



Is Obesity Associated with Higher Complication Rates in Total Hip Arthroplasty for High-Riding Dysplastic Hips?

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Abstract

Objective Developmental dysplasia of the hip (DDH) is a disabling pathology leading to hip problems, such as painful arthritic hip, unstable hip, etc. Total hip arthroplasty (THA) is an effective treatment modality for this condition. Obesity has been shown to be associated with increased rates of complications following orthopaedic surgeries (Journal of Arthroplasty 20:46–50). The hypothesis of this study was that patients with a body mass index (BMI) greater than 30 (obese), who undergo total hip arthroplasty for dysplastic hip, are associated with longer operative and anaesthetic times, longer hospital stays and higher re-admission rates within 30 days.

Methods All the cases of total hip arthroplasty in patients with high-riding dysplastic hips were reviewed. Evaluation was made of a total of 68 patients comprising 64 females and 4 males, classified into two groups. Patients with BMI < 30 kg/m² formed the non-obese group and patients with BMI ≥ 30 kg/m² the obese group.

Results The mean age was 44.67 ± 6.49 years. BMI was < 30 in 44 (64.7%) patients and > 30 in 24 (35.3%) patients. The data analysis showed that mean surgical time, anaesthesia duration and re-admission rate were significantly higher in the group with BMI ≥ 30 (obese) as compared to the group with BMI < 30 (non-obese) ($p < 0.01$). The complication rate was determined to be higher in the obese group ($p < 0.05$).

Conclusion Obese patients performed with total hip arthroplasty for high-riding dysplastic hips had more complications and higher rates of re-admission to hospital compared with the non-obese patients.

Keywords Body mass index · Dysplastic hip · Total hip arthroplasty · Complications · Obesity

Introduction

Developmental dysplasia of the hip (DDH) is a disabling pathology leading to hip and lumbar vertebrae problems [2–5]. Although total hip arthroplasty (THA) is an effective treatment modality for this condition, it carries significant

challenges for surgeons [2, 6]. The surgical procedure itself entails specific difficulties including restoration of the normal hip centre, correction of excessive femoral anteversion and fitting the prosthesis in a narrow and straight medullary canal with the risk of neurovascular compromise by

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stretching, and often requires a femoral shortening osteotomy [7, 8].

According to the World Health Organization (WHO), obesity is defined as a body mass index (BMI) greater than 30 (kg/m^2) [9]. The increasing prevalence of obesity in the developed world represents a growing problem affecting the entire healthcare system. In orthopaedic patients, it is one of the most important reasons for premature osteoarthritis leading to a need for a joint arthroplasty procedure [10–12]. Obesity has been associated with increased rates of complications following orthopaedic surgeries, such as postoperative infections, intraoperative fractures, venous thromboembolism, dislocations and the need for revision surgeries [1, 13].

The aim of this study was to evaluate the risk posed by obesity in total hip arthroplasty for a dysplastic hip. It was hypothesised that obese patients ($\text{BMI} > 30$) who undergo total hip arthroplasty for a dysplastic hip, would be associated with longer operative and anaesthesia times, a longer hospital stay and higher rates of re-admission within 30 days.

Material and Methods

Approval for this retrospective study was granted by the Institutional Ethics Committee. The data were reviewed of cases of THA performed for dysplastic hips, including patient demographic data, surgical details, type of anaesthesia (regional versus general), ASA (American Society of Anaesthesiologists) status, length of stay (LOS) and the complications documented during postoperative follow-up whilst in hospital. LOS was defined as the duration of hospital stay from the day of admission for the index procedure until the day of discharge. The height and weight of the patient were routinely recorded in the pre-admission clinics or on the day of surgery by the trained nursing staff as

per our hospital practice. These values were used to determine body mass index (BMI). The patients were classified in two groups: the obese group comprised patients with $\text{BMI} \geq 30 \text{ kg}/\text{m}^2$ and the non-obese group, patients with $\text{BMI} < 30 \text{ kg}/\text{m}^2$.

THA was performed to 72 patients because of high congenital dislocations of the hip (Hartofilakidis type C) [14], (Crowe type 4) [15] by the same surgeon (M.E.) who had at least 10 years of experience in hip arthroplasty using the same surgical technique. Owing to the incomplete postoperative follow-up data, 4 patients were excluded, so final evaluation was made of 68 cases of THA performed because of high congenital dislocations of the hip, between March 2011 and March 2017. The mean age of the patients was 44.67 ± 6.49 years (range, 36–56 years) at the time of surgery.

