Effects of psychological predictors on hospital discharge duration after total knee arthroplasty

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Abstract

This study aims to evaluate the effects of somatosensorial amplification, kinesiofobia, health anxiety and depression on hospital discharge durations after knee arthroplasty. 193 patients with total knee arthroplasty were included in the study. Patients were divided into two groups due to discharge durations. Group 1 included patients who were discharged in 1 to 4 days; Group 2 included patients who were discharged in 5 to 7 days. Functional outcome was measured with Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC). For psychiatric evalution; a Sociodemographic form, Somatosensory Amplification Scale, Health Anxiety Inventory, Hospital Anxiety and Depression Scale and The Tampa Scale of Kinesiophobia were used. There wasn't any significant difference in terms of WOMAC scores between Group 1 and 2 postoperatively. (Pain; p=0.666, Stiffness; p=0.349, Functionality; p= 0.145). There was a significant difference in terms of Health Anxiety Inventory and Somatosensorial Amplification scores between Group 1 and 2 (p=0.006; p=0.031). In correlation analysis Somatosensorial Amplification score was positively correlated with hospital discharge duration. There was a significant difference in terms of Tampa kinesiophobia scores between Group 1 and 2 (p<0.001). In correlation analysis there was a positive correlation between Tampa kinesiaphobia score and hospital discharge durations (r: 0.618; p: 0.000). Multiple regression analysis indicated that Tampa Scale of Kinesisophobia was the major predictive factor for hospital discharge durations. Health anxiety, Somatosensory amplification and mostly Kinesiophobia were related with longer hospitalization periods due to worse functional outcomes after total knee arthroplasty. Maladaptive psychological strategies about false bodily sensations lead a worse outcome for knee arthroplasty patients. Therapeutic programs aiming false cognitive factors would result with improved functional recovery.

Keywords: somatosensory amplification, kinesiophobia, health anxiety, total knee arthroplasty, WOMAC

1. Introduction

As the life expectancy of the population continues to rise, the frequency of operations such as knee arthroplasty is becoming more prevalent. When conservative management strategies fail and the quality of life continues to decline for patients, knee arthroplasty may be the surgical treatment of choice to decrease pain and joint destruction to improve quality of life (1, 2). It's known that over 2% of individuals in the United States were living with a total hip or total knee replacement in 2010 which corresponds to an estimated seven million people (3). Another study conducted in US in 2013, represented an increasing prevalence that 4.2 % of the population had total knee replacement in fifty years of age or older patients (4). Although there are not many studies about the prevalence of knee arthroplasty in our country, in a recent study Ceyhan et al. indicated that a total of 283,400 primary and 9900 revision knee arthroplasty operations were applied in Turkey between 2010 and 2014, and also showed an increase in prevalence of knee arthroplasties (5).

There are many factors about a better outcome of a knee artroplasty; like type of surgery, age, gender, body mass index, comorbidities, duration of symptoms, home environment variables, baseline caregiver assistance, preoperative ambulation status; among those one of the most important predicting risk factor for worse outcome is shown as postsurgical pain and postoperative ambulation status (6, 7, 8). It has been shown that most patients have pain relief after approximately three months after total knee arthroplasty; but unfortunately despite surgical and radiological success, 8-34% patients still experience chronic postsurgical pain which effects patients' functional status and quality of life (9, 11). Also, pain after knee arthroplasty has been shown to be one of the most important predictive factor for prolonged use of opioids and postoperative dissatisfaction (11, 12).

Researchers have been suggested many preoperative and postoperative risk factors for postoperative pain in patients undergoing knee arthroplasty like genomics, functional status, clinical characteristics, medical comorbidities, socioeconomic status. But among all risk factors preoperative pain and psychological status especially anxiety, depression and pain catastrophizing were shown to have the strongest association

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with chronic postsurgical pain following total knee arthroplasty which cause delayed postoperative ambulation and complications (11, 13). In this context findings suggest that there may be differences in pain perception and somatization among patients. Previous studies showed a positive correlation between somatosensory amplification (SSA), pain perception and pain-related fear of movement called as Kinesiophobia (14, 17).

