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ORIGINAL ARTICLE

Influence of preoperative variables on total hip arthroplasty results

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KEYWORDS
Total hip arthroplasty;
Outcomes;
Health-related quality of life

Abstract
Objective: To evaluate the influence of certain preoperative variables (comorbidity, gender, age, aetiology, marital status or surgeon) on the results of the total hip arthroplasty (THA), and also to find out if there is agreement between the opinion of the patient and the surgeon when the final result is obtained.
Material and methods: The results of 100 of the same type of THA were analysed retrospectively using three methods: a clinical evaluation scale (Johnston protocol); the SF-36 quality of life scale, and a visual analogue scale that could assess the differences in scoring between the patient and the surgeon for the residual pain and the satisfaction obtained.
Results: The age, the sex of the patient or the type of arthrosis did not influence the final result ($p>.05$). Married patients presented a greater vitality ($p=.01$) than those not married, and those with greater preoperative comorbidity had more social activity after the surgery ($p=.04$). The patients showed more pain and less satisfaction than those noted by the surgeon, with more striking significant differences ($p<.05$) in the group of patients who showed higher levels of pain and lower levels of satisfaction with a significant linear regression ($p<.05$).
Discussion: We have found a discrepancy in the evaluation of the results of total hip arthroplasties between the surgeon and the patient, particularly regarding the residual pain, the more pain there was the less satisfied was the patient. In general, it could be said that the surgeon is happier with the result of the procedure than the patient.
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PALABRAS CLAVE
Artroplastia total de cadera;
Valoración de resultados;
Calidad de vida

Influencia de variables preoperatorias en los resultados de la artroplastia total de cadera

Resumen
Objetivo: Valorar la influencia de determinadas variables preoperatorias (comorbilidad, sexo, edad, etiología, estado civil o cirujano) en los resultados de las artroplastias totales de cadera y comparar si hay concordancia entre la opinión del paciente y del cirujano en cuanto al resultado obtenido.
Material y método: Hemos analizado retrospectivamente los resultados de 100 artroplastias totales de cadera del mismo modelo, mediante tres sistemas de evaluación: el protocolo de Johnston, el SF-36 y una escala analógica visual que permitió valorar las diferencias entre el paciente y el cirujano en cuanto al dolor residual y la satisfacción obtenida.
Resultados: La edad, el sexo del paciente o el tipo de artrosis no influyeron en el resultado final ($p > 0,05$). Los pacientes casados presentaron una mayor vitalidad ($p = 0,01$) que los no casados y aquellos con mayor comorbilidad preoperatoria tuvieron mayor función social tras la cirugía ($p = 0,04$). Los pacientes mostraron más dolor y menor satisfacción que los anotados por su cirujano, con diferencias significativas ($p < 0,05$) más llamativas en los pacientes que mostraban niveles más altos de dolor y más bajos de satisfacción con una regresión lineal significativa ($p < 0,05$).
Discusión: Determinadas variables pueden modificar los resultados de las artroplastias de cadera. Existe una discordancia en la valoración de los resultados de las artroplastias de cadera entre paciente y cirujano, mayor cuanto más elevado es el dolor o menor la satisfacción del paciente. El cirujano valora mejor el resultado del procedimiento que el propio paciente.
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Introduction

The optimal method for assessing the results of a total hip arthroplasty (THA) is still to be found;[1] who should do it and how it should be done is currently subject to debate. To assess such results we have clinical and radiological scales,[2-7] survival curves,[8] quality-of-life measuring instruments[9,10] —be they generic (the most commonly used of which is the Short Form 36[11]) or specific—, and visual analogue scales (VAS).[12-14] There are very few published studies comparing the opinions of patients with those of surgeons,[15-17] and it is possible that doctors and patients are not equally satisfied with the outcome of the operation. It may even be that results are not as good as we currently believe.

Our study aims to analyse the following: first, whether there is any factor (epidemiological or of another nature) that modifies the results of this procedure; second, the correlation between different instruments for measuring the outcome of THA; and third, whether patients and doctors share similar opinions regarding the outcome of this procedure. We formulated a working hypothesis that THA results are influenced by certain circumstances, either epidemiological or related to the surgeon himself.

