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Factors associated with severe postoperative pain in patients with total hip arthroplasty

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Objective: The aim of this study was to determine the risk factors for the development of postoperative pain following total hip arthroplasty, particularly those connected with psychological distress and personality traits.

Methods: The study included 90 patients with complaints of postoperative pain following cemented total hip replacement divided into two groups based on the intensity of postoperative pain as measured using the numerical rating scale (NRS). Patients with NRS scores of 5 or higher were included in the study group and those with NRS of less than 5 were included in the control group. The Hamilton scales for anxiety and depression and the DS14 test for the identification of Type D personality were used for psychological evaluation.

Results: In the study group, more patients were female (29 vs. 13) and had more anxiety (13 vs. 3), depression symptoms (11 vs. 2), and Type D personality (18 vs. 9) than the control group. Mean preoperative NRS was 7.2±1.7 in the study and 6.0±1.2 in the control group ($p<0.001$). Factors associated with development of strong postoperative pain was female gender (OR=4.91, 95% CI=2.01 to 12.01, $p<0.001$), Type D personality (OR=2.81, CI=1.17 to 7.32, $p=0.030$), severe anxiety (OR=6.01, CI=1.58 to 22.90, $p=0.009$), depressive symptoms (OR=7.33, CI=1.52 to 35.34, $p=0.013$) and subjects with marked preoperative painful condition (OR=2.64, CI=1.17 to 5.44, $p<0.001$).

Conclusion: Patients with severe anxiety, depression and Type D personality appear to be at risk of developing severe postoperative pain. In addition, female gender and the intensity of pain immediately after procedure were found to be important risk factors.

Key words: Anxiety; depression; female; postoperative pain; risk factors; total hip arthroplasty; Type D personality.

Modern anesthesiology has greatly advanced the prevention and treatment of pain after surgery. However, postoperative pain remains the most common concern for surgical patients. Almost a quarter of experience adverse reactions to analgesics and significant pain continues throughout the postoperative period in many subjects. [1] Therefore, greater knowledge of risk factors for both the development and maintenance of postoperative pain

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is necessary in order to avoid difficulties related to uninhibited nociceptive stimuli, such as worsening of patient's somatic and mental functions, increasing costs and obstacles to hospital management.[2]

Studies in cardiac, thoracic and abdominal surgery have identified several risk factors that trigger postoperative pain, classified into preoperative, intraoperative and postoperative factors. The most important predictors include previous surgery, comorbid conditions with moderate-to-strong pain, psychological determinants, type and duration of surgical procedure and the pain intensity immediately after surgery.[3,4] Female gender, younger age and incision characteristics also play a possible role in some settings.[5,6]

However, clinical investigations of patients undergoing hip replacement are less frequent.[7] In such patients, greater attention has been paid to chronic pain and its risk factors. In one medium-size cohort of orthopedic patients, those with hip replacement were grouped with subjects undergoing knee replacement and spinal decompression.[8] One rare study investigated acute pain predictors following arthroplasty and emphasized the importance of psychological factors such as optimism and anxiety.[9]

In addition, patients undergoing hip prosthetic surgery are, in general, older and are likely to have distinctive postoperative pain perception.[10] Changes in nociceptive pathways and areas with aging, mental disturbances, cognitive decline and some sociocultural determinants (e.g. stoic nature, respect toward medical staff) may contribute to a higher threshold for postoperative pain. Recently, research of personality traits has provided novel data on postoperative pain risk factors.[11] Patients with baseline anxiety, worry, tendency towards bad moods, pessimistic views or inhibited social interactions (Type D personality) are more sensitive to stress and develop less effective survival strategies.[12] It has been reported that chronic pain is related to depression and/or anxiety even without surgery.[13,14]

Therefore, we performed our study considering the link between severe early postoperative pain and negative outcomes after surgery taking into account the need for increased knowledge about the topic in the specific subpopulation of orthopedic patients. The aim of our study was to identify risk factors for severe postoperative pain following hip joint replacement.

