17	[12.9]	66.87 ± 11.53
Periprosthetic fractures	8	[6.1]	71.25 ± 15.39*
Prosthetic fractures	2	[1.5]	72.77 ± 12.99*
Periprosthetic cysts	1	[0.8]	48.0
Failure, Loosening	66	[50]	
Prosthetic removal	**28**	**2.7**	62.31 ± 13.20
Infection diagnosis	17	[60.7]	
Prosthetic reimplantation	**14**	**1.4**	64.42 ± 10.32
Infection diagnosis	10	[71.4]	
Periprosthetic fracture	1		
Relocation	**4**	**0.4**	65 ± 12.86
Dislocation	2	[50]	
Infection	1	[25]	
Debridement	**3**	**0.3**	28.33 ± 10.12*
Infection diagnosis	3	[100]	
Contralateral hip replacement	**60**	**5.7**	70.00 ± 8.90
Uncomplicated primary surgery	**791**	**76.0**	61.70 ± 11.37
Primary unilateral cases	737		
Primary bilateral cases	54		

Notes: Rates for items described in italics refer to their frequency of occurrence in the major listed category. Some numbers may be missing from sub categories because of insufficient descriptors of the surgical condition on the chart. *Significantly different from no complications and removals at the 0.05 level.

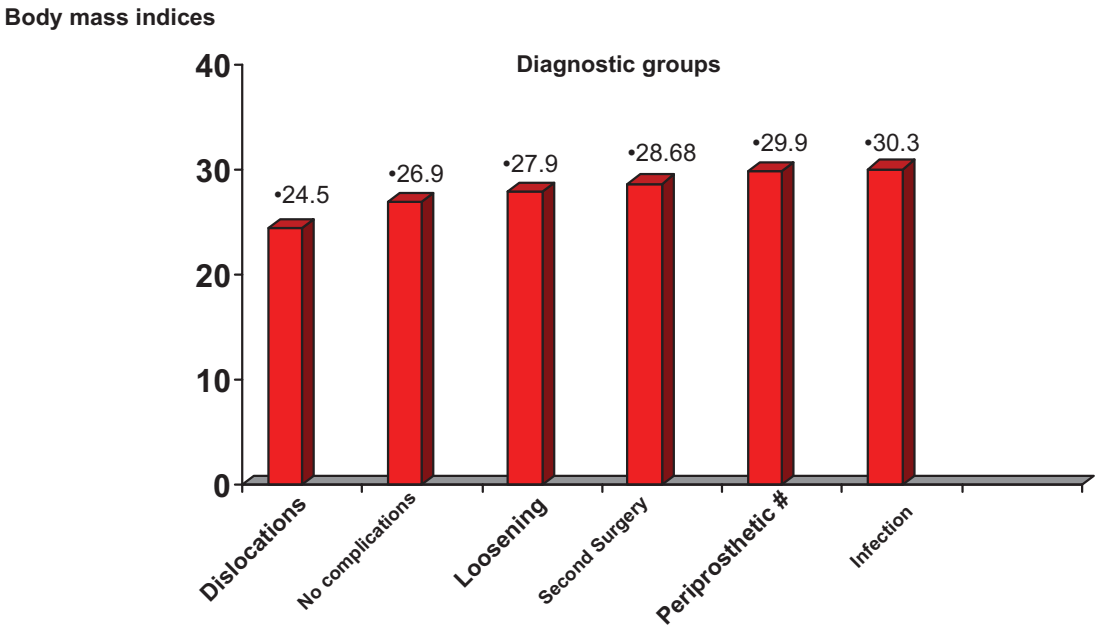

Figure 1 Body mass indices of hip osteoarthritis cases categorized by surgical requirements showing significant differences ($p < 0.05$) between those requiring reimplantation or removal and those requiring relocation due to dislocation.

cases with primary dislocation histories ranged from 18–43. For the approximately half of the cases hospitalized with a dislocation history who had recurrent dislocation histories (N = 10), their body mass indices ranged from 19–33 suggesting that being excessively underweight or obese may place some hip arthroplasty cases at risk for persistent complications.