Material and methods

We conducted a retrospective observational study of the results obtained in 100 patients who had undergone a primary, non-cemented THA. In all cases, one year had passed since the surgical procedure, which had been conducted in the same centre and using the Bihapro model (Biomet Inc, England). We collected the following preoperative variables from the medical history of each patient: age, gender, marital status, diagnosis of the joint disease that led to the surgery, main surgeon in charge of the operation and operative risk related to patient comorbidities at the time of surgery, according to the American Society of Anaesthesiologists (ASA). A total of 100 patients, 50 men and 50 women, were classified by surgery date. Their mean age was 64.37 years (range: 28-73). In terms of marital status, 78 patients were married, 14 widowed, 7 single and 1 divorced. In 79 cases, the patient suffered primary osteoarthritis and in 21 cases, the patient suffered secondary osteoarthritis (9 of them secondary to bone necrosis of the hip joint, 6 of them to hip dysplasia and the other 6 to various aetiologies). The surgery was performed by 9 surgeons who had carried out the procedure a varying number of times (in all cases at least 10 replacements with this model per year) and all were experts in THA. Other prosthetic models were discarded to ensure that the series was homogeneous. The preoperative ASA classification was level I in 18 cases, level II in 63 cases and level III in 19 cases. The following were excluded: cases of review surgery, patients with complications (two cases with a deep infection that required a two-stage replacement and one with an external sciatic peroneal nerve palsy from which the patient recovered 6 months after the surgical procedure), patients who did not have a complete medical and/or radiological history (4 cases), and, from a radiological point

of view, all the arthroplasties that in the follow up conducted one year after the surgery presented a gross malposition, that is, an inclination angle of the acetabulum over 50º or under 35º, and a varus-valgus deviation of the stem axis greater than 10º in the anteroposterior view (3 cases).

Three assessment tools (a clinical-radiological protocol [Johnston protocol[7]], the Short Form 36 [SF-36[18]] and a VAS) were used to analyse the results obtained from these 100 patients to evaluate the arthroplasties from different points of view: clinical, quality of life and from patient standpoint. For this study, we selected the part of the Johnston protocol corresponding to clinical evaluation (pain, work activity, function and ambulation), clinical examination (claudication, mobility of the hip joint, dysmetria and Trendelenburg sign) and patient opinion (functionality, pain, medication, satisfaction and the condition of the patient compared to the last review). At first, during the annual follow up at the outpatient clinic, the surgeon would fill in the follow-up notebook of the Johnston protocol[7] (from which we gathered the information). Afterwards, one of the authors who had not taken part in the surgery and had not been present during the assessment made by the surgeon would conduct a personal interview with each patient. It would take place in a room separate from the clinic and, to avoid bias, the interviewers would not wear white coats. They would also inform the patient that any data provided would not be shared with the surgeon nor reflected in the medical record. During the interview, the SF-36 was completed and the VAS was used to assess, from 0 to 10 points, the level of pain experienced and the satisfaction of each patient following the surgery. Finally, this VAS was used to record the surgeons' opinions about the pain and satisfaction they believed each of their patients had experienced. The surgeon was not informed of the opinions expressed by the patient.

For the analysis of the results, a statistical study of the data collected was performed using the R software package,[19] which is a programming language used for statistical analysis and graphics. The statistical basis of the techniques used can be found in Venables and Ripley[20] or Lebart et al.[21] The level of significance of the various statistical parameters used was set at $P<.05$. To represent the data better, the diagnoses were grouped as follows: primary or secondary osteoarthritis, age by intervals and marital status by married (or living with someone) and unmarried (living alone), because the number of single, divorced and widowed patients comprised a negligible percentage of the sample and the social conditions of this group (family or social support network) were regarded as similar, as in previous studies.[22,23] For the analysis of the correlations of pain and satisfaction between the assessment instruments used, we started from the idea or initial hypothesis that there should be a high correlation between the same domain, pain and satisfaction measured by the 3 instruments. The Pearson linear correlation coefficient between the different variables was calculated using the following reference values: poor correlation ($r<0.3$), moderate correlation ($0.3<r<0.6$), good correlation ($0.6<r<0.8$) and excellent correlation ($r>0.8$). To study the correlation of pain, we took the bodily pain recorded in the SF-36, the item of pain from the Johnston questionnaire and the pain experienced by the patient according to the VAS. To study satisfaction, we collected the opinion of the patient from the Johnston questionnaire and satisfaction data from the VAS.

