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Prospective psychometric characterization of hip and knee arthroplasty patients

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Background: Psychiatric conditions and/or psychopharmacological treatments have been demonstrated to be an important risk-factor for prolonged hospital length of stay, readmission and morbidity, following fast-track total hip (THA) and total knee arthroplasty surgery (TKA).

Aims: The aim of the study was to provide a detailed description of the preoperative psychiatric characteristics of a well-defined patient population undergoing THA and TKA, using the 90-item Symptom Checklist (SCL-90-R).

Methods: A pre-surgical population of 2183 patients completed the full SCL-90-R prior to THA/TKA from 2015-2016. The SCL-90-R scale and total scores of the pre-surgical sample were compared to the scores of an age- and gender stratified Danish general population sample. A Mokken scalogram analysis was conducted to assess the scalability of the SCL-90-R in both samples.

Results: There was no clinically significant difference (effect size = < 0.50) in the SCL-90-R total score between the pre-surgical and general population samples. Pre-surgical patients had lower mean scores compared to the general population in all subscales except somatization (effect size = -0.22).

Conclusion: The psychiatric profile of the pre-surgical patient sample show that patients undergoing THA/TKA are less burdened by psychiatric symptoms than the general population with the exception of symptoms relating to somatization. This is not surprising given that symptoms relating to somatization concern feelings of pain and bodily weakness that are to be expected in candidates for THA/TKA.

Clinical implications: The present study indicates that psychopharmacological treatment rather than the psychiatric profile of patients may be risk-factors in fast-track THA/TKA.
**Introduction**

Total hip and knee arthroplasty (THA & TKA) has proven to be a successful intervention in terms of improved function and reduction of pain in patients suffering from degenerative joint disease (1,2). Fast-track or enhanced recovery programs have minimized the post-operative hospital length of stay (LOS) without compromising functional outcome or safety (3). However, an increased focus on preoperative risk-factors is required to define strategies for further reduction of postoperative morbidity (4, 5, 6). In this context, psychiatric conditions and/or psychopharmacological treatment has been demonstrated as important risk-factors for prolonged LOS, readmissions and morbidity in the fast-track THA and TKA setting (7,8,9). Although psychopathology and psychopharmacological medications may independently or collectively contribute to suboptimal outcome, unhealthy lifestyle choices, poor health care access or utilization (10) may also increase perioperative risk. However, psychiatric comorbidity is often neglected in the preoperative assessment (11) and no official guidelines exist on perioperative management of the psychiatric patients (8). In this overview Gylvin et al. (8) have identified a dilemma between diagnosing patients with mental disorder according to ICD-10 (12) and assessing the current symptomatology by patient-reported outcome measures (PROMS). In measurement-based care of mental disorders the target syndrome for considering treatment with psychopharmacological medication is not an ICD-10 diagnosis but the current symptom profile conventionally measured by PROMS (13). However, the many different symptom-based questionnaires identified by Vissers et al. (14) in their systematic review on PROMS in patients with THA and TKA are all insufficient concerning psychometric validity (15).

To our knowledge the most psychometrically valid PROMS, the Symptom Checklist (SCL-90-R) (16) has not been applied to patients with THA and TKA. Therefore, the objective of the present study is to use the SCL-90-R in a well-defined surgical population to provide a detailed analysis of preoperative psychometric characterization in patients undergoing THA and TKA (17).
Materials and methods

Approval from the regional ethics committee and The Danish Data Protection Agency j.nr: RH-2016-250 was obtained. The study was registered at ClinicalTrials.gov ID: NCT02576405.

Preoperative patient characteristics on preoperative mental health status were prospectively collected on 2,415 THA and TKA patients from September 2015 to July 2016 at five different orthopedic centers. One center was not including patients in two separate time periods, i.e. 10th Nov. – 2th Dec. 2015 and 15th Feb. – 26th Feb 2016 due to understaffing. The 2,415 patients represented 96% of all eligible THA/TKA patients operated at the five centers in this period. The remaining 4% were not included for logistic reasons or did not wish to participate. Exclusion criteria were cognitive deficits and language issues that prevented completion of the preoperative psychometric questionnaire.

