Work in process

Is longer waiting time associated with health outcomes and costs of medication in hip replacement patients? A randomized clinical trial.

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Abstract

Aims: The aim of this prospective randomized controlled study was to evaluate the effect of waiting time on health outcomes and costs of medication in total hip replacement (THR) patients.

Methods: Between August 2002 and November 2005, 395 THR patients were recruited into the study in three Finnish hospitals. The key inclusion criteria were the need for primary THR due to osteoarthritis of hip joint as evaluated the hospital surgeon, age 16 or older and being placed on the waiting list in a research hospital, and the patient was willing and mentally able to participate in the study.

When placed on the waiting list, patients were randomized into a short (≤ 3 months) or a non-fixed waiting time (> 3 months) groups. The number of patients placed on the waiting list varied from one month to another, being specific to each hospital. Therefore, no advance estimates could be made of the number of patients to be placed on the list. In the final assessment 320 patients were included (short group n=145, non-fixed group n=175). Health-related quality of life (HRQoL), pain and function, were calculated when placed on the waiting list, at hospital admission, three and twelve months postoperatively using the generic 15D, and patients' self-report modified Harris Hip score (HHS), also use costs of disease-specific medication were calculated at the same measurement points. All analyses were performed using the intention to treat principle. When comparing the mean scores of 15D, HHS, pain and function or the costs of medication during the various points of follow-up, independent T-test and general linear model for repeated measures were used.

Results Of the 513 eligible patients invited to participate in the study, 118 refused to participate and were excluded. Of the 395 patients, 81% (n=320) completed the follow-up, 179 women with mean age of 65 years. The mean waiting time was 74 days in the short and 194 days in the non-fixed waiting time groups. In the intention to treat analyses there were no statistically significant differences between the groups in the weekly use and costs of medication, HRQoL or HHS at

baseline, at admission, or three or twelve months after surgery. The only differences were in the waiting time and in total medication costs during the waiting time, EUR 83 and 171, respectively.

Conclusions The length of waiting time did not result in different health outcomes in the randomized groups in cross-sectional follow-up measurements. The only difference between the groups was the waiting time, which was reflected in the total medication costs of the waiting period and in a small QALY gain in the short waiting time group, as it reached the same HRQoL level as the non-fixed waiting time group on average four months earlier.

Keywords: Waiting time, medication, health-related quality of life, 15D, pain and function, Harris Hip Score, randomization

Introduction

According to the Health 2000 Health Examination Survey in Finland, 12 % of the population aged over 65 had hip arthritis [1], while 8460 total hip replacements (THRs) were performed in 2004 with the median waiting time to surgery being 153 days. Between 1987 and 2004, the THR rate rose on average 5 % annually [2]. In 2005, the Finnish Social Insurance Institution paid EUR 85 million in drug reimbursements to 990 637 patients with musculoskeletal diseases, with the mean cost per patient being EUR 86 per year [3].

Earlier studies have established that arthritis causes pain, reduces the range of motion, and creates difficulties in participating in daily activities, which in turn affects quality of life. Because the waiting times for surgery are long, the disease becomes an increasingly chronic burden to patients [4–7]. Moreover, the duration of conservative treatment and the use of medication (analgesics and anti-inflammatory drugs) also increase with longer waiting time. Prior studies have demonstrated that

poorer health status preoperatively is predictive of higher out-of-pocket costs for patients during the first year postoperatively [8], and waiting more than 6 months is associated with higher mean total costs while longer waiting times results in deterioration in physical function while waiting [7].

The aim of this prospective randomized controlled trial was to identify the effects of waiting time on health and health-related quality of life (HRQoL) outcomes and the use and costs of disease-specific medication among two patients group; a short waiting time group (≤ 3 months) and a non-fixed waiting time group (> 3 months). Measurements took place when first placed on the waiting list, at admission, and three and twelve months after the THR.