Results

The first preoperative variable and its influence on the results of THA to be analysed (table 1) was patient gender. We found that gender, age and the cause for surgery did not significantly affect the final result ($P>.05$) in any of the dimensions assessed with the 3 instruments (Johnston, SF-36 and VAS). The marital status of the patient did not significantly influence the variables of the Johnston protocol, nor did the pain and satisfaction experienced by the patient. In the SF-36, married patients had a greater vitality than the unmarried ones, but we did not find any differences in other variables within these case studies (table 2). In terms of comorbidity, our only observation was that ASA 1 patients reported more pain than ASA 2 and ASA 3 patients on the Johnston scale (P ANOVA .01), while other variables did not present any differences. In the SF-36, the ASA 3 indicated better social function than the ASA 1 and ASA 2 (P .047). We also studied whether the outcome of THA could vary depending on the surgeon who carried out the intervention and monitored the patient, and if it was possible to measure this in both an objective and a subjective manner. First, we confirmed that there were no preoperative differences ($P>.05$) between the type of patients each surgeon operated on (in terms of age, aetiology or ASA). Next, we noted that, although the data obtained did not present significant differences in the different variables (P ANOVA and Kruskal Wallis >.05), a specific surgeon, labelled as X, presented different values in the various sections (table 3) with significant Lebart P-value and V-test. The Johnston questionnaire reflected that all the patients operated on by this surgeon had poorer function, poorer mobility and a lower opinion of their condition; the total value was also lower compared to other surgeons. The physical function in the SF-36 was also lower than average, and in the VAS this surgeon's patients presented more pain and were less satisfied with the outcome.

Our second objective was to show whether a moderate correlation in the measurement of residual pain existed among the 3 instruments. The largest correlation was between VAS and SF-36 (r-0.578), whereas the smallest was between Johnston and SF-36 (r 0.45). Regarding satisfaction, there was a moderate correlation between both (r 0.47).

In the study comparing the outcome of THA as perceived by doctor and patient, the third objective, a statistically significant difference between the pain perceived by the patient and that perceived by the doctor was found. In addition, the greater the pain experienced by the patient, the larger the difference between their perceptions (fig. 1), with a significant linear regression ($P<0.05$). Regarding satisfaction, there was also a statistically-significant difference between the level of satisfaction felt by the patient and the level perceived by the physician (P 0.03): the more satisfied the patient felt, the smaller the difference between the perceptions of the patient and doctor (fig. 2), with a significant linear regression ($P<.05$).

Table 1 Results obtained with the Johnston protocol, SF-36 and VAS in the entire series

	Mean	Median	SD	Min	Max	Ref. value
Johnston						
Pain	5.24	6.5	2.08	1	7	(0-7)
Working activity	5.52	6	1.82	1	9	(0-10)
Function	6.76	6	1.9	3	10	(0-9)
Ambulation	11.33	12	1.76	5	13	(0-13)
Claudication	2.55	3	0.74	0	3	(0-3)
Mobility	4.23	4	0.99	2	6	(0-6)
Dysmetria	0.94	1	0.24	0	1	(0-1)
Trendelemburg	0.85	1	0.36	0	1	(0-1)
Patient opinion	5.16	5	0.68	2	6	(0-6)
Total	42.91	43	7.74	20	55	(0-56)
SF-36						
Physical function	60	65	24.32	0	100	(0-100)
Physical role	41.25	25	44.01	0	100	(0-100)
Body pain	59.97	61	28.45	0	100	(0-100)
General health	60.76	57	23.44	15	100	(0-100)
Vitality	60.38	65	26.39	0	100	(0-100)
Social function	78.6	87.5	24.25	10	100	(0-100)
Emotional role	71	100	44.36	0	100	(0-100)
Mental health	69.32	74	25.14	8	100	(0-100)
VAS						
Patient pain	1.77	1	2.27	0	10	(0-10)
Patient satisfaction	8.79	10	2.23	1	10	(0-10)

SD: standard deviation.