All the operations were performed under general anaesthesia in the lateral decubitus position using the posterolateral approach. All the patients received a single dose of 1 gr intravenous tranexamic acid (TXA) before the skin incision was made and a further 750 mg dose of TXA at 4 h after skin closure. Cefazolin sodium at 1 gr dosage was administered to all patients as antibiotic prophylaxis before surgery and was continued for 24 h postoperatively. Low molecular weight heparin (4000 anti-xa IU/0.4 ml enoxaparin sodium) was administered as DVT prophylaxis and was continued for 30 days postoperatively. Biomet CDH (Zimmer Biomet, Warsaw, IN, USA) hip systems were used in the study (Fig. 1a–d). The perioperative variables collected were length of hospital stay, surgical time and anaesthesia time. Perioperative complications were defined as infection, dislocation, peri-prosthetic fracture, DVT and pulmonary embolus. The rates of postoperative re-admission within 30 days were also recorded. Superficial surgical site infection (SSI) was recorded if the patient developed either a superficial incisional SSI or prolonged wound leakage in the

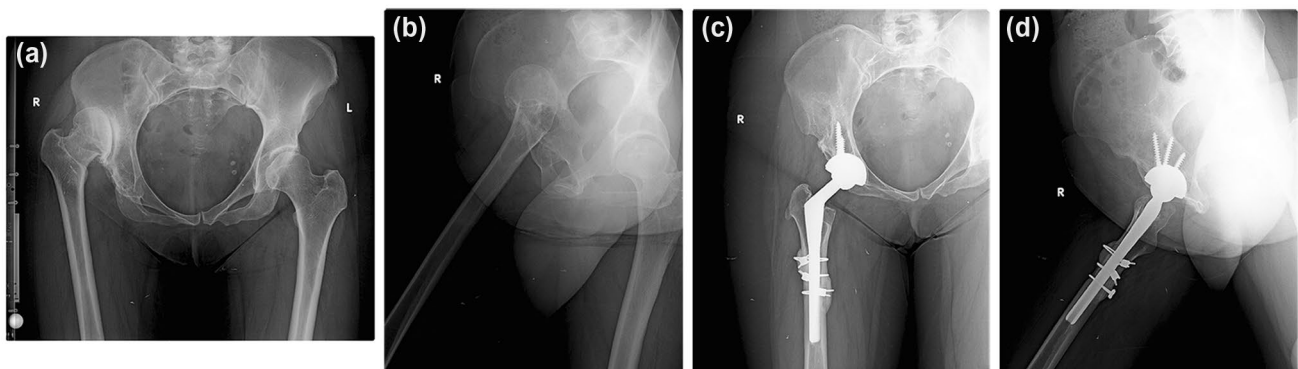


Fig. 1 **a** Preoperative AP radiograph of 45-year old female with high congenital dislocation, Crowe type 4. **b** Lateral radiograph of of 45-year old female with high congenital dislocation, Crowe type 4. **c**

Radiographs at 2 years after THA and Z subtrochanteric osteotomy. **d** Lateral radiograph at 2 years after THA and Z subtrochanteric osteotomy

30 days following arthroplasty surgery. Superficial incisional SSI was defined according to the criteria stated by the US Centers for Diseases Control and Prevention (CDC) [16, 17].

On the first postoperative day, active range of motion exercises was initiated together with toe-touch weight bearing on the operated side for 6 weeks. All the patients were mobilized using two crutches. After 6 weeks, control radiographs were obtained, and if the osteotomy site showed signs of healing, the patients were allowed full weight bearing. On discharge, patients were encouraged to attend the rehabilitation facility for physiotherapy.

Statistical Evaluation

The data obtained in the current study were analyzed statistically using IBM SPSS Statistics vn. 22.0 software. To compare two groups of parametric data, the Student's *t* test was used, and for non-parametric data, Fisher's Exact test. Logistic regression and linear regression methods were used to calculate risk coefficients. A value of *p* < 0.05 was considered statistically significant.

Results

Evaluation was made of a total of 68 hip arthroplasties in 68 patients, comprising 4 males and 64 females, with a mean age of 44.67 ± 6.49 years (range, 36–56 years). Arthroplasty

was performed to the left hip in 32 (47.1%) patients and to the right hip in 36 patients (52.9%). The mean body mass index (BMI) of all the patients was 30.59 ± 4.74 kg/m² (range, 25.88–38.10 kg/m²), with 44 (64.7%) patients with a BMI < 30 and 24 (35.3%) patients ≥ 30.

