Patient Related Pre-Operative Factors Influencing Return to Work After Total Knee Arthroplasty

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Each author certifies that his or her institution has approved the human protocol and that all investigations were conducted in conformity with ethical principles of research.

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Abstract

Background

Osteoarthritis is one of the leading causes of disability in working-age patients. Total joint arthroplasty is an effective procedure to reduce pain and functional disability when non-surgical methods fail to provide adequate relieve of symptoms due to end-stage osteoarthritis. The total number of working-age patients undergoing total knee arthroplasty is continuously increasing.

Methods

We used Cox proportional hazard models to examine patient-related prognostic factors that may influence the rate of return to work after total knee arthroplasty in a large cohort of patients working in public sector in Finland (n=452; n=90 male, n=362 female; mean age 56.4y, SD 5.1). Prognostic factors were measured on average 3.6 years before the operation. Of the patients, 83% (394 out of 452) returned to work after knee arthroplasty.

Results

87% (n=394) of patients returned to work and the mean length of return to work was 116 days. In multivariate analysis, patients at sick-leave $\leq$30 days during the last year before surgery were 2.2 (95% confidence interval 1.72-2.92) times more likely to returned to work compared with those with >30 days of sick-leave. Compared to patients in manual work, those in higher or lower level non-manual work showed a 2.6-fold (1.95-3.52) and 1.5-fold (1.15-1.92) increased probability returning to work. Age, gender, health risk behaviors, obesity, physical comorbidities or, common mental disorders, and other studied health-related factors were not associated with the rate of returning to work.

Conclusions

In this occupational cohort study amongst public sector employees, almost 90% of the patients who underwent a total knee replacement returned to work. Non-manual job and good self-rated general health predicted a higher rate of return to work while the other studied socioeconomic factors were not associated with return to work. Work modifications, starting of appropriate conservative treatment and correct timing of total knee arthroplasty may ensure patients work abilities.

Introduction

Osteoarthritis is one of the leading causes of disability in working age patients [42, 46]. Total knee arthroplasty (TKA) is a cost-effective treatment modality that relieves pain, restores function, and improves mobility and improves health related quality of life of patients with end-stage osteoarthritis when conservative treatment modalities fail [13, 18, 28, 38]. In the Western countries, the total number of patients undergoing total hip or knee arthroplasty has increased dramatically during the last decades and it has been estimated that the annual rate of TKA in 2030 will be nearly seven times the rate in 2005 [20, 25, 27]. In developed countries, eg. Finland and Australia, every fifth to seventh man and women undergoes total knee arthroplasty during their lifetime [1].

Of the patients undergoing total hip or knee arthroplasty, 15% to 45% are people of working age [44]. In 2009 it was projected that demand for TKA in patients below age 65 years would exceed 50% of all patients by 2016 [26]. In the past, total joint arthroplasty has been associated with inferior results in younger and physically active patients. However, the advances in surgical techniques and prosthesis models has led to expanding clinical indications for arthroplasty to meet physically active younger people who are suffering from osteoarthritis [5, 9, 11, 35].

Return to work is an important marker of successful TKA for patients [10, 32, 42, 44]. Return to work affects positively patients' physical and mental health and is beneficial socially and economically for the patients, the employers and the society [3, 30, 37]. It has been suggested that on average 70% of patients in working age undergoing TKA return to work and up to 50% return to work within three months [19]. With increasing numbers of TKA in younger age groups combined with policies to extend work careers

to avoid ‘the pensions crisis’ and higher expectations for mobility after TKA among patients, there is growing need for evidence on the predictors of return to work after a knee replacement. Fast increase in obesity, a risk factor of osteoarthritis and surgical complications, further increases the need towards identifying factors that predict the outcome of knee replacement. So far, the majority of studies have examined predictors of the clinical outcome and the risk of complications related to TKA [8, 14, 16, 18, 31, 40]. In contrast, less is known on the predictors of return to work after knee replacement [38, 42].

The objective of this study was to identify prognostic factors related to general health, health risk behaviors and socioeconomic status associating with the rate of return to work after a TKA in a large nation-wide cohort of public sector employees.

