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Comparative study of post-operative cognitive dysfunction and recovery between adolescents and elderly

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Abstract
Introduction: Post-operative cognitive dysfunction (POCD) is a short term decline in cognitive functions that may last for a few days or weeks after a surgery. It is characterized by progressive hypomnesia, personality change or deterioration in cognitive function post surgically. Even though POCD was previously linked to cerebral hypoxia and low blood pressure, newer studies suggested age, duration of anesthesia, intraoperative complications, and postoperative infections were much more associated with POCD. Therefore, as age being one of the major contributors of POCD, we carried out this study to analyze the post-operative cognitive dysfunction between two distinct age groups; the elderly, and the adolescents. Further, we also analyzed the time duration required for both the age groups to return to the normal functioning post operatively.
Materials and Method: This study is a comparative study of pre-operative and post-operative level of cognition in the two age groups: adolescents and elderly, both undergoing an operative procedure under general anaesthesia from February 2016 to April 2016. A total of 50 individuals (25 elderly and 25 adolescents) were screened 1 day prior to surgery, on the day of surgery, 5th post-operative day, 30th post-operative day (4 weeks) and 60th post-operative day (8 weeks) to analyse the postoperative cognitive dysfunction and to study to time duration required for recovery, if dysfunction was observed. The standardized mini-mental state examination (MMSE) was used to measure patients' cognitive function. Data analysis and presentation of data was done in the form of tables and charts.
Results and Conclusions: 50 patients were observed preoperatively, postoperatively, follow up on 5th day, 30th day and 60th day for a decline in the cognitive dysfunction. Results demonstrated that there was not much decline in the postoperative cognitive dysfunction in the adolescent age group. (1 out of 25; 4%)
However, the elderly age group did show a significant decrease in the post-operative cognitive dysfunction. (9 out of 25; 36%)
We then concluded that the cognitive dysfunction post operatively was lowest among the adolescent age group, but highest among the elderly. Although there was a cognitive dysfunction between the pre-evaluation and the post-evaluation in the elderly, follow-up of these patients showed recovery of the cognitive abilities over time in 7 out of the 9 (77%) elderly age-group patients.

Keywords: Cognitive Dysfunction, Post-operative, Elderly, Adolescents.

1. Introduction
Post-operative cognitive dysfunction is a short term decline in cognitive functions that may last for a few days or weeks after a surgery [1]. It is characterized by progressive hypomnesia, personality change or deterioration in cognitive function post surgically [2, 3]. The incidence of POCD is steadily rising in patients undergoing general anesthesia [3, 4]. Even though POCD was previously linked to cerebral hypoxia and low blood pressure, newer studies suggested age, duration of anesthesia, intraoperative complications, and postoperative infections were much more associated with POCD [5]. POCD patients show a decline in performance on neuropsychological tests relative to preoperative levels [6]. However, POCD is distinct from emergence delirium. Emergence delirium occurs most commonly in older patients and those with pre-existing cognitive impairment [1]

Pathophysiology of Post-Operative Cognitive Dysfunction is not well known. But, it is hypothesized that the body's inflammatory response to surgery is one of the causes. Various researchers have studied various factors that could possibly lead to POCD, those including Preoperative, intraoperative and postoperative causes, and the common conclusion to those studies have been that the causative agents of POCD are multifactorial [7, 8].

Past studies on POCD have concluded that not only is POCD common after cardiac surgery, but now has been verified that it also exists after major non-cardiac surgery, although at a lower incidence [9]. It is more likely associated after major surgeries than minor surgeries [10, 11]. Also, it has been studied that POCD has a higher incidence rate in patients with high alcohol intake [12].

It has been noted that for the best results of POCD analysis, Pre-operative mental status should be carefully assessed to facilitate evaluation in a systematic, well documented way [13]. Hence, we have included the Pre-operative analysis of the 50 patients as well, in the study. Data also suggests, that Pre-operative neurological disease increases rate of POCD. Therefore, to eliminate false positives in our results, we have excluded the patients that had a pre-operative neurological diseases [14].

1.1 Objectives

i) To study the difference between cognitive dysfunction of Adolescents and Elderly.
ii) To assess recovery time if decline of cognitive function was observed postoperatively.
iii) To compare the recovery time between the two selected groups.