The data analysis showed that the mean surgical time, anaesthesia duration and re-admission rate were all significantly higher in the group with BMI ≥ 30 (obese) as compared to the group with BMI < 30 (non-obese) (*p* < 0.001). No statistically significant difference was determined between the groups in respect of hospital stay, ASA scores and amount of leg length shortening (*p* > 0.05) (Table 1). An unit increase in BMI was determined to increase surgery time 4.16-fold (*B* = 4.19; 95% CI 3.53–4.86). An unit increase in BMI was determined to increase the duration of anaesthesia 4.16-fold (*B* = 4.98; 95% CI 3.99–5.98). In obese cases, the risk of re-admission in the first postoperative month was determined to be 50-fold higher (ODDS Ratio = 50.0; 95% CI = 6.12–409.05).

Discussion

THA is an effective treatment modality for sequelae of developmental dysplasia of the hip (DDH) at late stages, such as painful arthritic hip, unstable hip, etc. However, due to the anatomic abnormalities, this procedure has high rates of complications and especially when obesity is associated,

Table 1 Evaluation according to BMI groups

	Total Mean ± SD	BMI < 30 Mean ± SD	BMI ≥ 30 Mean ± SD	<i>p</i>
Operation time (mins)	125.24 ± 21.72	111.18 ± 6.54	151.0 ± 13.92	0.001**^a
Anaesthetic duration (mins)	161.29 ± 27.04	144.64 ± 6.84	191.83 ± 22.73	0.003**^a
Hospital Stay (days)	4.0 ± 0.49	3.82 ± 0.41	4.33 ± 0.52	0.066^a
Leg length shortening (mm)	21.77 ± 7.28	22.72 ± 6.84	20.0 ± 8.37	0.478^a
	<i>n</i> ; %	<i>n</i> ; %		
ASA				
2	44; 64.7%	32; 72.75	12; 50%	0.265 ^b
3	24; 35.3%	12; 27.3%	12; 50%	
Readmission in first 30 days				
No	44; 64.7%	40; 90.9%	4; 16.7%	0.001**^b
Yes	24; 35.3%	4; 9.1%	20; 83.3%	
Dislocation	8; 11.8%	4; 9.1%	4; 16.7%	
DVT	8; 11.8%	0; 0%	8; 33.3%	
Superficial surgical site infection	8; 11.8%	0; 0%	8; 33.3%	

Min minute, cm centimetres

^aStudent's *t* test

^bFisher's exact test

***p* < 0.01, **p* < 0.05

it has been considered to be related to many complications, such as higher rates of postoperative infection, non-union and arthroplasty dislocation [18–21]. Several studies have compared the outcomes of THA between obese and non-obese patients, but there is limited literature on the outcomes between these groups in patients with high riding hip dysplasia. In the current study of 68 patients who underwent THA for high riding hip dysplasia, obesity was found to be a risk factor for numerous increased postoperative complications as compared to the patients with lower BMI, and when considering the patients who underwent revision THA, even after controlling the demographic data and medical comorbidities.

The mean operative time and anaesthesia time were 111.18 ± 6.54 and 144.64 ± 6.84 min, respectively, in the obese group and 151.0 ± 13.92 and 191.83 ± 22.73 min, respectively, in the non-obese group. The time difference was statistically significant between the two groups ($p < 0.01$). This difference can be attributed to the extensive soft tissue dissection and also difficulty in positioning the implant in the obese group. These results were similar to the findings of Lübbecke et al. [22]. In a retrospective cohort study, Zusmanovich et al. [23] also showed that the operative times were longer for obese patients. In a study of 751 hips in 714 patients performed with THA, Zhang et al. [24] also reported longer operation times for obese patients.

In comparison with non-obese patients, THA surgery in obese patients was associated with greater soft tissue damage in addition to prolonged operation time, which might explain the increased incidence of superficial and deep infections. Obesity has also been associated with higher rates of wound healing complications and greater morbidity [25]. Furthermore, in obese patients the intervention can be technically more challenging in respect of exposure, implant positioning and soft tissue closure [26]. In the present study, tranexamic acid was administered to patients by modifying the protocol recommended by Imai et al. in the practice of tranexamic acid [27]. In addition, it can be considered that an inadequate dose of tranexamic acid administered to obese patients may increase the intraoperative bleeding, which may in turn affect the duration of surgery. Moreover, high rates of SSI in the obese group can be considered to be a result of an insufficient antibiotic dose.

