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Hanusch, BC, O'Connor, DB, Ions, P et al. (2 more authors) (2014) Effects of psychological distress and perceptions of illness on recovery from total knee replacement. Bone and Joint Journal, 96 B (2). pp. 210-216. ISSN 2049-4394

https://doi.org/10.1302/0301-620X.96B2.31136

Effects of psychological distress and illness perceptions on recovery following total knee replacement

Abstract

This cohort study investigated the influence of psychological factors, including perception of illness, anxiety and depression on recovery and functional outcome after total knee replacement surgery.

A total of 100 patients (55 male; 45 female) with a mean age of 71 (42 to 92) who underwent a primary total knee replacement for osteoarthritis were recruited into this study. In all 97 participants completed the six week and 87 the one year follow-up questionnaires.

Pre-operatively patients completed the revised Illness Perception Questionnaire (IPQ-r), Hospital Anxiety and Depression Scale (HADS) and Recovery Locus of Control Scale (RLOC). Function was assessed pre-operatively, at six weeks and one year using Oxford Knee Score (OKS) and range of motion (ROM).

The results showed that pre-operative function had the biggest impact on post-operative outcome for ROM and OKS. In addition questionnaire variables and depression had an impact on OKS at 6 weeks. Depression and anxiety were also associated with higher (worse) knee score at one year but did not influence the ROM at either six weeks or one year.

Recovery from total knee replacement can be difficult to predict. This study has identified psychological factors that play an important role in recovery from surgery and functional outcome. These factors should be taken into account when considering patients for total knee replacement.

Introduction

Total knee arthroplasty (TKA) is a well established treatment for osteoarthritis of the knee and is commonly regarded as a safe and reliable procedure to reduce pain and improve function in patients with osteoarthritis. In 2010 almost 77,000 primary total knee arthroplasty procedures were carried out in the UK and the number of knee arthroplasties has now exceeded the number of hip arthroplasties.

Functional outcome and rate of recovery after total knee arthroplasty, however, can vary greatly. It has been shown that up to 20% of patients are not entirely satisfied with their total knee arthroplasty[1] and this cannot always be explained by technical errors or postoperative complications. Brander et al[2] reported that 1 in 8 patients still had substantial pain one year after surgery despite well-fit and functioning implants. Wylde[3] found that 11% of patients thought their function was the same or worse than preoperatively at a minimum of two years following surgery.

Many studies have tried to identify factors that influence outcome and satisfaction following total knee arthroplasty[4-8]. It has been shown that preoperative pain and physical function are the strongest predictors of postoperative pain and physical function[6, 9], but these do not alone explain the great variability in postoperative outcomes and recovery.

In the past two decades the influence of psychosocial factors on functional outcome after joint arthroplasty has been increasingly recognised. It has been well documented that preoperative psychological distress, in particular anxiety

and depression, can affect functional outcome after total knee arthroplasty[7, 8, 10].

In recent years attention has been drawn to the role of illness perceptions in recovery from major illness. Illness perceptions encompass the patient's own understanding and beliefs about their illness, its effects, causes and progression. Illness perceptions have been found to predict recovery from a range of conditions, such as myocardial infarction[11, 12] or surgery[13, 14] and also seem to influence how patients cope with chronic conditions, such as diabetes[15, 16], chronic lung disease[17] or arthritis[18-20].

Very few studies, however, have examined the influence of illness perceptions on functional outcome after total knee arthroplasty[21, 22] and no study so far has used the revised Illness Perception Questionnaire (IPQ-r)[23].

The current study investigated whether psychological factors, including illness perceptions, anxiety and depression, can influence recovery and functional outcome following total knee arthroplasty.

Materials and Methods

Patients and Procedures

Patients who underwent a primary total knee arthroplasty for osteoarthritis between 2004 and 2006 were recruited into this prospective cohort study. Patients were recruited from two centres in the north of England.

Potential participants were identified by screening of the waiting lists of three participating surgeons. Patients were eligible for inclusion if they were listed for a primary total knee arthroplasty for osteoarthritis. Patients with rheumatoid arthritis, patients undergoing revision surgery and patients unable to understand the administered questionnaires were excluded from the study.

Between the two centres 130 consecutive patients were screened. 16 patients were excluded based on the exclusion criteria, 14 patients declined participation in the study.

One hundred patients were included in the study. Ninety-nine patients completed all preoperative questionnaires, one patient decided not to proceed with surgery after consent had been given. Ninety-seven patients attended their six-week follow-up and 87 patients were reviewed at a minimum of one year following their surgery. Five patients died during the follow-up period and seven did not attend their final review.