Table 2 Results of SF-36 according to marital status

	Married	Not married	ANOVA *P*	KW *P*
Physical function	59.81	60.68	0.88	0.67
Physical role	43.59	32.95	0.31	0.30
Body pain	61.96	52.91	0.18	0.16
General health	63.15	52.27	0.054	0.083
Vitality	63.97	47.64	0.01	0.01
Social function	80.10	73.30	0.24	0.15
Emotional role	74.78	57.57	0.10	0.08
Mental health	71.85	60.36	0.058	0.033

Discussion

In the study of the outcomes of arthroplasties, it is advisable to consider the possible influence that the prior history of the patient may have on the results. Lieberman et al[24] reported that studies evaluating the results of THA should assess the results of male or female patients separately when the sample size was sufficiently large. They also found that a higher preoperative comorbidity implied lower values, both in the clinical questionnaire and in the SF- 36. Ritter et al[25] reported that these comorbidity conditions did not influence the results, and Jones et al[26] concluded that

Table 3 Comparison of means obtained by surgeons in relation to surgeon X

	Mean Surgeon X	Mean surgeons	Lebart value *P*	V test	ANOVA *P*	KW *P*
Johnston						
Function	5.6	6.76	0.02	—2.04	0.51	0.49
Mobility	3.6	4.23	0.03	—2.11	0.42	0.37
Patient opinion	4.5	5.16	0	—3.25	0.03	0.16
Total	37.4	42.91	0.02	—2.37	0.41	0.67
SF-36						
Physical function	42.5	60	0.02	—2.4	0.476	0.723
VAS						
Patient pain	3.62	1.77	0.01	2.72	0.27	0.64
Patient satisfaction	7.42	8.79	0.04	—2.05	0.23	0.13

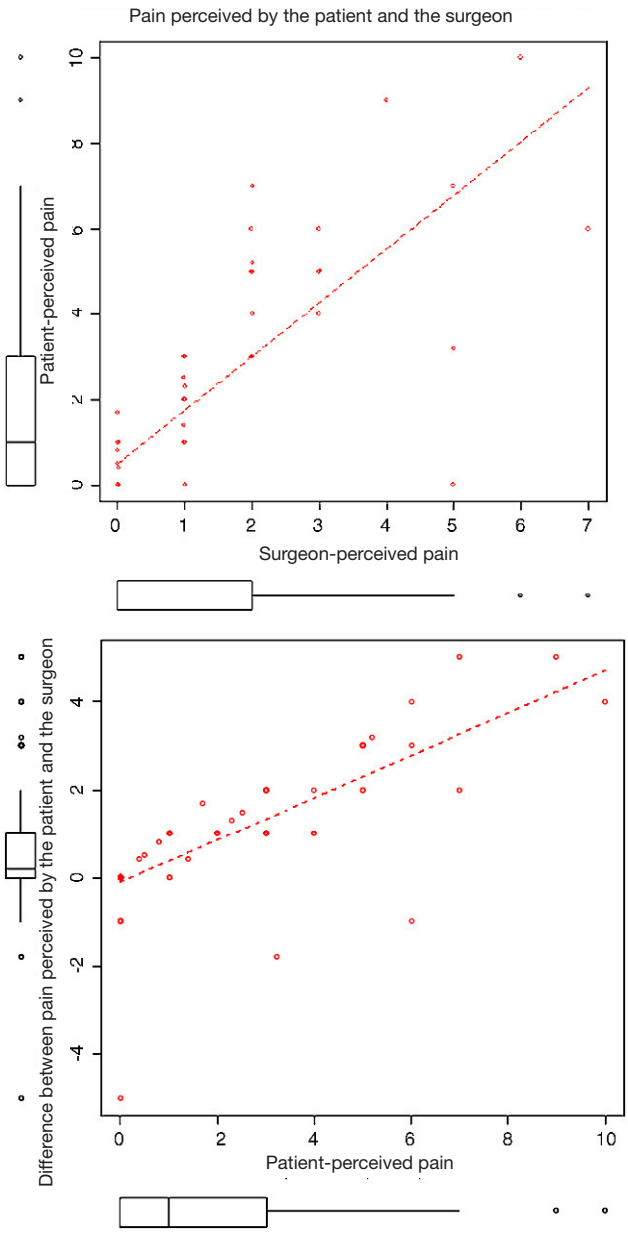

Figure 1 Pain perceived by the patient and the physician.