Materials and Methods

The population was from the Finnish Public Sector (FPS) study [2]. The cohort comprises employees of ten municipalities and six hospital districts. The participants have been employed for minimum of six months in the participating organizations between 1991 and 2005 (n=151 901). The cohort covered a wide range of occupations – from city mayors and doctors to semiskilled cleaners, nurses, and teachers. Nested survey cohort include all employees at the time of the surveys. The survey has been repeated every four years since 1997. Information on baseline characteristics before the surgery was derived from the repeated survey, employers’ records, and national health registers. All participants have been linked to surgical data on total knee arthroplasty from the National Care Register for Health Care, maintained by the National Institute for Health and Welfare as well as the national sickness absence register maintained by

the Social Insurance Institution of Finland. The ethics committee of the Hospital District of Helsinki and Uusimaa approved the study.

Type of surgery and patient characteristics

Of the FPS cohort participants, 1996 underwent a single total knee replacement between 1999 and 2011. Of them, we selected for this study those 452 participants who had responded to a survey before the surgery. The type of surgery was defined as NGB10, NGB20, NGB30, NGB40, NGB50, NGB60, or NGB99 according to the NOMESCO Classification of Surgical Procedures Version 1.14 by the Nordic Medico-Statistical Committee.

Return to work

Return to work was determined as the number of days between the date of discharge and the date of the end of the sick leave. Survey responses were linked to the national sickness absence register kept by the Social Insurance Institution of Finland using personal identification numbers. Finnish residents aged 16 to 67 years are legitimized to receive daily allowances due to medically certified sickness absence. After a qualifying period of the first 9 days of illness, compensation is paid based on salary for a maximum of one year. All sickness absence periods are medically certified and they are encoded to the register with start and end dates. Overlapping and consecutive periods of sick leaves were merged. The linkage data were available until December 31, 2011.

Predictors of return to work

The participants' gender, age, and occupational grade at the time of the surgery were obtained from the employers' registers. The spectrum of occupational grades was downsized to three groups: higher-grade non-manual workers (e.g. teachers, physicians), lower-grade non-manual workers (e.g. registered nurses, technicians), and manual workers (e.g. cleaners, maintenance workers). Marital status (married or cohabiting vs. single, divorced, or widowed) was obtained from the baseline questionnaire.

Information on health and behavioral health risks was obtained from the baseline questionnaire and national health registers. Physical activity was defined as average weekly hours of leisure-time physical activity (walking, brisk walking, jogging and running, or respective), including commuting, during the previous year [24]. The hours per week spent on activity at each intensity level were multiplied by the average energy expenditure of each activity expressed in metabolic equivalent of task (MET). Physical activity was categorized into two groups, 'low' ($\leq$14 MET hours/week) and 'high' activity (>14 MET hours/week). Alcohol consumption was categorized according to the habitual frequencies of drinking beer, wine and spirits as 'none', 'moderate', and 'heavy' consumption. The cut-off for heavy alcohol consumption was set as 210 g/week/week [36]. Smoking status was dichotomized as 'currently smoking' vs. 'quitted or never smoked'. Self-reported body weight and height were used to calculate a body mass index (BMI) in kg/m^2, which was used to identify obese (BMI $\geq$30 kg/m^2) and non-obese (BMI <30 kg/m^2) participants. Psychological distress was measured with the 12-item version of General Health Questionnaire (GHQ) [12] with three or more positive response set as a cut-off point of psychological distress ('no' vs. 'yes'). Participant rated their state of health on a 5-point scale (1=good … 5=poor), and the

self-rated health was then dichotomized by categorizing response scores 1 and 2 as good health and scores 3 to 5 as poor health. The data on the presence of diabetes, coronary heart disease, asthma, chronic obstructive pulmonary disease, or rheumatoid arthritis were obtained from the Drug Reimbursement Register, which contains information on persons entitled to special reimbursement for treatment of chronic health conditions. The presence of comorbidity was then dichotomized as 'yes' vs. 'no'.

Statistical analysis

The participants were followed from the date of the discharge to the date when an employee returned to work, was granted a disability pension, an old-age pension, died, or end of study (31 December, 2011), whichever came first.

Cox proportional hazard models were used to study the associations between baseline characteristics and return to work. We first examined the associations separately for each predictors adjusted for age and sex. Then we examined the associations mutually adjusted in a single model including all the predictors simultaneously. The results were presented as hazard ratios (HR) and their 95% confidence intervals (95% CI).

All analyses were performed using the SAS statistical software, version 9.1.3 (SAS Institute, Inc., Cary, North Carolina).

Results

The characteristics of the 452 patients are shown in Table 1. The majority, 80%, were women and 52% were employed in manual jobs. The average age at the time of surgery was 56.4 (SD 5.1) years. About 40% of the participants were obese or physically inactive, rated their general health as poor and were psychologically distressed at baseline. One fifth had a comorbid chronic medical condition. After the surgery, 87% (n=394) of patients returned to work on average after 116 (SD 53, range 28 to 356) days of sickness absence. For the whole study population, mean time of return to work was 142 days (SD 92, range 21-366).