Comorbid conditions

In association with the aforementioned variations in body mass distributions within the observed sub-groups, patients hospitalized due to dislocated or infected prostheses, as well as for periprosthetic fractures, were more likely to have a higher prevalence of comorbid conditions than those who required revision surgery or primary hip osteoarthritis, but this was not statistically significant. Those with infected hips who had experienced complications within a range of two months to 11 years after initial surgery, had either none, one or more comorbid diseases. Those hospitalized with dislocated prostheses had had their first surgeries 1–3 years prior to their current hospitalization, while time to aseptic loosening or experiencing a periprosthetic fracture was generally longer than that of the median time to infection or dislocation and ranged from 15–25 years.

Pre- and post-surgical trends

In terms of their overall pre-surgical subjective pain experience as evaluated on a 4-point Likert scale where 1 = mild pain and 4 = severe pain, an unexpected finding was that overall pain was reported to be 25%–50% less intense in those with dislocation and periprosthetic fracture histories (mean = 2.0) compared to those with infections (mean = 3.2) and those with requiring revision surgery (mean = 4.00, p = 0.088).

In addition, compared to patients with secondary infections requiring removals who generally had a very limited ability to flex their hips when compared to the other major subgroups, the most mobile groups were those with primary or recurrent dislocations. The difference in flexion range of motion between those with infections of 68.6 ± 8.3 and those with dislocations of 98.1 ± 7.8 was significant (p = 0.012).

In terms of baseline presentation, pre-surgical walking capacity as indicated by maximum number of blocks a patient could complete also differentiated the subgroups and was more limited among the cases re-admitted with an infection diagnosis than those undergoing primary hip replacement (0.3 blocks versus 3.9 blocks, p = 0.002). On the third post-surgical day, the distance walked by patients was 50% lower among the group who underwent removals and replacements for infections than those undergoing surgery for the first time (p = 0.048). The patients with secondary infections and surgeries also stayed in hospital longer, and required rehabilitation more often than the other patients upon hospital discharge.

Gender

Overall, although more females were undergoing surgery for the first time than males, gender did not seem to be

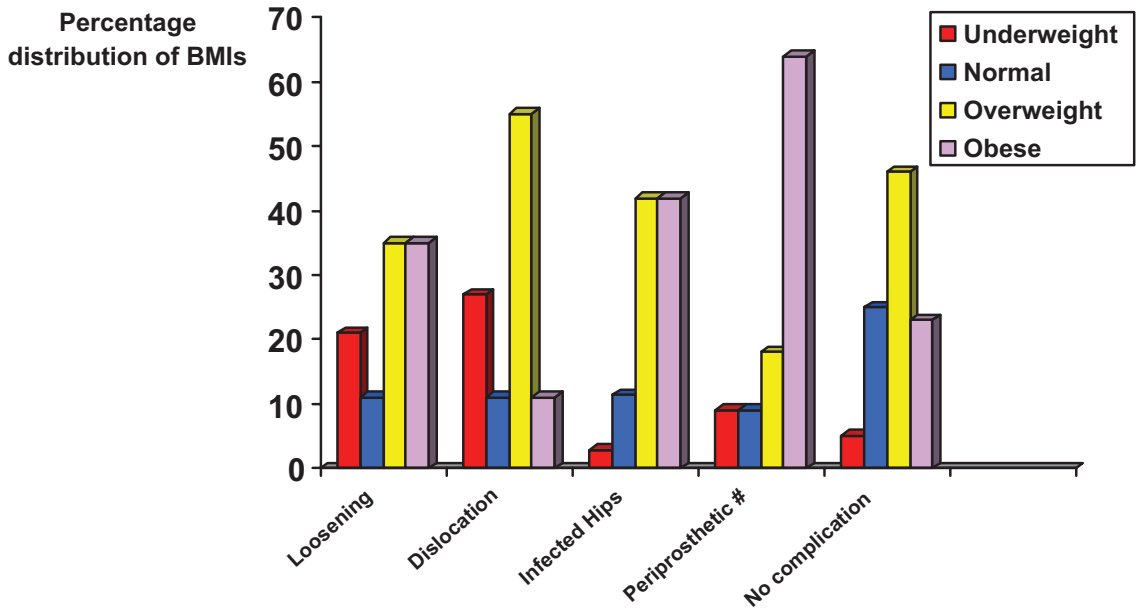

Figure 2 Body mass index profiles for subcategories of hip osteoarthritis patients showing breakdown of weight status across selected subgroups of hip osteoarthritis surgical candidates.

a factor placing patients at risk for revision. There were significantly more females with a diagnosis of dislocation and more males with a diagnosis of periprosthetic fracture and infection ($p \leq 0.05$).