Patients and methods

The study was approved by the Institutional Ethics Committee of the General Hospital, Jagodina, Serbia and written informed consent was obtained from all patients. The study included 90 patients (mean age: 66.7±4.5 years; mean body weight: 72.4±10.8 kg) who underwent total hip arthroplasty. Subjects were divided into study (n=44) and control (n=46) groups based on pain perception. Other demographic and clinical characteristics are presented in Table 1. The experimental group included patients with one of the following pain intensity patterns within the first 12 postoperative hours; (a) early postoperative pain ≥5 as assessed on the numerical rating scale (NRS), (b) early postoperative pain from ≥3 to ≤5 and progressing in intensity >5 despite analgesic use, (c) early postoperative pain of ≤3 and progressing in intensity ≥5, and (d) no early postoperative pain but progressing in intensity ≥5 regardless of analgesic drug treatment. The remaining patients from the study cohort were included in the control group without matching of patient characteristics.

Inclusion criteria were; adult, male or female patients undergoing hip joint replacement with a total cemented prosthesis, ASA 1-3 (American Society of Anesthesiologists) classification and the absence of concomitant neuropsychiatric disorders. Exclusion criteria were; the inability to self-assess pain, acute or chronic painful comorbid condition (e.g. neoplasia, migraine, neuropathy, radiculopathy), specific disorders (chronic renal failure, gastrointestinal bleeding, liver failure, coagulation disorders, asthma or chronic obstructive pulmonary disease), administration of analgesics used in the study 24 hours before surgical incision, and allergy to analgesics.

Patients were interviewed and clinically examined before surgery by the managing doctor who also prescribed drug treatment for postoperative pain. The local hospital treatment guideline Protocol for Pain Treatment in the Intensive Care Unit 2009, based on several evidence-based sources dealing with analgesia in the intensive care units with particular attention on morphine dose titration was used as a guideline.[15-17] Principal analgesics were ketorolac (30 mg q8h i.v.) and morphine (NRS≥5: 2 to 3 mg q10min until NRS≤3 or serious adverse effect appeared, e.g. respiratory depression). Postoperative pain evaluation and monitoring was conducted in the intensive care ward according to the study protocol.

The NRS was used to evaluate pain intensity at baseline (0 hour) and at postoperative hours 1, 2, 4, 6, 8, 10, 12 and 24. Scores of 5 or greater indicated severe postoperative pain.[18] The presence of severe anxiety and depressive symptoms as well as Type D personality in patients was identified preoperatively using the Hamilton Anxiety Rating Scale (HAM-A; total score ≥31), Hamilton Depression Rating Scale (HAM-D; total

Table 1. Characteristics of study patients which correspond to categorical study variables (n=90).

Variables	Number	%
Gender		
Female	42	46.7
Male	48	53.3
ASA Class		
1	18	20.0
2	48	53.3
3	24	26.7
Severe anxiety		
Yes	16	17.8
No	74	82.2
Serious depression		
Yes	13	14.4
No	77	85.6
Type D personality		
Yes	27	30.0
No	63	70.0
Emergency of surgery		
Urgent	14	15.6
Elective	76	84.4
Waiting for surgery (mos.)		
0	14	15.6
≤4	42	46.7
>4	34	37.8
Duration of surgery (min.)		
≤100	44	48.9
>100	46	51.1
Length of incision (cm)		
≤12	8	8.9
>12	82	91.1
Type of surgery		
Minor	12	13.3
Moderate	45	50.0
Difficult	33	36.7
Blood loss (ml)		
≤400 ml	81	90.0
>400 ml	9	10.0
Surgeon's experience (# of previous interventions)		
≤200	47	52.2
>200	43	47.8
Patient's satisfaction with pain treatment		
Better than expected	21	23.3
As expected	35	38.9
Worse than expected	34	37.8
Time to patient's first mobility (hours)		
No delay	9	10.0
≤24	46	51.1
>24-36	23	25.6
>36-48	6	6.7
>48-60	5	5.6
>60-72	1	1.1

score ≥23), and the DS14 questionnaire with Likert's five-point scale (cut-off total score 10) for negative affect and social inhibition.[12,19,20] Patients rated satisfaction with their own expectations about pain treatment success (1: better, 2: same, 3: worse than expected) and real effectiveness of prescribed analgesics (from 1: does not work at all to 5: completely suppresses pain). Mobility was graded according to the patient's self-assessment using the Likert's five-point scale. Patients reported their satisfaction with mobility achieved within a particular timeframe (1: very satisfied with immediate mobility or within the first 24h, 2: satisfied with mobility achieved within 24 to 36h, 3: neutral with mobility achieved within 36 to 48h, 4: dissatisfied with mobility achieved within 48 to 60h and, 5: very dissatisfied with mobility achieved within 60 to 72h). The selection and assessment of the 5 variables relating to the surgery (emergency of surgery, duration of surgery, type of surgery, length of incision, surgeon's experience) were based on a combination of experience of local practice, surgeon's clinical judgment and previously published studies in the field.[7,21,22]