Predictors of return to work

As shown in Table 1, patients with higher non-manual occupational status had 2.8 (95% CI 2.2 to 3.7) times higher rate of return to work as compared with patients with manual labor occupational status adjusted for age and sex (Figure 1). The respective rate ratio for those with lower-grade non-manual occupations was 1.5 (95% CI 1.2 to 1.9). Low level of sickness absence (<30 days) before the surgery was associated with a 2.4 (95% CI 1.9 to 3.0) times higher rate of return to work as compared with patients with longer sickness absence. Those patients whose self-rated health was good were 1.4 (95% CI 1.1 to 1.7) times more likely to return to work comparing to those with poor self-rated general health (Figure 1). In contrast, socioeconomic factors (age, gender, and marital status), health-behavior factors (smoking, physical activity, high alcohol consumption, and obesity), chronic medical comorbidities (asthma, diabetes mellitus, rheumatoid arthritis, and coronary artery disease), and psychological distress were not associated with return to work. The results from an analysis including all predictors in the same model essentially replicated the results obtained from age and sex-adjusted models with

one exception – self-rated health was not associated with return to work in the mutually adjusted model.

Discussion

The purpose of the current study was to evaluate the rate of return to work and to analyze patient related factors influencing the rate of RTW after TKA. Almost 90% of the patients returned to work after a total knee replacement on average 116 days after operation. Favorable prognostic factors were non-manual work, low number of pre-operative sickness absence days and good self-rated health. Surprisingly, patients that were in many ways in better physical shape did not return to work earlier than other patients. Indeed, other socioeconomic factors (age, gender, and marital status), behavior-related risk factors (smoking, physical inactivity, high alcohol consumption, and obesity), chronic medical comorbidities (asthma, diabetes mellitus, rheumatoid arthritis, and coronary artery disease), and poor mental health were not associated with return to work.

Total joint arthroplasty is an effective treatment modality for severe pain and functional disability when non-surgical methods fail to provide adequate relieve of symptoms due to end-stage osteoarthritis [41, 47]. Continued advances in surgical techniques and prosthesis models have expanded clinical indications even for more active people suffering from arthritis [26]. Based on the Finnish Arthroplasty register (FAR) in 2015 36.2% and in 2016 34.5% of primary total knee arthroplasties were performed for patients under the age of 65 years. The rise of retirement age in the western countries is further increasing the number of working age patients. In a systematic review Bieleman et al. [6] reported that patients with hip and knee osteoarthritis generally are able to stay at work, but it is also reported that patients undergoing THA or TKA are significantly more on sick leave than the general population both before and after surgery [15, 41, 45].

Successful return to work has been identified as a crucial outcome marker for patients after TKA [10, 32, 42, 44]. Return to work after TKA is influenced by several determinants including state of patient´s general health and presence of comorbid diseases, psychosocial and motivational factors, rate of work related knee demand and possibility to make adjustments to work tasks. Predictors of successful return to work after knee replacement have been thoroughly studied. To evaluate these contributing factors is especially important for TKA. This is because TKA patients have been reported to have more sick leave in the year before surgery and also as they return to work slower as compared to total hip arthroplasty patients [41, 47]. Additionally, TKA patients have been reported inferior work performance rate than THA-patients [21, 29].

The results of the present study are in line with some previous studies, which have found socioeconomic status, knee demanding work, and the duration of sick leave before surgery to associate with returning to work after knee replacement [17, 23, 33, 34, 39, 41]. For clinical work this is highly noteworthy as osteoarthrosis and related disability is common in patients with a low socioeconomic status [7, 9, 43]. While the rates of TKA are high among those with a low socioeconomic status [48], they have inferior satisfaction rates with surgery outcome and experience more residual symptoms after TKA [4]. Our results partly agree with two previous systematic reviews that suggested age, socioeconomic status, workplace conditions, preoperative sick leave duration, workplace accessibility, participation in workers' 'compensation program to be related to patients' RTW after knee arthroplasty [22, 44]. Scott et al. [39] reported that all working patients <50 years returned to work after knee replacement, while only half of those of 50 to 60 years did. As the vast majority of patients in our study were

aged 50 or more, we do not know what the prognosis would have been among young patients. In some aspects our results contradict recent findings suggesting that also female sex, obesity, self-reported work-related symptoms and mental health symptoms explained failing to return to work [23, 42].

