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ORIGINAL PAPER

Relationship of body mass index to early complications in hip replacement surgery

Study performed at Hinchingbrooke Hospital, Orthopaedic Directorate, Huntingdon, Cambridgeshire

A. D. Patel · M. Albrizio

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Abstract The purpose of this study was to evaluate the relationship between body mass index and early complications following total hip replacements. Five hundred and fifty patients who underwent primary total hip replacement were recruited. All these patients were subjected to a pre-operative assessment and follow-up at 6 weeks and 1 year following surgery. Any complications occurring during this period were recorded. Complications were grouped into systemic and local, both subdivided into minor and major depending on the risk involved. Fifty-six patients (10.2%) had an early complication following hip replacement surgery. Forty-four patients (8%) had a major local complication. Overall, there did seem to be a weak correlation between BMI and the rate of complications, with a p value of 0.104. A correlation was also found between the surgeon and presence of complications with a p value of 0.736. There is a weak correlation between BMI and early complications following hip replacement surgery, and there also seems to be a correlation between the operating surgeon and early complications, but this is not statistically significant.

Résumé Le propos de ce travail est d'évaluer la relation du BMI et des complications précoces pour les prothèses totales de hanche. Méthode: 550 patients ayant bénéficié d'une prothèse totale de hanche ont été évalués. Tous ces patients ont été analysés en préopératoire et à six semaines et un an de recul, après l'intervention. Toutes les complications survenant durant cette période ont été analysées. Les complications ont été groupées en complications générales et complications locales de même elles ont été également divisées en complications mineures et majeures. Résultat: 10.2% des patients (n=56) ont présenté une complication précoce après prothèse totale de hanche, 8% (n=44) ont présenté une complication majeure. Le BMI semble être en corrélation avec le taux des complications de même une corrélation a été trouvée également entre le chirurgien et les complications. En conclusion: le BMI a une corrélation avec les complications précoces après prothèse totale de hanche. Il en est de même en ce qui concerne l'équipe chirurgicale mais pas de façon satistiquement significative.

Introduction

Mounting evidence has removed all doubts that obesity has a direct link to an increase in conditions such as hypertension [1, 7, 19], atherosclerosis [1, 7, 19], diabetes [1, 7, 19], malignancy [1, 7] and many other medical conditions [1] reducing the life span [12, 24] of an individual. Obesity has also been shown to be a mechanical factor influencing the initiation and progression of osteoarthritis of the hip and the knee [2, 16, 21]. On the other hand studies have shown how weight loss reduces the risk of osteoarthritis [3]. Consequently, a large proportion of patients who undergo joint replacement are obese [11, 25]. In the scenario of such a higher rate of obesity-related medical conditions one would expect these patients to have a higher rate of surgical complications following surgery.

However does obesity actually influence the outcome of hip replacement surgery? Perka et al. [14, 15] have looked

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A. D. Patel · M. Albrizio (✉)
Department of Orthopaedics, Hinchingbrooke Hospital, Huntingdon, Cambridgeshire, UK
e-mail: mailbox@mauroalbrizio.eu

Table 1 Demographic distribution of patients

Demographics	Statistics
M/F	213/337
Age (minimum/maximum/mean)	21/93/69
BMI (minimum/maximum/mean)	13.3/49.5/28.3
Complications (yes/no)	56/494

at various peri-operative parameters that may be influenced by obesity such as the length of surgery, medical and surgical complications, fatalities, requirement for analgesia, transfusions and peri-operative haemoglobin levels. Obesity seemed to influence the length of surgery, but did not affect any of the other parameters. Thomas et al. [23] have shown that there is a higher rate of infections in obese patients having abdominal or gynaecological surgery. Other authors have concluded that the surgical costs for an obese patient are higher [15, 23].

