

Obesity, depression and factors associated to the quality of life in total knee arthroplasty

Obesidad, depresión y factores asociados a la calidad de vida en artroplastia total de rodilla

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Abstract

Background: Knee osteoarthritis can be accompanied by depression and obesity, which could affect the quality of life (QOL) and function after a total knee arthroplasty (TKA). **Objective:** To compare the QOL in subjects with depression and obesity 5 years after TKA. **Methods:** Cross-sectional study of prospectively collected data, with two and three groups based on depression and obesity status. Sociodemographic variables, QOL and pain were compared. Depression was evaluated with a screening geriatric depression questionnaire used in the Mexican Health and Age Study (CENASEM). QOL was evaluated with the health survey SF-36. **Results:** 378 participants were reviewed, 266 were included. Depression was detected in 24.1%, female ($p < 0.001$), with comorbidity ($p = 0.04$) and anxiety ($p < 0.001$), and the QOL score in subjects with depression was lower ($p < 0.001$). Obese subjects had greater pain (analogous visual scale 3 vs. 2; $p = 0.002$) and affection of the vitality domain in the QOL (75 vs. 80; $p = 0.02$). **Conclusions:** Evaluating depression and QOL with questionnaires such as CENASEM and SF-36 in elderly subjects who undergo ATR should be indispensable, since detecting and treating depression could increase QOL and function. Obese elderly with TKA may present greater pain.

Key words: Arthroplasty. Quality of life. Depression. Body mass index. Obesity.

Resumen

Antecedentes: La gonartrosis puede acompañarse de depresión y obesidad, afectando la calidad de vida (CV) y la funcionalidad después de una artroplastia total de rodilla (ATR). **Objetivo:** Comparar la CV en sujetos con depresión y obesidad 5 años después de una ATR. **Método:** Estudio transversal prolectivo, con dos y tres grupos basados en el estatus de depresión y la obesidad. Se obtuvieron variables sociodemográficas, clínicas, antropométricas y de CV. La depresión se evaluó con el cuestionario de tamizaje del Estudio Nacional sobre Salud y Envejecimiento de México (CENASEM). La CV se evaluó con la encuesta de salud SF-36. **Resultados:** Se revisaron 378 participantes, para incluir 266. Se detectó depresión en el 24.1%, mujeres ($p < 0.001$), con comorbilidad ($p = 0.04$) y ansiedad ($p < 0.001$). El puntaje en la CV en sujetos con depresión fue menor ($p < 0.001$). Las personas obesas tuvieron mayor dolor (escala visual análoga 3 vs. 2; $p = 0.002$) y afección del dominio

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Date of reception: 23-12-2018

Date of acceptance: 18-07-2019

DOI: 10.24875/CIRUE.M20000111

Cir Cir (Eng). 2020;88(2):140-146

Contents available at PubMed

www.cirugiaycirujanos.com

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de vitalidad en la CV (75 vs. 80; $p = 0.02$). **Conclusiones:** Es indispensable evaluar la depresión y la CV con cuestionarios como el CENASEM y el SF-36 en ancianos que se sometan a ATR, ya que detectar y tratar la depresión podría aumentar la CV y la función. Las personas ancianas obesas con ATR pueden presentar mayor dolor.

Palabras clave: Artroplastia. Calidad de vida. Depresión. Índice de masa corporal. Obesidad.

Introduction

Total knee arthroplasty (TKA) is an effective treatment for advanced-stage knee arthritis, since it provides pain relief and improves quality of life (QOL)^{1,2}. The prevalence of TKA in adults of 50 years of age or older is estimated to be 4.2%³, which corresponds to 4.7 million knee replacements⁴. Although TKA relieves pain, 7-34% of patients are not satisfied with surgery overall outcome⁵. In addition, subjects who undergo TKA suffer comorbidities that can impact on recovery and limit functional results, as well as QOL⁶. Factors involved in this dissatisfaction include gender, economic status, comorbidity, psychological health, marital status and social support, which if altered prior to surgery might be predictors of TKA inadequate results, both in terms of QOL and function⁷. One of these factors is depression⁸, which can be associated with persistent pain and constant use of medications to treat it⁹. Furthermore, depression influences TKA functional results regardless of the presence or intensity of pain¹⁰. Similarly, mental stress, by generating negative emotions, is associated with poor functional results, QOL deterioration, disability, and acute recurrent pain¹¹.

