Total hip replacement: unique challenges in the obese and geriatric populations

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Purpose of review

Total hip replacement is one of the safest and most clinically efficacious operations in orthopedic surgery. It has been extended to more and more patient populations over the past four decades. The purpose of this review is to present the contemporary data of total hip replacement in two unique patient populations: obese patients and geriatric patients older than 75 years of age.

Recent findings

There are unique clinical challenges in these patients. In addition, the clinical outcome and complications are different from more routine total hip replacement populations.

Summary

The recent research has shown that total hip replacement in the obese and elderly populations can be successful, and should not be denied solely based on these two criteria. There is a need for more research to investigate postoperative instability in the obese patient population, and perioperative mental confusion and cognitive function deterioration in the elderly patient population.

Keywords

elderly, obesity, total hip replacement

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Introduction

Total hip replacement (THR) has become one of the most clinically successful operations in orthopedic surgery; clinical outcome and safety has been extensively documented and validated over the past four decades. There has been a change of patient demographics in the US, especially over the past decade. There has been an increase in obese patients with a body mass index (BMI) greater than 30 kg/m^2. This population has unique clinical needs and risks, and they also pose challenges to surgeons with regard to workload and cost expenditure. Another special patient population is the elderly who have remained active and are candidates for THR. These patients often have several medical comorbidities that would affect the perioperative and postoperative risks as well as outcome. The purpose of this review is to discuss the clinical efficacy and safety of THR in these patient subsets.

Obese patients

Obesity has had a major impact on the development and progression of degenerative arthritis of the lower extremities. Obese patients pose challenges in anesthesia management, surgical exposure, wound healing, postoperative rehabilitation, complications, and durability of fixation and articulating surface wear.

Clinical outcome of THR in obese patients

Obesity is associated with several medical comorbidities, including cardiac disease, pulmonary issues (e.g. sleep apnea), diabetes and hypertension. There is therefore a higher likelihood of perioperative complications. Namba *et al.* [1] reported on data from a prospective studying following 149 obese patients with BMI >35 kg/m^2 (mean 39.5 kg/m^2). They compared the clinical outcome to a larger group of 922 patients with BMI <35 kg/m^2 (mean 27.0 kg/m^2) within their healthcare system. The study found a higher prevalence among women in the obese group (62%) in contrast to the nonobese group (57%). They found a higher prevalence of diabetes (14% vs. 9%, $P < 0.05$) and hypertension (53% vs. 36%, $P < 0.05$) in the obese patients. There was, however, no difference in dislocation (0.7% vs. 0.8%, $P > 0.05$) and venous thromboembolism (0.7% vs. 0.1%, $P > 0.05$). There was a trend toward a higher rate of wound infection (1.3% vs. 0.3%, $P > 0.05$) in the obese group. The difference, however, was not statistically significant. Further follow-up and studies of the obese patients will be necessary to determine if there is any difference in fixation durability, wear at the articulation, and late complications such as dislocation and infection.

Older reports have cited higher complications and poorer durability of fixation – in particular with cement fixation – in obese patients following THRs. More recent data have demonstrated improvements in both perioperative management and mid- to long-term clinical outcome. McLaughlin and Lee [2•] compared the outcome of THRs in obese and nonobese populations. This was a retrospective, nonrandomized analysis of a large database. They reviewed 209 THRs in 188 patients with a minimum follow-up of 10 years (mean 14.5 years, range 10–19 years). All THRs were done using identical implant design with cementless fixation. These patients were divided into two groups based upon BMI: a nonobese group with BMI $<30\,kg/m^2$ and an obese group with BMI $>30\,kg/m^2$. There were 99 nonobese patients (109 hips) and 89 obese patients (100 hips). There was no difference in the perioperative complications between the two groups, and no difference in the mean Harris hip score before and after surgery between groups ($P > 0.05$). Stem revision was necessary in 6 and 5%, respectively, for the nonobese and obese patients. An additional 1% stem loosening was observed in each group. Cup revision was quite high, however, although this was thought to be related to the particular cup design. Cup revision was done in 66 and 57%, respectively, in the nonobese and obese patients, and cup loosening was observed in an additional 18 and 17%, respectively. There was further analysis of two subsets within this large group: patients with BMI $<25\,kg/m^2$ and patients with BMI $>35\,kg/m^2$. No difference was found in any of the clinical outcome measures, radiographic evaluation or complications between these two groups. The study therefore concluded that THR could be safely performed in obese patients with equal clinical durability at comparable follow-up intervals.