Discussion

Minimizing the disability and related burden experienced by older adults who are commonly at risk for or already suffering from hip joint osteoarthritis is of growing importance in an aging society. While hip joint replacement surgery is often very helpful in this respect, hip joint replacement surgery clearly remains subject to a variety of post-operative complications and variable implant survival rates that can impact desired health outcomes adversely. The present aim was to specifically examine rates of post-operative hip complications, the nature of these, and factors that may reduce the success rate of total hip replacement surgery in the context of an urban orthopedic center with an active and progressive hip replacement surgery program. The goal was to identify factors that might further improve a patient's well-being and health in the course of undergoing total hip replacement surgery[2] and to try to resolve some discrepant views about body mass and its potential influence on perioperative hip replacement complication rates.[14,15]

The approach taken was that this would be an exploratory study, and that if any trends in the observed data emerged, these could be useful for guiding future research. Although the sample was primarily one of convenience, and patients in this current analysis were mostly Caucasian men and women, it was believed they would be reasonably representative of the type of patient commonly receiving a hip replacement in the context of modern urban orthopedic hospital settings. Moreover, although the present data set may be skewed because some successful cases may not have been included in the analysis due to missing files and incomplete hospital records, and more patients with complications than is commonly found in the population may have been observed due to the nature of the hospital and its expertise, as outlined in Table 2, it does appear a fair proportion of patients with hip osteoarthritis who undergo hip replacement surgery can be expected to experience post-surgical complications, despite excellent overall results. This finding was also observed by Mahomed and colleagues[16] for a United States Medicare population, and by Malchau and colleauges[17] for a Swedish population, and while these complications vary, the trends presently observed were generally consistent with several current reports in the related literature and those reported in Table 3.

However, because it is very challenging to follow controls who experience the same survival time but do not incur complications, and survival time does not appear to be the same for the different common post-operative complications observed, the reasons why post-surgical complications continue to prevail, why some forms of complication are more commonly observed than others and the specific risk factors involved remains unclear in the context of hip replacement surgery for disabling hip joint osteoarthritis. The present work thus focused specifically on ascertaining the extent to which complications following hip joint replacement surgery might prevail, the nature of these, and whether age, comorbid status and body mass might explain variations in the outcomes of such surgery. The extent to which these complications add to the burden of the disease was also a point of interest. While there is support for a correlation between obesity and post-hip surgery complications as outlined by Lübbeke and colleagues[13] and Joshi and colleagues[18] who showed linear wear was positively correlated with body weight, those presently analyzed, while somewhat overweight, were generally comparable in weight to those undergoing primary hip arthroplasty surgery as noted by McLaughlin and Lee,[19] and Haverkamp and colleagues.[15] Consistent with Effenberger and colleagues,[20] obesity did not seem to predominate among those requiring revision surgery, and their protracted survival times compared to those with infection diagnoses, suggested prosthetic 'wear and tear' rather than excess body weight alone explained this complication.

By contrast, those 24% of hip replacement patients with complications who were re-admitted with infection diagnoses generally had shorter arthroplasty survival rates than those requiring revision surgery, even though they should have had a generally equal chance of comparable prosthesis survival rates. They also had higher overweight and obesity rates than those requiring revision surgery with no infection history, suggesting mechanical wear and tear may be accelerated in those with excess body mass. Indeed, several cases with infection diagnoses were morbidly obese, and several had recurrent infection histories. They were also more likely to have one or more comorbid conditions, and to be more impaired than those with no infection history as discussed by Choong and colleagues[21] and Dowsey and Choong.[22] Also noteworthy was that this group required a significantly increased length of hospital stay compared to the other hospitalized groups, which is consistent with MacWilliam and colleagues[23] and Pulido and colleagues.[24] These observations also appear consistent with comparable findings of others outlined in Table 3, the significantly diminished functional outcomes