Somatosensory amplification is defined as the tendency to experience strong bodily sensations, to the extent that they become harmful and troublesome. In other words, SSA is a tendency to experience bodily sensations as intense, noxious and disturbing. There are many reports about SSA in terms of increased somatic symptoms in various medical conditions like rheumatoid arthritis, drug sensitivities, pseudocoronary symptoms of patients with normal coronary arteries and specifically reports mostly suggest that patients who have higher SSA scores are more vulnerable about higher pain perception (15, 18-22).

SSA is associated with a tendency to catastrophize bodily sensations that patients may have disease-avoidance behaviors such as delayed postoperative ambulation. We therefore carried out a longitudinal investigation and determined the knee arthroplasty patients for delayed postambulation in terms of psychological factors; kinesiophobia, anxiety, depression and SSA. It's hypothesized that patients' functional status and discharge from the hospital would relate to psychological factors, somatosensorial amplification, or kinesiophobia.

2. Materials and Methods
2.1. Subjects
The study was approved by the University Ethics Committee. All patients signed a written informed consent form. 193 patients with total knee arthroplasty who were operated between August 2018-August 2019 were included in the study. A total of 193 of the 212 patients were included in the study. The patients whose BMI were above 40, who had a chronic joint disease like rheumatoid arthritis, who were not able to answer the scale questions, who had secondary surgery and who had a serious psychiatric disease like dementia, delirium were excluded from the study. They were determined and operated by the same orthopedic surgeon and a psychiatrist before and after the surgery. Patients who had cognitive inability, diagnosis of another chronic disease that may impair joint functions were excluded from the study. Also patients with severe obesity (BMI>40kg/m²) were excluded. Patients were divided into two groups due to their discharge durations. Group 1 included patients who were discharged in 1 to 4 days; Group 2 included patients who were discharged in 5 to 7 days. Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) was used to determine functional outcomes of patients postoperatively while discharge. A sociodemographic form including age, gender, body mass index (BMI) were applied to all participants. Patients were determined with Somatosensory Amplification Scale (SAS), Health Anxiety Inventory (Short Form) (HAI), The Hospital Anxiety and Depression Scale (HADS) and The Tampa Scale of Kinesiophobia (Tampa Scale) before the surgery.

2.2. Measures
Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC)

The WOMAC osteoarthritis index is a generalized scoring system for osteoarthritis, including three parts as pain, stiffness and functionality with a total score ranging from 0 to 96 (a low score indicates a better result) (23).

2.3. Somatosensory Amplification Scale (SAS)
The scale has 10 items describing the tendency to experience harmless bodily sensations as intense, noxious or disturbing. Participants rate each item on a 5-point likert type scale from 1 ("not at all") to 5 ("extremely"). A higher total score suggests greater symptom amplification with the scores ranging between 10 and 50. Turkish version of the scale was used to determine all patients (24, 25).

2.4. Health Anxiety Inventory (Short Form) (HAI)
The short form of Health Anxiety Inventory is a measure designed to assess the spectrum of health anxiety and to discriminate between individuals with exaggerated health anxiety from those without it, also in samples of somatically ill patients. This scale is comprised of 18 items highly correlated with the full scale (26, 27).

2.5. The Hospital Anxiety and Depression Scale (HADS)
The Hospital Anxiety and Depression Scale (HADS) which measures anxiety and depression in physically ill adults was used to determine all patients. The scale comprises 14 items, 7 items screen for anxiety, 7 for depression. Each item takes four possible response options [0−3] making the possible sum scores range from 0 to 21 for each of the subscales, HADS-A and HADS-D. Higher values indicate greater symptom severity. A score≥8, has been proposed for the identification of for both depression and anxiety. In accordance with the original HADS, we defined respondents with a score below 8 as "no cases/low", respondents with a score between 8 and 10 as "suspicious cases/moderate" and respondents with a score higher than 10 as "definite cases/high". Turkish version of the scale was used for all patients (28, 29).

