Acta Orthop. Belg., 2011, **77**, 47-52

ORIGINAL STUDY

Outcome of hip resurfacing in obese patients

Jonathan M. Loughead, William Manning, James P. Holland

From Freeman Hospital, Newcastle upon Tyne, England

The effect of obesity on outcome for patients undergoing hip resurfacing has been evaluated. Pre and post-operative objective patient scored outcomes for a group of 181 cases of hip resurfacing performed over a three year period were collected. Cases have been stratified by body mass index (BMI) with evaluation of post-operative complications. Patient outcomes included : SF-36, WOMAC, and satisfaction scores, and were compared pre-operatively, and at one year.

We found an increased rate of wound complications in the obese group (BMI > 30) with 4 cases of prolonged wound drainage and 2 superficial infections, compared to none in the non-obese group. A similar improvement in SF-36, WOMAC and patient satisfaction was found for both groups. No increase in the risk of femoral neck fracture or aseptic loosening was seen in the obese group.

These results suggest excellent early outcomes for obese patients undergoing hip resurfacing with no added risk of early failure.

Keywords : hip resurfacing ; obesity ; complications ; outcome ; WOMAC.

INTRODUCTION

Hip resurfacing has gained increasing popularity, and we are now beginning to see excellent medium-term survivorship reported in the literature (*1,23,24, 32*). In addition, the patient reported satisfaction and functional outcome scores have been very promising when compared to conventional hip replacement using more sensitive outcome measures (*18*).

An increase in weight has been shown to make patients more likely to develop osteoarthritis of the hip (*9,15*) and there is an increasing trend towards operating on larger numbers of obese patients, and at a younger age (*6,7*). Body Mass Index (BMI) is in widespread use as a measure of obesity (*8*) and the outcome of total hip replacement (THR) in patients with a higher BMI has been reported in a number of studies (*5,12,25,27,30,31,35*). Some authors have suggested increased complication rates including prolonged wound drainage (*27*), infection (*30*), and aseptic loosening (*12,31,35*), whilst others have suggested no difference in complications (*5,25*). More recent work on survivorship of THR in obese patients has shown that obesity does not affect survivorship of THR (*14,22*). Survivorship of hip resurfacing in obese patients has been reported by Le

■ Jonathan M. Loughead, MSc, FRCS (Tr&Orth), Consultant Orthopaedic Surgeon.

■ William A. Manning, MB BS, Orthopaedic Specialist Trainee.

■ James P. Holland, FRCS (Tr&Orth), Consultant Orthopaedic Surgeon.

Department of Orthopaedics, Freeman Hospital, Newcastle upon Tyne, England.

Correspondence : Jonathan M. Loughead , Department of Orthopaedics, Queen Elizabeth Hospital, Sheriff Hill, Gateshead, England, NE9 6SX.

E-mail : Jonathan.loughead@ghnt.nhs.uk

No benefits or funds were received in support of this study

Duff *et al* (*17*) who found no significant increase in aseptic loosening at a minimum of two years follow-up.

The purpose of this study was to compare the early patient reported outcomes between patients with a BMI > 30 (obese), BMI 25-30 (overweight) and BMI < 25 (ideal), who had undergone hip resurfacing, and to evaluate the rate of post-operative complications in the obese and control groups. Limited data is available for the outcome of hip resurfacing in this population, and in addition some surgeons may be reluctant to operate on obese patients because of perceived technical difficulties and perceived added risk of early failure.

PATIENTS AND METHODS

A consecutive series of 181 cases (165 patients) who had undergone Birmingham hip resurfacing (Smith and Nephew ; Memphis, TN, USA) for end-stage arthritis between January 2004 and January 2008 was reviewed from the hospital registry to allow a minimum of one year since surgery. The diagnosis was osteoarthritis in 163 cases, the remainder were : Perthes disease (5 cases), hip dysplasia (5), avascular necrosis (4), inflammatory arthritis (3) and slipped femoral epiphysis (1). Patients were routinely seen again at one year post-op and bi-annually thereafter. All the operations were performed in a single hospital by the senior author (JPH). The distribution of cases broken down by BMI is outlined in Table I.

