The impact of tobacco use and body mass index on the length of stay in hospital and the risk of post-operative complications among patients undergoing total hip replacement

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We carried out a retrospective cohort study of 3309 patients undergoing primary total hip replacement to examine the impact of tobacco use and body mass index on the length of stay in hospital and the risk of short term post-operative complications.

Heavy tobacco use was associated with an increased risk of systemic post-operative complications (p = 0.004). Previous and current smokers had a 43% and 56% increased risk of systemic complications, respectively, when compared with non-smokers. In heavy smokers, the risk increased by 121%. A high body mass index was significantly associated with an increased mean length of stay in hospital of 4.7% and 7%. The risk of systemic complications was increased by 58% in the obese. Smoking and body mass index were not significantly related to the development of local complications.

Greater efforts should be taken to reduce the impact of preventable life style factors, such as smoking and high body mass index, on the post-operative course of total hip replacement.

Given the large number of patients who undergo total hip replacement (THR) it is important both clinically and for public health, to identify those patients who are more susceptible to post-operative complications. We therefore studied the impact of tobacco use and body mass index (BMI) on the post-operative complications following THR and the length of stay in hospital using prospectively collected exposure information from a large, nationwide occupational cohort.

It is widely accepted that smoking is an important risk factor for the development of post-operative complications. To our knowledge, the impact of total life-time tobacco smoking and different types of tobacco products on the outcome of THR has not previously been reported.

Similarly, few studies have looked at the impact of BMI on the outcome of THR. Namba et al suggested an association between obesity and post-operative wound infection, but their study was based only on univariate analysis and did not consider potential confounding factors.

Patients and Methods

The Construction Industry's Organisation for Working Environment, Safety and Health (Bygghälsan) was established in 1968 and provided out-patient medical services to construction workers throughout Sweden between 1969 and 1992. The organisation was a joint venture launched by the trade unions and the corresponding employers associations, which offered preventative health check-ups to all workers in the industry. Data from these check-ups were kept in a central register.

The workers filled in a questionnaire before each visit and to minimise any misunderstanding or inconsistency, the answers were double-checked by a nurse in the patient's presence. Each worker underwent a mean of three (1 to 9) health check-ups over six to nine years. The questionnaire collected data including a detailed smoking history, anthropometric measurements, and occupation. The quality of the data on smoking has been reviewed and when answers between two and three years apart were compared perfect accordance was found in 89%. Figures were missing for 1.3% of current and 1.4% of previous smokers and inconsistencies were found in 2.6% of the smoking data. There were inconsistencies in the oral snuff data for 7% of the workers.

The Swedish Inpatient Register stores diagnostic hospital discharge data, and each record corresponds to one hospital admission and contains up to six discharge diagnoses, coded according to the current International Classification of Disease (ICD). Patients were identified through their national registration
numbers which are embedded in each record. The register has been evaluated for validity and completeness, and the codes for the main diagnoses were correct at three-digit level for 92% to 94% of the records on surgical patients. For surgical procedures excluding endoscopies or biopsies, the codes were incorrect for 2% of the records and were missing for 5.3%. We were able to follow each patient up to the end of 2002.

Using the Construction Industry’s Organisation for Working Environment and the Swedish Inpatient Register, we identified workers who had undergone elective primary THR for osteoarthritis. We excluded women (because gender could be a possible confounding variable), patients who had undergone a previous THR and those who had their THR as an emergency procedure. We also excluded patients with rheumatoid disease, secondary osteoarthritis, lower extremity fractures, all those who had previous orthopaedic surgical procedures from the lower back to the ankle joint, and those with erroneous personal identification numbers. The final cohort consisted of 3309 male patients.

Two different outcomes were studied; length of stay in hospital and post-operative complications. In order to study the length of stay in hospital, each patient was followed up until the day they returned home. Five patients died in the immediate post-operative period and were excluded from the final analysis. Of the remaining 3304 patients, 3077 (93%) were discharged home from the hospital and post-operative complications. In order to follow each patient up to the end of 2002.

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The BMI of the patients was divided into three groups according to the World Health Organization (WHO) criteria; normal weight (18.5 kg/m$^2$ to 24.9 kg/m$^2$), overweight (25 kg/m$^2$ to 29.9 kg/m$^2$) and obese (> 30 kg/m$^2$). No patient was underweight (< 18.5 kg/m$^2$). The mean age at the time of surgery was 65.6 years (33 to 89). The mean BMI was 26.4 kg/m$^2$ (18.5 to 43.5), with overweight and obese patients accounting for 64.8% (2142) of the study population. The median length of stay in hospital increased from nine days for patients with a normal BMI to 10 days in the obese group. With regards to the overall smoking status, 38.6% (1275) of the patients had never smoked, 32.9% (1087) were current smokers and 28.5% (942) had smoked previously. The use of snuff (22.5%; 744) was not as common as smoking. The cohort consisted of 33.1% (1095) who had never used tobacco in any form, 23.1% (763) cigarette users, 8.8% (290) pipe or cigar users, 5.5% (180) who used snuff exclusively and 27.9% (922) who used a combination of products. This data was missing for 54 patients (1.6%). The median length of stay in hospital did not vary much between patients with different forms of tobacco use. Patients with diabetes, congestive heart failure, chronic obstructive lung disease, or a past history of an acute cerebrovascular or cardiovascular event had a longer stay in hospital.