2.6. The Tampa Scale of Kinesiophobia (Tampa Scale)
The Tampa Scale is a 17-item questionnaire to determine fear of movement and re-injury due to movement and physical activity on a scale of 0-68, where 68 indicates greater fear of re-injury due to movement. Turkish validated version was used for all patients (30, 31).

2.7. Surgical method
Total knee arthroplasty was applied to all patients with mid-vastus approach under general or spinal anesthesia. Cemented

prosthesis was used for all patients under tourniquet. All patients were given systematic prophylactic antibiotics and anticoagulants to decrease deep venous thrombosis risk after the surgery. Patients were given analgesics for 24-hours to control pain due to the same analgesic procedure.

2.8. Hospital Discharge Criteria's
The hospital discharge decision was due to the pain and knee flexion ROM. Patients whose pain is under 5 in the 10 –point visual analog scale and patients who can flex their knee to 90 degrees were discharged from the hospital. Also patients were able to walk with walkers and had no need any intravenous analgesics.

2.9. Statistical analysis
SPSS v.18 is used for statistical analysis. Kolmogorov-Smirnov test is used to determine whether the variables have normal distribution or not. Variables were expressed as mean± standard deviation. Chi-square test was performed for qualitative variables. Continuous variables between two groups were compared with Independent-t test. Pearson correlation test is used to determine correlation between SAS, HAI, HADS, Tampa Scale and hospital discharge status in knee arthroplasty patients. Multiple linear regression analysis was used to determine independent associations between variables. The threshold of statistical significance was p<0.05.

3. Results
A total of 193 patients were included in the study. Sociodemographic variables were shown on Table 1. A total of 145 (57.1%) female patients and 48 (18.9%) male patients participated in the study. The mean age of the participants was 66.97±7.41. The mean body mass index (BMI) score was 28.29±3.69. There were no significant difference between Group 1 and Group 2 in terms of age, gender and BMI (Table 1). In terms of WOMAC scores, there wasn't any significant difference in discharge durations postoperatively for pain, stiffness and functionality (p=0.666; p=0.349; p= 0.145)

3.1. Comparison of HAI and HADS scores
The mean HAI score in female was 21.30±6.97, the mean HAI score in male was 21.30±6.97 (p=0.865). In correlation analysis, age was not correlated with HAI scores (p=0.530). The mean HAI score for Group 1 was 20.72±6.91; the mean score for Group 2 was 24.84±6.90. There was a significant difference in terms of HAI scores between Group 1 and Group 2 (p=0.006). In correlation analysis HAI scores were positively correlated with hospital discharge durations (r: 0.197; p: 0.006).

The mean HADS anxiety scale score in female was 8.88±4.56, the mean hospital anxiety score in male was 7.81±4.22 (p=0.153). In correlation analysis, there wasn't any correlation between age and HAI scores (r: 0.016; p=0.822). The mean HADS anxiety scale score in Group 1 was 8.45±4.01; the mean HADS anxiety scale score in Group 2 was 9.68±6.95 There wasn't any significant difference in

terms of HADS anxiety scores between Group 1 and Group 2 (p=0.205). The patients whose HADS anxiety scale scores were above 8 were determined as anxiety, that 79(47.02%) patients in Group 1 and 17 (68%) in Group 2 had anxiety diagnosis (p=0.050).

The mean HADS depression scale score in female was 8.67±2.90, the mean hospital depression score in male was 8.72±2.76 (p=0.902). In correlation analysis, age was not correlated with HADS depression scale scores (r: 0.006; p=0.931). The mean HADS depression scale score in Group 1 was 8.98±2.76; the mean HADS anxiety scale score was 8.88±2.26. There wasn't any significant difference in terms of HADS depression scores between Group 1 and Group 2 (p=0.852). The patients whose HADS depression scale scores were above 8 were determined as depression, that 92(54.76%) patients in Group 1 and 9 (36%) in Group 2 had depression diagnosis (p=0.080).