2. Materials and Methods

The present 3 month study was conducted during the Period of February 2016 to April 2016. Patients' and relatives' consents were taken before the study. The study population includes two distinct age groups, one being the adolescent age group, ranging from 12 years of age to 19 years of age, and second being the elderly, ranging from 55 years of age to 65. There were 50 patients in all; 25 adolescent patients with mean age of 16.3 years and 25 elderly patients with a mean age of 61.1 years. The patients were admitted for diagnoses which required surgical management.

The study consisted of patients who fulfilled the inclusion criteria:

Adolescents: Patients aged 12-19 years.
Patients posted for planned surgeries.
Patients who gave consent.
Elderly: Patients aged 55-65 years.
Patients posted for planned surgeries.
Patients who gave consent.

Exclusion criteria:

Adolescents: Patients aged below 12 and above 19 years.
Patients who required acute surgical intervention.
Patients with trauma and in casualty.
Patients who did not give consent.
Patients with congenital history of neurological diseases (MMSE < 23)
Patients posted for neuro-surgery or cardiac surgery
Elderly: Patients aged below 55 and above 65 years.
Patients who required acute surgical intervention.
Patients with trauma and in casualty.
Patients who did not give consent.
Patients with previous history of neurological diseases (MMSE < 23)
Patients posted for neuro-surgery or cardiac surgery

The test used for detection of POCD was the standardized mini-mental state examination (MMSE). It is an 11-question measure that tests five areas of cognitive function: orientation, registration, attention and calculation, recall, and language [15]. Advantages to the MMSE include requiring no specialized equipment or training for administration. Disadvantages to the utilization of the MMSE is that it is affected by demographic factors; age and education exert the greatest effect. The most frequently noted disadvantage of the MMSE relates to its lack of sensitivity to mild cognitive impairment [15]

Category	Maximum Points	Description
Orientation to Time	5	Year, Season, Date, Day, Month
Orientation to Place	5	Country, State, Town, Hospital, Floor
Registration	3	Repeating named objects
Attention and Calculation	5	Serial 7's, or spelling "World" backwards
Recall	3	Registration recall
Language	2	Name a pencil and watch
Repetition	1	Repeating or speaking back a phrase
Complex Commands	6	Drawing of a complex figure
	Total: 30	

Interpretation

Score	Interpretation
≥24	Normal Cognition
19-23	Mild cognitive impairment
10-18	Moderate cognitive impairment
≤9	Severe cognitive impairment

3. Results

50 patients were chosen between February 2016 and April 2016 from the department of surgery who fulfilled the inclusion criteria. The two groups, i.e. the adolescents (n=25), with a mean age of 16.3 years, and the elderly, (n=25) with a mean age of 61.1 years, were studied preoperatively, post-operatively (on the same day) and follow up on 5th day for post-operative cognitive dysfunction. The patients were admitted for diagnoses which required surgical intervention. The method by which we assessed the cognitive function was by a standard Mini Mental State Examination.

After assessing the 25 adolescents preoperatively, all 25 (100%) had a normal cognitive ability. The mean score preoperatively was 29 out of 30. Chart 1 shows the results of the cognitive abilities of the adolescents pre-operatively.