The volume of revision THRs has continued to increase. It is not uncommon to have to perform complex revision surgery in obese patients. Kim *et al.* [3•] reported on a comparative analysis of a matched-pair cohort study between obese and nonobese patients undergoing revision THRs. There were 31 patients with BMI $>35\,kg/m^2$ in the obese group and 62 patients with BMI $<30\,kg/m^2$ in the nonobese group. Failure mechanisms leading to revision in the obese group included: 80.6% loosening or osteolysis, 16.1% septic failure and 3.2% instability. In the nonobese group, failure mechanisms for revision included: 82.3% loosening, 6.4% septic failure and 11.2% instability. There was no difference in the preoperative or follow-up Harris hip scores between the groups, but the study found a six-fold higher dislocation rate following revision THR in the obese group ($P < 0.05$). This was especially important because more nonobese patients underwent the index revision for recurrent dislocation.

Another clinical concern is whether the obese patient would be able to have effective rehabilitation after surgery to achieve optimal functional outcome. Vincent *et al.* [4] reported on 178 patients who underwent inpatient rehabilitation following THR. The patients were stratified into four groups based upon their BMI: <25, 26–30, 31–40 and $>40\,kg/m^2$. The study measured outcome by using the functional independence measurement (FIM), a validated outcome scoring instrument. They also evaluated length of rehabilitation unit stay, hospital charges and disposition location. The findings included: FIM scores improved from admission to discharge in all BMI groups; and FIM efficiency, length of stay and total hospital charges were correlated to BMI with better outcome in every category in patients with BMI $<40\,kg/m^2$. This difference was significant ($P < 0.05$). Moreover, significantly more patients in the morbidly obese group (BMI $>40\,kg/m^2$) required disposition to another institution other than the patients' own home, because of functional limitations and other medical comorbidities. The study concluded that obese patients could have the same improvement in functional capacity as the nonobese patient; morbidly obese patients would have lower efficiency at higher costs for rehabilitation after THR, however.

There has been a dramatic increase in the number of obese patients undergoing bariatric surgery in the past decade. According to the American Society for Bariatric Surgery, the volume increased from approximately 16 000 per year in the early 1990s to more than 160 000 in 2006. There is little data on patients undergoing THR either before or after bariatric surgery. Parvizi *et al.* [5] reported on seven patients (eight hips) who had undergone bariatric surgery prior to their THRs. Patient age ranged from 25 to 69 years. The mean clinical follow-up was 3.7 years with a minimum 2-year follow-up. All patients were satisfied with their THR. The mean Harris hip score improved from 40 (preoperative) to 67.5 (follow-up). Two patients had a wound infection that did not require revision of the implants. One patient required revision for loosening and osteolysis at 5 years. It remains unclear whether bariatric surgery would reduce the potential perioperative complications or the long-term durability of THR in this population.

Lastly, the obese patient poses a considerable burden on surgeons with regard to the added workload during and after performing a THR. There is a discrepant financial compensation for the added effort, however. Fehring *et al.* [6••] reviewed the data at their tertiary referral center from 1990 to 2005. They also reviewed the surgeon reimbursement rates for THR from Medicare over the same time interval. The proportion of obese THR patients (BMI $>30\,kg/m^2$) increased from 30.4% in 1990 to 52.1% in 2005. The proportion of morbidly obese

patients (BMI > 40 kg/m^2) increased from 5.2% in 1990 to 12.8% in 2005. In contrast, the proportion for nonobese THR patients at their center decreased from 26.1% in 1990 to 10.1% in 2005. This observation was interpreted as higher referrals to their center for obese patients from other communities. Medicare payment to the hospitals increased as adjusted for inflation over the 15-year interval. Surgeon reimbursement was reduced 64%, adjusted for inflation, however, over the same time period. The study specifically reviewed the center's billing records to determine if there was additional reimbursement when the modifier for complex surgery was used for cases involving obese patients. Additional compensation for the added workload was found in less than 1% of the center's claims involving obese patients.