Patients underwent a primary total knee arthroplasty (TKA) through a midline incision using a medial parapatellar approach. Postoperative rehabilitation was carried out according to standardised protocols at both centres.

The study was approved by the Local Research Ethics Committee and all participants gave written informed consent.

Clinical Assessment

Knee function was assessed preoperatively, at six weeks and a minimum of one year postoperatively by an independent orthopaedic surgeon or nurse practitioner using the Oxford Knee Score (OKS [12 to 60])[24] and range of motion (ROM). Range of motion was measured with a goniometer with the patient in the supine position. A low score in the OKS indicates a good outcome.

In addition data on occupation status (in work/retired) was collected preoperatively and data on complications up to one year post surgery.

Psychological Measures

All participating patients were asked to complete the revised Illness Perception Questionnaire (IPQ-r)[23], Hospital Anxiety and Depression scale (HADS)[25] and Recovery Locus of Control scale (RLOC)[26] on the day before surgery.

Revised Illness Perception Questionnaire (IPQ-r)

The IPQ-r[23] is the revised version of the Illness Perception Questionnaire (IPQ) developed by Weinman et al.[27]. The IPQ was developed to provide a

quantitative assessment of the components of illness representations. It has been used to study illness adaptation in a wide range of conditions[11, 14, 16, 17]. The IPQ-r consists of three sections with twelve subscales, each representing different aspects of patients' illness perceptions.

The first section, the identity scale, consists of 12 commonly experienced symptoms (pain, nausea, breathlessness, weight change, fatigue, stiff joints, sore eyes, headaches, upset stomach, sleep difficulties, dizziness, loss of strength). Patients were asked whether or not they had experienced these symptoms since the onset of their illness and whether or not they thought these symptoms were related to their illness.

The second section consists of seven dimensions, representing patients' perceptions of their disease:

1) Timeline acute/chronic: Perception of likely duration of their illness
2) Timeline cyclical: Perception of likely variability of their illness
3) Consequences: Patient's beliefs about impact of illness on their life
4) Personal control: Patient's belief in personal control over their illness
5) Treatment control: Patient's belief in treatment curing their illness
6) Illness coherence: Patient's understanding of their illness
7) Emotional representation: Patient's negative emotions caused by their illness

Each dimension contains a number of statements, which are rated on a 5-point Likert type scale from 'strongly disagree' to 'strongly agree'. High scores indicate strong beliefs in each individual dimension.

The third section consists of potential causes of illness and patients were asked to rate these on the same 5-point Likert type scale. The statements are summarised into four causal dimensions: psychological attributions, risk factors, immune attributions and accident/chance.

For this study the term 'illness' in the IPQ-r was replaced with the term 'arthritis'.

Hospital Anxiety and Depression Scale (HADS)

The HADS[25] is a widely used measure of anxiety and depression. It consists of a 14-item scale with seven items relating to anxiety and seven items relating to depression. Patients indicate the level of agreement with each item with a maximum score of 3 per item.

Higher scores suggest a higher level of psychological distress. Scores of 0-7 in respective subscales are considered normal, with 8-10 borderline and 11 or over indicating clinical 'caseness'.

Recovery Locus of Control (RLOC)

The Recovery Locus of Control Scale[26] provides a measure for the perceived control of recovery from illness. It consists of nine items, five reflecting the strength of belief in internal control (i.e. "It matters what I do") and four reflecting the strength of belief in external control ("It matters what others do"). Patients respond to each item using a 5-point Likert-type scale from 1

('strongly agree') to 5 ('strongly disagree'). An overall low score indicates a strong belief in external control, a high score a strong belief in internal control.

Data analysis

The collected data was summarised using descriptive statistics. Data was tested for normality and all postoperative scores for OKS and ROM were found to be skewed. Therefore non-parametric tests were used for the analysis. Preoperative and postoperative data were compared using a Wilcoxon Signed Rank Test, data between groups were analysed using a Mann-Whitney-U test.

All psychological variables were correlated with demographics (age, gender) and functional outcomes (OKS, ROM) at every time point using a Spearman's correlation coefficient.

Variables that showed a statistically significant correlation were then entered into a multiple regression analysis after controlling for age, gender and preoperative scores. Statistical analysis was carried out using SPSS Version 19.0 (SPSS Inc, Chicago, Illinois).