There was also a statistically significant difference between the groups with regard to the re-admission rate within 30 days ($p < 0.01$). There were more re-admissions in the obese group. DVT and superficial surgical site infection in particular were more common in the obese group. In many previous studies, obesity has been found to be associated with higher superficial and deep infection rates (24, 29–32). Longer operative times and prolonged exposure of the operative wound could be a risk factor for infections in obese patients. It can also be speculated that the physical

characteristics of obese patients, such as an increased subcutaneous fat might predispose them to infections.

In the present study, there was a significantly high rate of re-admission to hospital in the obese group related to deep venous thrombosis. Fu et al. [31] reported that there was no significant difference between obese and non-obese patients in respect of DVT in a retrospective large cohort study, whereas Werner et al. [30] reported higher rates of hospital re-admission because of DVT in obese patients. Mantilla et al. [32] found that increased BMI independently increased the DVT rate. It can be speculated that anecdotally obese patients could be slower to mobilize postoperatively, which can be a risk factor for venous thromboembolism as stated by Zusmanovich et al. [23]. In the current study, obese and non-obese groups, the same treatment protocol to avoid DVT was used, so it may be that an insufficient dose of low molecular weight heparin could have been associated with the higher percentage of DVT in the obese patients. Therefore, the DVT protocol of obese patients should be determined according to their BMI.

Alberston et al. [33] stated that the crude incidence rate of dislocation was 3.1 times higher in obese individuals. Kennedy et al. [34] also reported that obese patients suffered higher rates of dislocations as compared to non-obese patients. The present study also confirmed the conclusions of these previous studies on the dislocation rates of obese and non-obese patients. This could be related to the soft tissue dissection for exposure and prosthesis application.

When the two groups were compared in respect of perioperative femoral fracture occurrence rate, there was no significant difference. However, biomechanics evaluation has shown that when body mass index was $> 33 \text{ kg/m}^2$, femoral specimens had a significantly higher rate of periprosthetic fracture [35]. Ibrahim et al. [36] reported no difference in the rate of intra- and postoperative complications between obese and non-obese patients. In another case-control study, Zhao et al. [37] stated that body mass index had no significant effect on the incidence of intraoperative proximal femoral fracture. Although the sample size of the current study was not large enough to have a strong opinion, it can be considered that the absence of a significant difference between the groups was due to well-planned preoperative sizing of prosthesis, that is, templating the implant selection and prophylactic cerclage usage as required.

Limitations of this study included being a retrospective design, relatively small sample size and short-term observations of complications in patients with THA for high riding hips. Furthermore, conditions that could be a risk factor for complications, such as comorbid diseases (diabetes mellitus, cardiovascular disease, renal disease etc.) and the nutritional status of patients, postoperative mobilization time, age and family history were not included in the evaluations. However, strong aspects of the study were the use of

a well-documented database and that all the operations were performed by the same surgeon. To the best of our knowledge, this is the only study in the literature to date that has examined complications in obese patients undergoing THA for high riding hips.

In conclusion, total hip arthroplasty in obese patients suffering from high riding dysplastic hips had more complications and higher re-admission rates to hospital when compared with the non-obese patients. It can be recommended that patients with high BMI (> 30) should be informed about the greater risk of complications in these operations and surgeons who perform the operation should take precautions related to those risks. Furthermore, antibiotics and DVT prophylaxis should be administered at an appropriate dose for the weight of the patient.

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Compliance with Ethical Standards

Conflict of interest None of the authors of this manuscript received funding, grants or in-kind support in support of this research or the preparation of this manuscript. The authors have no financial relationships with any company. Each author certifies that he or she has no commercial associations (e.g. consultancies, stock ownership, equity interest, patent/licensing arrangements, etc.) that might pose a conflict of interest in connection with the submitted article. The authors declare that the research for and communication of this independent body of work does not constitute any financial or other conflict of interest.

Ethical standard statement The present study was approved by the ethical Committee of Sakarya University, Faculty of Medicine. (2018/158).

Informed consent Informed consent was obtained from all individuals participants included in the study.

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