Intra-Operative and Post-Operative Impact of Body Weight on Total Hip Arthroplasty: Are We Approaching It Correctly?

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ABSTRACT

Background: To this date, the impact of body weight on total hip arthroplasty is still debated. The literature lacks evidence on the impact of body weight on surgical times and complications.

Methods: We retrospectively evaluated all the patients who underwent primary total hip arthroplasty (THA), collecting patients' pre-operative BMI before surgery. We recorded the surgical approach performed (anterior or posterolateral), and their duration. All the major complications were recorded.

Results: Seven-hundred-thirty-two cases were included (627 posterolateral and 105 anterior approach). The mean BMI was 27.3. The mean surgical time was 90.8 minutes (104.9 for anterior and 88.5 for posterolateral approach). We found a significant positive relationship between BMI and surgical times for both cases treated with a posterolateral approach, and (even more remarked) in case anterior approach. Thirty-nine cases (5.3%) had major complications; 27 of them (69.2%) were overweight or obese. The surgical times of those who had complications were significantly higher compared to others.

Conclusions: Patients' body weight, and in particular their Body Mass index, has a direct impact on the duration of THA surgical procedures, particularly if performed using an anterior approach, and an indirect effect on complication rates.

KEYWORDS

BMI; THA; arthroplasty; osteoarthritis; anterior approach; posterolateral approach

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INTRODUCTION

Obesity is a pathology on the rise, as it has reached epidemic proportions in many Western countries (1, 2). Obesity is associated with a series of other pathologies, such as asthma, type 2 diabetes, hypertension, sleep apnea, and cardiovascular diseases due to weight gain and the accumulation of visceral adiposity, which increases the release of pro-inflammatory hormones and cytokines (3–5). All these comorbidities concur to make obesity a serious issue for individuals' health and a major source of cost for national healthcare systems all over the world (1, 2).

Increased adiposity and a higher body mass index (BMI) also impact the musculoskeletal system by increasing the joint load and progressively leading to osteoarthritis. Characterized by loss of articular cartilage, bone hypertrophy, and joint capsule thickening, osteoarthritis is a progressive pathology that causes joint pain and consequent functional limitation, particularly in the hip joint (5, 6).

Although conservative approaches like the administration of NSAIDs or local infiltrations can temporarily counteract the clinical symptoms and delay articular degeneration, surgery with prosthetic replacement still represents the treatment of choice for advanced hip osteoarthritis (7–9).

Body mass and weight enhance articular degeneration, increase the rates of earlier prosthetic replacements, and, according to some authors, may also be responsible for complications, including infections and wound dehiscences (10, 11).

This study aims to evaluate the correlation between patients' BMI, operating times, and peri- and postoperative complications between two groups of patients treated with total hip arthroplasty (THA) using anterior and posterolateral approach.

MATERIALS AND METHODS

This single-center retrospective study was conducted according to the ethical standards in the 1964 Declaration of Helsinki and its later amendments.

Our study consisted of a review of all patients with hip osteoarthritis treated with THA in our institution between January 2020 and December 2023. The data of all patients were collected in a digital database. Inclusion criteria were (I) a pre-operative diagnosis of primary hip osteoarthritis (grade II–III according to the Tönnis classification), (II) an anterior or posterolateral surgical approach, (III) a primary implant with cementless prosthesis, and (IV) a follow-up longer than 12 months. Exclusion criteria were (I) a hip fracture at the moment of hospitalization, (II) a history of avascular necrosis of the femur head, (II) previous surgeries in the treated hip of the nearby inguinal or gluteal region, and (IV) pre-operative neurological deficits or other systemic diseases that could have impeded a proper rehabilitation, and reduced patients' mobilization after surgery. All surgical procedures were performed by high-volume surgeons, experts in both surgical approaches. The approach of choice was chosen by the single surgeons based on their personal preference for the anatomical characteristics of each single patient.

Patients were divided into two groups depending on the surgical approach performed. Group A included cases treated with a posterolateral approach, whereas patients that received an anterior approach to their hip were included in Group B.

We collected general data for each patient, including age, gender, height, and weight at the moment of surgery. The latter were used to calculate the BMI. We recorded the duration of each procedure for each patient. We reported each intraoperative or postoperative complication with a Clavien-Dindo grade III or higher.