Results

Demographics

One hundred patients (55 male and 45 female) were recruited into the study. The mean age was 71 years (range 42 to 92 years). There was no significant difference in mean age between gender or centre.

Descriptive statistics

Both functional outcome parameters, mean OKS and mean ROM, improved significantly over the follow-up period. Mean OKS showed a significant improvement at both time points, whilst the improvement in mean ROM mainly occurred between the six week and one year review (Table 1).

Analysis of the IPQ-r measures showed that most patients saw their arthritis as a chronic process and felt that it had a major impact on their lives. Patients did not always have a clear understanding of their illness, but mostly believed that treatment would improve their arthritis.

The mean scores for HAD Anxiety and Depression indicated that the majority of patients did not suffer from either condition, but frequency tables revealed that 30 patients (30.3%) suffered from anxiety and 19 patients (19.2%) from depression of at least borderline level (Table 2). There was no difference between men and women.

Mean scores on the RLOC scale imply that patients have a strong belief in internal control, i.e. they believe that their own efforts are more important for their recovery than the actions of others (see Table 3).

Data on occupation status were available at one of the centres, at which 88% of patients were retired at the time of participation. Similar figures are likely for the second centre as the age distribution is comparable between the two centres. Due to low numbers of participants in work sub-group analysis of outcome measures based on occupation status was not deemed to be useful.

Complications

Detailed data on complications are available for only one of the centres. Out of 60 patients at this centre two patients underwent a manipulation under anaesthesia within three months of surgery and one patient was diagnosed with a symptomatic DVT. No patients were readmitted for infection or other implant related complications. There was no statistically significant difference in functional outcome parameters between participants with and without complications.

The relationship between functional outcome and psychological measures

Correlating functional outcome parameters with psychological measures showed a number of statistically significant correlations (Table 4). The IPQ-r dimensions 'consequences' and 'emotional representation' were correlated with OKS at all time points, but the dimensions 'consequences' and 'timeline

cyclical' showed a correlation with ROM only at one year. HAD Anxiety and Depression were also correlated with OKS, but not with ROM. We found no correlation between the RLOC scale and any of the functional outcome parameters.

OKS and ROM at one-year were also statistically significantly correlated to their respective preoperative scores.

Effects of psychological factors on functional outcome

Multiple regression analysis was used to determine if psychological factors could help predict ROM and OKS at six weeks and one year following surgery (after controlling for age, gender and pre-operative function). Separate analyses were carried out to explore the influence of HADS scores and IPQ-r variables for ROM and OKS at each time point. For each outcome variable in the regression analysis, pre-operative function, age and gender were entered at step 1, followed by either the IPQ-r variables or HADS scores at step 2. Only significantly correlated parameters were entered into the regression analysis (Table 5 and 6).

Effects on functional outcome at six weeks (Table 5)

None of the examined variables had an influence on ROM at six weeks.

The IPQ-r variables consequences, illness coherence and emotional representation were correlated with OKS at six weeks and entered into

multiple regression analysis. The analysis showed that pre-operative OKS had the greatest effect on OKS at six weeks and explained 13.5% of the variance (Step 1). The variables illness coherence and consequences had an additional effect and explained a further 7.9% of the variance (Step 2).

The HADS variable depression was also correlated with OKS at six weeks and entered into a separate multiple regression analysis. Similar to the IPQ-r variables pre-operative OKS explained 13.5% of the variance of OKS at six weeks (Step 1). HADS depression had a lesser effect, but still explained an additional 3.4% of the variance (Step 2).

Effects on functional outcome at one year (Table 6)

At one year the IPQ-r variables, timeline cyclical and consequences were correlated with ROM and entered into multiple regression analysis. This showed that pre-operative ROM had the largest effect on ROM at one year and explained 13.5% of the variance (Step 1). It was further influenced by the variables timeline cyclical and consequences which explained an additional 7.1% of the variance.

The IPQ-r variables consequences and emotional representation correlated with OKS at one year. Similar to the outcome at six weeks, pre-operative functional status had a significant impact on the outcome at one year and pre-operative OKS explained 15.2% of the variance in OKS at one year (Step 1). The IPQ-r variables had no further significant influence (Step 2).

Both HADS variables depression and anxiety correlated with OKS at one year and were entered into separate multiple regression analyses. In addition to the impact of the pre-operative OKS (Step 1), HADS anxiety explained an additional 6.1% of the variance of OKS at one year (Step 2) and HADS depression explained a further 6.3% of the variance (Step 2).