On the other hand, obesity is a global epidemic with social, medical and financial implications. More than 502 million people are estimated to be able to be classified with obesity in the world¹², which will increase the demand for TKA by 673% by the year 2030. In view of this increase, its adequate evaluation becomes mandatory in order to avoid unsatisfactory results¹³. Two years after a TKA in obese subjects, weight has been reported to increase, since obesity is a multifactorial problem and simple pain relief is not enough to improve physical activity and thereby reduce the body mass index (BMI) and increase QOL¹⁴.

This way, the studies that evaluate obesity and depression, as well as their influence on TKA results, are discordant and there is still no consensus that homogeneously evaluates QOL, function and satisfaction, and contradictory and discrepant results are thus generated. Therefore, the main purpose of this study

was to compare QOL in patients with obesity and depression 5 years after TKA.

Method

Prolective, cross-sectional survey, carried out in a regional hospital specialized in trauma and orthopedics of the Mexican Institute of Social Security from northeastern Mexico. Inclusion criteria were: patients who had undergone TKA between 2010 and 2012, with more than 5 years elapsed since surgery, older than 50 years, without antidepressant or anxiolytic treatment, and with no cognitive impairment. Exclusion criteria were: subjects with replacement in other joints, revision or tumor-related surgeries, inflammatory arthritis, joint fibrosis, previous infection, arthrodesis and aseptic loosening. The sample selection was made resorting to the TKA daily surgical record, with simple random probability sampling without replacement and sample size for proportion, in a finite population (2,500 TKAs per year), with an expected frequency of depression of 11.7%¹⁵ and $d = 0.01$, to obtain 266 patients.

Participants were contacted by phone for their evaluation, and after informed consent was granted, the purpose of the study was explained to subsequently record age, gender, level of education (≤ 6 years or > 6 years), marital status (married or not married), smoking and alcohol consumption, as well as the presence of diabetes mellitus, high blood pressure, comorbidity (pulmonary, cardiovascular, urological, renal conditions, liver disease, cancer, endocrine pathologies and brain disease), intake of non-steroidal anti-inflammatory drugs, recent retirement, occupation and main economic source (pension, family or job). Weight and height were measured with light clothing, without shoes, on an analog scale with height rod and calibration verification; these measurements were recorded on two occasions and the mean was taken as the definitive measurement, to then calculate the BMI (kg/m^2) and categorize it in three groups: ≤ 24.9 (normal weight), 25 - 29.9 (overweight) and ≥ 30 (obesity).

The instruments were applied on two occasions by personnel unrelated to the research (previously

trained medical students), in a blinded and independent manner, when entering and leaving the office; in addition, between-observer agreement was estimated. To detect depression, the screening questionnaire of the Mexican Health and Aging Study (MHAS)¹⁶ was used, which is a sensitive (80.7%), specific (68.7%) and consistent (Cronbach's alpha: 0.74) instrument, made up of nine items with yes/no answers, with six positive and three negative answers assessing previous week's events for each question. A score of 5 or more indicates depression. QOL was assessed with the SF-36 questionnaire (SF-36-Q), which consists of 36 questions and 8 dimensions: physical function, physical role, bodily pain, general health, vitality, social functioning, emotional role and mental health. It is self-administered, the results are transferred to a scale from 0 (worst health) to 100 (best health), and has a Cronbach alpha of 0.56 to 0.84¹⁷. Pain intensity was measured with a 0-to-10 visual analogue scale (VAS), where 0 was absence and 10 was the highest pain intensity. The patient indicated the number that best described that intensity. It is a reliable scale ($r = 0.94$), useful even for illiterate individuals ($r = 0.71$)¹⁸. It was applied twice, with the median being taken as the definitive value. Anxiety was assessed with the Goldberg questionnaire, which has two subscales (depression and anxiety), each one with nine yes/no answer items, with four initial screening items and the other five that are formulated when positive answers to the screening are obtained. It is sensitive (83.1%) and specific (81.8%), with a Cronbach alpha of 0.65¹⁹. For the study, only the anxiety questionnaire was applied.

For the correct application and filling of the evaluation instruments, several meetings were held with the hospital psychiatrist, as well as weekly supervision of collaborators, and a pilot test prior to starting the study. The protocol was authorized by the Local Research and Research Ethics Committee 1903, with registration identifier R-2017-1903-10.