Table 1. Sociodemographic characteristics of the patients

	Group 1 (N=168) Mean±SD	Group 2 (N=25) Mean±SD	p
Age (years)	66.95±7.38	67.16±7.77	0.893*
Gender (F/M)	130/38	15/10	0.061**
BMI (kg/m²)	28.27±3.65	28.39±4.08	0.873*

*Independent sample *t* test ** Chi-square test SD: Standard deviation BMI: Body Mass Index

3.2. Comparison of Somatosensory Amplification Scale (SAS) and The Tampa Scale of Kinesiophobia (TSK) scores
The mean SAS score in female was 32.54±8.92, the mean SAS score in male was 31.71±9.07 (p=0.579). In correlation analysis, there wasn't any correlation between age and SAS scores (r: 0.061; p=0.400). The mean SAS score in Group 1 was 31.80±9.08; the mean SAS score in Group 2 was 9.68±6.95. There was a significant difference in terms of SAS scores between Group 1 and Group 2 (p=0.031). In correlation analysis SA score was positively correlated with hospital discharge duration times (r: 0.155, p: 0.031).

The mean Tampa scale score in female was 41.06±7.00, the mean Tampa scale score in male was 41.50±5.16 (p=0.646). In correlation analysis, there wasn't any correlation between age and Tampa scale scores (p=0.539). The mean Tampa scale score in Group 1 was 40.04±4.72; the mean SAS score in Group 2 was 50.44±1.76. There was a significant difference in terms of Tampa scale scores between Group 1 and Group 2 (p<0.001). In correlation analysis there was a positive correlation between Tampa scale score and hospital discharge durations (r: 0.618; p: 0.000).

3.3. Correlation analysis of SAS, TSK, HAI and HADS anxiety
Correlation analyses of all scales are shown in Table 2. According to the analysis all scales are positively correlated with each other and the strongest relation was between TSK and HAI scores (Table 2).

Table 2. Correlation coefficients between SAS, TSK, HAI and HADS anxiety scores

	SAS (r-value)	TSK (r-value)	HADS-Anxiety (r-value)
HAI	*0.496	*0.531	*0.507
SAS	-	*0.348	*0.453
TSK	*0.348	-	*0.323

3.4. Multiple linear regression analysis of variables

Heath anxiety, SAS and Tampa Scale scores, which were statistically correlated to hospital discharge durations mentioned as Group 1 and Group 2 were considered to multiple regression analysis. Multiple regression analysis indicated that Tampa Scale of Kinesisophobia was the major predictive factor for hospital discharge durations (Table 3).

Table 3. Multiple lineer regression analyses associated with Hospital discharge duration in knee arthroplasty patients

Independent variables	Standard regression coefficients (ß)
	Hospital Discharge Duration
HAI	0.013
SAS	0.049*
Tampa Scale of Kinesiophobia	0.176*

R^2 (Multiple coefficient of 0.611 determination) * $p < 0.001$

4. Discussion

The main findings of this study was higher health anxiety, somatosensory amplification and kinesiophobia scores were correlated with longer hospital discharge durations independent of age, gender and BMI in knee arthroplasty patients.

First of all, we determined both health anxiety, and general anxiety in both groups and found higher anxiety scores in patients those have longer hospital durations. Health anxiety is defined to discriminate individuals with exaggerated health concerns from those without it. In our study patients who had longer hospital durations were found as more concerned about their health and disabilities. Although most of the studies determining anxiety levels and clinical outcomes in knee arthroplasty patients mention that higher anxiety levels are related with worse clinical outcomes, to our knowledge our study was the first investigating both anxiety and health concerns in knee arthroplasty patients using health anxiety inventory (32, 33). In literature, health anxiety is mostly found related with chronic pain that our study findings about longer discharge durations might be due to heath anxiety and prolonged pain (34-36). Also anxiety was found associated with a negative effect on muscle tone causing a reduced local blood flow due to hyperplasia of sympathetic ganglia, which results with symptom increases (37). In a study conducted in Turkey revealed better functional outcomes and less analgesic use with an anxiolytic agent Alprazolam after total knee arthroplasty (38). Alattas et al mentioned that greater pre-operative anxiety, pain and poorer function predict a worse outcome of a total knee arthroplasty consistent with our findings (32).