Follow-up data were collected and recorded in our database as patients underwent our standardized postoperative protocol. The protocol consisted of serial office visits, clinical evaluations, and postoperative X-rays performed within one month (clinical evaluation only) and later 3, 6, and 12 months after surgery. Further evaluations were scheduled on a yearly basis, with eventual changes depending on each patient's needs.

STATISTICS

Statistical analysis was performed using Stata SE 13 (StataCorp LLC, College Station, TX). Statistical significance was set at 0.05 for all endpoints.

RESULTS

Seven hundred thirty-two cases met our inclusion criteria and were thereby included in our study. There were 402 females and 330 males, with a mean age of 74.7 years (48–87). Six hundred twenty-seven cases had a posterolateral approach and were therefore included in Group A, whereas 105 cases received an anterior approach and were enrolled in Group B. The mean BMI of our whole population was 27.2 (16.9–48.7): 27.4 (17.5–48.7) for Group A and 25.8 (16.9–39.3) for Group B. Among our 732 patients, 311 (43.5%) were overweight and 172 (23.5%) were obese. In particular, within Group A, 206 (33%) were normal weight or underweight, 262 (42%) were overweight, and 157 were obese (25%). Group B had 45 normal weight or underweight cases (43%), as many overweight, and 15 obese (14%).

The mean duration of surgical procedures was 90.8 (30–235) minutes: 88.5 (30–235) for posterolateral approaches (Group A) and 104 (50–180) for anterior approaches (Group B). A Pearson correlation test reported a statistically significant direct correlation between all patients' BMI and surgical times ($r = 0.148$; $p = 0.00005$). Performing the same test separately for the two groups, although the correlation was statistically significant also for Group A ($r = 0.113$; $p = 0.00443$), we observed a particularly strong correlation between BMI and surgical times in Group B ($r = 0.478$; $p < 0.00001$).

Thirty-seven cases, accounting for 5.0% of all treated patients, had significant complications. The most frequent complications were infections (12), aseptic loosening (7), periprosthetic fractures (5), hematomas, and neurological damage (3). Table 1 details all complication types.

Tab. 1 A schematic resume of our population, sorted in the middle into two groups according to the surgical approach and on the left into three columns according to the patient's BMI.

	TOTAL	GROUP A (Posterolateral)	GROUP B (Anterior)	Normal Weight (BMI < 25)	Over Weight (25 < BMI < 30)	Obese (BMI > 30)
Number of cases	**732**	**627**	**105**	**249**	**311**	**172**
Mean BMI	**27.2** (16.9–48.7)	**27.4** (17.5–48.7)	**25.8** (16.9–39.3)			
Mean surgical time	**90.8** (30–235)	**88.5** (30–235)	**104.9** (50–180)	**88.5** (30–200)	**90.1** (35–235)	**95.3** (55–180)
Complications	**37**	**31** (84%*)	**6** (16%*)	9 (24%*)	18 (49%*)	**10** (27%*)
Infections	12	11	1	1	9	2
Aseptic loosening	7	7	0	1	3	3
Periprosthetic fracture	5	3	2	1	3	1
Neurological damage	3	3	0	1	1	1
Hematoma	3	2	1	1	1	1
Seroma	2	2	0	2	0	0
Wound dehiscence	2	2	0	1	0	1
Other	3	1	2	1	1	1

* Relative percentage among all complications.

Twenty-eight of the 37 patients who had complications (76%) were overweight (18; 49%) or obese (10; 27%). The mean BMI of those who developed complications was 28.8 (22.0–43.0). A Withney-Mann test reported that those who developed complications had a significantly higher BMI compared to those who did not develop any complication ($p = 0.02341$). Furthermore, according to another Withney-Mann test ($p = 0.00059$), the surgical times of those who had complications were significantly higher than those who did not develop complications. Our cohort's size was insufficient to detect whether one surgical approach had a higher complication rate than another.

DISCUSSION

Surgical timing is known to have a crucial role in determining the outcomes of hip arthroplasty (12, 13). Limiting surgical times intuitively shortens the duration of anesthesia, reduces blood loss, and minimizes the risk of infection by restraining the exposition of the surgical site (14–16).

That increase in operating time can be attributed to several aspects.

Intuitively, tissue dissection is required to reach the joint plane, and larger adipose masses require longer dissections. At the end of the procedure, the same goes for suturing the access, a step that takes more time in patients with wide subcutis surfaces.

These latter may not allow for tracing the landmarks necessary to perform the surgical approach and expose the acetabulum, and may limit exposure of the joint unless largely extending the skin incision (17).