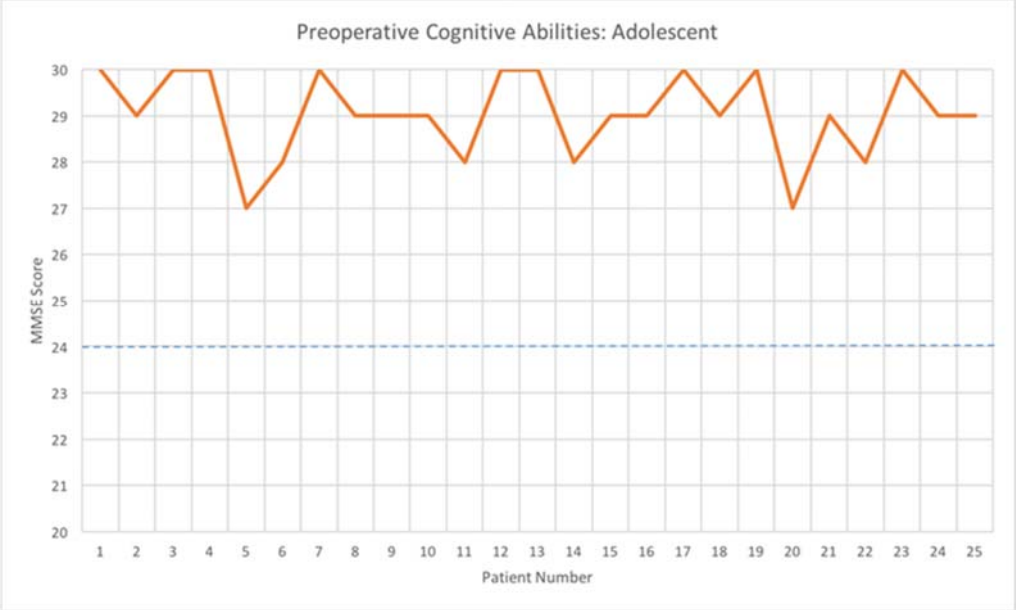

Chart 1: Preoperative Cognitive Abilities: Adolescents

Also, after assessing the 25 elderly patients, preoperatively, all 25 (100%) had a normal cognitive ability, as it was one of our screening and inclusion criteria to rule out false positives. The mean score, here was 27.5 out of 30. Chart 2 shows the result of the cognitive abilities of elderly patients pre-operatively.

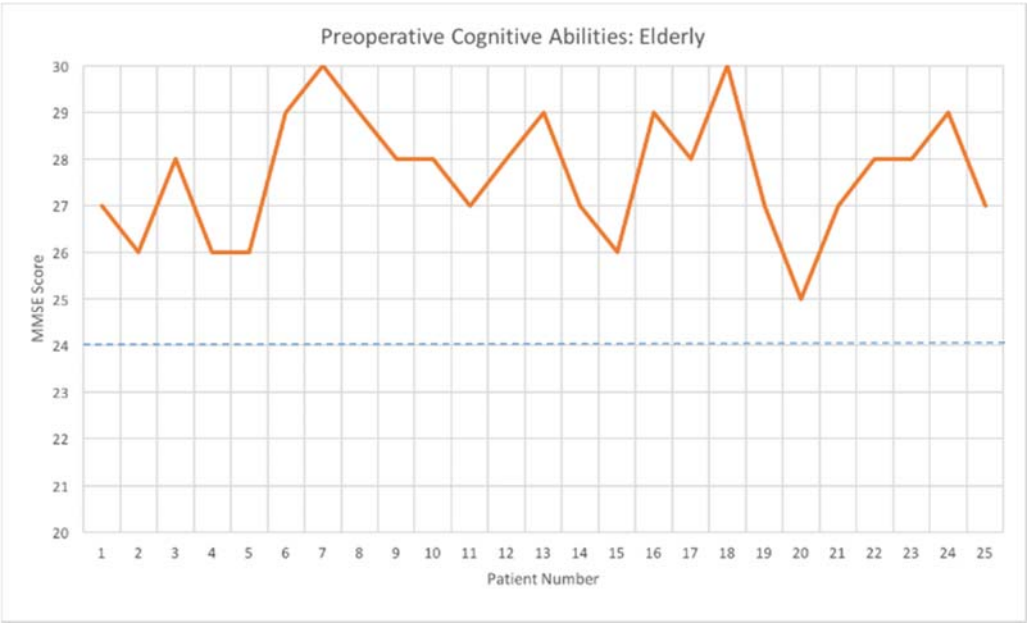

Chart 2: Preoperative Cognitive Abilities: Elderly

The post-operative assessment was done on the same day of the procedure, with a mean time of about 4.5 hours post operatively. The results revealed a decline in cognitive abilites of adolecents as well as the elderly; however, only 1 out of the 25 (4%) adolescents were below 24 on the MMSE score, who was in the range of 19-23, interpreted as mild cognitive dysfunction. Contraraily, there was a cognitive decline in 9 out of the 25 (36%) elderly individuals, score of whom was below 24. Out of the 9 affected elderly individuals, 6 were in the range on 19-23 MMSE score; which was interpreted as the mild cognitive imparirment, and the rest 3 were in the range of 10-18 on the MMSE score, which was interpreted as moderate cognitive impairment.

Table 3 shows the comparison between the preoperative and the postoperative MMSE scores of the adolescents, and table 4 shows the comparison between the preoperative and the postoperative MMSE scores of the elderly.

As many as 23 out of 25 (92%) adolescents showed a slight cognitive dysfunction post operatively, but 22 out of the 23 were within the normal limits (MMSE score 24 and above), and all (100%) elderly individuals showed cognitive dysfunction, although, only 9 of them had a cognitive dysfunction of 23 and below.