In our study, we suggested that somatosensory amplification (SSA) may explain inter-individual differences for functional outcomes and effects to discharge durations in knee arthroplasty patients (39). SSA is defined as a tendency to experience bodily sensations as disturbing and SSA is found associated with increased somatic sensations which was defined before in various medical conditions (22). In non-psychiatric patients it was hypothesized that SSA could explain inter-individual differences in symptom reporting. And although the exact mechanisms and determinants of SSA are still unknown, Nakao et al. reported a significant relationship between the event-related potentials (P300) amplitude and SSA which may cause 'hypervigilance' to body sensations (39). Higher levels of SSA are assumed to turn body sensations into symptoms and increase the severity of already body sensations into symptoms (41). In literature, chronic pain and lower back pain was found associated with higher SSA (42, 43). In our study, we firstly reported the negative effects of higher SSA in knee arthroplasty patients consistent with previous findings.

Kinesiophobia was another important term investigated in our study. We found that kinesiophobia was the most significant factor for prolonged hospital discharge durations. Kinesiophobia is defined with fear avoidance model. In fear avoidance model, patients feel pain as harmful (pain catastrophizing) leading an avoidance of movement or touch. According to fear-avoidance model kinesiophobia can be a risk factor for persistent pain and disability (44). If patients don't have kinesiophobia they are more likely to confront daily activities resulting with fast recovery. In a study conducted with 89 total knee artroplasty patients, authors reported that during six-minute walk test, patients without kinesiophobia walked significantly farther than patients with kinesiophobia and consistent with our findings the effect of kinesiophobia on functional results was independent of age, gender and BMI (45). But Monticone et al. didn't find any difference for knee flexion ROM of knee arthroplasty in terms of kinesiophobia (45). However, in another study conducted in Turkey reported that, in early functioning, higher kinesiophobia levels were related with lower flexion of knee after total knee arthroplasties as indicated in our study (46). Also Brown et al. found a negative correlation between kinesiophobia levels and knee flexion ROM in total knee arthroplasty patients (47).

Another important point of our study was all psychological parameters were interacting with each other positively. In other words health anxiety and somatosensory amplification was increasing kinesiophobia mutually. Maladaptive psychological, behavioral and cognitive strategies like health anxiety were increasing kinesiophobia. It's known that somatosensorial amplification may be reduced

with psychoeducational programs by applying techniques that aim to prevent catastrophic thoughts about bodily sensations (37). Hence, such techniques including therapies or agents to reduce anxiety and also cognitive restructuring for somatosensoriel amplification would lower kinesiophobia resulting with a better outcome for total knee arthroplasty patients in early functioning.

The main limitation of our study was the short follow up that makes it difficult for us to comment on long-term results. Also the psychological measures were self-report questionnaires. Furthermore this study didn't include obese patients that may change the outcomes.

In conclusion we found health anxiety, somatosensory amplification and mostly kinesiophobia were related with longer hospital discharge periods due to worse functional outcomes after total knee arthroplasty in early periods. The strength of our study was we evaluated health anxiety and somatosensory amplification function with the relation of kinesiophobia for the first time in literature. We highlight that maladaptive psychological strategies about false bodily sensations lead a worse outcome for knee arthroplasty patients. Total knee arthroplasty in patients is particularly challenging for orthopedic surgeons and requires close interdisciplinary cooperation. We suggest therapeutic programs aiming false cognitive factors that contribute to activity avoidance would result with improved functional recovery after total knee arthroplasty.

Conflict of interest

The authors have no conflict of interest.

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