Preoperative physical optimization in fast-track hip and knee arthroplasty

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ABSTRACT

INTRODUCTION: The aim of this study was to investigate if screening and optimization of risk patients combined with a motivational conversation is effective in reducing complications in patients scheduled for a fast-track hip and knee arthroplasty.

MATERIAL AND METHODS: We included 78 patients in the intervention group and 54 patients in a control group before the intervention. In the intervention group, all patients participated in a motivational conversation during which they were screened, and a nurse addressed all risk areas in patients at risk. The primary outcome was unintended patient paths, defined as a path where the discharge criteria were not reached within five days (minor complications), major postoperative complications, readmissions or death within three months postoperatively.

RESULTS: A total of 35 (45%) of the 78 patients in the intervention group were classified as being at risk in one or more areas after the screening. The number of unintended patient paths was significantly reduced from 19 (35%) in the control group to 14 (18%) in the intervention group ($p = 0.025$).

CONCLUSIONS: Preoperative physical optimization of patients who are at risk of following an unintentional path is effective in patients scheduled for fast-track hip and knee arthroplasty.

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In their Cochrane review, McDonald et al [1] concludes that in patients undergoing hip or knee replacement surgery, there is little evidence to support the use of pre-operative education, especially with respect to pain, functioning and length of hospital stay. However, a randomized clinical trial included in their review concludes that preoperative intervention is effective if addressed at specific risk patients [2], and Ditmyer et al [3] introduced the concept of prehabilitation defined as preoperative improvement of an individual's functional capacity through increased physical activity prior to an orthopaedic procedure – i.e. a method that may have the potential to address detraining before surgery. MacDonald et al [4] found that developing a risk screening tool and addressing the identified risk areas may reduce the length of a hospital stay, and The Danish Clinical Unit for Disease Prevention has presented guidelines for the prevention of complication caused by surgery [5]. The guidelines, however, do not address preoperative intervention at risk areas in patients scheduled for fast-track hip and knee arthroplasty. In this study, we define fast-track intervention as perioperative intervention where patients satisfy discharge criteria within five days. We aimed at investigating the effect of implementing a simple risk screening tool combined with an intervention in order to ascertain if this would reduce the number of unintended paths after fast-track total hip arthroplasty (THA), total knee arthroplasty (TKA) and unicondylar knee arthroplasty (UKA).

MATERIAL AND METHODS

Hip and knee patients receiving primary elective THA, TKA or UKA in the study period were included in the study. From existing monitoring data, we knew that between one fourth and one third of patients would not reach discharge criteria within five days, which would imply a reduction in the proportion of patients with unintentional paths of 20 percentage points. With alpha set at 5% and beta at 20%, we would need a minimum of 50 patients in each group corresponding to at least two months of inclusion in each group.

The intervention group comprised all patients who underwent surgery from 1 May to 30 June 2007, and the control group included patients operated in the period from 1 January to 28 February 2007.

We based the preoperative arthroplasty screening questionnaire (PASQ) on proposed risk areas [5], and a two-page questionnaire was sent to all patients prior to their first preoperative outpatient visit.

A patient was considered to be at risk if any of the five PASQ areas exceeded the risk cut points:

1) For the patient to be at risk regarding *nutrition,* the patient's body mass index (BMI) estimated from height and weight had to be below 18.5 kg/m^2 or above 30.5 kg/m^2, or the patient needed to report an unexplained weight loss, or his or her nutrition had to be considered insufficient.
2) For *general health and medication,* the patient was at risk if his or her blood pressure was too high, untreated or unregulated. Further, any patient with

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untreated or unregulated diabetes was considered at risk, along with any patient reporting signs of wound infection and any patients who were insufficiently pain-medicated.

3) For *physical activity,* any patient with less than 30 minutes of activity daily was considered to be at risk.
4) Any patient who smoked was considered at risk.
5) Finally, patients were considered to be at risk if their *alcohol consumption* exceeded the recommendations from The Danish National Board of Health, which at the time of the study was no more than 21 units of alcohol per week for men and 14 units of alcohol for women.

Intervention group

All patients participated in a preoperative motivational conversation during which any identified risk factor was addressed by the interviewing nurse. If a nutritional risk factor was identified, the nurse would choose an appropriate intervention ranging from providing information to referring the patient to a dietician. Identification of a risk factor for health and medication would be handled by providing information or by returning the patient to the general practitioner with information on what to improve.

An identification of low physical activity would be handled by giving information on how to increase non-painful activity, and the patient was, if necessary, invited to borrow an exercise bike until hospitalization. If the patient was a smoker or had an alcohol intake exceeding the threshold stipulated in the national Danish guidelines, the nurse informed the patient about risks and benefits from stopping or postponing. All information was supported by leaflets obtained from The Danish Clinical Unit for Disease Prevention [5]. The optimization period was planned not to exceed four weeks because of a new Danish act which became effective in the post-implementation period and which introduced a guarantee of operation within four weeks from referral to hospital.