The results showed that there was a 6.4% difference between the pre-operative and post-operative cognitive function in the alodescents. Comparitively, there was a drop of 14.6% in the cognitive abilities of the elderly.

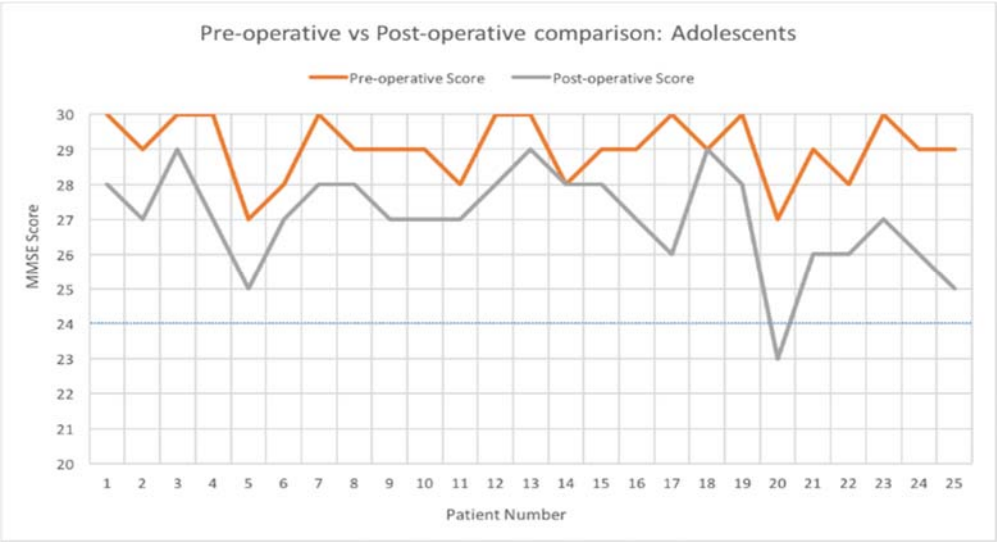

Chart 3: Preoperative and Postoperative Cognitive Abilities: Adolescents

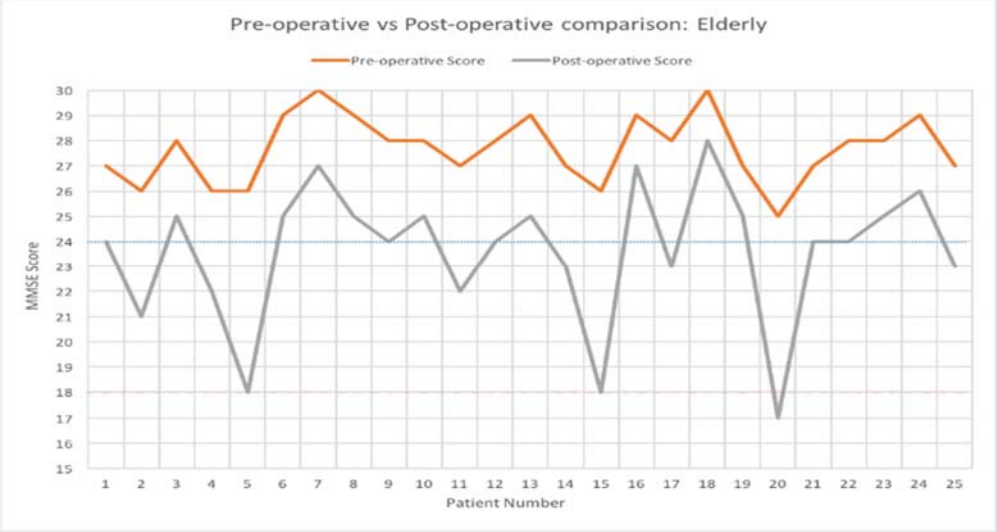

Chart 4: Preoperative and Postoperative Cognitive Abilities: Elderly

However, even if there was a decline in the cognition post operatively, we found out that all (100%) of the adolescent patients returned to their normal cognitive abilites within 4 weeks, and had a MMSE score of greater than 24.

The elderly age group, however, did not recover completely in the 1st 4 weeks. Only 8 out of 25 (32%) showed recovery to their normal cognitive abilites in the 1st 4 weeks. About 15 more individuals recovered from the post-operative cognitive dysfunction in the next 4 weeks, taking the tally of 23 out of 25 (92%) recovery in the 8 weeks post operatively. 2 elderly individuals did not recover from the POCD even after 8 weeks, but they did show a slow upward trend.