To our knowledge no prior studies have looked at the effect of waiting time on HRQoL and the use and costs of disease-specific medication (DSM) among hip replacement patients in a randomised study design. The question of whether the length of waiting time for THR affects the use and costs of medication and health and quality of life outcomes is a contested issue.

Methods

Data collection

Between August 2002 and November 2003, 513 THR patients in three Finnish hospitals were invited to participate in the study: two of the hospitals (the Surgical Hospital and Jorvi Hospital) are part of the Helsinki University Central Hospital, while the third is the Coxa Hospital for Joint Replacement. Patients were recruited into the study through contact with orthopedic and practice staff.

The key inclusion criteria were the need for a primary THR due to osteoarthritis of the hip joint as evaluated by the hospital surgeon, the patient was aged 16 or older and placed on the waiting list in a research hospital, and the patient was willing and mentally able to participate in the study. The key

exclusion criteria were patients with rheumatoid arthritis, fractures, and congenital haemophilia or congenital deformities.

Randomization

After being placed on the hospital waiting list, patients were randomly assigned to one of two groups: 1) a short waiting time (hereafter SWT) with a maximum wait of 3 months, or 2) a non-fixed waiting time (hereafter NFWT) with surgery performed according to the hospital's routine procedure, with the waiting period measured from the date the patient was added to the waiting list to the date of admission for surgery. The number of patients placed on the waiting list varied from one month to another, being specific to each hospital. Therefore, no advance estimate could be made of the number of patients to be placed on the list. The patients randomized into the SWT group could only be operated on in one of four operating periods during the year, and only half of the hospital's one-month surgical capacity could be allocated to the SWT group, so the number of SWTs was restricted and determined specifically for each hospital.

Patients were recruited into the study in over three (for one of the hospitals) or four recruitment periods (for the other two hospitals), each period lasting three months in order to avoid the waiting time for the SWT group exceeding three months. Patients in the SWT group were operated within two weeks following the end of each recruitment period. The size of the NFWT group was not restricted so as to ensure that all eligible patients placed on the waiting list had an opportunity to be recruited into the study (randomization takes place at the end of the period, allowing everyone the possibility of a SWT). The two patient groups therefore differed in size.

Computer-generated randomization sequences were produced by the National Research and Development Centre for Welfare and Health and supplied to the hospitals using consecutively numbered and sealed opaque envelopes. The patient's named nurse assigned participants to their

groups after the decision for surgery had been made. The randomization envelops contained information on whether the patient belonged to the SWT or NFWT group. Surgeons were blind to patient allocation. For ethical reasons double-blinding was not possible.

Patients completed a self-administered questionnaire when placed on the waiting list, at admission, and at three and twelve months postoperatively. The questionnaires were either distributed to the patients at the hospital or in some cases mailed to patients, as happened with one hospital for the third and fourth questionnaires. All questionnaires were returned by post. Common guidelines for administering the questionnaires were provided in each hospital. The patients completed a sociodemographic form, reported their medication and comorbidities as diagnosed by a medical doctor, and completed the disease-specific modified HHS and a separate questionnaire for HRQoL. Each patient provided informed consent. The study was approved by the Helsinki University Central Hospital Surgery Ethics Committee.

Measurement instruments

HRQoL was measured by the generic 15D instrument. The 15D is composed of 15 dimensions: moving, vision, hearing, breathing, sleeping, eating, speech, eliminating, vitality, usual activities, mental function, discomfort and symptoms, depression, distress, and sexual activity. Each dimension has 5 ordinal levels to choose from. The 15D can be used as a profile measure or to give a single index score by means of population-based preference weights. The index score (15D score) ranges from 0 (dead) to 1 (completely healthy) [9]. Completing the 15D questionnaire takes 5–10 minutes and it describes the HRQoL of the respondent at present. A difference of >|0.03| in the 15D score is clinically important in the sense that on average people can feel the difference [10]. In most of the important properties (reliability, content validity, sensitivity in terms of discriminatory power and

responsiveness to change) the 15D compares at least equally with other similar instruments that produce a valuation-based single index number [10–15].

