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Post - Anesthesia Cognitive Dysfunction of Aged Patients in One Day Surgery

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Abstract: ***Background: Nowadays, ambulatory anesthesia is becoming more desirable type of anesthesia for aged patients [1]. The modern drugs for day case surgery, with a short onset and reduced duration of action and fewer side effects, enable safe anesthesia with a shorter postoperative recovery and minimal length of stay in hospital settings. It is becoming obvious that ambulatory anesthesia and analgesia could also meet the needs of the elderly patients [2] but never underestimate the postoperative impairment of cognitive functions causing prolonged postoperative recovery and longer in-hospital stay of the elderly. The development of postoperative cognitive dysfunctions (POCD) is the reason for greater morbidity and delays of functional recovery of patients [3]. The problem of development of POCD after ambulatory surgery has not been investigated and reviewed in details. There are present two multicentre studies, ISPOCD 1 and ISPOCD 2, but they are insufficient to give the answers to all problems concerning this matter [4, 5]. The goal of this article is to discuss the post-anesthesia recovery of aged patients in one day surgery, and the incidence of postoperative impairment of cognitive function in elderly.***

Keywords: Ambulatory anesthesia, elderly, cognitive dysfunction

1. Introduction

General anesthesia (GA) alters brain function by reducing the level of awareness, attention, memory, and reaction time in a patient [6, 7]. Among elderly patients, those sorts of mental changes are often encountered in the post-operative phase and in the intensive care unit. The human lifespan is getting longer; age is not a contraindication for surgery, but the level of postoperative complications, including mental disorders in elderly, are more frequent. Older patients often take many medications that produce psychological and physiological changes that influence the postoperative recovery and induce changes in the mental status of patients [8]. The level of cognitive impairment after anesthesia in elderly has a significant impact to the health of the patient in the post-operative period and is associated with prolonged hospital recovery. Some of the patients experience significant delays in regaining full cognitive functions, notably learning, memory, attention, concentration and verbal capabilities. Current research shows those patients have significantly greater mortality in the first year after surgery compared to general population of the same age [9]. The risk factors and the degree of functional decline for postoperative cognitive deficits are depends on the patient's characteristics, the type of surgery and the type of anesthesia [10].

1.1 Ambulatory anesthesia

A lot of short surgical procedures are performed in ambulatory settings, with fast recovery soon after termination of anesthesia. The development of the minimal invasive surgical procedures and "Enhanced recovery programs" (ERAS) generated advances in anesthesia techniques for day surgery. The main goal of ambulatory anesthesia and analgesia is a safe anesthesia and early, discharge of the pain free patients from the hospital.

Ambulatory anesthesia is a well-tolerated type of anesthesia with few serious adverse outcomes. Patients achieve early recovery and are discharged soon after a short period of time on the same day of the surgery [11].

In this contest, palettes of new drugs suitable for ambulatory anesthesia were developed. It seems that from this point of view ambulatory anesthesia is beneficial for the elderly, and the advantages are apparent having in mind that elderly are very susceptible to the changes of their habits: separation from their homes and different daily activities in the hospital environment

In elderly, the risk of developing postoperative cognitive impairments even and after minor surgical procedures can compromise the expected short stay in hospital.

According to Silbert et al., the anesthesiologist is ideally situated to follow patients in the pre-, peri-, and postoperative stages, and can contribute new data and knowledge for the clinical management of patients with MCI (minimal cognitive impairment) [12]. The ideal anesthetic for day case surgery must not affect mental capabilities of the patients. The persistence of post-operative nausea, vomiting, analgesia and postoperative care, have influence on the time to discharge [13].

1.2 Post-operative cognitive dysfunction

In the last decade the causes of prolonged recovery of cognition and memory and development of true POCD were intensively researched. According to the literature, POCD is defined as a decline in mental capabilities for concentration, memory, perception and problem-solving abilities with deterioration in emotional or social behavior [14]. Those deteriorations in cognitive function may last for weeks, months or longer [10].