On the other hand evidence suggests that there is no significant long-term difference in parameters like patient satisfaction [18], post-operative pain [15], aseptic loosening (despite a different load) [5, 17] and 10-year survival rates [9] between obese and non-obese patients having a joint replacement. There does not seem to be any conclusive evidence about a higher rate of surgical and non-surgical complications between patients who are obese and those who are not obese [9, 10, 14, 15].

The purpose of this study was to investigate if obese patients were at any higher risk of developing short-term complications following total hip replacement surgery compared with non-obese patients.

Materials and methods

Since January 2002, all patients having a hip replacement have undergone a pre-operative assessment at our hospital. A standard form was used to record all details of the patient including the height and weight. Co-morbid conditions were also recorded at this stage. Between January 2002 and February 2005, 550 patients underwent a primary total hip replacement at Hinchingbrooke Hospital, operated on by 7 different surgeons.

All primary joint replacements were included in this study. Patients undergoing a resurfacing or a revision were excluded from this study. All patients were followed up by an orthopaedic nurse practitioner 4 weeks after operation and then followed up 6 weeks after discharge by the treating consultant. The next follow-up for joint replacements occurred at 12 months. Any complications reported by the patient or the medical staff were recorded.

Body mass index was calculated for each patient by dividing the weight in kilograms by the square of the height in metres [Body Mass Index=Weight in Kilograms/(Height in metres)^2].

Complications were grouped into systemic and local, each group being subdivided into minor and major. A complication that could be treated with medical and

Table 2 Mean BMI for each complication

Type of complication	Major		Minor	
	Number of patients	BMI (mean)	Number of patients	BMI (mean)
Local				
Wound dehiscence	3	27.8	–	–
Infection (deep)	16	31.9	–	–
Infection (superficial)	–	–	–	–
Manipulation under anaesthetic (postoperative stiffness)	–	–	–	–
Ooze	–	–	12	29.3
Haematoma (second operation)	–	–	–	–
Pain (re-admission)	–	–	–	–
Haematoma (no surgical management)	–	–	–	–
Dislocation	13	29.7	–	–
Systemic				
Cardiac arrest	1	20.3	–	–
Systemic infection	1	32.7	–	–
Congestive cardiac failure	1	47.3	–	–
Cardiovascular accident	1	27.8	–	–
Deep venous thrombosis	5	27.0	–	–
Intensive care unit admission	1	22.9	–	–
Myocardial infarction	1	27.8	–	–
Pulmonary embolism	1	24.2	–	–

Table 3 Age and BMI against complication rate

	Complications	*n*	Mean	Standard deviation	Standard error of the mean
Age	No	494	69	10.5	0.5
	Yes	56	69.2	13.3	1.8
BMI	No	494	28.1	4.6	0.2
	Yes	56	29.5	5.8	0.8

Student *t* test, p=0.925 for age, p=0.104 for BMI

conservative management or that was not a risk to the artificial joint and/or the patient was listed as a minor complication (superficial infection, ooze, pain). Any complication that needed surgical/medical intervention and posed a risk to the joint or the patient was listed as a major complication (dehiscence, deep infection, post-operative stiffness requiring manipulation under anaesthesia, haematoma requiring second operation, cardiac arrest, deep vein thrombosis, cardiovascular accident, congestive cardiac failure, systemic infection, intensive care unit admission, myocardial infarction, pulmonary embolism).

Data collection was commenced following ethical committee approval. Data were first fed in electronic format into Excel. Accuracy of the electronic data was confirmed by two independent observers. Data of 24 patients was rechecked (square root of the total number of patients plus one [13]) on randomly selected cases by comparing the notes and the electronic data by each observer. No error was found. This highlights the accuracy of the collected data.

Data were then transferred to SPSS Version 12 and analysed for frequencies, Chi-squared test, univariate logistic regression and multivariate analysis with the support of a statistician.

Results

The demographic distribution of patients is shown in Table 1. Fifty-six patients (10.2%) were found to have complications.

