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Obesity Increases the Risk of Postoperative Complications and Revision Rates Following Primary Total Hip Arthroplasty: An Analysis of 131,576 Total Hip Arthroplasty Cases

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ABSTRACT

Background: The aim of our study is to evaluate the association of body mass index (BMI) and the risk of postoperative complications, mortality, and revision rates following primary total hip arthroplasty given other potentially confounding patient characteristics in a large cohort study.

Methods: Using nationwide billing data for inpatient hospital treatment of the biggest German health-care insurance, 131,576 total hip arthroplasties in 124,368 patients between January 2012 and December 2014 were included. Outcomes were 90-day mortality, 1-year revision procedures (with and without removal or exchange of implants), 90-day surgical complications, 90-day femoral fractures, and overall complications. The effect of BMI on outcome was analyzed using multivariable logistic regression. Risk-adjusted odds ratios (ORs) and 95% confidence intervals (CIs) were calculated.

Results: BMI had a significant effect on overall complications (30–34 in kg/m²: OR 1.1, CI 1.0–1.2, *P* = .014; 35–39: OR 1.5, CI 1.3–1.6, *P* < .001; ≥40: OR 2.1, CI 1.9–2.3, *P* < .001; <30: reference). The OR for 1-year revision procedures (30–34: OR 1.2, CI 1.1–1.4, *P* = .001; 35–39: OR 1.6, CI 1.4–1.8, *P* < .001; ≥40: OR 2.4, CI 2.1–2.7, *P* < .001; <30: reference) and 90-day surgical complications increased with every BMI category. For mortality and periprosthetic fractures there was a higher risk only for patients with BMI ≥40.

Conclusion: BMI increases the risk of revision rates in a liner trend. Therefore, the authors believe that patients with a BMI >40 kg/m² should be sent to obesity medicine physicians in order to decrease the body weight prior elective surgery.

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Obesity is the leading cause of preventable death worldwide [1,2] with an increasing prevalence over the last 3 decades [3]. For example, in the United States, the age-adjusted prevalence of obesity in 2013–2014 reached 35% among men and 40.4% among women [4]. Similar findings have been demonstrated in Germany [5]. In general, growth in the prevalence of obesity is a global reality, and it has been projected to rise by 40% within the next decade [6–8].

Obesity is associated with a higher incidence of medical comorbidities such as cardiovascular disease, chronic kidney disease, or metabolic syndrome [9–11]. Focusing on orthopedics, obesity is a significant contributor to the development of osteoarthritis (OA) [5,12]. The risk of undergoing primary total hip arthroplasty (THA) at an earlier age is higher in obese patients as reported by Guenther et al [5]. In their study, patients with a body mass index (BMI) >40 kg/m² were approximately 7 years younger at the time of primary THA compared to patients with a BMI <30 kg/m². However, the risk of perioperative and postoperative complications was similar in obese and normal patients in their study cohort of 6078 cases [5].

In contrast, other studies have shown increased complications after THA, including prolonged wound drainage, an increase in deep venous thrombosis, and a higher rate of superficial or deep infection in obese patients [13–17]. The majority of prior studies have presented single-center results involving less than 10,000 patients [13–17].

In a recent publication by Adhikary et al [18], a cohort of 49,475 primary THA subjects was analyzed, under the auspices of the American College of Surgeons National Surgical Quality Improvement Program. The authors concluded that a BMI >45 kg/m² is associated with dramatically higher postoperative complication rates following primary THA and total knee arthroplasty (TKA).

In the current investigation, we used the German insurance claims database to evaluate the following research question: Is there any association between BMI and postoperative complications, mortality, and revision rates following THA? If yes, is there an increase with higher BMI? Other potentially confounding patient characteristic are included in the largest cohort study, to the authors' best knowledge, to date.

Materials and Methods

Database Characteristics

Data were collected from the German healthcare insurance Allgemeine Ortskrankenkasse (AOK). The AOK provides nationwide healthcare insurance for approximately 30% of the German population [19] and is the largest provider of statutory healthcare insurance in Germany. Everyone is allowed to enroll in the AOK regardless of factors such as age, pre-existing comorbidities, income, or type of employment. Anonymized nationwide administrative claims data were analyzed for inpatient episodes (including diagnoses, procedures, length-of-stay, transfers, and discharge type) and core data (including age, gender, insurance status, and survival status). Diagnoses were coded according to the 10th revision of the International Classification of Diseases (ICD-10) [20]. Procedures were documented using the German version of the International Classification of Procedures in Medicine [21] the "Operationen-und Prozedurenschlüssel" (OPS).

Healthcare providers and healthcare insurances jointly issue binding guidelines for coding of diagnoses and procedures in hospital claims. Hospital claims data in Germany are thoroughly checked against these guidelines and for plausibility by the Medical Review Board of the Social Health Insurance Funds and are returned

to hospitals for correction if necessary. Corrections are included in the claims data used in this analysis.

All AOK-insured patients over the age of 20 years, who had undergone either THA (OPS code "5-820.0X") or short-stem THA (OPS code "5-820.9X") between January 2012 and December 2014 for diagnoses of OA (M16), osteonecrosis (M87), or rheumatoid arthritis (M05–M08) of the hip, were identified and initially included in this study. Bilateral hip replacement surgery during the study period was counted as 2 separate cases. Patients were excluded from the study if they met any of the following criteria: a diagnosis of post-traumatic arthritis of the hip (M16.4, M16.5); surgery involving the hip joint within 2 years of hip replacement surgery; a diagnosis of neoplastic disease, osteoporosis, cystic bony pathology involving the femur or pelvis, and a history of hip dysplasia.

Outcome Measures

The analysis endpoints were complications corresponding to the definitions of hospital quality indicators for hip replacement, which were developed by the Research Institute of the Local Health Care

Table 1
Demographic Characteristics.

	Cases	
	n	%
Number	131,576	100.00
Age (y)		
<50	7147	5.4
50–59	18,364	14.0
60–69	29,607	23.0
70–79	55,305	42.0
80–89	20,486	15.6
>89	685	0.5
Female gender	79,590	60.5
Primary indication		
Osteoarthritis	127,532	96.9
Osteonecrosis	3956	3.0
Rheumatoid arthritis	88	0.1
Type of prosthesis		
THA	123,678	94.0
Short-stem THA	7898	6.0
Fixation		
Cemented	12,752	9.7
Uncemented	95,435	72.5
Hybrid	23,389	17.8
BMI (kg/m ²)		
<30	110,628	84.1
30–34	11,209	8.5
35–39	6134	4.7
≥40	3607	2.7
Comorbidities (sorted by frequency) ^a		
Hypertension	83,666	63.6
Diabetes mellitus	22,672	17.2
Fluid and electrolyte disorders	14,910	11.3
Cardiac arrhythmia	14,680	11.2
Renal failure	10,836	8.2
Chronic pulmonary disease	10,263	7.8
Congestive heart failure	9161	7.0
Depression	5812	4.4
Peripheral vascular disorders	3905	3.0
Valvular disease	3384	2.6
Rheumatic disease	3242	2.5
Coagulopathy	2881	2.2

^a Double entries possible; sorted by descending frequency; other analyzed comorbidities with frequency <2% are not shown (pulmonary circulation disorders, liver disease, blood loss anemia, deficiency anemia, hypothyroidism, peptic ulcer disease excluding bleeding, weight loss, paralysis, alcohol abuse, drug abuse, psychoses, neurological disorders, AIDS/HIV).

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