Table 3 Table depicting study findings as regards the role of body mass in the context of complications following total hip replacement surgery

Authors	Study topic + sample	Findings	Conclusion
Choong et al[21]	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 two co-morbidities and infection	Diabetes and high body mass are possible risk factors that influence the onset of early infection after primary hip arthroplasty
Dowsey and Choong[22]	The authors reviewed 1207 consecutive primary hip arthroplasties separating patients into four weight related groups, normal, overweight, obese, and morbidly obese, and compared the incidence of periprosthetic infection between the groups	There was a significantly higher infection rate in obese patients, independent of comorbidities such as diabetes and cardiovascular disease	Obesity is an independent risk factor for acute periprosthetic infection after primary hip arthroplasty
Järvholm et al[41]	This study examined the need for total hip replacement in relation to normal range and high body mass among 320,192 male construction workers	Body mass is an important predictor of osteoarthritis, especially osteoarthritis of the hip	Body mass is an important predictor of osteoarthritis even within normal body mass
Kessler and Käfer[29]	67 total hip replacement patients of varying weights were assessed 10 days and three 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 overweight or obese patients
Kim et al[32]	Studied the outcomes of revision total hip arthroplasty in a matched cohort of obese and nonobese 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
Lübbeke et al[13]	A hospital-based cohort who underwent total hip replacement or revision total hip arthroplasty was assessed	Patients undergoing 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
Lübbeke et al[25]	Studied the effect of obesity on the incidence of adverse events and selected outcomes after revision total hip arthroplasty	The incidence rate for one or more complications increased with rising body mass indices, especially in the obese range	There is an increased risk of surgical infection and dislocation in obese patients undergoing revision total hip arthroplasty
Münger et al[33]	725 cases in a multinational sample collected over 25 years were studied to examined 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
Pulido et al[24]	Reviewed data on 9245 patients undergoing primary hip or knee arthroplasty between January 2001 and April 2006	Prosthetic joint infections occurred in 63 patients or 0.7%, commonly within the first year	An important predictor for prosthetic infection was morbid obesity, among other factors
Sadr Azodi et al[14]	A cohort of 2106 male patients who underwent total hip replacement between 1997 and 2004 were identified	53 developed dislocation within three 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

these individuals may experience as outlined by Lübbeke and colleagues,[25] and the need to investigate and treat all potential determinants of this very disabling problem.

Another less commonly observed patient subgroup, namely those with diagnoses of periprosthetic fractures also tended to be overweight or obese rather than of normal weight. While patient demographics, a variety of clinical characteristics and surgical procedures may underpin this specific post-operative problem, it is unclear why periprosthetic fractures, while uncommon after hip arthroplasy, are

increasing in number and severity.[26] These disturbances, which are serious and costly, may involve stress fractures of the pubis or medial wall, significant bone loss secondary to osteolysis and subsequent loss of column integrity, or complete pelvic discontinuity.[27] They may occur due to trauma or without significant trauma as outlined by Katzer and colleagues.[26] They may also occur as a result of bone weakening and loosening of the prosthesis stem[18] and the use of small hip replacement components in patients with a high body mass.[28] It is possible too, there may be some age-related factor, along with trauma that raises the risk for this complication, as this subgroup was significantly older than the others, and the patients' charts revealed all had recent fall-related histories and a majority were overweight.

Dislocations, which occurred in about 10% of the cases with complications, and in varying time frames from initial surgery were also potentially influenced by body mass and its impact on the distribution of joint load as outlined in Figures 3 and 4. In addition to influencing joint loading, surgery may also be more problematic in either the overweight or extremely underweight candidate because of its impact on the long-term healing process, even though a short-term study has suggested no impact of body mass on early outcome or hospital length of stay.[29] Many candidates who are extremely overweight or underweight are also likely to be in poor health in general due to the presence of one or more comorbid conditions and/or the presence of past hip fractures, congenital joint problems, or trauma and may be more prone to developing problems related to implant failure and dislocation as a result. Patients who experience high dislocation rates may also include those who do not even sense there is any problem until they can no longer function because they do not perceive this situation in terms of pain, as was presently observed and thus early detection is unlikely.[30]