Mann-Whitney's U and Kruskal-Wallis statistical tests were used for quantitative variables, and Pearson's chi-square test was resorted to for the comparison of frequencies. For the magnitude of association, the odds ratio was calculated, with a 95% confidence interval. A multivariate analysis was carried out using a logistic regression model to discriminate those factors that were significant in the bivariate analysis. A p-value < 0.05 was considered significant. Analysis was carried out with the SPSS program, version 22 (SPSS, Chicago, IL, USA).

Results

Three-hundred and seventy-eight subjects were evaluated, out of whom 112 failed to meet the selection criteria (23 with hip joint replacement, 16 with revision prosthesis, 13 with a history of prosthetic loosening, 9 with arthrodesis, 7 with tumor prosthesis, 12 who reported anxiety and 32 with depression), to finally include 266 participants. Median age was 71 years (range: 51-89). Subjects were predominantly women (61.7%), and in 51.9%, BMI was ≥ 30 kg/m². The prevalence of depression and anxiety was 24.1% and 17.7%, respectively. In the comparison of variables in subjects with TKA classified with and without depression, female gender, anxiety, alcohol consumption and comorbidity were significant (Table 1). Subjects classified with depression obtained low scores in all SF-36-Q domains, with significant differences in comparison with those without depression ($p < 0.001$) (Table 2). In the comparative analysis by gender, women had a prevalence of depression and anxiety of 84.4% and 74.5%, respectively. In the results of diabetic subjects with TKA, a median time of diabetes evolution of 8 years was obtained (range: 1 - 33), in 25.9%, treatment was with hypoglycemic agents, 4.9% used insulin and only the SF-36-Q domain general health showed a low score ($p = 0.009$). In subjects with high blood pressure, the social functioning domain was significant ($p = 0.03$). In participants classified with anxiety, there were low scores in all eight SF-36-Q domains ($p < 0.001$), while no significant differences were observed in the VAS scores. In turn, in the comparison between the groups of subjects with normal weight, overweight and obesity with the SF-36-Q, the physical functioning, bodily pain, vitality and VAS components had statistical significance (Table 3). In the multivariate analysis using a binary logistic regression model, the independent factors associated with depression in elderly subjects with TKA were anxiety, social functioning, vitality and mental health (Table 4).

Discussion

In this study, a high prevalence of depression and anxiety could be observed in elderly patients with TKA. In contrast, Stundner et al.²⁰, in subjects prior to undergoing TKA, report a prevalence of 1.8% for depression, 3% for anxiety and 0.07% for both, which reflects that these psychiatric disorders might become more prevalent 5 years after TKA. This is consistent

Table 1. General population characteristics comparison according to with and without depression status

Characteristic	With depression, n = 64 (24.1%)	Without depression, n = 202 (75.9%)	OR	95% CI	p
Age (years)	70.5 (63.25-76)*	71 (66-75)*	–	–	0.61 [†]
Female gender (%)	54 (84.4)	110 (54.5)	4.5	2.2-9.4	< 0.001 [‡]
Weight (%)	75.5 (68-87.3)*	79.5 (72-86)*	–	–	0.16 [†]
Height (%)	1.6 (1.53-1.61)*	1.6 (1.55-1.68)*	–	–	0.06 [†]
Level of education ≤ 6 years (%)	7 (10.9)	20 (9.9)	1.1	0.4-2.8	0.81 [‡]
Marital status not married (%)	23 (35.9)	55 (27.2)	0.7	0.4-1.2	0.18 [‡]
Smoking (%)	5 (7.8)	26 (12.9)	0.6	0.2-1.6	0.27 [‡]
Alcohol consumption (%)	6 (9.4)	47 (23.3)	0.3	0.1-0.8	0.02 [‡]
Diabetes mellitus (%)	23 (35.9)	62 (30.7)	1.3	0.7-2.3	0.43 [‡]
High blood pressure (%)	41 (64.1)	124 (61.4)	1.1	0.6-2.0	0.70 [‡]
Comorbidity (%)	39 (60.9)	93 (46)	1.8	1.03-3.2	0.04 [‡]
Anxiety (%)	32 (50)	15 (7.4)	12.5	6.0-25.5	< 0.001 [‡]
Use of NSAIDs (%)	51 (79.7)	141 (69.8)	1.7	0.9-3.3	0.12 [‡]
Recent retirement (%)	10 (15.6)	38 (18.8)	0.8	0.4-1.7	0.56 [‡]
Active worker (%)	10 (15.6)	19 (9.4)	1.8	0.8-4.1	0.16 [‡]
Economic support (%)					0.96 [‡]
Job	15 (23.4)	25 (12.4)	–	–	
Pension	43 (67.2)	157 (77.7)	–	–	
Family	6 (9.4)	20 (9.9)	–	–	

NSAIDs: non-steroid anti-inflammatory drugs; CI: confidence interval; OR: odds ratio.