By using the mean 15D scores from each measurement point and assuming a linear change in the scores between the measurement points we also estimated the possible gain in quality-adjusted life years (QALY gain) for both groups within the observation period.

The disease-specific modified Harris Hip Score (HHS) was used to measure hip pain and function. The self-report HHS consists of two sections: pain (0–44 points) and functional activities of daily living and gait (0–47). The total score ranges from 0 to 91, with higher scores representing better health states [16]. A further 9 points of the total Harris Hip Score would normally be assigned to describing deformity and range of motion, but were excluded because these items could not be measured in a patient self-report questionnaire.

The use of DSM (analgesics and anti-inflammatory drugs) during the week preceding every measurement point was measured based on self-report. The unit costs of medication per tablet were obtained from CD-Pharmacy [17]. The costs of medication during the waiting period were calculated as a product of the weeks spent on the waiting list and the medication costs per week. The calculations for medication costs were made at each of the four measurement points.

Statistical analysis

The sample size estimate was based on the primary outcome variable 15D. A subgroup of 177 patients would provide the 80 % power (two-tailed α error 5%) to detect clinically important differences (Δ0.03) in the 15D score between the randomized groups.

Primary analyses were conducted with an intention-to-treat (ITT) principle [18], so that patients were followed in the groups to which they were randomly allocated. When comparing the mean scores of 15D, total HHS, pain, function and costs of DSM at the various points of follow-up between SWT and NFWT, general linear model for repeated measures were used. Univariate (tests of within-subject effects) p-values were calculated, while a p-value <0.05 was considered statistically significant. Also the mean differences, standard deviations and confidence intervals (CI) of 95% of the variables 15D, total HHS, pain, function and costs of DMS were presented for the estimated effect.

Descriptive characteristics at baseline in the randomized groups and the patients who were lost to follow-up were compared using either the F-test or the chi-squared test, depending on whether the variable was on a continuous or nominal scale.

Missing values on the 15D were replaced if a minimum of 80 % of dimensions had been completed, using a regression model with the patient's responses for other dimensions, age and gender as explanatory variables [11]. Data analyses were performed using SPSS versions 14 and 16 for Windows.

Results

Of the 513 eligible patients invited to participate in the study, 118 refused to participate and were excluded. Thus, 395 patients after providing a signed informed consent were randomly allocated to either the SWT (n=174) or NFWT (n=221) group. Of these patients, 81 were lost to follow-up during the waiting time and were not included into the final analyses. Eleven of these patients did not return the questionnaire at baseline, seven were operated on elsewhere, operations for twelve patients were cancelled, and seven died while waiting and 53 did not return the questionnaire at admission. All analyses are based on 320 (81 %) patients (179 women) with a mean (SD) age of 65 (±9.9) years, of which 145 were in the SWT and 175 in the NFWT group (Fig. 1).

Baseline characteristics

The baseline characteristics of the groups were similar and are reported in Table 1. The mean (±SD) 15D score in the SWT group was 0.767 (±0.09) and 0.764 (±0.12) in the NFWT group; the difference was not statistically significant or clinically important (p=0.295). The mean (±SD) total HHS was 43.9 (± 13.6) and 44.1 (± 14.1) in the SWT and NFWT group, respectively (p=0.853). The percentage of patients receiving DSM was 91 % (n=136) in the SWT and 89 % (n=149) in the NFWT group. The mean weekly medication costs were EUR 5.4 and EUR 6.3 in the SWT and NFWT groups, respectively. The difference was not statistically significant (Table 1).

A comparison between patients who completed the questionnaire and those who were lost to follow-up showed no statistically significant differences between the groups (Table 1).

Outcomes and waiting time

At admission there was a statistically significant difference in mean waiting time between the groups: 74 days in the SWT and 194 days in the NFWT group (95% CI: 93.03- 142.57, p<0.001). There were no statistically significant differences between the groups in the mean 15D score, total HHS, pain and function or in the weekly cost of medication. However, due to a shorter waiting time the total cost of DSM during the waiting period was lower in the SWT group (EUR 81.3) than in the NFWT group (EUR 171.3)(95% CI: 42.49 - 134.90, p<0.001) (Table 2).