In summary, while patients differ in their pre-surgical functional abilities, age at admission and morphology, and not all are susceptible to complications after hip replacement surgery, the immense costs of complications to the individual

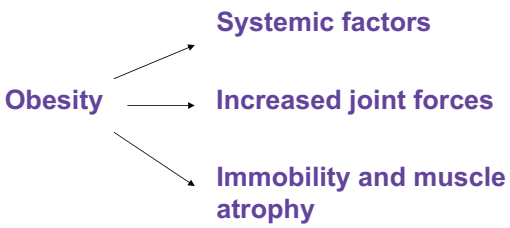

Figure 3 Possible role of obesity in mediating complications post-hip replacement surgery among hip osteoarthritis patients.

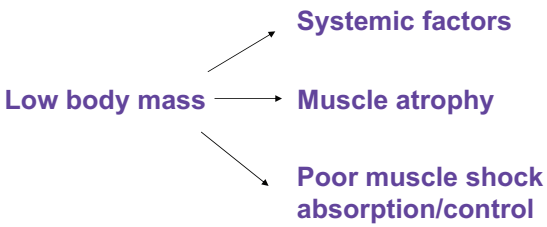

Figure 4 Possible role of low body mass in mediating complications post-hip replacement surgery among hip osteoarthritis patients.

and hospital when they occur demands more be done to understand and prevent or reduce these. In light of the present observations, the 1994 observations by Woolf and colleagues[31] and that being obese may impact the success of hip replacement surgery in a negative way[14,32] especially in younger patients with unrestricted mobility,[33] it seems this is one factor worthy of further exploration. Moreover, a growing literature indicates that being overweight may be associated with the need for total hip replacement.[9,10,34] Other patients undergoing this form of surgery, such as those with a prior hip fracture injury, are a group often found to be frail and underweight, and these features may explain why a moderate percentage of these cases are likely to experience aseptic loosening, and/or infection, periprosthetic fractures and especially dislocations.[35]

Thus even though this present research is limited in that it was done largely retrospectively with only a limited follow up period, cases were not strictly matched on the time of the hip replacement, and the information presented was dependent on accuracy of the chart records and measurement approaches, the possibility that body mass, a modifiable factor may be a predictor of some common deleterious post-hip replacement surgical outcomes such as infections, periprosthetic fractures and dislocations, should not be ignored. As well, it is possible there are age and gender-specific differences in risk for some complications and these warrant further study. As well, even though revision surgery at the hip may not be driven by weight factors *per se*,[19] obesity was also found by Lübbeke and colleagues[13] to be strongly associated with unfavorable outcomes after revision, and more research to see if weight control and careful radiological and clinical follow-up will reduce the prevalence of these complications[36,37] may be fruitful. 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/or better recovery after surgery,[38] and this avenue warrants further study.[39]

Conclusion

Complications that occur after surgical replacement of a hip joint for painful disabling osteoarthritis are costly and

potentially preventable conditions. While the literature on this topic remains equivocal, it is possible that common complications such as infections, periprosthetic fractures and dislocations are more likely to arise in patients who are excessively over or underweight. Other factors that need to be examined in well-designed case control studies include the potential role of age, gender, comorbid disease profile, trauma and extent of prevailing joint pain, among other factors. Given that primary hip osteoarthritis cases are growing in number and these patients are more than likely to be overweight than of normal weight, concerted efforts to examine the relative risks of failure after total hip replacement where body mass is clearly too high, or too low, seems highly advisable. In addition to well designed case control studies of hip prosthesis cases who do and do not experience complications, prospective studies to tease out the predictive validity of some of the aforementioned risk factors and to examine if it is possible to improve upon current outcomes and reduce costs associated with end-stage hip osteoarthritis may be especially fruitful.

Disclosure

The author reports no conflicts of interest in this work.