Patient selection for hip resurfacing was on the basis of pain and functional limitation in the younger age group with suitable femoral bone anatomy and quality. A desire to get back to a high level of function with a lower rate of dislocation was an added attraction for some patients. BMI was not used as a selection or exclusion criterion for surgery, however where possible, pre-operative weight reduction was advised.

Surgical technique and post-operative management were similar to those described by other authors (*24*) and were consistent for all patients in the series. Surgery was performed in a laminar flow theatre through a posterior approach with broad spectrum antibiotic given prior to anaesthesia and two postoperative doses. Adequate release of the tendinous insertion of gluteus maximus to the linea aspera was performed together with anterior capsular release to allow full rotation and translation of the femur in exposing the acetabulum and full visualisation of the femoral head and neck. The Birmingham Hip Resurfacing (Smith & Nephew) was used in all cases comprising a monobloc, as-cast cobalt-chrome hydroxyapatite-coated uncemented cup and cemented cobalt-chrome femoral head. Closure was in layers with absorbable continuous suture to external rotators, capsule, fascia and fat layers, with clips to skin. Three drains were used routinely for 24 hours.

Table I. — BMI and Gender

	BMI < 25	BMI 25-30	BMI > 30	Total
Male	28	55	29	112
Female	24	14	13	51
Total	52	69	42	163

No chemical thromboprophylaxis was routinely used. Foot pumps were utilised until the patient was ambulant and below-knee compression stockings were applied for 6 weeks. Full protected weight bearing was started on the first post-operative day without normal dislocation precautions. Progression was made from frame onto elbow crutches and the patient discharged when deemed safe by the physiotherapists, typically on the third post-op day. Patients were advised to fully weight-bear as tolerated, but to keep the crutches for four to six weeks to allow soft tissues and muscle repairs to heal.

Hospital Joint Registry data consisted of a questionnaire collected preoperatively and again one year after surgery. Preoperative data were collected within six weeks prior to surgery by independent research staff and follow-up data were collected at one year following surgery by postal questionnaire. The preoperative questionnaire included demographic details, height, weight and history of comorbid conditions. The self-administered comorbidity questionnaire has been validated with a medical record-based comorbidity instrument as well as with subsequent health status and utilization (*28*). Body mass index (BMI) was calculated as weight in kilograms divided by height in meters squared. At each evaluation two health status scales were administered : the Western Ontario and McMaster University Osteoarthritis Index (WOMAC) (*2,3*), a disease-specific measure of pain, stiffness and function ; and the Short-Form 36 (SF-36) (*20,21,33*), a generic health status measure. We transformed WOMAC scores to a 0 to 100 scale for each domain (100 best). The standardized method of calculating the SF-36 domains was used so that each of the eight subscales had a score of 0 to 100 (100 best) (*34*).

At 1-year assessment, questionnaires included four questions on patient satisfaction with a 4-point Likert

response format ranging from very satisfied to very dissatisfied. This scale has been validated for use on THR patients (*19*). Hospital paper and electronic records were reviewed for evidence of peri-operative complications. Post-operative AP pelvic radiographs were evaluated to assess component orientation, and evidence of loosening or failure.

Statistical analysis

Patients were categorised into three groups according to preoperative BMI using the following values : > 30 (obese), 25 to 30 (overweight) and 20 to 25 (ideal). Comparisons of categorical data, for example gender and satisfaction, between the three groups were made using chi-squared analysis. Comparisons of continuous data, for example age, WOMAC and SF-36 scores, were made using ANOVA. A significance level of $p < 0.05$ was maintained throughout.

RESULTS

The original cohort of hip resurfacings between January 2004 and January 2008 included 181 consecutive cases. Data was incomplete for 18 cases, which left 163 cases available for full analysis. Thirteen patients were staged bilateral and 3 simultaneous bilateral. Mean age at surgery was 49 years (range : 22 to 70) and there was a higher proportion of males in the study cohort (69%). WOMAC data are presented in Fig. 1. There was no significant difference ($p > 0.05$) between WOMAC pain, stiffness and function score in each BMI sub-group preoperative or at one year.