The cognitive deterioration after surgery is encountered in three forms: 1. *Delirium* (POD), 2. *Short-term cognitive disturbance* (STCD) and 3. *True POCD*. Some studies suggest that the effects may last much longer than anticipated and affect the patient's functional capabilities for several days [15].

The survey results of a large, international multi-center prospective study called ISPOCD showed that the incidence of POCD following non-cardiac surgery is lower than in cardiac surgery. Transient POCD, which dissipates after one week, was observed in 25.8% of patients, of which 9.9% were elderly. The conclusion of this survey was that cognitive dysfunctions after anesthesia and surgery are multifactorial [16, 17].

The main reasons incriminated for development of POCD are type, depth and length of anesthesia and the surgical procedure itself. In the very beginning the research shows a connection between GA and POCD. The evidence was the apparent prolonged cognitive decline within the first 24 hours post-operatively for up to 3 days in patients receiving general anesthesia (GA) for day case surgery. In contrast to those findings, it was later found that there are no clinically significant differences in cognitive deterioration in patients given either regional or general anesthesia [16, 18]. There are claims that the type of anesthesia influences cognitive dysfunction, but other results show that during the first week following regional anesthesia (RA) the occurrence of cognitive disorders is lower compared to GA, but these results balance out after three months [19]. In 1% of the patients the symptoms persisted for 3 months, and continued for up to 2 years [20]. A survey made by the authors of this article demonstrated that both types of anesthesia (GA & RA) in non-cardiac surgery can cause post-operative changes in the mental status of patients [8, 17]. Canet at all. in their researches found that at 7 days and 3 months post procedure, 6.8% and 6.6% of patients had some form of POCD respectively. They suggested that the duration of the hospital stay significantly affects the development of POCD in the immediate post-operative period. The incidence of the development of POCD after 7 days and 3 months for outpatients was 3.5% and 3.5% respectively [16].

On the question why this has happened, most of the researchers are certain that it may not be a true reflection on the development of cognitive decline but rather more directly related to patient comorbidities and hospital factors. The main postulate of anesthesiologist is to provide a safe GA, with optimal surgical conditions and early recovery. There is evidence that the postoperative speed of recovery depends on patient's characteristics and variations are acceptable but may also be associated with the choice of anesthetic drugs. Some anesthetics can affect the postoperative cognition because of residual levels of volatile anesthetics. The mechanism of cognitive impairment has been proposed as the residual effect of anesthetic drugs on higher brain centers. Use of volatile anesthetics that are rapidly eliminated with minimal metabolic breakdown may reduce cognitive dysfunction in surgical patients and facilitating a faster recovery after general anesthesia. It was concluded that in general, in outpatient settings, it is rational the use of modern volatile anesthetics for general anesthesia [22].

1) Anesthetics

Most of the frequently used agents such as propofol, sevoflurane, nitrous oxide (N2O), midazolam, and fentanyl may act by causing long-term receptor changes, apoptosis, changes in cholinergic binding and gene expression [23, 24]. All those effects in turn may lead to POCD [25]. Delayed functional recovery as a consequence of cognitive dysfunction would lead to prolonged hospital stay in patients undergoing GA.

Some authors [25, 26], who investigated the early postoperative period at 2 and 4 hours postoperatively, found that propofol had serious impact on cognitive functions and memory in comparison to sevoflurane in the immediate postoperative period of up to 1 hours. **Sevoflurane** as an inhalational anesthetic of the ethereal origin with low solubility in blood and body tissue, is characterized by rapid induction and recovery and has been found to produce less cognitive impairment than propofol, [27-29] which suggests that sevoflurane anesthesia is a better option in day care surgeries.

In the research of Ward 2005, it was found that sevoflurane and desflurane anesthesia is connected with an earlier return to baseline cognitive function [26]. It shows that sevoflurane and desflurane, have better cognitive effects over isoflurane and propofol, because of its low solubilities compared to isoflurane's higher solubility [30 - 32].