*Median and interquartile range.

[†]Mann-Whitney's U-test.[‡]Chi-square test.**Table 2. Comparison of SF-36 scale components according to with and without depression status**

Component	With depression, n = 64 (24.1%)	Without depression, n = 202 (75.9%)	p
Physical functioning	62.5 (50.5-83.75)	80 (70-90)	< 0.001*
Physical role	25 (25-50)	75 (25-80)	< 0.001*
Bodily pain	52 (32.75-61)	73 (51-84)	< 0.001*
Physical health	47 (35.5-60)	65 (52-80)	< 0.001*
Vitality	60 (50-68.75)	82 (72-90)	< 0.001*
Social functioning	54 (50-75)	100 (75-100)	< 0.001*
Emotional role	66 (33-100)	100 (92-100)	< 0.001*
Mental health	62.5 (48-76)	92 (84-96)	< 0.001*
VAS	3 (2-4)	2 (1-4)	< 0.001*

All values are expressed as the median and interquartile range.

VAS: visual analogue scale.

*Mann-Whitney's U-test.

with the results obtained by Singh and Lewallen²¹, who found that, after 13 years, there is an increase in the prevalence of depression and anxiety from 4.1% to 14.8% and from 4.1% to 8.9%, respectively, which could be explained by the presence of persistent pain, which can favor dissatisfaction and psychological disturbances. Similarly, Dhurve et al.²² observed that persistent pain and presence of depression 3 years after TKA is the main cause of dissatisfaction; furthermore, subjects who present with depression before undergoing TKA surgery are associated with higher levels of pain at 1 year of postoperative course²³. Khatib et al.²⁴ refer that subjects with depression and who are on TKA waiting list report higher levels of pain, even with the same degree of joint degeneration. Similarly, Duivenvoorden et al.¹⁵ observed that depression and anxiety might decrease 1 year after TKA was performed, but that in subjects with preoperative

Table 3. Comparison of SF-36 scale components with the body mass index

Component	Normal weight, n = 20 (7.5%)	Overweight, n = 108 (40.6%)	Obesity, n = 138 (51.9%)	p
VAS	3 (1-4)	2 (1-4)	3 (2-4)	0.002*
Physical functioning	72.5 (52.5-80)	80 (70-90)	75 (60-85)	0.01*
Physical role	50 (25-75)	50 (25-75)	50 (25-75)	0.54*
Bodily pain	55.5 (41-72)	74 (50.25-84)	61 (50-76)	0.04*
General health	61 (45-80.25)	65 (47-79.5)	60 (50-72.5)	0.64*
Vitality	75 (70-88.75)	80 (70-90)	75 (61.5-85)	0.03*
Social functioning	68.5 (50-100)	92 (62-100)	81 (62-100)	0.32*
Emotional role	100 (69-100)	100 (66-100)	100 (76-100)	0.72*
Mental health	84 (75-95)	88 (76-96)	88 (68-92)	0.29*

All values are expressed as the mean and interquartile range.

VAS: visual analogue scale.

*Kruskal-Wallis test.

Table 4. Analysis of results with a binary logistic regression model

Step 4	B	SE	Wald	df	p	OR	95% CI
Anxiety	2.062	0.545	14.301	1	< 0.001	7.9	2.7-23
Social functioning	0.024	0.011	4.96	1	0.026	1.024	1.003-1.046
Vitality	0.057	0.017	11.882	1	< 0.001	1.059	1.025-1.094
Mental health	0.074	0.016	22.153	1	< 0.001	1.077	1.044-1.111
Constant	-11.951	1.679	50.635	1	< 0.001		

Presence or absence of depression was taken as reference for analysis.

CI: confidence interval; OR: odds ratio.

anxiety and depression, worse functional results and greater dissatisfaction are obtained.