Outcomes after total hip replacement

The use and costs of medication had decreased in both groups at three months and one year after the THR: 43 % (n=55) in the SWT and 48 % (n=71) in the NFWT group reported using medication for arthritis. In the SWT group the weekly costs at three months were EUR 1.58 and in the NFWT group

EUR 1.96 and after one year EUR 0.80 and EUR 0.98 respectively. The differences were statistically significant between different measurement points ($F=63.08$; $p<0.001$), but not between the randomized groups ($F=1.08$; $p= 0.372$).

At three months the mean 15D score was 0.852 in the SWT and 0.859 in the NFWT group, and after one year 0.856 and 0.873, while the mean total HHS was after three months 67.02 and 67.12, respectively and after one year 72.18 and 74.57 respectively. The differences between the groups are not statistically significant (Table 3). There were statistically significant differences between different measurement points, but not between the randomized groups.

There was an improvement from three months to twelve months postoperatively in the mean 15D score and total HHS, pain and function and a decrease in the cost of medication in both groups. SWT resulted in a gain of 0.028 QALYs (area between the curves in Figure 2) during the observation period.

Conclusions

Scientific evidence on the relationship between waiting time and THR outcomes is inconsistent and the absence of randomized trials has prevented an assessment of whether longer waiting is somehow related to health and quality of life outcomes. To our knowledge, the present study is the first to assess the use and costs of DSM in THR patients randomly allocated to short and non-fixed waiting time groups. The study also analysed whether the length of the waiting time was related to HRQoL, hip pain and function as measured by the 15D and HHS, respectively.

The main finding was that the time spent on the waiting list was not related to the weekly use and costs of DSM, with no differences found between the randomized groups. The weekly costs were almost identical in both groups at each of the four measurement points. The same applies to the mean HRQoL scores and pain and function scores, which reached their highest values twelve months

postoperatively. However, the SWT resulted in a small QALY gain of 0.028 during the observation period.

In this study, patients' HRQoL at baseline was deteriorated and they had pain and difficulties in functioning and daily activities. However, the length of waiting time alone did not affect HRQoL or pain and function scores, which is in line with the findings of some earlier studies [4, 5, 7, 19, 20, 21]. However THR has been found to be effective (13, 22, 23), with this study also showing significant improvement in HRQoL and in pain and function three and twelve months postoperatively in both randomized groups.

To our knowledge no studies have so far been published on the effect of waiting time on the use and costs of disease-specific medication. Fielden et al. (2005) estimated the costs and outcomes of the waiting time for THR in a prospective study. They found that waiting more than 6 months was associated with higher total costs and deterioration in physical function while waiting. These cost results are not comparable to ours, as they estimated all costs during the waiting period [6].

The strengths of this study were that the patients awaiting THR were prospectively followed from the time of being placed on the waiting list to admission—with waiting times recorded precisely—and for a further year of follow-up postoperatively, providing evidence of the effect of WT on pre- and post-operative health status. Further the patients were randomly assigned to either a SWT or NFWT group. The findings were based on the simultaneous use of patient-reported generic and disease-specific instruments as outcome measures.

Some limitations pertain to this study. First, medication information was obtained only from patient self-reports, while there was no distinction between self-care and prescription medication. For temporary medication we used mean dosages. Second, a total of 42 patients in the SWT group waited

more than three months. The reasons were hospitals' limited capacity to carry out THR within the three months waiting time period or the patient's unwillingness to have THR within three months. Due to these factors, the differences between the randomized groups may have been underestimated.

According to this study the length of the waiting time, at least as realized in practice in this study, did not result in different health outcomes in the randomized groups in three cross-sectional follow-up measurements from baseline to one-year postoperatively. The only difference between the groups was the waiting time, which was reflected in the total medication costs of the waiting period and in a small QALY gain in the short waiting time group, as it reached the same HRQoL level as the non-fixed waiting time group on average four months earlier.