Sample size calculation of at least 85 cohort subjects was based on an expected difference of 30% in frequency of neuroticism, a categorical variable defined as a presumed pain predictor between the study groups, with α=0.05 and study power of 0.8. In the absence of studies dealing with arthroplasty, baseline frequencies of preoperative neuroticism (~20% pain-sensitive, ~50% pain-tolerant patients) were obtained from the study in another surgical discipline.[23] Data analysis included descriptive methods, Student's t-test, chi-square test (χ^2), correlation and analysis of variance. Logistic regression analysis was used to examine the association of each variable with the severe postoperative pain, which was the primary study outcome. Significance level was set at $p<0.05$.

Results

Pain intensity as self-assessed using the NRS was 6.6±1.6 preoperatively. NRS was 4.7±2.0 at the start of the study (0 hour), and 1.5±1.7 at the end of the study (24th hour). The mean value of the 8 measurements taken within the 24-hour period was 3.4±1.5. The highest intensity of pain was detected in the first 6 hours after surgery. The proportion of patients dissatisfied with postoperative pain control closely approached those with good analgesia. Mean estimate of the effectiveness of the analgesics was 3.3±1.2 (from 1 to 5) and the mean score for patients' pain treatment satisfaction was 2.1±0.8 (from 1 to 3). Three months after surgery,

Table 2. Study variables between case and control subjects.

Variables	Cases (n=44)			Controls (n=46)			p*
	Mean±SD	n	%	Mean±SD	n	%	
Age (years)	64.2±3.8			69.0±3.9			<0.001
Gender							
Female		29	65.9		13	28.3	<0.001
Male		15	34.1		33	71.7	
ASA Class							
1		7	15.9		11	23.9	0.603
2		24	54.5		24	52.2	
3		13	29.5		11	23.9	
Weight (kg)	72.1±10.8			72.7±10.9			0.785
Preoperative pain (NRS)	7.2±1.7			6.0±1.2			<0.001
Severe depressive symptoms							
Yes		11	25.0		2	4.3	0.005
No		33	75.0		44	95.7	
Severe anxiety symptoms							
Yes		13	29.5		3	6.5	0.004
No		31	70.5		43	93.5	
Type D personality							
Yes		18	66.7		9	33.3	0.027
No		26	41.3		37	58.7)	
Emergency of surgery							
Urgent		6	13.6		8	17.4	0.623
Elective		38	86.4		38	82.6	
Duration of surgery (min)							
≤100		21	47.7		23	50.0	0.829
>100		23	50.0		23	50.0	
Type of surgery							
Minor		4	9.1		8	17.4	0.468
Moderate		24	54.5		21	45.7	
Difficult		16	36.4		17	37.0	
Length of incision (cm)							
≤12		5	11.4		3	6.5	0.420
>12		39	88.6		43	93.5	
Surgeon's experience (# of previous interventions)							
≤200		20	45.5		27	58.7	0.209
>200		24	54.5		19	41.3	
Patient's satisfaction with pain treatment							
Better than expected (1)		0	0		21	45.7	<0.001
As expected (2)		12	27.3		23	50%	
Worse than expected (3)		32	72.7		2	4.3	
Score	2.7±0.4			1.6±0.6			<0.001
Patient's estimate of analgesics effectiveness (1-5)	3.0±1.2			3.5±1.2			0.039
Time to patient's mobility (1-5)	1.7±1.1			1.3±0.9			0.065
Pain after three months (NRS)	1.4±1.2			0.2±0.6			<0.001

*The frequencies are compared with x^2 test and the numbers with t-test. NRS: numerical rating scale.

the pain significantly correlated with each of the 9 measurement points for early postoperative pain intensity (r rho=0.381 to 0.581, p<0.001) as well as with their mean (r rho=0.604, p<0.001) (Spearman's correlation).