In this study, as it could be observed, patients who were classified with depression had low scores in all SF-36-Q domains, as opposed to Pérez-Prieto et al.,²⁵ who report that subjects with depression and TKA show no negative effects on the SF-36-Q score components 5 years after TKA and that, therefore, depression should not contraindicate TKA. This difference can be explained because, in that study, anxiety was not taken into account, which in our report was an independent predictor associated with depression in elderly subjects at 5 years of having undergone TKA surgery. Therefore, detecting patients with depression and anxiety, to be thereof treated prior to surgery, should be an integral part of primary care protocols in patients with knee arthrosis in order to enhance TKA benefits.

Another factor that seems relevant mentioning is comorbid state. One study²⁶ refers that psychiatric disorders, high blood pressure and diabetes are factors associated with TKA revision surgery within the first 5 years after primary operation. However, in this report, diabetic and hypertensive subjects showed little impact on QOL. Similar results were obtained in another study²⁷, where diabetic subjects did not show a decrease on SF-36-Q domains scores, which shows that diabetes should not contraindicate TKA. However, it is evident that comorbid states can be associated with mental state disorders, and the presence of comorbidity in subjects that are candidates to TKA might be a factor associated with depression; for this reason, subjects with comorbidity should be thoroughly evaluated, because they might continue with pain and have poor functional results after TKA²⁸.

On the other hand, in this report, women were observed to undergo TKA in a higher proportion and to have depression and anxiety more frequently. Buller et al.²⁹ report similar results to ours, with 78% and 76% of women with depression and anxiety, respectively. This may be due to a longer life expectancy in women and to the fact that mental disorders are more prevalent in them.

As for QOL analysis in subjects with obesity and TKA, in the study by Xu et al.,¹³ subjects with obesity were reported improve their QOL in the postoperative period, but when assessed after 2 and 10 years, they showed decreasing scores in all SF-36-Q domains. However, in this report, subjects with normal BMI were observed to have low scores in more SF-36-Q

components in comparison with obese individuals, which is in agreement with a report that claims that QOL and function in obese subjects, 5 years after TKA, are not different from those in normal-weight subjects³⁰, but that obese individuals have higher scores in pain intensity. Similarly, we observed higher pain perception VAS scores in obese subjects, but with little impact on QOL components. In contrast, one study³¹ refers that obese subjects, at 6 months of TKA postoperative course, have a similar pain intensity to that of non-obese subjects. Similarly, Jones et al.³² point out that, 3 years after TKA, there are no differences in terms of pain in obese patients and in patients with lower BMI, and that TKA should not be contraindicated in obese individuals. In view of the above, the question remains on whether or not TKA should be denied to obese subjects. It is important pointing out that we studied patients with more than 5 years of having undergone surgery, and that median age was 71 years, which reflects that age affects QOL and might increase pain levels in elderly obese patients with TKA.

As limitations of the study, it should be mentioned that BMI, depression, anxiety and QOL were not documented prior to TKA, which precludes evaluating possible changes. A functional assessment scale was not applied to compare the results in obese subjects, as well as in subjects with and without depression. Neither was anesthetic risk documented to assess organ compromise in patients with comorbidity associated with knee arthrosis. The study was restricted to patients from a single geographical region, which can make it difficult for the results to be generalized. The depression diagnosis was not confirmed by a psychiatrist, which may have caused classification bias.

Among the strengths of the study, the use of the MHAS scale, created and validated for the Mexican elderly population, stands out. Sampling was probabilistic in order to reduce possible selection biases. The interviews were blinded and independent, and the interviewers were research-unrelated personnel to avoid politeness and interviewer biases.

Conclusion

Subjects with depression have low scores on SF-36-Q components and report high scores on VAS pain perception. Anxiety was the most important predictor associated with depression in elderly subjects with TKA. Similarly, the SF-36-Q components that are possible factors associated with depression in subjects

with more than 5 years of having undergone TKA are social functioning, vitality and mental health. Obesity in subjects with TKA increases pain perception, with little impact on QOL. We recommend carrying out a systematic evaluation with questionnaires such as MHAS questionnaire and SF-36-Q in elderly subjects who are to undergo TKA, given that detecting, treating and monitoring depression might increase QOL and improve TKA functional results. Finally, in elderly patients with obesity and TKA, we recommend further research works to be carried out, since evidence is still conflicting.