Patient reported mental status scale: Symptom Checklist (SCL-90-R)

The Hopkins Symptom Checklist (SCL) was originally developed to measure the symptoms people presented when seeking help for their anxiety or depression at the outpatient clinic for psychotherapy at the University Hospital in Baltimore (18). The original SCL containing 41 symptoms (SCL-41) was published by Bech (19) with permission from Jerome D. Frank, the senior author on the Parloff et al paper from 1954(18). From 1954 to 1974 the SCL was broadened to cover states of anxiety, depression, interpersonal sensitivity, neuroticism (i.e. prone to nervousness, worrying or sadness), hostility, or psychoticism (i.e. prone to suspiciousness) (20). This SCL-90 version was later by Derogatis revised to SCL-90-R (21). In this revision two anxiety items were changed. In our Danish population study from 2004 we used the SCL-92 version which is a combination of the SCL-90 and SCL-90-R to be able to refer to both versions, where necessary (16). We have focused on the SCL-90-R here.
Each item in the SCL-90-R is scored on a 5 point Likert scale ranging from 0=not able, 1=a little bit, 2=moderately, 3=quite a bit, 4=extremely. The time frame is the past week and the responder is asked to select for each item the degree of a problem the symptom under evaluation has bothered him or her.

According to Derogatis (20) the SCL-90-R is scored on 9 subscales identified by a factor analysis in which only 83 of the 90 symptoms are used. These 9 subscales (factors) are somatization, obsessive compulsive disorders, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, and psychoticism altogether providing a Global Severity Index (GSI) using 90 items.

In the present clinimetric evaluation of the SCL-90-R we have identified four clinically valid subscales for non-psychotic persons covering together 28 items and containing the subscales of depression, anxiety, neuroticism (i.e. coops poorly with stress), interpersonal sensitivity, and consequently a GSI using all 28 items (19).

Sample

1. THA and TKA patient sample  N=2183

A total of 2,184 patients completed the full SCL-90-R. However, one patient had more than 10 items missing and was therefore excluded.

2. Danish citizens study N= 1153

This study is an age- and gender-stratified sample including Danish citizens aged 20-79 years and drawn randomly from The Civil Registration System in Denmark. The data were collected in April 2000 using a mailed questionnaire booklet. The response rate was 1153 out of 2040, i.e. 58 %. Data from this sample including SCL-92 have been reported by Olsen et al. 2004 (16) and 2006 (22).
3. Norwegian general population study N=1082

This is also an age and gender-stratified sample with a response rate of 90 %. This sample consisted of 1082 responders being considered to represent the non-institutional Norwegian population age 15 year and above. Data have been reported by Vassend and Skrondal (23).

Scalability: The Mokken analysis

The Mokken analysis is a non-parametric item response theory model by which clinically valid rating scales or questionnaires are psychometrically tested for their scalability (24,25). The concept of scalability refers to a measurement model testing to what extent an item of the rating scale provides unique information about the dimension being measured. During the analysis each item is located on the latent dimension of severity being tested. Some items will be identified as placed on the mild end of the dimension, others in the severe end of the dimension, and others again in between. According to the Mokken analysis it is a coefficient of homogeneity or scalability that indicates to what extent the rank order of the location is acceptable for measuring the dimension under examination (25). A coefficient of scalability between 0.30 and 0.39 is only just acceptable for considering the scale as an “yardstick” measuring severity. A coefficient of scalability of 0.40 or higher is definitely accepted (24). We have used the program developed by Molenaer et al. (26) for calculating the coefficient of scalability.

Effect size statistics

Due to the very large number of observations both in the THA and TKA patients sample and the two general population studies we have performed effect size statistics when comparing males versus females or THA and TKA patients versus general population participants (27). Thus, a P value of statistical significance is not the answer to the clinical significance of “how much?” estimation question, Cumming (27). The effect sizes
were calculated using means and standard deviations when comparing males with females, the effect size is mean (males) minus mean (females) divided by the pooled standard deviation. We have used Cohen’s reference values: an effect size of 0.2 to 0.5 is with clinical significance and an effect size of 0.5 or above is of clinical significance (28).