Regarding the perioperative period, no changes were made during the study period, and we followed an accelerated/fast-track protocol in both groups described in details in four other publications from our institution [6-9]. Primary outcome was an unintentional patient path defined as a path by which the patient did not reach the discharge criteria within five days (minor complications), or had any postoperative complication within three months (major complications) leading to a non-planned inpatient visit, was readmitted within three months irrespective of cause, or died within three months postoperatively irrespective of cause. Data concerning the period after discharge were collected by interview at a clinical follow-up after three months at hospital. The secondary outcomes were health-related quality-of-life (HRQOL) pre- and postoperatively measured with the EuroQuol 5d questionnaire (EQ-5D) [10, 11] and disease specific outcome score (DSOS) [12] measuring e.g. walking distance and ability. The DSOS was translated into Danish by using the answer categories of the Harris Hip Score in the Danish Hip Arthroplasty Register and the Knee Society Clinical Rating Scale used by the Danish Knee Arthroplasty Register.

Control group

Control group patients received no formal preoperative screening for risk factors and received no intervention in the period from the first visit at which arthroplasty was decided to surgery.

Statistics

All outcomes were analyzed using both univariate and multivariate methods to adjust for confounding. In the univariate analysis, the χ^2 test was used for categorical outcome. Furthermore, the two-sample t test was used for normally distributed and the Mann-Whitney non-parametric test for non-normally distributed continuous outcomes. In the multivariate analysis, dichotomized outcome was analyzed using logistic regression.

The study was registered with The Danish Data Protection Agency (j.no. 2007-41-1197).

Trial registration: not relevant.

TABLE 1

Patient characteristics in the two groups at baseline.

	Control group (n = 54)	Intervention group (n = 78)	p value
Gender, male:female, n	33:21	34:44	0.05
Age, mean (SD), years	69 (9.0)	68 (11.0)	0.50
Diagnosis, arthrosis:other, n	54:0	75:3	0.14
Implant type, cemented:uncemented, n	23:31	18:60	0.02
Patient type, THA:TKA/UKA, n	23:31	37:41	0.58
HRQOL, mean (SD)	0.56 (0.22)	0.58 (0.23)	0.82
DSOS, mean (SD)	46.2 (16.8)	48.2 (13.0)	0.44

DSOS = disease-specific outcome score; HRQOL = health-related quality-of-life; SD = standard deviation; THA = total hip arthroplasty; TKA = total knee arthroplasty; UKA = unicompartmental knee arthroplasty.

RESULTS

A total of 140 patients were eligible for the study of whom eight refused to participate which left 132 included patients. The baseline characteristics of the two periods are presented in **Table 1**. Follow-up data were obtained for all patients. The average waiting time in the control group was 63 days (standard deviation (SD)

14.0) and 31 days (SD 16.9) in the intervention group. The HRQOL in the control group was 0.55 (SD 0.23) and it was 0.60 (SD 0.25) in the intervention group (p = 0.440). The DSOS was 47 (SD 18) in the control group and 50 (SD 14) in the intervention group (p = 0.292). The average time used for the screening was 25 minutes and the median was 20 (range 10–120) minutes. A total of 35/78 patients (45%) were classified as being at risk of an unintentional path. Among the patients with identified risk areas, 26/35 (74%) had only one risk area, whereas 9/35 (26%) had two or more risk areas.

The number of patients per identified risk area was: 1) nutrition 19/77 (25%), 2) general health and medication 6/78 (8%), 3) physical activity 8/78 (10%), 4) smoking habits 10/78 (13%), and 5) alcohol consumption 4/78 (5%). In the control group, we observed a total of 19/54 (35%) unintentional patient paths compared with 14/78 (18%) in the intervention group (p = 0.025). When adjusting for gender, age, diagnosis, implant type and patient category, the odds ratio (OR) was 0.34 (95% confidence interval (CI), 0.13-0.84) (p = 0.019). In the control group, 16/54 (30%) reached the discharge criteria late compared with 8/78 (10%) in the intervention group (p = 0.005). The adjusted analysis resulted in an OR of 0.26 (95% CI 0.1-0.7) (p = 0.012). The median length of stay (LOS) was four (range 2-10) in the control group compared with a median LOS of three in the intervention group (p < 0.001). Adjusted analysis resulted in a reduction in LOS of 1.0 day (95% CI 0.3-1.7) (p = 0.005).

We observed nine (17%) complications within the first three months postoperatively in the control group and seven (9%) in the intervention group (p = 0.183). The adjusted analysis resulted in an OR of 0.33 (95% CI 0.1-1.2) (p = 0.09). The causes of complications are presented in **Table 2**. We observed one readmitted patient in each group during the first three months postoperatively. In the control group, readmission was due to deep infection and resulted in operation and 30 additional days of hospitalization. In the intervention group, one patient was readmitted because of wound problems causing an additional six days of hospitalization. We observed no deaths in either of the two groups within a three-month period postoperatively. The HRQOL was 0.79 (SD 0.18) in the control group and 0.81 (SD 0.13) in the intervention group (p = 0.985). Adjusted analysis resulted in a non-significant gain in HRQOL in the intervention group of 0.02 (95% CI –0.03 to 0.08) (p = 0.379). The DSOS was 78 (SD 18) in the control group and 83 (SD 14) in the intervention group (p = 0.094). Adjusted analysis resulted in a non-significant gain in DSOS in the intervention group of 4.5 (95% CI –0.8 to 10.0) (p = 0.094).