Elderly patients

The demographic distribution of the US population has continued to evolve toward a greater proportion of patients older than 65 years of age. Moreover, the population of patients older than 85 years of age increased by 38% during the 1990s, according to the US National Census in 2000. Surgeons have long been wary of performing THR in the elderly, due to increased risks such as anesthesia complications, cardiac and pulmonary problems, venous thromboembolism, a poor capacity for rehabilitation, cognitive limitations resulting in not following dislocation precautions, among others, in this patient population.

Hip replacement surgery in the elderly, either partial or THR, has been principally done for displaced femoral neck fractures. We will limit our discussion in this paper to elective THRs in the elderly population. Wurtz *et al.* [7] studied 40 patients (46 hips) older than 80 years of age. All but two of these patients were living at home independently prior to surgery. The other two patients lived in an assistive living community and were independent community ambulators. Six patients underwent bilateral THRs. Two of these patients (four hips) underwent surgery in a two-stage approach during the same inpatient hospitalization. The other four patients (eight hips) had unilateral surgeries on average 3.5 years apart. There was a mean of 2.2 medical comorbidities per patient. The two most prevalent comorbidities were hypertension and cardiac disease. Thirty-four of the 40 patients were classified as American Society of Anesthesiologists class 2 or 3. The mean hospital stay was 7.7 days. Eleven patients (27.5%) had medical complications, none of which were fatal. The most common complication was mental confusion and transient cognitive function deterioration. One patient died from urosepsis during the first 90 days. Six patients had orthopedic complications: five dislocations, and one each of infection, foot ulcer and peroneal nerve palsy. The mean clinical follow-up was 4 years. Nineteen patients (47.5%) had died by a mean of 5.2 years after THR. All patients had a dramatic improvement of their Harris hip scores. Moreover, no component was judged to be loose. The study concluded that THR was safe in the elderly, had a predictable clinical improvement and durable implant fixation.

Kreder *et al.* [8] conducted a retrospective review comparing outcome between octogenarian patients and those who were between 65 and 79 years of age. There were 11 291 primary THRs in their large database, with 1953 THRs performed in octogenarians. The mean age for the octogenarians was 83 years compared with a mean of 71.7 years for the younger patients. There were significantly more women in the octogenarian group (68 vs. 59%, $P < 0.05$). There was no difference in the mean medical comorbidities per patient between groups, but a significant difference in mortality ($P = 0.01$): 1.54 (octogenarian) vs. 0.35% (younger patients). They also found significantly more perioperative complications ($P < 0.05$) including: myocardial infarction (1.28 vs. 0.47%), pneumonia (0.92 vs. 0.27%), urinary tract infection (4.4 vs. 2.03%) and mental confusion (2.8 vs. 1.0%). There was no difference in wound infection between groups. No data was provided on any difference in dislocation rate.

Surgeons from the Rothman Institute [9••] reported the outcome of 170 revision THRs in octogenarians at a tertiary high-volume arthroplasty center over an 8-year period. There was significant improvement in function and pain relief according to the SF-36 scores after revision ($P < 0.05$). There was a 16.5% rate of orthopedic complications and a 15.3% rate of major medical complications in the first 6 months after revision. Approximately half (48.1%) of the patients had died by a mean of 4.6 years after revision. The authors concluded that revision THR is excellent for improving quality of life, despite a high rate of complications in this patient population.