4. Discussion

This study used a wider range of neuropsychological tests than in previous tests for POCD, which had a few set parameters. Data suggests that age is one of the important factors associated with POCD. Out of all the tests, significant deterioration in geometric form association and visual memory were observed in the test immediately post operatively, which was persistent for a long time, for about 2-4 weeks, in both, adolescents and the elderly. Thus, geometric and visual deterioration was independent of age. The main difference noted was the difference between the two age groups in the verbal tasks, language tasks and repetition. The adolescent age group improved quickly post operatively, on these 3 parameters, whereas, the elderly patients required about 4 weeks for these parameters to recover.

The neuropsychological test results showed that patients who had POCD performed poorer on day 0, 5 as compared to baseline performance, post-operative day 30, 60. As for the incidence, POCD was detected in 4% of our adolescent patient population and 36% in our elderly patient population. Day 30 results showed a significant improvement in the adolescent population, whereas, about 32% elderly patients showed recovery in the 1st 4 weeks. Irrespective of duration of surgery.

Our short-term POCD evaluation at post-operative days 0, 5, 30 and 60 showed a gradual decline in the incidence of POCD, suggesting that it is temporary in a number of patients (92%) but could persist long-term in others (8%), probably even beyond 30 days. To the best of our knowledge, this is the first study to have evaluated the incidence, comparison of incidence, and recovery rate of POCD at early time points compared to the existing literature. The results presented are in accordance with earlier reports and most importantly, highlights the early onset of trend in decline of POCD, thus stressing the importance of evaluating POCD at earlier time points before 3 months.

Clinicians and patients have many a times assumed that local/regional anesthesia is not associated with cognitive disturbances and is a safer option compared to general anesthesia. Rasmussen *et al*., in a randomized study of Regional Anesthesia versus general anesthesia found no causative relationship between the incidence of long-term POCD. Also, regional anesthesia does not offer any apparent direct physiologic benefit on cognitive function [16]. Studies reported by O'Dwyer *et al*., Casati *et al*., and Somprakit *et al*., found no statistical difference in the incidence of POCD after either a general anesthesia or a regional anesthesia [17-19].

Canet *et al*., concluded that the incidence of POCD at 7 days was remarkably lower after minor surgery (6.8%) than after major surgery (25.8%). After 3 months, no statistical difference was present between the two groups [20]. Factors such as duration of anesthesia, surgical trauma, postoperative stress response, hospitalization and post-operative pain and analgesics are implicated to explain the difference in rates of POCD between major and minor surgery [21-23].

Thus, we have established with the help of this research that post-operative cognitive dysfunction is based on age, and the recovery rate of younger patients from this dysfunction is faster as compared to the elderly.

5. Conclusion

POCD is a decline in the cognitive functions of an individual which are seen post surgically. The incidence is much higher in elderly individuals as compared to the adolescent age group. The recovery rates of the adolescents are much faster as compared to the elderly patients. The geometric and visual disturbances were independent of age, but verbal tasks, language tasks and repetition improved faster in the younger age group. There was a cognitive decline in both the age groups on post-operative day 0, however, it was much more significant in the elderly, as according to the MMSE interpretation. POCD is independent of type of anesthesia, however, duration of anesthesia does play a significant role.