Age, female gender, depressive and anxiety symptoms, Type D personality and patient's self-assessment outcomes were significantly different between the two groups (Table 2). Pain intensity was used to determine

Table 3. Morphine dosing data (excluding morphine-free patients) and the pain intensity.

Time from surgery	Morphine dose (mg)	Pain intensity (NRS)
	Mean±SD	Mean±SD
Baseline	2.07±0.73	6.23±1.55
1st hour	1.77±1.12	5.73±1.83
2nd hour	1.11±1.22	5.18±1.71
4th hour	1.07±1.11	5.34±1.56
6th hour	1.14±0.96	5.23±1.59
8th hour	0.64±0.84	4.45±1.48

NRS: numerical rating scale

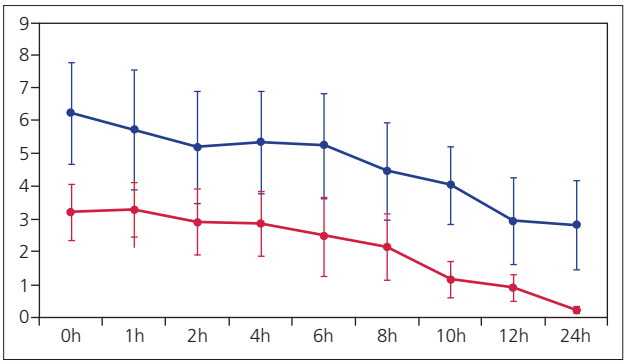

Fig. 1. Pain intensity at the study visits (hours) between the groups (blue: cases, red: controls), as measured by NRS. (p<0.001). [Color figure can be viewed in the online issue, which is available at www.aott.org.tr]

the study (more pain) and control groups (less pain) at the study points. Nevertheless, the statistically significant differences in pain intensity (as assessed using NRS) remained constant between the groups (mixed model, χ^2=146.9, df=35, p<0.001) (Fig. 1). The frequency of subjects with severe anxiety and depressive symptoms was greater in the study group than in the control group.

Prescription of morphine in the study group was used as a proxy measure for pain treatment evaluation. Morphine doses and pain intensity gradually decreased during the postoperative period but many patients underwent significant pain intensity (NRS>3) (Table 2). Morphine doses across all eight dosing intervals were significantly different (one-way ANOVA, F=15.1, df=7, p<0.001). Pairwise, post-hoc comparisons showed that each subsequent dose was significantly different from, at least, another one and that the last dose (at the 24th hour) was significantly lower from the other ones. The dosage range showed a progressive decrease in individual dose amounts with a stable period from the 2nd to 6th hour (p>0.05). During 24 hours, the total mean morphine dose was 8.52±1.98 mg (0.12±0.02 mg per kg of body weight) and the mean number of doses was 4.6±1.0. In addition, morphine doses and pain intensities in the study group showed a very strong positive correlation (r=0.939, p<0.01) (Table 3).

Type D personality was present in 27 and absent in 63 patients. Female gender (17/10 vs. 25/38, OR=2.58, 95% CI=1.02 to 6.54, p=0.042), anxiety symptoms (9/18 vs. 7/56, OR=4.0, CI=1.3 to 12.2, p=0.012) and depressive symptoms (8/19 vs. 5/58, OR=4.89, CI=1.42 to 16.73, p=0.007) were associated more in patients who satisfied the criteria for Type D personality. Patients with Type D personality had significantly lower satisfaction in their self-evaluation of the pain treatment (2.4±0.7 vs. 2.0±0.8, t=2.5, p=0.015). Three months after the operation, pain was more intense in patients with Type D personality (1.6±1.3 vs. 0.5±0.8; t=4.9, p<0.001).

The univariate logistic regression analysis revealed 5 statistically significant determinants of serious postoperative pain. However, this number of variables required a larger number of patients in both groups in order to avoid data overfitting which undermines the validity of more complex, multivariate regression model. An increase in sample size proved impossible due to logistic constraints and therefore results from the univariate model were as follows; the odds ratio for the development of postoperative pain for female gender was 4.91 (95% CI=2.01 to 12.01, p<0.001), for Type D personality 2.81 (CI=1.17 to 7.32, p=0.030), for severe anxiety 6.01 (CI=1.58 to 22.90, p=0.009), for depressive symptoms 7.33 (CI=1.52 to 35.34, p=0.013) and for subjects with marked preoperative painful condition 2.64 (CI=1.17 to 5.44, p<0.001).