References

1. Anissian HL. In vitro evaluation of hip prostheses. Doctoral Thesis. Karolinska Institute; 2001.
2. March LM, Cross MJ, Lapsley H, et al. Outcomes after hip or knee replacement surgery for osteoarthritis. A prospective cohort study comparing patients' quality of life before and after surgery with age-related norms. *Med J Aust.* 1999;171:235–238.
3. Segal A, Krauss ES. Infected total hip arthroplasty after intravesical bacillus Calmette-Guérin therapy. *J Arthroplasty*. 2007;22(5): 759–762.
4. Parvizi J, Tarity TD, Slenker N, et al. Proximal femoral replacement in patients with non-neoplastic conditions. *J Bone Joint Surg Am*. 2007;89(5):1036–1043.
5. Berend KR, Lombardi AV Jr, Mallory TH, Adams JB, Russell JH, Groseth KL. The long-term outcome of 755 consecutive constrained acetabular components in total hip arthroplasty examining the successes and failures. *J Arthroplasty*. 2005;Suppl 3:93–102.
6. Ikema M, Oyama M, Kita A, Funayama K. Poor results of the cementless total hip arthroplasty with a nonporous coated acetabular component: AcSys Shearer Cup. *J Orthop Sci*. 2007;12:466–470.
7. Young NL, Cheah D, Waddell JP, Wright JG. Patient characteristics that affect the outcome of total hip arthroplasty: a review. *CJS*. 1998; 4:188–195.
8. Jacobsen S, Sonne-Holm S. Increased body mass index is a predisposition for treatment by total hip replacement. *Int Orthop*. 2005;29: 229–234.
9. Flugsrud GB, Norsletten L, Espehaug B, Havelin LI, Meyer HE. Risk factors for total hip replacement due to primary osteoarthritis: a cohort study in 50,034 persons. *Arthritis Rheum*. 2002;46:675–682.
10. Harms S, Larson R, Sahmoun AE, Beal JR. Obesity increases the likelihood of total joint replacement surgery among younger adults. *Int Orthop.* 2007;31:23–26.
11. Alfonso DT, Howell RD, Caceres G, Kozlowski P, Di Cesare PE. Total hip arthroplasty in the underweight. *J Arthroplasty*. 2008;23(7): 956–959.
12. Wroblewski BM, Siney PD, Fleming PA. Increasing patients' body mass. Are the criteria for testing stemmed femoral components in total hip arthroplasty still valid? *Proc Inst Mech Eng [H]*. 2007;221(8): 959–961.
13. Lübbeke A, Katz JN, Perneger TV, Hoffmeyer P. Primary and revision hip arthroplasty: 5-year outcomes and influence of age and comorbidity. *J Rheumatol.* 2007;34:394–400.
14. Sadr Azodi OS, Adami J, Lindstrom D, Eriksson KO, Wladis A, Bellocco R. High body mass index is associated with increased risk of implant dislocation following primary total hip replacement: 2,106 patients followed for up to 8 years. *Acta Orthop.* 2008;79:141–147.
15. Haverkamp D, de Man FH, de Jong PT, van Stralen RA, Marti RK. Is the long-term outcome of cemented THA jeopardized by patient's being overweight? *Clin Orthop Relat Res.* 2008;466:1162–1168.
16. Mahomed NN, Barrett JA, Katz JN, et al. Rates and outcomes of primary and revision total hip replacement in the United States medicare population. *J Bone Joint Surg Am*. 2003;85:27–32.
17. Malchau H, Heberts P, Eisler T, Garellick G, Soderman P. The Swedish Total Hip Replacement Register. *J Bone Joint Surg Am*. 2002;84 Suppl 2:2–20.
18. Joshi A, Ilchmann T, Markovic L. Socket wear in bilateral simultaneous total hip arthroplasty. *J Arthroplasty*. 2001;16:117–120.
19. McLaughlin JR, Lee KR. The outcome of total hip replacement in obese and non-obese patients at 10- to 18-years. *J Bone Joint Surg Br*. 2006;88:1286–1292.
20. Effenberger H, Ramsauer T, Dorn U, Imhof M. Factors influencing the revision rate of Zweymueller acetabular cup. *Int Orthop*. 2004;28: 155–158.
21. Choong PFM, Dowsey MM, Carr D, Daffy J, Stanley P. Risk factors associated with acute hip prosthetic joint infections and outcome of treatment with a rifampin-based regimen. *Acta Orthopaedica.* 2007;78:755–765.
22. Dowsey MM, Choong PFM. Obesity is a major risk factor for prosthetic infection after primary hip arthroplasty. *Clin Orthop Relat Res.* 2008;466:153–158.
23. MacWilliam CH, Yood MU, Verner JJ, McCarthy BD, Ward RE. Patient-related risk factors that predict poor outcome after total hip replacement. *Health Serv Res.* 1996;3:623–638.
24. Pulido L, Ghanem E, Joshi A, Purtill JJ, Parvizi J. Periprosthetic joint infection. *Clin Orthop Relat Res*. 2008;466:1710–1715.
25. Lübbeke A, Moons KGM, Garavaglia G, Hoffmeyer P. Outcomes of obese and nonobese patients undergoing revision total hip arthroplasty. *Arthritis Rheum*. 2008;59:738–745.
26. Katzer A, Ince A, Wodtke J, Loehr JF. Component exchange in treatment of periprosthetic femoral fractures. *J Arthroplasty*. 2006;21: 572–579.
27. Helfet DL, Ali A. Periprosthetic fractures of the acetabulum. *Instr Course Lect*. 2004;53:93–98.
28. Harvie P, Haroon M, Henderson N, El-Guindi M. Fracture of the hydroxyapatite-ceramic-coated JRI-Furlong femoral component: body mass index and implications for selection of the implant. *J Bone Joint Surg Br*. 2007;89:742–745.
29. Kessler S, Käfer W. Overweight and obesity: two predictors for worse early outcome in total hip replacement? *Obesity.* 2007;15: 2840–2845.
30. Roder C, Eggli S, Aebi M, Busato A. The validity of clinical examination in the diagnosis of loosening of components in total hip arthroplasty. *J Bone Joint Surg B*. 2003;85:37–44.
31. Woolf VJ, Charnley GJ, Goddard NJ. Weight changes after total hip arthroplasty. *J Arthroplasty.* 1994;9:389–391.
32. Kim Y, Morshed S, Joseph T, Bozic K, Ries MD. Clinical impact of obesity on stability following revision total hip arthroplasty. *Clin. Orthop Rel Res*. 2006;453:142–146.
33. Münger P, Röder C, Ackermann-Liebrich U, Busato A. Patient-related risk factors leading to aseptic stem loosening in total hip arthroplasty: a case-control study of 5, 035 patients. *Acta Orthop*. 2006;77: 567–574.