Furthermore, the intraoperative moves to place and reduce the joint prosthesis can be more difficult due to the increase in the masses to maneuver (18).

Finally, as suggested by Cannata et al. (19), the link between body weight and surgical time could also be related to the comorbidities that, in many cases, accompany obese patients.

Our study demonstrates a statistically significant linear correlation between patients' BMI and surgical times. On average, heavier patients had longer surgeries. Although this correlation was significant for both anterior and posterolateral approaches, it was noticed that the correlation between high BMI and increased surgical time was particularly evident in anterior hip arthroplasty operations.

Some authors already investigated the influence of BMI on anterior THA surgical timing, mostly focusing on obese patients (19, 20). Cannata et al. (19) and Antoniadis et al. (20) and showed increased operating times in THA surgery with direct anterior access. Russo et al. (21) found greater success and fewer complications in normal-weight patients than patients with high BMI during the direct anterior approach. Our findings are consistent with those of Russo et al. and allow for a direct comparison between two of the most used surgical approaches to the hip. According to our experience, the anterior approach seemed to be the most sensitive to BMI variations, and this difference should be considered by surgeons who are experts in both techniques and face severely overweight and obese cases.

Several studies in modern literature suggest that increased body mass index, overweight, and particularly obesity also increase the risk of complications directly or indirectly related to orthopedic surgical procedures (19, 22–26).

In a recent paper, Schmerler et al. (27) analyzed the outcomes of a survey on over eighty thousand patients who underwent revision total hip arthroplasty in the United States of America. Their results suggest that BMI was associated with the rates of some of the most common com-

plications in hip arthroplasty. Compared to normal-weight patients, overweight and obese patients were 10% more likely to have a revision due to periprosthetic joint infections (PJIs). However, the same study also reported that obese patients were 19% less likely to have a revision due to dislocation, suggesting that the patient's weight and BMI might modulate the relative risk of complications rather than increasing their overall likelihood.

The impact of obesity on postoperative complications was also evaluated on an even larger scale by Onggo et al. (23), who published a literature review on over two million THA patients from sixty-seven studies. According to their findings, obese patients had higher global complication rates and were significantly more at risk of developing infections and dislocations compared to non-obese people.

Our outcomes mainly align with these observations. In our population, those who developed complications had a significantly higher BMI compared to those who did not develop any complications. Our cumulative complication rate was 3.6% for normal-weight patients, whereas it rose to 5.8% for both overweight (BMI between 25 and 30) and obese patients (BMI higher than 30). These data suggest that not only obesity but also overweight could be exposed to a higher risk of complications after THA.

Infections and dislocations are among the most common complications in THA surgery (28, 29). The lack of revision surgeries due to dislocations did not allow us to evaluate the impact of BMI on this eventuality. Infections, instead, represented the most frequent reason for prosthetic failure in our cohort and were more common among overweight and obese patients than normal-weight patients.

In our study, surgical times and the risk of developing postoperative complications were directly correlated, as the surgical times of those with complications were significantly higher than those of the remaining patients. In our population, surgical time was also linked with BMI, therefore increments of this latter could indirectly raise the risk of postoperative complications.

We are aware that our study is not free of limitations.

The retrospective nature of our study did not allow the complete standardization of intraoperative procedures and postoperative follow-ups for each patient. Another limitation is the monocentric nature of our study, which limited the number of available cases and partially limited the statistical significance of some of the data associations we wanted to investigate at the beginning of our research. These limits could be overcome by performing similar evaluations on a prospective basis and with broader populations.

Beyond these limits, our findings could increase our knowledge of BMI's impact on THA surgery. In our study, an increased BMI led to significantly longer surgical times in patients treated using both posterolateral and anterior approach, with this latter being the most sensitive to body mass variations. Furthermore, patients with a higher BMI were most likely to develop postoperative complications and require revision surgeries. These findings confirm the importance of weight in determining the ease of the surgical procedure alone and the success of the whole treatment.

Patients' weight should be considered when planning the surgical approach. They should be made aware that being overweight and obese could increase their risk of developing surgery-related complications and potentially undermine the success of THA. For these reasons, when feasible, overweight patients should be encouraged to lose their weight before surgery and avoid returning to a higher body mass index in the postoperative phase.

CONCLUSION

Patients' body weight, and in particular their Body Mass index, has a direct impact on the duration of THA surgical procedures, particularly if performed using an anterior approach, and an indirect effect on complication rates.

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