Multivariate analyses were performed to identify the impact of different tobacco-related variables and BMI on the mean length of stay in hospital. In a multivariate model, increasing BMI was significantly associated with an increased mean length of stay (p < 0.001). On a log scale,
after adjustment, the mean length of stay in hospital among overweight and obese patients increased 0.05 and 0.07 respectively when compared with those of normal weight. However, there was no statistically significant association between smoking status or tobacco preference and the mean length of stay after adjustment for the other covariates in the model (age, calendar period, BMI, medical region, diabetes, congestive heart failure, chronic obstructive lung disease and a history of previous cerebrovascular or acute myocardial events).
Post-operative complications. In total, 373 of 3309 patients (11.3%) developed one or more post-operative complication. Systemic complications developed in 268 patients, comprising 113 (3.4%) venous thromboembolisms, 44 (1.3%) acute cardiac or cerebrovascular events, 69 (2.1%) cases of post-operative anaemia, blood transfusion or gastrointestinal bleeding, 57 cases (1.7%) of urinary tract infection or pneumonia and 14 cases (0.4%) of death within 60 days. A total of 128 patients developed one or more local complications comprising 89 (2.7%) prosthesis-related complications and 41 (1.2%) wound-related complications. The baseline characteristics of patients developing post-operative complications are presented in Table II.

We found a significant increase in the risk of systemic post-operative complications associated with overall smoking status (p = 0.013). When adjusted by multivariate logistic analysis, previous and current smokers had a 43% (odds ratio (OR) 1.32, 95% CI 1.04 to 1.97) and 56% (OR 1.56, 95% CI 1.14 to 2.14) increased risk respectively of suffering from systemic post-operative complication compared with non-smokers. The preference for different tobacco products was not significant.

A higher number of pack years of tobacco smoking was found to be significantly associated with an increased risk of systemic post-operative complication (p = 0.004). When adjusted by multivariate logistic analysis, membership of the heaviest tobacco smoking group was associated with a 121% (OR, 2.21; 95% CI 1.28 to 3.82) increased risk of systemic complications when compared with non-smokers. However, the estimated OR (1.35; 95% CI 0.99 to 1.84) for those smoking for 0 to 19.9 pack years was not found to be significantly different to that of non-smokers.

There was a tendency for the risk of systemic post-operative complications to rise with increasing BMI (p = 0.082). In the obese group, there was a 58% (OR, 1.58; 95% CI 1.06 to 2.35) increased risk of systemic post-operative complications compared with those of normal weight.

No statistically significant association was found between smoking status, preference of tobacco product or pack years and local complications.

Discussion
The results of our study show that tobacco smoking substantially increases the risk of developing systemic post-operative complications. This increase is seen most prominently in the heaviest tobacco smokers, with a risk that is twice as high as that for those who have never smoked. A previous study on patients undergoing hip and knee replacement showed that any history of smoking increased the risk of overall post-operative complications. Our study has the advantage of using prospectively-collected information on tobacco exposure and is based on a very large sample size. Furthermore, it is able to highlight the impact of the total life-time dose of tobacco on the outcome of THR. Although the Swedish Inpatient Register gives a very accurate main discharge diagnosis, we are aware that the data on secondary discharge diagnoses could be incomplete or misclassified. However, it is reasonable to assume that misclassifications or missing data occurring in this registry are evenly spread across all types of smoker.

Of particular interest is the estimated increased risk of systemic post-operative complications due to a high BMI. Previous studies have shown an increase in the incidence of post-operative complications among patients undergoing procedures such as solid pancreas organ transplantation, prostatectomy and radical cystectomy. Smokers and the obese are prone to chronic systemic diseases. Poor health may make these patients more susceptible to systemic complications. The incidence of post-operative complications after knee or hip replacement is substantially reduced if patients stop smoking before surgery.

In this study, there was no significant association between smoking status and the incidence of local complications. Previous studies have shown an increased risk of wound-related complications among smokers. Relatively few of our patients developed these (1.2%). We are aware that wound-related complications may be under-reported. Furthermore, detection of factors affecting the survival of the prosthesis need longer follow-up periods. Therefore, our analysis of tobacco status on local complications may lack the statistical power to detect a significant difference in rates of complication between the different groups.

There was no correlation between the median length of stay in hospital and smoking status. This is consistent with the results of previous studies of patients undergoing orthopaedic operations. Our findings could, in part, be explained by the minimal variation in the median length of stay in hospital between the different tobacco status groups. We were not able to detect any statistically significant difference between these groups.

Patients with high BMI seemed to spend up to 7% longer in hospital. This may increase the costs to the health care system.

Our findings show that smoking and obesity substantially increase the risk of systemic complications after THR. Greater attention should be paid to these factors when preparing patients for surgery.

Supplementary Material
Supplementary tables showing the statistical analysis of changes in the length of stay in hospital according to smoking status and body mass index are available with the electronic version of this article on our website at www.jbjs.org.uk

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References