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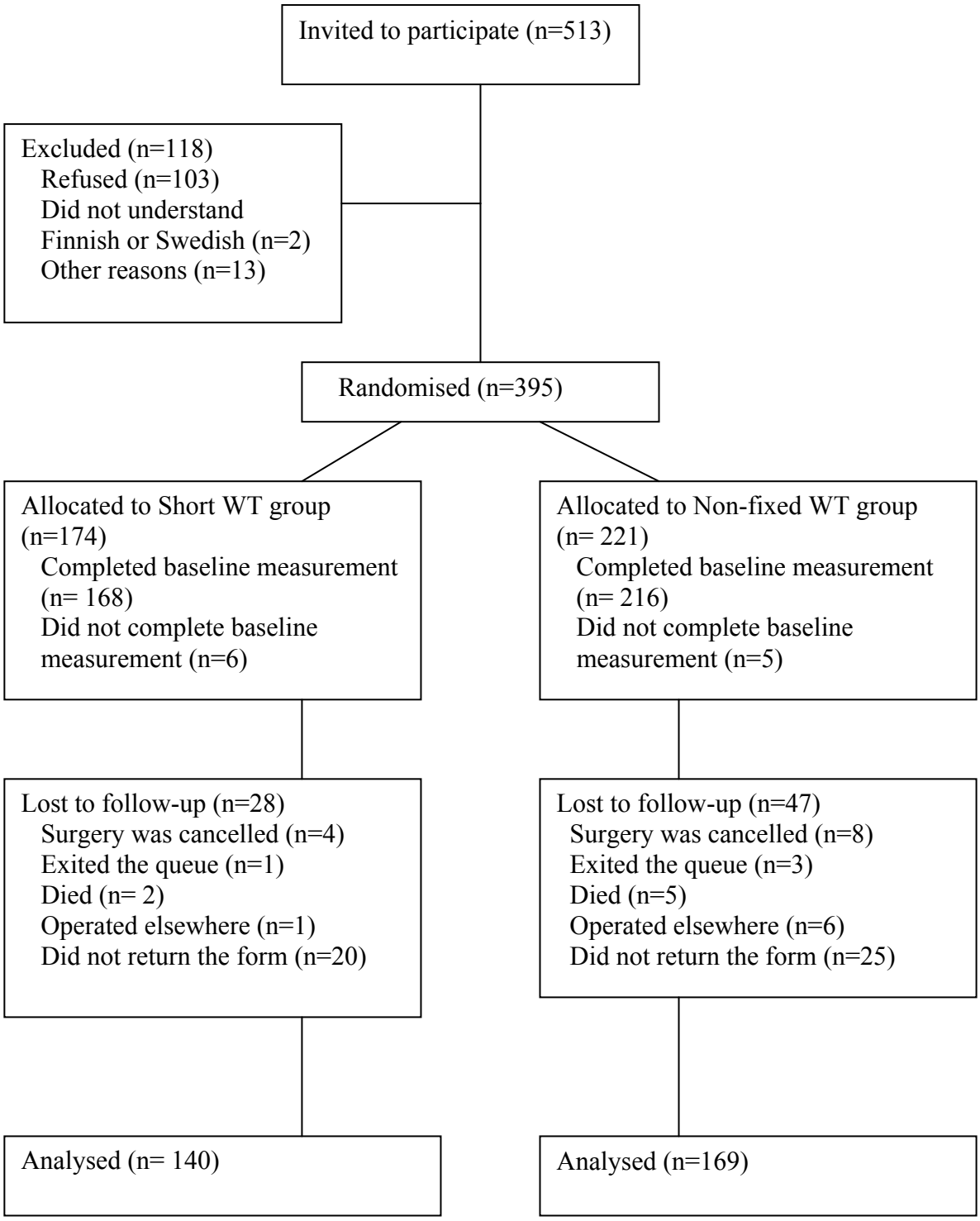