Conflict of interests

The authors declare that they have no conflicts of interest.

Ethical disclosure

Protection of people and animals. The authors declare that no experiments were performed on humans or animals for this research.

Confidentiality of data. The authors declare that they have followed the protocols of their work center on the publication of patient data.

Right to privacy and informed consent. The authors have obtained informed consent from the patients and/or subjects referred to in the article. This document is in the possession of the corresponding author.

References

1. Yang Z, Liu H, Xie X, Tan Z, Qin T, Kang P. The influence of diabetes mellitus on the post-operative outcome of elective primary total knee replacement: a systematic review and meta-analysis. *Bone Joint J.* 2014;96-B:1637-43.
2. Dusat A, Pedro S, Mikuls TR, Hartman CW, Garvin KL, O'Dell JR, et al. Impact of total knee arthroplasty as assessed using patient-reported pain and health-related quality of life indices: rheumatoid arthritis versus osteoarthritis. *Arthritis Rheumatol.* 2015;67:2503-11.
3. Weinstein AM, Rome BN, Reichmann WM, Collins JE, Burbine SA, Thornhill TS, et al. Estimating the burden of total knee replacement in the United States. *J Bone Joint Surg Am.* 2013;95:385-92.
4. Maradit Kremers H, Larson DR, Crowson CS, Kremers WK, Washington RE, Steiner CA, et al. Prevalence of total hip and knee replacement in the United States. *J Bone Joint Surg Am.* 2015;97:1386-97.
5. Peter WF, Dekker J, Tilbury C, Tordoir RL, Verdegaa SH, Onstenk R, et al. The association between comorbidities and pain, physical function and quality of life following hip and knee arthroplasty. *Rheumatol Int.* 2015;35:1233-41.
6. Smith TO, Penny F, Fleetcroft R. Medical morbidities in people following hip and knee arthroplasty: data from the Osteoarthritis Initiative. *Eur J Orthop Surg Traumatol.* 2016;26:99-106.
7. Hossain FS, Konan S, Patel S, Rodríguez-Merchán EC, Haddad FS. The assessment of outcome after total knee arthroplasty: are we there yet? *Bone Joint J.* 2015;97-B:3-9.
8. Bierke S, Häner M, Petersen W. Influence of somatization and depressive symptoms on the course of pain within the first year after uncomplicated total knee replacement: a prospective study. *Int Orthop.* 2016; 40:1353-60.