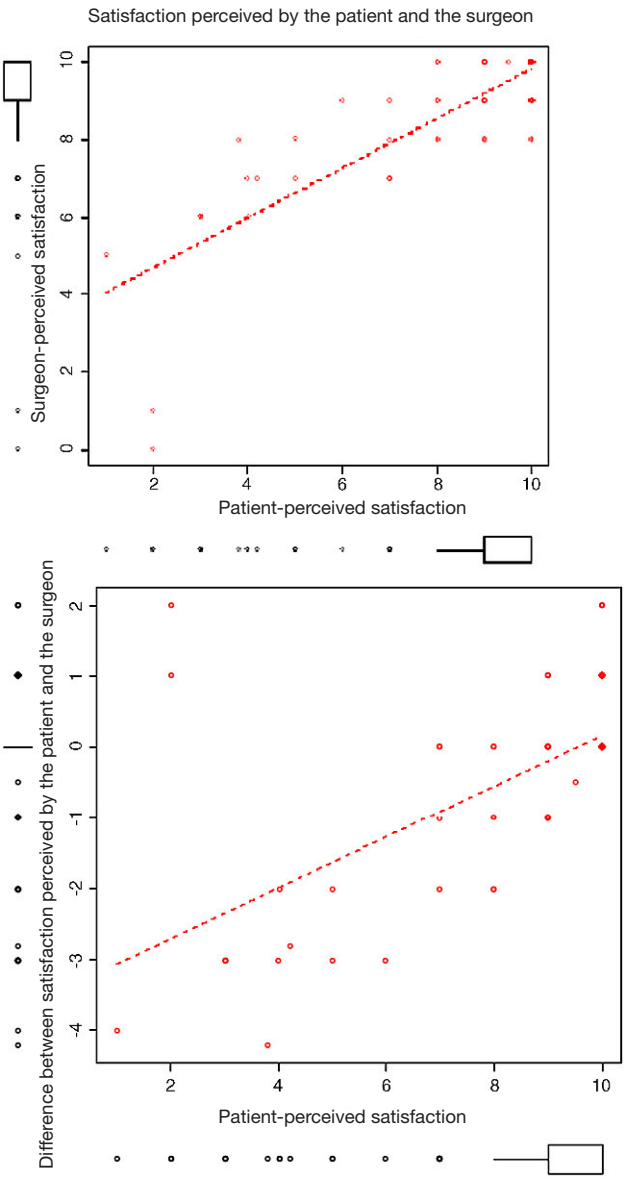

Figure 2 Satisfaction perceived by the patient and the surgeon.

age on its own did not affect the outcome of THA in terms of pain, functioning and quality of life. As some studies have shown,[27-30] men tend to score higher than women in the SF-36, but the reason for this difference, as other studies have shown,[31] is not clear. Ethgen et al[32] have shown that patients with better social support or company present better physical function, general health, mental health, social function and vitality in the SF-36 after an arthroplasty. They concluded that, although the primary aim of hip surgery is to treat pain and physical impairment, it should be complemented by a social support network to obtain better results. Greenfield et al[23] associated the marital status of the patient with an improvement in daily activities after THA, and Fitzgerald et al[22] found that patients with ample preoperative social support showed improvement in physical function and body pain after the intervention. Our study did not find any differences in the results related to patient gender or age, indicating that these should not be limiting factors when it comes to recommending THA. Neither did we find that the final result was influenced by the type of arthritis leading to the surgery. We also noted that patients with higher comorbidity (ASA 3) presented better postoperative social function than ASA 1 and 2 patients. This could be due to the fact that ASA 3 patients have a higher prevalence of potentially limiting preoperative diseases, and that their social activity prior to the surgery is consequently more limited than that of younger and healthier patients; as a result, for them, the hindrances associated with THA are fewer. We noted that in terms of marital status, although there were no differences in the objective values of the Johnston questionnaire, married