Fig 1 Flow of patients through the trial

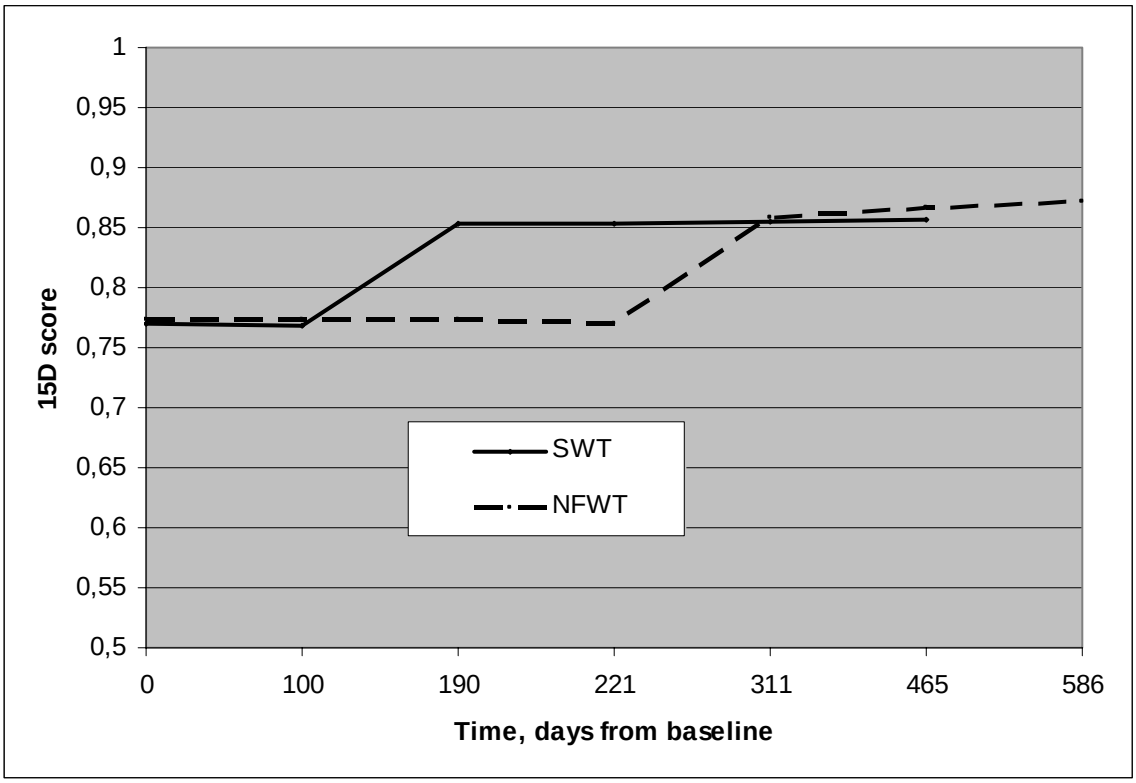

Fig. 2. The QALY gain (area between the curves) due to short waiting time during the observation period

Table 1. Baseline characteristics of randomised groups and those lost to follow-up