Discussion

Results of our study indicated that female gender, severe anxiety and depression, Type D personality and the intensity of pain immediately after procedure are triggers for severe postoperative pain. In general, these findings agree with previous research dealing with postoperative pain in other surgical disciplines and, in some extent, in joint replacement procedures.[4,9,24,25] One recent study included subjects undergoing either hip or knee arthroplasty with more analgesics and pain modulatory drugs, using a single psychometric instrument for assessment of different domains of mental symptoms.[9] In contrast, we presented distinctive psychological determinants within a focused group of orthopedics patients who received selective analgesics.

Interest in the examination of the mental status of orthopedic patients, particularly of the older population, has emerged in recent decades, focusing on the relationships between cognitive functioning, postoperative delirium, neuroticism and anxiety with different clinical outcomes.[26-28] However, evidence regarding the association between postoperative pain and particular mental states in the field of orthopedic surgery is scarce. In one rare study, different anesthetic techniques and pain management protocol could be associated with either protection or disturbances of cognitive functioning, depending on the particular settings.[29]

Type D personality trait has been associated with negative effects in both clinical outcomes and in healthy people.[12,30] While studies have reported an association between Type D personality and some painful conditions, the connection with postoperative pain has not yet been established.[31] However, Type D personality is associated with negative emotions such as anxiety, anger and catastrophizing mood, which have been connected with acute perioperative pain following knee arthroplasty.[32] In our patients, those identified with Type D personality traits had more frequent and significant postoperative pain, significantly lower satisfaction with pain therapy and less favorable evaluation of pain treatment. Therefore, our study presented novel evidence that Type D personality traits predispose patients to a more intensive painful experience in orthopedic settings. We confirmed previous evidence of the positive relationship between significant anxiety, depressive symptoms and postoperative pain in various surgical fields.[33,34] In addition, our study presented supplementary data about risk quantification measures for both severe anxiety and depressive symptoms in the prediction of postoperative pain intensity, specifically for orthopedic patients. Better discrimination of chronic pain and depression and/or anxiety is necessary to avoid bias.

In terms of morphine usage and postoperative pain, although the physician was allowed to use repeated doses as necessary, many patients had pain of an intensity above the target level and the baseline difference between the groups remained at the same distance. In fact, total morphine intake in our study was several times lower than in other studies with patient-controlled analgesia after hip arthroplasty.[35,36] Such findings seem to indicate the difficulties in the patient-physician relationship concerning both pain assessment and treatment.

Anesthesiologists have recently recognized the importance of a physician's non-technical skills for the improvement of patient outcomes in intensive care units.[37] Sociological determinants such as family, occupation, cultural, ethnic and geographical factors influenced the diversity of pain characteristics and outcomes, encompassing surgical environments.[38] Public health research has also stressed the importance of patient attitudes about surgery and anesthesia due to the fear of postoperative pain, a highly ranked concern among the general population.[39] It seems that these and similar factors generated a major limitation to the research and to suboptimal pain treatment in routine clinical practice. Such fears resulted in the aggregation of study patients within the experimental (strong pain) group that precluded a fine statistical adjustment of the risks in the multivariable approach. The necessity for a more aggressive approach in this field through either increasing competences within the clinicians' community or liaising with medical professionals in mental health issues is strongly suggested by many researchers.[40,41]

In conclusion, mental health determinants within affective and personality traits appear to play an outstanding role in the prediction of severe postoperative pain in patients with total hip arthroplasty. Other factors such as female gender and baseline pain level were also significant contributors. The findings of suboptimal pain control in the high-risk group despite intense pain evaluation and available analgesic drug treatment suggest the complexity of the matter. Therefore, further research is necessary in order to identify additional important predictors and develop instruments for better screening of premorbid chronic pain in those patients.