Table 4 Correlation between BMI and operating surgeon

Surgeon	Complication rate (%)
5	8.1
7	8.6
1	9.5
3	10.3
2	10.9
4	12.5
6	15.7

Pearson's Chi-squared test, p=0.736

Body mass index ranged from 13.3 to 49.5 with a mean of 28.3. Hospital length of stay ranged from 2 to 44 days with a mean of 6.

The complication distribution is shown in Table 2. Forty-four (8%) patients had a major (systemic or local) complication. Table 3 shows the correlation between the complication rate and BMI/age of the patient.

Seven surgeons operated on all the patients in this study. A casual number from 1 to 7 has been assigned to every surgeon. Complication rates for each surgeon vary from a lowest of 8.1% to a highest of 15.7% with a p value of 0.736 (Table 4).

For the purpose of analysis patients were split into groups of BMI less than 25, 25–29.9, 30–34.9, and over 35 (Table 5) with a complication rate ranging from 8.9 to 10.2%.

A multivariate logistic regression model was constructed using forward selection. The variables BMI (continuous), sex and surgeon were considered. Only surgeon and BMI were found to be significant and there was no significant interaction between these two parameters.

A multivariate analysis was performed using the grouped BMI as above. When patients were put into BMI groups there was no effect on complication rate, even after adjustment for the influence of the surgeon was made.

Discussion

We undertook this study to see if there was any justification in refusing joint replacement surgery to patients who are obese. Various authors have tried to look at the long-term results of joint replacements in obese individuals [4–6, 17, 18, 20, 22]. Some authors have found evidence of early failure and a slightly higher rate of revisions in morbidly obese individuals having a knee replacement [4]. There is no evidence to suggest that obese individuals having a hip replacement are at a disadvantage when it comes to long-term survival of a joint replacement [8].

Table 5 Correlation between complications and BMI divided into four groups

BMI groups		Complications	
		No	Yes
<25	Count	113	11
	% within BMI group	91.1	8.9
25–29	Count	201	15
	% within BMI group	93.1	6.9
30–34	Count	144	22
	% within BMI group	86.7	13.3
>34	Count	36	8
	% within BMI group	81.8	10.2

There is no doubt that surgical procedures are difficult in obese individuals. Patient transport, venous access, positioning, surgical procedure, and post-operative care can be extremely difficult with increasing BMI. However, with no conclusive evidence that there is any increase in the rate of systemic complications following surgery and no conclusive evidence of the early failure of a prosthesis, are we justified in refusing surgery to obese individuals on the basis of a high BMI?

In our study, there was a higher number of females; however, sex and age did not seem to make any difference in terms of complication rates.

Overall, there did seem to be a slight relationship between BMI and complication rates. When BMI was split in groups of less than 25, separated by a value of 5 with the final group being over 35, there seemed to be a gradual increase in the complication rates which was statistically significant (p=0.029).

Analysis of our group of patients has shown that there is a correlation between the surgeon and the complication rate, even after the contribution of BMI was accounted for, but this was not statistically significant (p=0.736).

In this study it seems that the rate of minor complications is very low compared with major complications. Only 2.2% (n=12) of patients had a minor complication following joint replacement surgery at our hospital. It is likely that a number of patients having a minor complication were treated at the primary care level and this was not recorded in the hospital notes.

Conclusions

In summary, it seems that age and sex does not affect the early complication rate following hip replacement surgery. There is a weak correlation between BMI and early complications following joint replacement surgery, which is statistically significant. There is a correlation between the surgeon and early complication rates following joint replacement surgery, but this is not statistically significant.

Obesity is detrimental to an individual's health and the authors do not want to promote the fact that obesity is acceptable for a patient undergoing elective joint replacement surgery. However, with only a weak correlation between BMI and the complication rate, an obese individual should be made aware of the slightly higher risk involved in such a surgical procedure and surgeons should be prepared to perform more complicated operations in order to guarantee a satisfactory outcome to these patients.

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