Characteristics at baseline	SWT (n= 145)	NFWT (n=175)	Lost to follow-up (n= 61)	P-value[a]
Age, years (mean ± SD)	66 ± 9.8	64 ± 10.1	68 ± 10.1	0.053
Females [n, (%)]	88 (49.2)	91 (52.3)	38 (62.3)	0.539
Housing [n, (%)]				
Living alone	50 (33.6)	45 (26.5)	20 (33.9)	0.313
Basic education [n, (%)]				
Lower level	118 (79.2)	133 (78.7)	46 (78.0)	0.494
Comorbidity, yes [n, (%)]	103 (69.1)	116 (68.2)	40 (67.8)	0.504
Medication to arthritis, yes [n, (%)]	136 (91.3)	149 (87.6)	56 (94.9)	0.136
Medication costs €/week ± SD	5.4 ± 5.8	6.3 ± 7.0	5.5 ± 7.2	0.997
BMI[1] ± SD	27.9 ± 3.9	27.7 ± 3.8	27.7 ± 4.6	0.865
HHS[2] ± SD	43.9 ± 13.5	44.09 ± 14.4	44.3 ± 12.9	0.853
Pain score ± SD	16.8 ± 7.6	17.4 ± 6.8	16.2 ± 7.0	0.388
Function score ± SD	27.1 ± 8.6	27.2 ± 9.0	27.7 ± 8.1	0.612
15D score[3] (mean ± SD)	0.767 ± 0.09	0.764 ± 0.12	0.753 ± 0.01	0.295

[a] Between patients who completed the questionnaire and those lost to follow-up

[1] Body mass index (kg/m²)

[2] The scale 0 - 91, worst to best

[3] The scale 0 - 1, worst to best

Table 2. Outcome measures at admission, ITT-analyses

Outcome measure	SWT (mean ,SD) (n=139 - 140)	NFWT (mean, SD) (n=167 - 169)	Mean difference	95% confidence interval	P-value
15D score[1]	0.768 (0.107)	0.769 (0.107)	0.001	(-0.022 to 0.024)	0.931
Self-Report HHS [2]	42.99 (15.32)	41,73 (14.08)	-1.262	(-0.022 to 0.024)	0.456
HHS pain score	17.63 (7.64)	17.14 (8.55)	-0.493	(-2.332 to 1.346)	0.602
HHS function score	25.86 (9.08)	24.79 (8.42)	-1.067	(-3.051 to 0.915)	0.29
Costs of medication[3]	5.56 (6.80)	5.63 (6.22)	0.793	(-1.399 to 1.557)	0.916
Costs of medication[4]	81.3 (129.54)	171.3 (264.36)	88.49	(42.49 to 134.90)	0.000***
Waiting time, days	74 (145)	194 (175)	117.80	(93,03 to 142,57)	0.000***

[1] The scale 0-1, worst to best

[2] The scale 0-91, worst to best

[3] Weekly costs of medication in EUR (EUR is 1.6 US$)

[4] Medication costs during the waiting time

***p<0.001

Table 3. Descriptive statistics of the outcomes in SWT and NFWT groups; mean and standard deviation

	At baseline		At admission		Three months postoperat.		One year postoperatively	
Outcome	SWT	NFWT	SWT	NFWT	SWT	NFWT	SWT	NFWT
15D, mean	0.770	0.779	0.772	0.775	0.852	0.859	0.857	0.873
±SD	0.090	0.100	0.090	0.090	0.090	0.100	0.110	0.110
Total HHS, mean	43.75	43.05	43.55	41.82	67.02	67.12	72.18	74.57
±SD	13.78	14.58	15.27	14.48	16.54	17.15	16.91	16.9
Function score, mean	26.68	26.19	26.11	24.93	34.93	35.05	39.05	39.24
±SD	8.73	8.95	8.97	8.56	8.41	9.04	7.67	8.5
Costs of medication (€), mean	5.06	6.41	5.31	5.57	1.59	1.96	0.8	0.98
±SD	5.78	7.23	6.73	6.4	4.12	4.47	2.45	2.71

Table 4. Effect of waiting time between the randomized groups

GLM repeated measures, tests of within-subjects effect

Source	Mean square	F	P-value
15D	0.813	207.324	0.000†
15D* randomized group	0.003	0.694	0.531‡
HHS	83719.63	470.763	0.000†
HHS* randomized group	254.18	1.429	0.239‡
Function score	15429.81	308.701	0.000†
Function score* randomized group	34.68	0.703	0.511‡
Costs of medication	1850.85	86.104	0.000†
Costs of medication* randomized group	22.37	1.04	0.365‡

† difference between the measurement points

‡differences between randomized groups