The reasons for differences between the results of the present and previous studies remain unclear. Part of the reasons might be methodological, eg some studies collected predictor data retrospectively several years after the surgery and used self-reports to measure return to work [23]. Societal factors, eg differences in national insurance systems may explain part of the diversities. It is possible that sets of relevant predictors may vary in different subgroups, e.g., based on age on gender distribution.

Strengths and weaknesses

The generalizability of these findings may be affected the differences in national welfare, pension, and workers' compensation schemes [39]. The studied cohort was limited to public sector employees in a Scandinavian well-fare state. Although the sample was predominated by women, the absolute number of men was higher than in most previous studies. No data on workplace adjustments before or after the surgery were unavailable. The motivation to return to work, a potentially important factor, remained unknown. However, psychological distress, a correlate of negative emotional traits, was not associated with return to work in our study. No data on possible complications or re-operations, that may have a significant influence on return to work, were available. A further limitation is that that we were not able to assess post-surgery prognostic factors, such as patients' activity levels, satisfaction with the outcome or functional outcome scores. Patient's pre-surgery expectations as well as the patient -

healthcare provide interaction was not known [3]. Compared to previous literature, our study has notably strengths. The large patient sample was drawn from a well-characterized occupational cohort and represented a wide range of occupations with comprehensive data on health and health risk behaviors well before the surgery. All data were linked to reliable national health registers including detailed information on the operation and the beginning and ending dates of all periods of sickness absence enabling accurate estimation of the timing of return to work. Many predictors of RTW, such as occupational status, sickness absences before the operation and comorbid medical conditions, were measured objectively from the registers. Further population-based research is needed to confirm these findings in other national and occupational settings. Further research may reveal if the associations found in this study are robust for all subgroups of patients with knee implants.

Conclusions

It is important to identify patients at an early stage who are at risk of not returning to work after TKA. Work modifications, starting of appropriate conservative treatment and correct timing of TKA may ensure patients work abilities.

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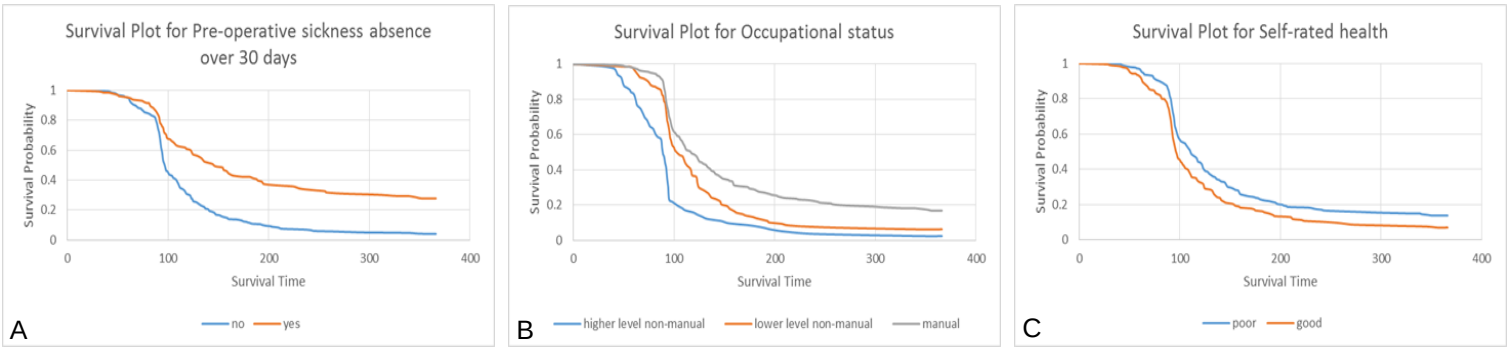
Table legends

Table 1. Characteristics of the patient and their associations with the rate of return to work after total knee arthroplasty. Hazard ratios and their 95% confidence intervals are derived from Cox proportional hazard analyses

Figure Legends

Figure 1. Survival Plot analyses of preoperative sickness absence (A), occupational status (B) and self-reported health (C).

Figure 1.


Survival Plot for Pre-operative sickness absence over 30 days
Survival Probability
Survival Time
no
yes
A
Survival Plot for Occupational status
Survival Probability
Survival Time
higher level non-manual
lower level non-manual
manual
B
Survival Plot for Self-rated health
Survival Probability
Survival Time
poor
good
C