patients were more vital than unmarried ones. In addition, although the difference was not significant, they presented better general and mental health. This may indicate that unmarried patients require greater socio-emotional support to achieve better results. Lastly, we know that classic questionnaires make it possible to compare the results among different surgeons from an objective point of view (clinical and radiological), but the assessment of patient satisfaction and surgery success was not based on only the data recorded by the doctor, as we previously mentioned. We compared the results, both from an objective point of view and from the point of view of quality of life, among different surgeons in the same hospital, and found that they can differ depending on who had performed the operation. That is, the personal results obtained after THA can be assessed from different dimensions using different assessment tools; this would allow surgeons to self-evaluate and compare their results with those of other surgeons. This would, in turn, help them to understand which aspects to change or improve to obtain better results. This aspect has not been studied in the literature on THA and we feel it is important. When assessing the disparity between the results of one surgeon (referred to as surgeon X) and those of the other surgeons, we should not associate this disparity with bad practice, technical defects or lack of communication with the patient (all the surgeons were experts and had extensive experience in THA). It does prove, however, that it is possible to measure our results and, especially, to compare them with those of other surgeons.

Brokelman et al[16] found a low correlation in the satisfaction of patients, which was measured using a VAS, and other clinical metrics. They indicated that a possible explanation for this low correlation may be that satisfaction is determined by many factors, including pain, functional ability, expectations of the patient and emotional state. In our study, we found a moderate correlation among the 3 assessment tools for the measurement of residual pain after THA, indicating that pain following surgery is assessed differently depending on the control method used. We also observed a moderate correlation between the levels of patient "satisfaction-opinion" (in other words, between an objective method and a subjective one) for addressing the same question: the level of satisfaction of the patients with the outcome of their surgery. This indicates that when patients are asked for their evaluation using a VAS, they may express their satisfaction regarding the overall outcome of a procedure, which involves more factors than just the absence of pain or reduction in the medication, such as a pleasant stay at the hospital, social and family support, etc.

An issue that has resulted from assessing THA is whether the surgeons really knows what the patient wants when they agree to this type of surgery. Some classic studies, such as those conducted by Knhar et al[33] and Lieberman et al,[15] indicate that in many cases the assessment made by the surgeon of the THA outcome differs markedly from the one made by the patient. Lieberman et al[15] found that patients felt more pain and less satisfaction than noted by the surgeon, with the greatest differences occurring in the group of patients showing more pain and less satisfaction. These authors concluded that combining traditional evaluation methods by the physician with questionnaires completed by the patient would help to assess patients undergoing THA better. Brokelman et al[16] noted that if the level of patient satisfaction was low, the difference in levels of satisfaction between the patient and surgeon increased, and that the surgeon was notably more satisfied. The results of our study were similar to those reported by Lieberman et al,[15] and we found that, using the same scale, patients felt more pain and were less satisfied than the surgeon had assessed. The greatest differences were observed in the group of patients with higher levels of pain and lower levels of satisfaction. If patients recovered well, the assessments of the results made by patient and surgeon were quite similar, but if the patient did not recover well, the disparity in the results then increased and the surgeon generally tended to report better results than the patient who had received the implant. There may be several explanations for these differences between the assessments made by the physician and the patient, such as: the patient and the doctor having different expectations following surgery,[34,35] each of them having different definitions of what a successful result is, or, possibly, the patient not being completely honest about his problems and/or poor recovery for fear of disappointing the doctor. Another reason may be that the doctor really does not know how to measure the level of patient pain or satisfaction, attributing patient discontent to a lack of technical knowledge about the good work carried out.

Our work thus highlights the discrepancies between doctors and patients and recommends including questionnaires for patients (such as a standard VAS or health assessment tools) to complement clinical assessment scales in the evaluation of patients who have undergone a hip replacement arthroplasty.