SF-36 data are presented in Fig. 2. Scores in each of the SF-36 domains did not differ significantly ($p > 0.05$) either pre-operatively or at one year across the BMI sub-groups.

Satisfaction following surgery was high with 95% of patients either very satisfied or somewhat satisfied at one year. There was no significant variation in rates of satisfaction when stratified by BMI sub-group ($p > 0.05$).

Complications

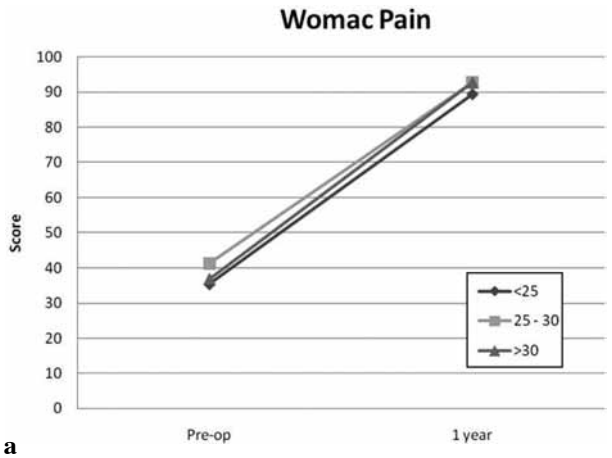
Data on peri-operative complications was available for all 181 cases and therefore none were excluded from the analysis. In the obese group, prolonged wound drainage occurred in four patients (9.5%) and settled without intervention within one week. Two patients developed a superficial wound infection which resolved with antibiotics. No patient required a return to theatre as a result of wound problems and no deep infections occurred in any patient. There were no dislocations and no femoral or sciatic nerve palsy occurred. A single patient developed unexplained groin pain after surgery (obese group) and a single patient developed significant heterotopic bone formation Brooker grade 3 (BMI not recorded). Two patients developed deep vein thrombosis (one obese and one overweight) both demonstrated on ultrasound below the knee, and one patient suffered a non-fatal pulmonary embolus (normal weight) demonstrated by ventilation/perfusion lung scan. Two patients in the series were revised each at two years following surgery, one (normal weight) for development of a wear-debris mass secondary to impingement and one (overweight) for an osteopenic stress fracture. Two patients in the study cohort died at 12 and 18 months following surgery respectively (one normal weight, one overweight) from unrelated causes.

At a mean radiological follow-up of 28 months (SD 15) no cases of femoral or acetabular loosening were noted. Measurement of cup inclination and stem-shaft angle were similar between the groups.

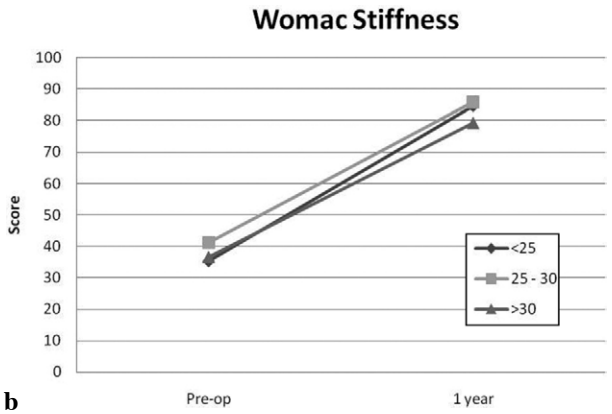
DISCUSSION

Many patients who develop osteoarthritis of the hip are overweight (*5,10*), and as the general trend in the population is for increasing size (*6,13*) this is becoming more prevalent (*4,7*). Some surgeons have in the past recommended weight reduction before hip replacement (*16*), however our results suggest the benefit of hip resurfacing should not be denied to patients on the basis of weight alone.