9. Browne JA, Sandberg BF, D'Apuzzo MR, Novicoff WM. Depression is associated with early postoperative outcomes following total joint arthroplasty: a nationwide database study. *J Arthroplasty*. 2014;29:481-3.
10. Riddle DL, Wade JB, Jiranek WA. Major depression, generalized anxiety disorder, and panic disorder in patients scheduled for knee arthroplasty. *J Arthroplasty*. 2010;25:581-8.
11. Qi A, Lin C, Zhou A, Du J, Jia X, Sun L, et al. Negative emotions affect postoperative scores for evaluating functional knee recovery and quality of life after total knee replacement. *Braz J Med Biol Res*. 2016;49:e4616.
12. Chen JY, Lo NN, Chong HC, Bin Abd Razak HR, Pang HN, Tay DK, et al. The influence of body mass index on functional outcome and quality of life after total knee arthroplasty. *Bone Joint J*. 2016;98-B:780-5.
13. Xu S, Chen JY, Lo NN, Chia SL, Tay DKJ, Pang HN, et al. The influence of obesity on functional outcome and quality of life after total knee arthroplasty: a ten-year follow-up study. *Bone Joint J*. 2018;100-B:579-83.
14. Kandil A, Novicoff WM, Browne JA. Obesity and total joint arthroplasty: do patients lose weight following surgery? *Phys Sportsmed*. 2013;41:34-7.
15. Duivenvoorden T, Vissers MM, Verhaar JA, Busschbach JJ, Gosens T, Bloem RM, et al. Anxiety and depressive symptoms before and after total hip and knee arthroplasty: a prospective multicentre study. *Osteoarthritis Cartilage*. 2013;21:1834-40.
16. Aguilar-Navarro SG, Fuentes-Cantú A, Ávila-Funes JA, García-Mayo EJ. Validity and reliability of the screening questionnaire for geriatric depression used in the Mexican Health and Age Study. *Salud Publica Mex*. 2007;49:256-62.
17. Zúñiga MA, Carrillo-Jiménez GT, Fos PJ, Gandek B, Medina-Moreno MR. Evaluation of health status using Survey SF-36: preliminary results in Mexico. *Salud Publica Mex*. 1999;41:110-8.
18. Hawker GA, Mian S, Kendzerska T, French M. Measures of adult pain: Visual Analog Scale for Pain (VAS Pain), Numeric Rating Scale for Pain (NRS Pain), McGill Pain Questionnaire (MPQ), Short-Form McGill Pain Questionnaire (SF-MPQ), Chronic Pain Grade Scale (CPGS), Short Form-36 Bodily Pain Scale (SF-36 BPS), and Measure of Intermittent and Constant Osteoarthritis Pain (ICOAP). *Arthritis Care Res (Hoboken)*. 2011;63(Suppl 11):S240-52.
19. Goldberg D, Bridges K, Duncan-Jones P, Grayson D. Detecting anxiety and depression in general medical settings. *BMJ*. 1988;297:897-9.
20. Stundner O, Kirksey M, Chiu YL, Mazumdar M, Poultsides L, Gerner P, et al. Demographics and perioperative outcome in patients with depression and anxiety undergoing total joint arthroplasty: a population-based study. *Psychosomatics*. 2013;54:149-57.
21. Singh JA, Lewallen DG. Time trends in the characteristics of patients undergoing primary total knee arthroplasty. *Arthritis Care Res (Hoboken)*. 2014;66:897-906.
22. Dhurve K, Scholes C, El-Tawil S, Shaikh A, Weng LK, Levin K, et al. Multifactorial analysis of dissatisfaction after primary total knee replacement. *Knee*. 2017;24:856-62.
23. Bistolfi A, Bettoni E, Aprato A, Milani P, Berchiolla P, Graziano E, et al. The presence and influence of mild depressive symptoms on post-operative pain perception following primary total knee arthroplasty. *Knee Surg Sports Traumatol Arthrosc*. 2017;25:2792-800.
24. Khatib Y, Jenkin D, Naylor JM, Harris IA. Psychological traits in patients waiting for total knee arthroplasty. A cross-sectional study. *J Arthroplasty*. 2016;31:1661-6.
25. Pérez-Prieto D, Gil-González S, Pelfort X, Leal-Blanquet J, Puig-Verdié L, Hinarejos P. Influence of depression on total knee arthroplasty outcomes. *J Arthroplasty*. 2014;29:44-7.
26. Jämsen E, Peltola M, Eskelinen A, Lehto MU. Comorbid diseases as predictors of survival of primary total hip and knee replacements: a nationwide register-based study of 96 754 operations on patients with primary osteoarthritis. *Ann Rheum Dis*. 2013;72:1975-82.
27. Singh JA. Effect of comorbidity on quality of life of male veterans with prevalent primary total knee arthroplasty. *Clin Rheumatol*. 2009;28:1083-9.
28. Utrillas-Compained A, De la Torre-Escuredo BJ, Tebar-Martínez AJ, Asúnsolo-Del Barco A. Does preoperative psychologic distress influence pain, function, and quality of life after TKA? *Clin Orthop Relat Res*. 2014;472:2457-65.
29. Buller LT, Best MJ, Klika AK, Barsoum WK. The influence of psychiatric comorbidity on perioperative outcomes following primary total hip and knee arthroplasty: a 17-year analysis of the National Hospital Discharge Survey database. *J Arthroplasty*. 2015;30:165-70.
30. Torres-Claramunt R, Hinarejos P, Leal-Blanquet J, Sánchez-Soler JF, Mari-Molina R, Puig-Verdié L, et al. Does obesity influence on the functional outcomes of a total knee arthroplasty? *Obes Surg*. 2016;26:2989-94.
31. Li W, Ayers DC, Lewis CG, Bowen TR, Allison JJ, Franklin PD. Functional gain and pain relief after total joint replacement according to obesity status. *J Bone Joint Surg Am*. 2017;99:1183-9.
32. Jones CA, Cox V, Jhangri GS, Suárez-Almazor ME. Delineating the impact of obesity and its relationship on recovery after total joint arthroplasties. *Osteoarthritis Cartilage*. 2012;20:511-8.