Within the limitations of this study, we must note that this is a retrospective review of a small number of cases. In addition, although the Johnston protocol resulted from an attempt to elaborate a uniform questionnaire on the results of hip arthroplasties, its complexity and difficulty for completion has prevented it from becoming widespread, despite it being recognised as a valid tool for evaluating such results. We have not been able to compare our results regarding the discrepancy between the assessments of different surgeons with previous studies given that there are no references on this subject in the literature. On the other hand, it is difficult to assess a patient's social support, and it may be necessary to improve the evaluation method in future studies, because the assumed benefits of such support are more related to good motivation and postoperative family support than to being accompanied or not. A prospective analysis monitoring the different variables more precisely may possibly explain the reasons for the differences observed in the assessments by doctors and patients.

Our conclusions can be summarised as follows: neither patient age or gender nor the type of arthritis affect the result of THA, and patients who are married have greater vitality than those who are not. There is also a discrepancy in the assessments by patients and surgeons of the results of hip replacement arthroplasties; this lack of agreement tends to increase with higher residual pain or with lower level of patient satisfaction. In general, it can be said that surgeons are more satisfied with the outcome of the procedure than patients.

Level of evidence

Level of evidence IV.

Conflict of interest

The authors declare no conflict of interest.

References

1. Hernandez Vaquero D, Barrera Cadenas JL. Sistemas de evaluación de los resultados en las artroplastias. Rev Ortop Traumatol. 1999;43:245—51.
2. Merle D'Aubigne R, Postel M. Functional results of hip Arthroplasty with acrylic protesis. J Bone Joint Surg Am. 1954;36A:451—75.
3. Larson CB. Rating scale for hip disabilities. Clin Orthop Relat Res. 1963;31:85—93.
4. Harris WH. Traumatic arthritis of the hip after dislocation and acetabular fractures: Treatment by mold arthroplasty and results study using a new method of result evaluation. J Bone Joint Surg Am. 1969;51A:737—55.
5. Charnley J. The long-term results of low-friction arthroplasty of the hip performed as a primary intervention. J Bone Joint Surg Br. 1972;54B:61—76.
6. Kavanagh BF, Ilstrup D, Fitzgerald Jr RH. Revision total hip arthroplasty. J Bone Joint Surg Am. 1985;67A:517—26.
7. Johnston RC, Fitzgerald Jr RH, Harris WH, Poss R, Muller ME, Sledge CB. Clinical and radiographic evaluation of total hip replacement. A standard system of terminology for reporting results. J Bone Joint Surg Am. 1990;72A:161—8.
8. Kaplan EL, Meier P. Non parametric estimation from incomplete observation. J Am Stat Asoc. 1958;53:457—81.
9. Gómez Barrena E. Analisis de resultados finales en Cirugía Ortopédica y Traumatología. Rev Ortop Traumatol. 1997;41: 613—8.
10. Sánchez Sotelo J. Instrumentos de valoración del estado de salud en Traumatología y Cirugía Ortopédica. Rev Ortop Traumatol. 2004;48:304—14.
11. Ware JE, Sherbourne CD. The MOS 36-item short-form health survey (SF-36). Med Care. 1992;30:473—83.
12. Angst F, Aeschlimann A, Michel BA, Stucki G. Minimal clinically important rehabilitation effects in patients with osteoarthritis of the lower extremities. J Rheumatol. 2002;29:131—8.
13. Bijur PE, Silver W, Gallagher EJ. Reliability of the visual analog scale for measurement of acute pain. Acad Emerg Med. 2001; 8:1153—7.
14. Salaffi F, Stancati A, Silvestri CA, Ciapetti A, Grassi W. Minimal clinically important changes in chronic musculoskeletal pain intensity measured on a numerical rating scale. Eur J Pain. 2004;8:283—91.