Results

Table 1 shows the coefficient of scalability obtained by the Mokken analysis for the group of THA and TKA patients all of which were 0.30 or higher, apart from the SCL subscale of psychoticism where the coefficient of scalability was 0.30. In the general population study the coefficient of scalability was 0.30 or higher apart from somatization and psychoticism where the coefficients of scalability were 0.28. As mentioned above, a coefficient of 0.30 – 0.39 indicates a just acceptable scalability (total scale score a sufficient statistic) whereas a coefficient of 0.40 or higher indicates a clear acceptable scalability.

Table 2 shows the numerically differences between males and females for the THA and TKA patient group in terms of effect size statistics. For the SCL subscales of hostility, paranoid ideas, and psychoticism males have higher mean scores than females as indicated by a negative effect size. In general the effect size is 0.20 or lower apart from somatization where the effect size is 0.29.

When using the total score of SCL-90 (GSI), the correlation with the age of the patients was insignificant (Spearman coefficient was 0.01 in the group of THA and TKA patients and -0.03 in the Danish general population).

Table 3 shows the mean (sd) for the individual SCL scale items when the group of THA and TKA patients is compared with the Danish general population study. In the results from the general population study we have corrected for the gender ratio in the THA and TKA group, but not for the age of the participants.
The effect sizes in Table 3 are rather diverse ranging from -0.22 to 0.88. Obviously, the group of patients scored higher on the SCL subscale of somatization than the group of healthy persons (effect size = -0.22) but on all the psychic SCL subscales the healthy group actually scored higher than the group of patients especially for the SCL subscales of interpersonal sensitivity, hostility, paranoid ideas, and psychoticism. The effect sizes were clinically significant, i.e. 0.50 or higher (Table 3). On the Global Severity Index (GSI) the effect size both for SCL-90-R and SCL-28 the effect size was below 0.50.

Discussion

This is the first study on a prospective psychometric characterization of hip and knee arthroplasty patients where the symptom Checklist (SCL-90) has been applied. We have demonstrated that both the Global Severity Index (GSI) of the SCL-90 and the various subscales obtained a coefficient of scalability of 0.30 or higher indicating that the total scores of these scales express a valid level for the psychopathology of the individual persons. When compared to the Danish general population study the scalability for the THA and TKA patients was similar.

The mean score for the various SCL-scales items showed a gender but not an age bias. In terms of effect size statistics the difference between males and females was very small when taking into account that effect sizes below 0.20 are of borderline clinical significance. However, when comparing the hip or knee patients with healthy controls we have matched the two groups according to gender.

In terms of effect size statistics the group of hip or knee patients have higher mean scores on the SCL-scale items than the control group apart from somatization. The SCL-subscale of somatization includes such symptoms as headache, pains in lower back, feeling weak in parts of the body, and heavy feelings in arms or legs which obviously explain the negative effect size for somatization. However, on all the other SCL-sub scales the mean item scores were higher than the control group than in the group of his or knee patients. Considering an effect size of 0.50 or higher to indicate clinical significance we found that the SCL subscales of interpersonal sensitivity, hostility, paranoid ideas, and psychoticism to differ significantly. In
In this context we have to take into consideration that the Danish general population study (16) was carried out in the year of 2000, i.e. there is a time frame of 15 years between this study and the present study of hip or knee patients. When focusing on the prevalence of DSM-IV major depression using the Major Depression Inventory which also was included in the study by Olsen et al. 2004 (16), we obtained a prevalence of 3.4 %. In our resent population study (29) we obtained a prevalence of 2.0 % for DSM-IV major depression. Therefore only a new Danish general population study on SCL-90 can elucidate the background for the difference we have obtained between the control group and the group of hip or knee patients. However, our results clearly demonstrate that the THA and TKA patients included in our study have no major psychopathological disturbances.

In summary, the present data have important implications for future strategies to improve outcome after fast-track THA and TKA in patients with psychiatric diseases and/or psychopharmacological treatment (8,9) since the present data add further support to the negative outcome effects of the psychopharmacological treatment per se rather than patient psychometric characteristics prior to operation.
References

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