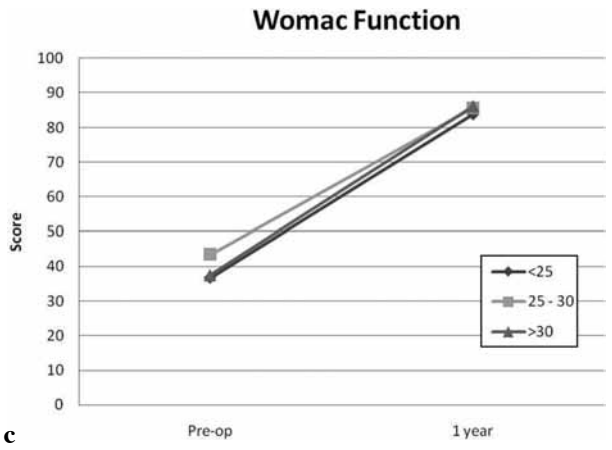
The pre-operative function scores confirm a significant degree of disability and pain in all the patients irrespective of their BMI, which confirms that these patients have significant arthritis and are suitable candidates for surgery. Equally the improvement in function and satisfaction for both patient groups confirms that hip resurfacing is an



a



b



c

Fig. 1a, b, c. — Mean Western Ontario and McMaster's osteoarthritis index scores pre-operatively and at one-year assessment for the three sub-groups of patients with BMI < 25, 25-30 and > 30 respectively.

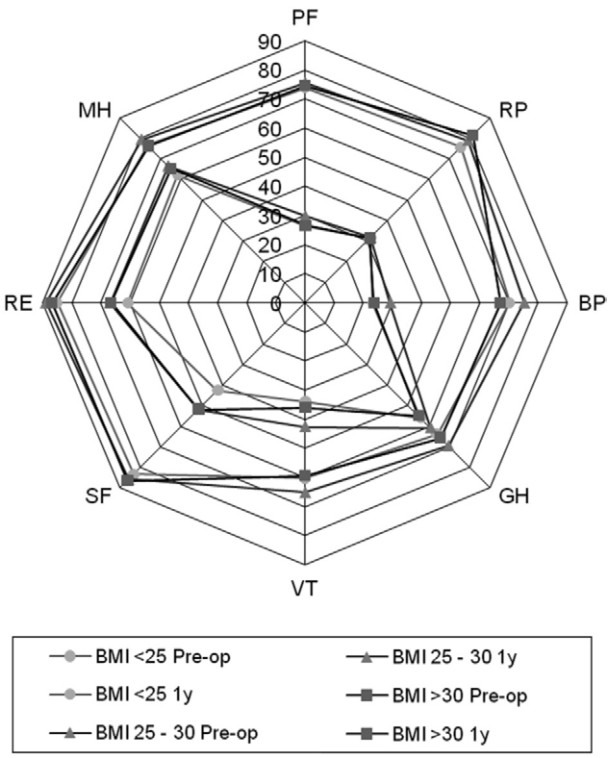


Fig. 2. — Mean SF-36 scores Pre-operatively and at 1 Year. The radar graph is scaled so that the central point is 0 and each gridline is a 20-point increment, 100 maximum for the outer gridline. PF = Physical functioning, RP = Role-Physical, BP = Bodily Pain, GH = General Health, VT = Vitality, SF = Social Functioning, RE = Role-Emotional, MH = Mental Health.

effective treatment for a disabling condition. With the use of resurfacing the added benefits of a more wear resistant bearing and conservation of bone, which we feel are important for the younger age group, are applicable to patients even if they are significantly overweight**.** Indeed the work by some authors suggests this population of obese patients do not reduce their weight even after pain relieving surgery (*11*).

It is acknowledged that there is increased technical difficulty that may be encountered at the time of surgery and an increase in local wound complications for the obese patients. However, obese patients are shown to have similar clinical improvement as

non-obese patients and have a high level of satisfaction after surgery. We believe a BMI > 30 is not a contra-indication to hip resurfacing but does require a degree more planning. Pre-operative measures including secure and accurate patient positioning, wide access draping and extended exposure are all required. Particular care is required with regard to surgical releases of both the gluteus maximus tendon from the femur and anterior capsule to allow full acetabular view for cup orientation and full delivery of the head for femoral preparation, alignment and safe fixation. Our results confirm no radiological suggestion that obesity risks component mal-alignment due to difficulty in exposure, in particular closing the cup abduction angle and adequate femoral neck positioning using conventional instrumentation. Data on survivorship of hip resurfacing by Le Duff *et al* (*17*) suggest that in the short term a lower rate of revision is found for patients with a higher BMI, although their overall survivorship of < 95% at 5 years is disappointing. Interestingly the high BMI group from the work by Le Duff *et al* had a larger femoral head diameter which suggests that the patients in the obese group may contain a cohort of male patients with high lean body weight and correspondingly bigger anatomy. In this study, there were no radiological lucencies and no additional early failures of hip resurfacing in the overweight or obese patients over normal patients, specifically no increase in the risk of femoral neck fractures, which if seen generally present within the first year following surgery (*29*).