34. Karlson E, Mandl L, Gideon A, Sangha O, Liang MH, Grodstein F. Total hip replacement due to osteoarthritis: the importance of age, obesity, and other modifiable factors. *Am J Med*. 2003;114:93–98.
35. Meek RMD, Allan DB, McPhillips, Kerr L, Howie CR. Epidemiology of dislocation after total hip arthroplasty. *Clin Orthop Rel Res.* 2006; 447:9–18.
36. Busato A, Roder C, Herren S, Eggli S. Influence of high BMI on functional outcome after total hip arthroplasty. *Obesity Surgery*. 2008;18:595–600.
37. Namba RS, Paxton L, Fithian DC, Stone ML. Obesity and perioperative morbidity in total hip and total knee arthroplasty patients. *J Arthroplasty*. 2005;20:46–50.
38. Naylor JM, Harmer AR, Heard RC. Severe other joint disease and obesity independently influence recovery after joint replacement surgery: an observational study. *Austral J Physiother*. 2008;54:57–64.
39. Felson DT, Chaisson CE. Understanding the relationship between body weight and osteoarthritis. *Baillieres Clin Rheumatol*. 1997;11(4): 671–681.
40. Changulani M, Kalairajah Y, Peel T, Field RE. The relationship between obesity and the age at which hip and knee replacement is undertaken. *J Bone Joint Surg (Br)*. 2008;90B:360–363.
41. Järvholm B, Lewold S, Malchau H, Vingård E. Age, bodyweight, smoking habits and the risk of severe osteoarthritis in the hip and knee in men. *Eur J Epidemiol*. 2005;20:537–542.