6. References

1. Newman SD, Stygall J, Hirani S, Shaefi S, Maze M. Postoperative cognitive dysfunction after noncardiac surgery: a systematic review, Anesthesiology. 2007; 106(3):572-590.
2. Fong HK, Sands LP, Leung JM. The role of postoperative analgesia in delirium and cognitive decline in elderly patients: a systematic review. Anesth Analg. 2006; 102(4):1255-1266.
3. Qiao Y, Feng H, Zhao T, Yan H, Zhang H, Zhao X. Postoperative cognitive dysfunction after inhalational anesthesia in elderly patients undergoing major surgery: the influence of anesthetic technique, cerebral injury and systemic inflammation BMC Anesthesiol. 2015; 15:154.
4. Price CC, Levy SA, Tanner J, Garvan C, Ward J, Akbar F *et al.* Orthopedic Surgery and Post-Operative Cognitive Decline in Idiopathic Parkinson's Disease, J Parkinsons Dis. 2015; 5(4):893-905.
5. Rundshagen I. Postoperative cognitive dysfunction, Dtsch Arztebl Int. 2014; 111(8):119-125.
6. Rudolph JL, Schreiber KA, Culley DJ, McGlinchey RE, Crosby G, Levitsky S *et al.* Measurement of postoperative cognitive dysfunction after cardiac surgery: a systematic review Acta Anaesthesiol Scand. 2010; 54(6):663-677.
7. Stenvall M, Berggren M, Lundström M, Gustafson Y, Olofsson B. A multidisciplinary intervention program improved the outcome after hip fracture for people with dementia—subgroup analyses of a randomized controlled trial, Archives of Gerontology and Geriatrics: 2011; 54(3):e284-289.
8. Handoll HHG, Cameron ID, Mak JCS, Finnegan TP. Multidisciplinary rehabilitation for older people with hip fractures. Cochrane Database of Systematic Reviews 2009; (4):CD007125.
9. Rasmussen LS. Postoperative cognitive dysfunction: incidence and prevention, Best Practice & Research Clinical Anaesthesiology 2006; 20(2):315-30.
10. Neubauer RA, Golden C. Can postoperative cognitive dysfunction be prevented? (PDF). Journal of American Physicians and Surgeons. 2005; 10(1):22.
11. Monk TG, Weldon BC, Garvan CW, Dede DE, Van Der Aa MT, Heilman KM *et al.* Predictors of cognitive dysfunction after major noncardiac surgery. Anesthesiology. 2008; 108(1):18-30.
12. Hudetz JA, Iqbal Z, Gandhi SD, Patterson KM, Hyde TF, Reddy DM *et al.* Postoperative cognitive dysfunction in older patients with a history of alcohol abuse. Anesthesiology. 2007; (3):423-30.
13. Francis J Jr., Goldman DR, Brown FH, Guarneri DM. Surgery in the elderly: Peri-operative medicine 2nd ed. California, McGraw-Hill, Inc. 1994, 385-94.
14. Sophie S. Anaesthesia for the elderly patient, Pak Med Assoc. 2007; 57(4):196-201.
15. Folstein M, Folstein SE, McHugh PR. Mini-Mental State: a Practical Method for Grading the Cognitive State of Patients for the Clinician. Journal of Psychiatric Research. 1975; 12(3):189-198.
16. Rasmussen LS, Johnson T, Kuipers HM, Kristensen D, Siersma VD, Vila P. Does anaesthesia cause postoperative cognitive dysfunction? A randomised study of regional versus general anaesthesia in 438 elderly patients. Acta Anaesthesiol Scand. 2003; 47:260-266.
17. O'Dwyer PJ, Serpell MG, Millar K, Paterson C, Young D, Hair A. Local or general anesthesia for open hernia repair: A randomized trial. Ann Surg. 2003; 237:574-579.
18. Casati A, Aldegheri G, Vinciguerra E, Marsan A, Fraschini G, Torri G. Randomized comparison between sevoflurane anaesthesia and unilateral spinal anaesthesia in elderly patients undergoing orthopaedic surgery. Eur J Anaesthesiol. 2003; 20:640-6.
19. Somprakit P, Lertakyamanee J, Satraratanamai C, Wanicksamban S, Silapadech A, Chainchop P. Mental state change after general and regional anesthesia in adults and elderly patients, a randomized clinical trial. J Med Assoc Thai. 2002; 85(Suppl 3):S875-83.
20. Canet J, Raeder J, Rasmussen LS, Enlund M, Kuipers HM, Hanning CD *et al.* Cognitive dysfunction after minor surgery in the elderly. Acta Anaesthesiol Scand. 2003; 47:1204-10.
21. Lynch NM, Trousdale RT, Ilstrup DM. Complications after concomitant bilateral total knee arthroplasty in elderly patients. Mayo Clin Proc. 1997; 72:799-805.
22. Hall GM, Peerbhoy D, Shenkin A, Parker CJ, Salmon P. Relationship of the functional recovery after hip arthroplasty to the neuroendocrine and inflammatory responses. Br J Anaesth. 2001; 87:537-42.
23. Mann C, Pouzeratte Y, Boccara G, Peccoux C, Vergne C, Brunat G *et al.* Comparison of intravenous or epidural patient-controlled analgesia in the elderly after major abdominal surgery. Anesthesiology. 2000; 92:433-441.