A limitation of the study is that BMI can be elevated in patients who have a high lean body mass, and these patients may not be directly comparable to a patient who has a high body fat component (*26*). In addition it may be more relevant to consider the quantity of fat which is deposited around the hip region, rather than the total weight of the patient.

Although this is only a short-term study concentrating on patient-reported outcome, we have seen no increase in early failure of hip resurfacing in high BMI patients, which is in keeping with the finding of other authors (*17*). Longer term review will be required to assess the effects of BMI on metal ion levels and possible sequelae of wear rates in the future.

Acknowledgement

We would like to acknowledge the assistance of Arthroplasty Nurse Practitioner Suzanne Osborne in collecting data for this study, and to Dr.Elizabeth Lingard for her help with the data analysis.

REFERENCES

1. **Australian Orthopaedic Association National Joint Replacement Registry.** Annual Report. Adelaide : AOA ; 2009.
2. **Bellamy N.** *WOMAC Osteoarthritis Index : A User's Guide*. 1995, London, Ontario.
3. **Bellamy N, Buchannan WW, Goldsmith CH, Campbell J, Stitt L.** Validation study of *the WOMAC :* a health status instrument of measuring clinically-important patient-relevant outcomes following total hip or knee arthroplasty in osteoarthritis. *J Orthop Rheumatol* 1988 ; 1 : 95-108.
4. **Bourne R, Mukhi, Zhu N, Zeresteci M, Marin M.** Role of obesity on the risk of total hip or knee arthroplasty. *Clin Orthop Relat Res* 2007 ; 465 : 185-188.
5. **Chan CLH, Villar RN.** Obesity and quality of life after primary hip arthroplasty. *J Bone Joint Surg* 1996 ; 78-B : 78-81.
6. **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* 2008 ; 90-B : 360-363.
7. **Flugsrud GB, Nordsletten L, Espehaug B *et al*.** The impact of body mass index on later total hip arthroplasty for primary osteoarthritis : a cohort study in 1.2 million persons. *Arthritis Rheum* 2006 ; 54 : 802-807.
8. **Garrow JS, Webster J.** Quetelet's index (weight/height^2) as a measure of fatness. *Int J Obes* 1985 ; 9 : 147-153.
9. **Gelber AC.** Obesity and hip osteoarthritis : the weight of the evidence is increasing. *Am J Med* 2003 ; 114 : 158-159.
10. **Goldin RH, McAdam L, Louie JS, Gold R, Bluestone R.** Clinical and radiological survey of the incidence of osteoarthrosis among obese patients. *Ann Rheum Dis* 1976 ; 35 : 349-353.
11. **Heisel C, Silva M, de la Rosa MA, Schmalzried TP.** The effects of lower extremity total joint replacement for arthritis on obesity. *Orthopedics* 2005 ; 28 : 157-159.
12. **Hierton C, Blomgren G, Lindgren U.** Factors leading to rearthroplasty in a material with radiographically loose total hip prostheses. *Acta Orthop Scand* 1983 ; 54 : 562-565.
13. **Hill JO, Catenacci V, Wyatt HR.** Obesity : overview of an epidemic. *Psychiatr Clin North Am* 2005 ; 28 : 1-23.
14. **Jackson MP, Sexton SA, Yeung E *et al*.** The effect of obesity on the mid-term survival and clinical outcome of cementless total hip replacement. *J Bone Joint Surg* 2009 ; 91-B : 1296-1300.
15. **Karlson EW, Mandl LA, Aweh GN *et al*.** Total hip replacement due to osteoarthritis : the importance of age,

obesity, and other modifiable risk factors. *Am J Med* 2003 ; 114 : 93-98.