The impact of anxiety and depression was further investigated by comparing ROM and OKS at each time point between participants with normal and borderline/caseness scores in each domain using a Mann-Whitney U test.

The analyses for anxiety showed a statistically significant difference in OKS at six weeks ($p=0.006$) and one year ($p=0.005$) between participants with and without anxiety, but no difference in ROM.

There was also a statistically significant difference in OKS at six weeks ($p=0.013$) and ROM at one year ($p=0.012$) between participants with and without depression.

Discussion

The results of this study show that functional outcome after knee arthroplasty surgery can be significantly influenced by psychological factors. Various dimensions of IPQ-r showed significant impact on OKS or ROM at different time points.

Illness coherence, the patients understanding of their illness, appears to play an important role in early recovery. Patients who felt that they had a better understanding of their illness had lower OKS at six weeks, indicating a better functional outcome. Consequences, the patients' beliefs about the impact of illness on their life, were found to influence outcome at every time point. Patients who believed that their illness had less impact on their personal lives had lower OKS at six weeks and one year, again suggesting a better functional outcome.

Orbell et al.[22] described similar findings. Their study of 72 patients undergoing total hip or knee arthroplasty showed that patients who perceived that their illness had more severe consequences for their lifestyle were less functionally active at nine months following surgery. They also found that illness perceptions overall accounted for 15% of the variance in functional activity. Bethge et al.[21] used the Brief Illness Perception Questionnaire to assess 127 patients following knee arthroplasty. Patients concerns were highlighted as the only illness perception influencing functional outcome. Neither study showed an impact of patients understanding of illness on functional outcome.

Our study further highlighted the impact of anxiety and depression on functional outcome. HADS scores significantly influence OKS at one year, but

we could not show any effect on ROM. Dichotomising the individual scores for anxiety and depression allowed further comparison between participants with and without either of those conditions. The results of this analysis are suggestive of poorer outcomes for patients who were more likely to be anxious or depressed. The impact of mental health issues on postoperative function and recovery has been highlighted in a number of published studies. Lingard et al.[8] showed a significant impact of preoperative distress, measured using the mental health scale of the SF-36, on postoperative WOMAC scores in 952 patients following TKA. Brander et al.[4] identified a strong association between depressive symptoms and long-term pain and function after TKA surgery. Faller et al.[7] also demonstrated that baseline psychological distress assessed preoperatively was predictive of functional outcome up to one year following surgery. A recent study by Scott et al.[28] further identified lower preoperative SF-12 mental component scores to be predictive of patient dissatisfaction.

The results of our study and indeed the results of other studies with similar findings have to be viewed in the context of the patient population that the data has been collected from. It is well known that preoperative pain and functional status vary between countries[6] and equally health behaviour and health beliefs vary between countries and even regions within one country. Our findings may therefore not be generalisable to other regions of the UK. Larger studies recruiting patients from a variety of backgrounds and multiple regions across the UK would be needed to get a better understanding of these possible differences.

Occupation status may also have an effect on functional outcome, but is likely to be less relevant in our patient population. The majority of patients in this study were already retired or close to retirement age, with only 12% of patients still in work at the time of recruitment. We recognise that this is an important issue for future research, in particular when involving younger participants.

A potential shortcoming of the study relates to the lack of data on co-morbidities and socio-demographics and their influence on functional outcome These data were not collected and therefore, their effects cannot be taken into account. However, in a similarly designed study, Orbell et al.[22] have shown that these variables do not account for changes in outcome in their patient population. Furthermore psychological measures were only collected preoperatively to identify preoperative predictors of outcome. It may, however, have given additional relevant information to collect data on change of psychological variables over time and the impact of this change on outcome.

Our study is the first evaluation of the revised Illness Perception Questionnaire in the context of total knee arthroplasty surgery. Its findings have shown that psychological factors, in particular patients understanding of their illness and their perception on the impact it has on their lives, play an important role. It has further supported the existing evidence that demonstrates the potential influence of anxiety and depression on postoperative outcomes. In addition our study has provided baseline data for the use of the IPQ-r in future larger studies.

In summary, this study suggests that psychological factors, anxiety and depression should be taken into account when selecting patients for total knee arthroplasty. An awareness of the impact of these factors on recovery and functional outcome provides the opportunity to address these prior to surgery. Further studies are needed to identify suitable interventions and to assess if these lead to improved outcomes.