15. Lieberman JR, Dorey F, Shekelle P, Schumacher L, Thomas BJ, Kilgus DJ, et al. Differences between patient˘ıs and physician˘ıs evaluations of outcome after total hip arthroplasty. J Bone Joint Surg Am. 1996;78A:835—8.
16. Brokelman RB, Van Loon CJ, Rijnberg WJ. Patient versus surgeon satisfaction after total hip arthroplasty. J Bone Joint Surg Br. 2003;85B:495—8.
17. Hernández Vaquero D, Cervero-Suárez J, Cima Suárez M, Cuervo-Olay MC, Fernández Carreira JM. Resultados de las artroplastias de rodilla. ¿Coinciden la opinión del cirujano y la del paciente? Rev Ortop Traumatol. 2008;52:295—9.
18. Alonso J, Prieto L, Anto JM. La versión española del SF-36 Health Survey (Cuestionario de Salud SF-36): Un instrumento para la medida de los resultados clínicos. Med Clin (Barc). 1995;104. pp. 771-176.
19. R Development Core Team. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. (2007). ISBN 3-900051-07-0, URL. Available from: http://www.R-project.org.
20. Venables WN, Ripley BD. Modern Applied Statistics with S. Fourth Edition. New York: Springer; 2002.
21. Lebart L, Morineau A. *Piron M. Statistique exploratoire multidimensionnelle*. Paris: Dunod; 1995.
22. Fitzgerald JD, Orav EJ, Lee TH, Marcantonio ER, Poss R, Goldman L, et al. Patient quality of life during the 12 months following joint replacement surgery. Arthritis Rheum. 2004; 51:100—9.
23. Greenfield S, Apolone G, McNeil BJ, Cleary PD. The importance of co-existent disease in the occurrence of postoperative complications and one-year recovery in patients undergoing total hip replacement. Comorbidity and outcomes after hip replacement. Med Care. 1993;31:141—54.
24. Lieberman JR, Dorey F, Shekelle P, Schumacher L, Kilgus DJ, Thomas BJ, et al. Outcome after total hip arthroplasty. Comparison of a traditional disease-specific and a quality-of-life measurement of outcome. J Arthroplasty. 1997; 12:639—45.
25. Ritter MA, Albohm MJ, Keating EM, Faris PM, Meding JB. Comparative outcomes of total joint arthroplasty. J Arthroplasty. 1995;10:737—41.
26. Jones CA, Voaklander DC, Johnston DW, Suarez-Almazor ME. The effect of age on pain, function, and quality of life after total hip and knee arthroplasty. Arch Intern Med. 2001;161: 454—60.
27. McGuigan FX, Hozack WJ, Moriarty L, Eng K, Rothman RH. Predicting quality-of-life outcomes following total joint arthroplasty. Limitations of the SF-36 Health Status Questionnaire. J Arthroplasty. 1995;10:742—7.
28. Hozack WJ, Rothman RH, Albert TJ, Balderston RA, Eng K. Relationship of total hip arthroplasty outcomes to other orthopaedic procedures. Clin Orthop Relat Res. 1997;344: 88—93.
29. Rannou F, Boutron I, Jardinaud-Lopez M, Meric G, Revel M, Fermanian J, et al. Should aggregate scores of the Medical Outcomes Study 36-item Short Form Health Survey be used to assess quality of life in knee and hip osteoarthritis? A national survey in primary care. Osteoarth Cartilage. 2007;15:1013—8.
30. Benroth R, Gawande S. Patient-reported health status in total joint replacement. J Arthroplasty. 1999;14:576—80.
31. Ng CY, Ballantyne JA, Brenkel IJ. Quality of life and functional outcome after primary total hip replacement. A five-year follow-up. J Bone Joint Surg Br. 2007;89B:868—73.
32. Ethgen O, Vanparijs P, Delhalle S, Rosant S, Bruyere O, Reginster JY. Social support and health-related quality of life in hip and knee osteoarthritis. Qual Life Res. 2004;13:321—30.
33. Knahr K, Kryspin-Exner I, Jagsch R, Freilinger W, Kasparek M. Evaluating the quality of life before and after implantation of a total hip endoprosthesis. Z Orthop Ihre Grenzgeb. 1998; 136:321—9.
34. Mancuso CA, Sculco TP, Salvati EA. Patients with poor preoperative functional status have high expectations of total hip arthroplasty. J Arthroplasty. 2003;18:872—8.
35. Mahomed NN, Liang MH, Cook EF, Daltroy LH, Fortin PR, Fossel AH, et al. The importance of patient expectations in predicting functional outcomes after total joint arthroplasty. J Rheumatol. 2002;29:1273—9.