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References

1. Apfelbaum JL, Chen C, Mehta SS, Gan TJ. Postoperative pain experience: results from a national survey suggest postoperative pain continues to be undermanaged. Anesth Analg 2003;97:534-40. CrossRef
2. Sinatra R. Causes and consequences of inadequate management of acute pain. Pain Med 2010;11:1859-71. CrossRef

3. Dahmani S, Dupont H, Mantz J, Desmonts JM, Keita H. Predictive factors of early morphine requirements in the post-anaesthesia care unit (PACU). Br J Anaesth 2001;87:385-9. CrossRef
4. Caumo W, Schmidt AP, Schneider CN, Bergmann J, Iwamoto CW, Adamatti LC, et al. Preoperative predictors of moderate to intense acute postoperative pain in patients undergoing abdominal surgery. Acta Anaesthesiol Scand 2002;46:1265-71. CrossRef
5. Kalkman CJ, Visser K, Moen J, Bonsel GJ, Grobbee DE, Moons KG. Preoperative prediction of severe postoperative pain. Pain 2003;105:415-23. CrossRef
6. Nikolajsen L, Minella CE. Acute postoperative pain as a risk factor for chronic pain after surgery. Eur J Pain Suppl 2009;3:29-32. CrossRef
7. Foss NB, Kristensen MT, Palm H, Kehlet H. Postoperative pain after hip fracture is procedure specific. Br J Anaesth 2009;102:111-6. CrossRef
8. Thomas T, Robinson C, Champion D, McKell M, Pell M. Prediction and assessment of the severity of postoperative pain and of satisfaction with management. Pain 1998;75:177-85. CrossRef
9. Pinto PR, McIntyre T, Ferrero R, Almeida A, Araújo-Soares V. Predictors of acute postsurgical pain and anxiety following primary total hip and knee arthroplasty. J Pain 2013;14:502-15. CrossRef
10. McCleane G. Pain perception in the elderly patient. Clin Geriatr Med 2008;24:203-11. CrossRef
11. Pirrotta R, Jeanmonod D, McAleese S, Aufenberg C, Opwis K, Jenewein J, et al. Cognitive functioning, emotional processing, mood, and personality variables before and after stereotactic surgery: a study of 8 cases with chronic neuropathic pain. Neurosurgery 2013;73:121-8. CrossRef
12. Denollet J. DS14: standard assessment of negative affectivity, social inhibition, and Type D personality. Psychosom Med 2005;67:89-97. CrossRef
13. Castro M, Kraychete D, Daltro C, Lopes J, Menezes R, Oliveira I. Comorbid anxiety and depression disorders in patients with chronic pain. Arq Neuropsiquiatr 2009;67:982-5. CrossRef
14. Sagheer MA, Khan MF, Sharif S. Association between chronic low back pain, anxiety and depression in patients at a tertiary care centre. J Pak Med Assoc 2013;63:688-90.
15. Jacobi J, Fraser GL, Coursin DB, Riker RR, Fontaine D, Wittbrodt ET, et al. Clinical practice guidelines for the sustained use of sedatives and analgesics in the critically ill adult. Crit Care Med 2002;30:119-41. CrossRef
16. Truog RD, Campbell ML, Curtis JR, Haas CE, Luce JM, Rubenfeld GD, et al. Recommendations for end-of-life care in the intensive care unit: a consensus statement by the American College [corrected] of Critical Care Medicine. Crit Care Med 2008;36:953-63. CrossRef
17. Aubrun F, Langeron O, Quesnel C, Coriat P, Riou B. Relationships between measurement of pain using visual analog score and morphine requirements during postoperative intravenous morphine titration. Anesthesiology 2003;98:1415-21. CrossRef
18. DeLoach LJ, Higgins MS, Caplan AB, Stiff JL. The visual analog scale in the immediate postoperative period: intrasubject variability and correlation with a numeric scale. Anesth Analg 1998;86:102-6. CrossRef
19. Hamilton M. The assessment of anxiety states by rating. Br J Med Psychol 1959;32:50-5. CrossRef
20. Hamilton M. A rating scale for depression. J Neurol Neurosurg Psychiatry 1960;23:56-62. CrossRef
21. Sathappan SS, Strauss EJ, Ginat D, Upasani V, Di Cesare PE. Surgical challenges in complex primary total hip arthroplasty. Am J Orthop (Belle Mead NJ) 2007;36:534-41.
22. Pflüger G, Junk-Jantsch S, Schöll V. Minimally invasive total hip replacement via the anterolateral approach in the supine position. Int Orthop 2007;31 Suppl 1:7-11. CrossRef
23. Bisgaard T, Klarskov B, Rosenberg J, Kehlet H. Characteristics and prediction of early pain after laparoscopic cholecystectomy. Pain 2001;90:261-9. CrossRef
24. Holtzman J, Saleh K, Kane R. Gender differences in functional status and pain in a Medicare population undergoing elective total hip arthroplasty. Med Care 2002;40:461-70. CrossRef
25. Ip HY, Abrishami A, Peng PW, Wong J, Chung F. Predictors of postoperative pain and analgesic consumption: a qualitative systematic review. Anesthesiology 2009;111:657-77. CrossRef
26. Ristić B, Ristić DI, Milicić B, Obradović Z. Factors which influence postoperative mortality after hip fracture. [Article in Serbian] Vojnosanit Pregl 2006;63:49-53. CrossRef
27. Badura-Brzoza K, Zajac P, Brzoza Z, Kasperska-Zajac A, Matysiakiewicz J, Piegza M, et al. Psychological and psychiatric factors related to health-related quality of life after total hip replacement - preliminary report. Eur Psychiatry 2009;24:119-24. CrossRef
28. Schaller F, Sidelnikov E, Theiler R, Egli A, Staehelin HB, Dick W, et al. Mild to moderate cognitive impairment is a major risk factor for mortality and nursing home admission in the first year after hip fracture. Bone 2012;51:347-52. CrossRef
29. Zywiel MG, Prabhu A, Perruccio AV, Gandhi R. The influence of anesthesia and pain management on cognitive dysfunction after joint arthroplasty: a systematic review. Clin Orthop Relat Res 2014;472:1453-66. CrossRef
30. Mols F, Denollet J. Type D personality in the general population: a systematic review of health status, mechanisms of disease, and work-related problems. Health Qual Life Outcomes 2010;8:9. CrossRef
31. Kuijpers PM, Denollet J, Wellens HJ, Crijns HM, Honig A. Noncardiac chest pain in the emergency department: the role of cardiac history, anxiety or depression and Type D personality. Eur J Cardiovasc Prev Rehabil