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Tables

Table 1: Mean OKS and ROM at each time point

	Preoperative	6 weeks	one year
mean OKS (SD)	40.8 (7)[a]	26.7 (8.7)[b]	21.3 (6.9)[c]
mean ROM (SD)	94.1 (16.9)[a]	96.2 (16.7)[a]	103.4 (13.8)[b]

Note: OKS = Oxford Knee Score; ROM = range of motion; superscripts that differ are statistically significant at $p<0.001$

Table 2: Number of patients with normal, borderline and clinical levels of depression

	Normal	Borderline	Caseness
HADS Anxiety	69	20	10
HADS Depression	80	15	4

Table 3: Descriptive statistics for psychological measures

IPQ-r Variable (min-max)	Mean	Range
Identity (0-12)	4.16	2-9
Timeline acute/chronic (6-30)	22.74	10-30
Timeline cyclical (4-20)	12.93	4-20
Consequences (6-30)	21.01	10-30
Personal Control (6-30)	19.55	7-30
Treatment Control (5-25)	18.55	9-25
Illness Coherence (5-25)	15.95	5-25
Emotional Representation (6-30)	16.96	6-30
Psychological Attributions (6-30)	13.59	6-28
Risk Factors (7-35)	18.1	7-33
Immune Attributions (3-15)	6.86	3-12
Chance (2-10)	5.68	2-10
HAD Anxiety (0-21)	5.44	0-18
HAD Depression (0-21)	5.27	0-18
RLOC (9-45)	37.55	28-45

Table 4: Spearman rank order correlation coefficients between main study variables

	ROM pre	ROM 6w	ROM 1y	OKS pre	OKS 6w	OKS 1y
Identity	-0.084	0.081	-0.027	**0.380*** **	0.151	0.114
Timeline acute/ chronic	-0.020	-0.54	-0.025	**0.236***	0.068	0.144
Timeline cyclical	0.073	0.001	**0.221***	-0.127	-0.056	-0.097
Consequences	-0.178	-0.093	**0.252***	**0.484*** **	**0.310** **	**0.314** **
Illness Coherence	0.111	0.166	0.017	-0.049	**-0.234***	-0.034
Emotional Representation	-0.117	-0.075	0.054	**0.480*** **	**0.256***	**0.239***
HAD Anxiety	-0.011	-0.058	0.008	**0.391*** **	0.184	**0.264***
HAD Depression	-0.113	-0.087	-0.197	**0.491*** **	**0.295** **	**0.286** **

Note: ROM = range of motion, OKS = Oxford Knee Score, pre = pre-operative, 6w = at six week follow-up, 1y = at one year follow-up, *p<0.05; ** p<0.01, *** p<0.001

Table 5: Linear regression analysis – effects on functional outcome at six weeks

		ß step 1	ß step 2	ΔR^2 for step	Total R^2
OKS	**Variables – IPQ-r**				
Step 1	OKS pre OP Gender Age	0.365*** 0.023 0.122	0.228* 0.066 0.047	0.135**	
Step 2	Consequences Illness Coherence Emotional Rep		0.203 -0.224* 0.002	**0.079***	0.214
OKS	**Variables – HADS**				
	OKS pre OP Gender Age	0.365*** 0.023 0.122	0.257* 0.040 0.139	0.135**	
	HADS Dep		0.216^{+}	0.034	0.169

Note: $^{+}$p=0.05, *p<0.05; ** p<0.01, *** p<0.001

Table 6: Linear regression analysis – effects on functional outcome at one year

		ß step 1	ß step 2	ΔR^2 for step	Total R^2
ROM	**Variables – IPQ-r**				
Step 1	ROM pre OP Gender Age	0.313** 0.144 0.169	0.289** 0.143 0.178	0.135**	
Step 2	Timeline cyclical Consequences		0.190 -0.165	**0.071***	0.206
OKS	**Variables – IPQ-r**				
Step 1	OKS pre OP Gender Age	0.385** -0.109 -0.040	0.236 -0.092 -0.066	0.152**	
Step 2	Consequences Emotional Rep		0.178 0.135	0.048	0.200
OKS	**Variables – HADS**				
Step 1	OKS pre OP Gender Age	0.385** -0.109 -0.040	0.296 -0.122 0.001	0.152**	
Step 2	HADS Anx		0.270*	**0.061***	0.213
OKS	**Variables - HADS**				
Step 1	OKS pre OP Gender Age	0.385** -0.109 -0.040	0.239* -0.074 0.002	0.152**	0.215
	HADS Dep		0.296*	**0.063***	

Note: *p<0.05, **p<0.01, ***p<0.001