16. **Larsen VH, Sorensen KH.** Weight reduction before hip replacement. *Acta Orthop Scand* 1980 ; 51 : 841-844.
17. **Le Duff MJ, Amstutz HC, Dorey FJ.** Metal-on-metal hip resurfacing for obese patients *J Bone Joint Surg* 2007 ; 89-A : 2705-2711.
18. **Lingard E, Muthamayandi K, Holland J.** Comparison of patient-reported outcomes between hip resurfacing and total hip replacement. *J Bone Joint Surg* 2009 ; 91-B : 1550-1554.
19. **Mahomed N, Sledge CB, Daltroy L, Fossel AH**, **Katz JN.** Self-administered patient satisfaction scale for joint replacement arthroplasty. in 52nd Annual Canadian Orthopaedic Association Meeting. 1997. Hamilton, ON.
20. **McHorney CA, Ware JE Jr, Lu JF, Sherbourne CD.** The MOS 36-item Short-Form Health Survey (SF-36) : III. Tests of data quality, scaling assumptions, and reliability across diverse patient groups. *Med Care* 1994 ; 32 : 40-66.
21. **McHorney CA, Ware JE, Jr, Raczek AE.** The MOS 36-Item Short-Form Health Survey *(SF-36) : II*. Psychometric and clinical tests of validity in measuring physical and mental health constructs. *Med Care* 1993 ; 31 : 247-63.
22. **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* 2006 ; 88-B : 1286-1292.
23. **McMinn DJW, Daniel J, Ziaee H, Pradhan C.** Results of the Birmingham Hip Resurfacing dysplasia component in severe acetabular insufficiency : A six- to 9.6-year follow-up. *J Bone Joint Surg* 2008 ; 90-B : 715-723.
24. **McMinn D, Treacy R, Lin K, Pynsent PB.** Metal on metal surface replacement of the hip : experience of the McMinn prosthesis. *Clin Orthop Relat Res* 1996 ; 329(Suppl) : 89-98.
25. **Moran M, Walmsley P, Gray A, Brenkel IJ.** Does body mass index affect the early outcome of primary total hip arthroplasty ? *J Arthroplasty* 2005 ; 20 : 866-869.
26. **Nevill AM, Stewart AD, Olds T, Holder R.** Relationship between adiposity and body size reveals limitations of BMI. *Am J Phys Anthropol* 2006 ; 129 : 151-6.
27. **Patel VP, Walsh M, Sehgal B *et al.*** Total hip and knee arthroplasty factors associated with prolonged wound drainage after primary total hip and knee arthroplasty. *J Bone Joint Surg* 2007 ; 89-A : 33-38.
28. **Sangha O, Stucki G, Liang MH, Fossel AH, Katz JN.** The Self-Administered Comorbidity Questionnaire : a new method to assess comorbidity for clinical and health services research. *Arthritis Rheum* 2003 ; 49 : 156-163.
29. **Shimmin AJ. Back D.** Femoral neck fractures following Birmingham hip resurfacing : a national review of 50 cases. *J Bone Joint Surg]* 2005 ; 87-B : 463-464.
30. **Strauss RJ, Wise L.** Operative risks of obesity. *Surg Gynecol Obstet* 1978 ; 146 : 286-291.
31. **Surin VV, Sundholm K.** Survival of patients and prostheses after total hip arthroplasty. *Clin Orthop Relat Res* 1983 ; 177 : 148-153.
32. **Treacy RBC, McBryde CW, Pynsent PB.** Birmingham hip resurfacing arthroplasty : A minimum follow-up of five years. *J Bone Joint Surg* 2005 ; 87-B : 167-170.
33. **Ware JE Jr., Sherbourne CD.** The MOS 36-item short-form health survey (SF-36). I. Conceptual framework and item selection. *Med. Care* 1992 ; 30 : 473-483.
34. **Ware JE, Kosinski M, Dewey JE.** *How to Score Version 2 of the SF-36 Health Survey*. 2000, Lincoln, RI : Quality Metric Incorporated.
35. **Wroblewski BM.** Fractured stem in total hip replacement : a clinical review of 120 cases. *Acta Orthop Scand* 1982 ; 53 : 279-284.