2007;14:273-9. CrossRef
32. Roth ML, Tripp DA, Harrison MH, Sullivan M, Carson P. Demographic and psychosocial predictors of acute perioperative pain for total knee arthroplasty. Pain Res Manag 2007;12:185-94.
33. Granot M, Ferber SG. The roles of pain catastrophizing and anxiety in the prediction of postoperative pain intensity: a prospective study. Clin J Pain 2005;21:439-45. CrossRef
34. Carr EC, Nicky Thomas V, Wilson-Barnet J. Patient experiences of anxiety, depression and acute pain after surgery: a longitudinal perspective. Int J Nurs Stud 2005;42:521-30. CrossRef
35. Aguirre J, Baulig B, Dora C, Ekatodramis G, Votta-Velis G, Ruland P, et al. Continuous epicapsular ropivacaine 0.3% infusion after minimally invasive hip arthroplasty: a prospective, randomized, double-blinded, placebo-controlled study comparing continuous wound infusion with morphine patient-controlled analgesia. Anesth Analg 2012;114:456-61. CrossRef
36. Murphy TP, Byrne DP, Curtin P, Baker JF, Mulhall KJ. Can a periarticular levobupivacaine injection reduce postoperative opiate consumption during primary hip arthroplasty? Clin Orthop Relat Res 2012;470:1151-7. CrossRef
37. Reader T, Flin R, Lauche K, Cuthbertson BH. Non-technical skills in the intensive care unit. Br J Anaesth 2006;96:551-9. CrossRef
38. Shaw WS, Campbell P, Nelson CC, Main CJ, Linton SJ. Effects of workplace, family and cultural influences on low back pain: what opportunities exist to address social factors in general consultations? Best Pract Res Clin Rheumatol 2013;27:637-48. CrossRef
39. Osinaike BB, Dairo MD, Oyebamiji EO, Odesanya JO, Tanimowo A. Attitude of general public to risks associated with anaesthesia. East Afr J Public Health 2007;4:40-2.
40. Ni Mhaolain AM, Butler JS, Magill PF, Wood AE, Sheehan J. The increased need for liaison psychiatry in surgical patients due to the high prevalence of undiagnosed anxiety and depression. Ir J Med Sci 2008;177:211-5. CrossRef
41. Chun MB, Young KG, Honda AF, Belcher GF, Maskarinec GG. The development of a cultural standardized patient examination for a general surgery residency program. J Surg Educ 2012;69:650-8. CrossRef