TABLE 2

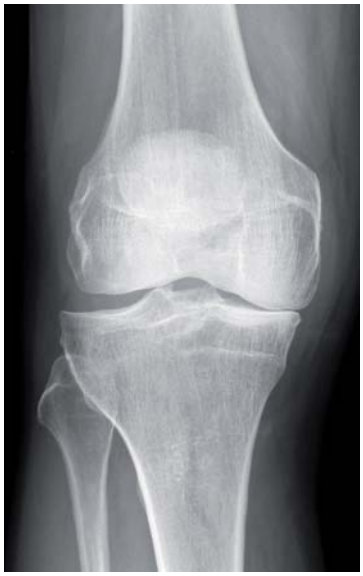
Overview of numbers of registered complications during the first three preoperative months in the two groups.

Complication cause	Control group (n = 54)	Intervention group (n = 78)
Leg pain	0	1
Minor AMI	1	0
Pneumonia	1	0
Superficial infection	1	0
Swelling of knee	2	0
Wound problem	1	3
Haemarthron below wound	0	3
Knee extension deficit	2	0
Infection	1	0
Complications, any	9	7

AMI = acute myocardial infarction.

DISCUSSION

To our knowledge, this is the first study to demonstrate that preoperative optimization before fast-track perioperative THA, TKA and UKA is effective. During the motivational conversation and by using the PASQ, a substantial proportion of the patients scheduled for fast-track THA, TKA and UKA were classified as being at risk for an unintentional perioperative path. The more frequent risk areas were suboptimal nutrition, smoking and low physical activity. Suboptimal nutrition was relatively easy to address with guidance. Low physical activity was a problem in patients with impaired use of the knee or hip, and the patients were guided to make use of exercises not stressing the diseased joint such as swimming or using a stationary training bike. Smoking represents a major problem in the intervention as it may be underreported by patients, and the only intervention used in this context was a motivational conversation and an



Hip osteoarthritis before surgery.

invitation to attend a smoking cessation seminar combined with Nicorette treatment. However, the motivational conversation held with all patients and the intervention against risk patients may, in our view, have served as a more general approach to discuss life style changes with the patients at a time immediately preceding a major operation, i.e. when they were very motivated.

This may play a major role in the significant reduction in unintentional patient paths, particularly for the sub category of patients not reaching the discharge criteria within five days postoperatively; a category which was reduced to one third using exactly the same discharge criteria in the control and intervention group. Patients who do not reach the discharge criteria within five days postoperatively include those with minor complications that are not registered but do affect discharge.

The result from our study is in accordance with the results of MacDonald et al, who demonstrated that the length of stay could be reduced through screening, patient education and modification of care pathways [4]. Furthermore, our results are in accordance with those of Crowe & Henderson [2], who demonstrated that a preoperative, individually tailored, rehabilitation programme reduced the length of stay. None of the above mentioned studies did, however, focus on registering complications. Our study is also in line with the review by Lucas [13], who demonstrated that a preoperative motivational conversation can be used to increase the patients' self-efficacy and to tailor psycho-social demands preoperatively. A potential for further effect of preoperative intervention exists as four studies have demonstrated that more intensive preoperative physical optimization or prehabilitation has a positive effect on preoperative pain and function [14-17]. The study by Gilbey et al furthermore demonstrated that preoperative physical optimization had an effect when measured three weeks postoperatively [15], and the study by Topp et al actually proves the efficacy of prehabilitation [18].

It is a limitation of the present study that it was not performed as a randomized study. This leaves us with a possible flaw with regard to group selection as illustrated in the difference in male/female ratio between the intervention group and the control group. We did, however, not use any exclusion criteria, and all patients in the two periods were consecutively included in the study. We used patients treated before the intervention as a control group, and this may bias our results due to the general evolution of treatment over time. However, the time span between the control group and the intervention group was only two months so we consider that any bias is minor. An amendment was made to the in treatment strategy during the study which affected the distribution of cemented and uncemented implants, respectively, but this should not result in a change in complication rates in the two groups as both surgical technique and postoperative treatment are identical.

Another change made during the study was a reduction of the waiting time from screening to operation from an initial 63 days in the control group to 31 days in the study group. This change in waiting time reduces the intervention period and should not bias the results in favour of the intervention. A limitation to our study is that the questionnaire has not been validated, but it focuses on simple and well-defined risk factors which limits the risk of bias. It is also a limitation to our study that we did not monitor to which degree the patients actually followed the intervention in the optimization period, and this may be addressed in future studies. We performed analysis both as univariate analysis and as multivariate analysis in order to adjust for known potential confounders between the two periods, but other confounders may flaw our study which suggests a need of a randomized controlled study. Until such study may be realized, we believe that this low-cost, no-risk intervention should be implemented for all THA, TKA and UKA planned for fast-track perioperative intervention.

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