2) Other suspected factors

Apart from anesthetic agents, various other suspected factors are glucocorticoid levels, pre-existing cognitive impairment, neuroinflammation, age, brain hypo perfusion, hypoxia, and genetic aspects [33-37]. Influence of the depth of anesthesia on the patient's recovery profile is one of the main factors that should be taken in consideration [28]. The differences in the results obtained from the researchers depend on the methodological issues, as well as on the individual patient differences.

3) Methodology of development of POCD - TESTS:

The preoperative evaluation of the physical and mental health is highly important for the adequate evaluation of the risk and benefit of the planned surgical intervention. Early recognition of postoperative impaired cognitions (PICs) and postoperative cognitive deficit (POCD), allows proper access and possible curing. For this purpose intelligence tests or tests developed for clinical neuropsychology have been used mostly in the geriatric age group.

With the aim to measure the degree of cognitive deterioration, huge lists of multiple cognitive function tests are developed and currently used on a daily base. The lack of uniformities of the test methods makes difficulties in interpretation of the results of different authors. Many of THE TESTS USED have considerable limitations, and they have been too complicated for the patients. The tests must be simpler and adapted to the potential of the patients [38-43]. As an illustration the list of some most used tests is presented:

- The mini–mental state examination (MMSE) or Folstein test (brief 30-point questionnaire test that is used to screen the cognitive impairment)
- Digit-symbol substitution test
- Maddox Wing Test
- Blessed Test of orientation, memory, and concentration (BOMC) - it is fast, simple, and suitable for the frenetic surgery work
- Cognitive failures questionnaire (CFQ) - before the procedure which will affect the degree of neurological impairment detected in the patient

2. Discussion

The ambulatory anesthesia presents a challenge for anesthesiologists because of the expectation of a fast recovery soon after termination of anesthesia; it is believed that between five and ten percent of patients admitted to the hospital have a hidden symptom of cognitive impairment functions, while 10 to 50% of disorders occur during hospitalization [13]. Postoperative delirium is the most common form of mental disorder in the elderly and the most common postoperative complication in hospitalized patients, but not for ambulatory patients. The etiology of POCD and POCD is multifactorial and understanding of the pathophysiological mechanism is still limited. One of the hypotheses about the emergence of delirium is an imbalance in the synthesis and release of neurotransmitters that control cognitive functions, behavior and mood, with the greatest emphasis on dopamine and acetylcholine. Imbalance in the form of excess dopamine or acetylcholine deficiency is associated with delirium [14]. In addition to hyperactive (upset) delirium, so-called hypoactive (silent) delirium can also be observed. POCD is subtle impairment to the memory, attention, concentration and speed of processing information. Unlike patients with delirium, typical patients with POCD are orientated, but show a decline in their basic level of performance in more neurological functions [17].

Whether or not general or regional anesthesia is the primary factor behind cognitive deficits is still the subject of research. A number of comparative studies discuss a change in mental status in patients after major non-cardiac surgical interventions in the first 3 months, but the results are not strong enough to assert that most changes occur in following general anesthesia. It is expected that with the increasing number of elderly patients undergoing surgery there will be an increased occurrence of changes in mental status. The number of occurrences is relatively small and has no statistical significance; there were not enough respondents to produce a strong conclusion [8, 15].

3. Conclusion

In contrast to the findings in the literature that the incidence of POCD in elective non-cardiac surgery was 9%, the ambulatory anesthesia provides less episodes of POCD (3.5%). Most of the authors conclude that ambulatory anesthesia has many advantages concerning the elderly patients and it must be a technique of choice whenever is appropriate. It was found that the cognitive deterioration in patients given either local or general anesthetics in ambulatory settings is less intensive than in patients which are hospitalized longer and they could safely be discharged with full cognitive function on the same day as surgery. It was shown that sevoflurane has better cognitive effects and is favorable volatile anesthetic for ambulatory GA. Our mission is to avoid the development of POCD, especially aware, that it is one of predictors of mortality and morbidity in patients in the first year after surgery.

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