Clinicians are faced with the issue of whether the elderly patient would be able to comply with rehabilitation to have the most optimal functional outcome. Vincent *et al.* [10] reviewed 333 patients in their inpatient rehabilitation hospital after THR. The patients were grouped into: older than 85 years of age and younger than 85 years of age. The study conducted identical analysis, as cited earlier, for the obese patient population, and found lower FIM scores in the older patients, both at admission to the rehabilitation unit and upon discharge from the unit ($P < 0.05$). The hospital length of stay was also longer in the older patients. The percentage gain (efficiency) was similar between groups, however. The study therefore concluded that older patients had worse baseline

functional status, but demonstrated similar potential for gains after THR rehabilitation; older patients could successfully participate in the rehabilitation protocols and return to their activities of daily living with improvement in overall function following THR.

Conclusion

In conclusion, THR can be safely performed in the obese patients. Careful preoperative and perioperative multidisciplinary management is needed for medical comorbidities. More complications have been reported in obese patients following revision THR, particularly with regard to instability. There is a nonsignificant trend for longer wound healing and higher infection rates in the obese patients. Different wound closure and dressing protocols may be required in this population. Lastly, morbidly obese patients use more resources for rehabilitation after THR and have less efficient functional outcome improvement. At present, there is insufficient data to support preoperative bariatric surgery in hope of reducing perioperative and long-term complications of THR in these patients.

In addition, THR is safe and durable in the elderly. A comprehensive preoperative and perioperative multidisciplinary management protocol is necessary to minimize complications. More research and improvement is necessary, in particular, to reduce perioperative mental confusion and cognitive function deterioration in this patient population.

References and recommended reading

Papers of particular interest, published within the annual period of review, have been highlighted as:

- • of special interest
- •• of outstanding interest

Additional references related to this topic can also be found in the Current World Literature section in this issue (pp. 80–81).

1 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.

2 • McLaughlin JR, Lee KR. The outcome of total hip replacement in obese and nonobese patients at 10- to 18-years. J Bone Joint Surg Br 2006; 88:1286–1292.

This paper retrospectively compares the long-term follow-up of nonobese vs. obese patients following THR.

3 • Kim Y, Morshed S, Joseph T, *et al.* Clinical impact of obesity on stability following revision total hip arthroplasty. Clin Orthop Relat Res 2006; 453: 142–146.

This paper examines the effect of revision THR in obese vs. nonobese patients.

4 Vincent HK, Vincent KR, Weng J. Influence of obesity on inpatient rehabilitation outcomes following total hip arthroplasty. Obesity 2007; 15:522–530.

5 Parvizi J, Trousdale RT, Sarr MG. Total joint arthroplasty in patients surgically treated for morbid obesity. J Arthroplasty 2000; 15:1003–1008.

6 •• Fehring TK, Odum SM, Griffin WL, *et al.* The obesity epidemic: its effect on total joint arthroplasty. J Arthroplasty 2007; 22 (suppl 6):71–76.

This is an excellent review of the increasing prevalence of obesity in the US, and the associated interrelationships between obesity and arthroplasty.

7 Wurtz LD, Feinberg JR, Capello WN, *et al.* Elective primary total hip arthroplasty in octogenarians. J Gerontol 2003; 58A:468–471.

8 Kreder HJ, Berry GK, McMurtry IA, Halman SI. Arthroplasty in the octogenarian. J Arthroplasty 2005; 20:289–293.

9 •• Huo MH, Parvizi J, Gilbert NF. What's new in hip arthroplasty. J Bone Joint Surg 2006; 88A:2100–2113.

A comprehensive review of the pertinent literature regarding many aspects of total hip arthroplasty, including primary surgery, surface replacement, revision surgery, biomaterials and prosthetic design, complications, practice management, and treatment of intracapsular hip fractures.

10 Vincent KR, Lee LW, Alfano AP, Vincent HK. Preliminary comparison of inpatient rehabilitation outcomes based upon morbid obesity and age greater than 85 years in total hip arthroplasty patients. Am J Phys Med Rehabil 2006; 85:285.