Presse Med. 2018; □□: □□□

on line on
www.em-consulte.com/revue/lpm
www.sciencedirect.com

Quarterly Medical Review

Tools to screen and measure cognitive impairment after surgery and anesthesia

Sérgio Vide [1,2,3], Pedro L. Gambús [1,4,5]

Available online:

1. Hospital CLINIC de Barcelona, Anesthesiology Department, Systems Pharmacology Effect Control & Modeling (SPEC-M) Research Group, Barcelona, Spain
2. Hospital Pedro Hispano, Department of Anesthesia, Matosinhos, Portugal
3. Centro Hospitalar Universitário do Porto, Department of Anesthesiology, Center for Clinical Research in Anesthesia, Porto, Portugal
4. University of California San Francisco (UCSF), Department of Anesthesia and Perioperative Care, San Francisco, California, USA
5. Institut d'Investigacions Biomèdiques August Pi i Sunyer (IDIBAPS), NeuroImmunology Research Group, Barcelona, Spain

Correspondence:
Pedro Gambús, Department of Anesthesiology, Hospital CLINIC de Barcelona, Villarroel 170, 08036 Barcelona, Spain.
plgambus@clinic.cat

Summary

Cognition is essential to all aspects of our everyday life. Although we take our cognitive function for granted, the perioperative period is prone to several aggressions that might impair it. Postoperative cognitive dysfunction, has been the aim of many studies recently, and was shown to be very common with an incidence that can reach 40%, yielding not only impairment in cognition, but also longer hospital stays, higher costs and greater mortality. While several studies have revealed some of the mechanisms contributing to postoperative cognitive dysfunction, the search for the perfect instrument to screen and measure cognitive (dys)function has proven more elusive. The present paper aims to review several cognitive evaluation methods, discussing their advantages and disadvantages as well as their potential clinical applications in evaluating the dynamics of the recovery of cognitive function after anesthesia and surgery. The current availability of easy to use computerized tests might provide the tools necessary to identify patients at risk, and promptly provide them with the adequate course of action.

Postoperative cognitive dysfunction

Cognition requires several cortical and subcortical functions, such as perception, memory and information processing, which allows the individual to acquire knowledge, solve problems, and plan for the future [1]. These functions are essential for everyday living, and cognitive dysfunction appears when there is some form of impairment in these functional capacities.

To cite this article: Vide S, Gambús PL.. Tools to screen and measure cognitive impairment after surgery and anesthesia. Presse Med. (2018), https://doi.org/10.1016/j.lpm.2018.03.010

One aspect of cognition in anesthesia is the strong effects of anesthetic drugs on cognitive functions which might affect normal recovery after general anesthesia or sedation. The complexity of evaluation of cognitive function has made that it has not been until recently included as a relevant criteria to consider that a patient was fit to discharge. Given the increasing amount of procedures being performed under outpatient conditions, being able to evaluate the patient from a cognitive perspective a patient is fit for discharge acquires a relevant importance, at least as much importance as other criteria like absence of uncontrollable pain, hemodynamic stability, absence of nausea or tolerance to diet.

From a different, longer term view, changes in cognition after surgery have been reported since the beginning of anesthesia [2], and are currently known as postoperative cognitive dysfunction (POCD). Early POCD is common perioperatively (30–40% incidence) yielding longer hospital stays, higher costs and greater mortality [3]. This entity does not come as a surprise, as the perioperative period is prone to several aggressions (*table I*) (stress, inflammation, pain, medications, anesthesia) [3], being some brains uniquely sensitive to these (*table I*).

Although an unifying theory has proven elusive, from the several mechanisms proposed to contribute to POCD [4], both pain and the inflammatory process are accumulating consistent evidence [5]. The aggressions in the perioperative period can lead to an increase in pro-inflammatory cytokines. When there is no adequate balance through mechanisms of resolution of inflammation it is possible to subsequently generate a neuro-inflammatory process that facilitates the onset of cognitive dysfunction. The risk of POCD is greater in cases of increased surgical severity and with the occurrence of complications, as both of these factors are related to a higher magnitude of the inflammatory response [4,6]. Also, some authors have related the presence of Metabolic Syndrome with a higher risk of POCD [7] which could be related to the low-grade systemic inflammation characteristic of the Metabolic Syndrome [8,9]. Older animals and those with pathology of the CNS are more likely to develop inflammatory related alterations that go beyond the adaptive response of the sickness behaviour [6,10]. These observations add credence to the concept of diminished "cognitive reserve'' in which elderly patients and those with existing neurodegeneration are more likely to suffer an episode of delirium [11,12]. Furthermore, both pain and opioid use can cause postoperative delirium [13], which can by itself lead to cognitive dysfunction [14]. Consequently, it is very important to adequately measure the nociception/antinociception balance, in order to provide the optimum level of analgesia.

Unfortunately, even though some of the mechanisms leading to these insults to the brain start to being understood, anesthesiologists are not totally aware of the dimension of this problem partly because an evaluation of brain function is absent neither in the formal preoperative assessment and during the course of the post-surgical recovery process [15]. The solution to this problem would be to routinely assess the cognitive function throughout the perioperative period, the same way other organ functions are [3].

The problem is that standard neuropsychologic test batteries, and many standard bedside screening tests are too cumbersome and time consuming to be practical in a perioperative evaluation [15]. The lack of a practical tool enabling the clinician to objectively assess and track the cognitive function trajectory throughout the perioperative period has hindered the knowledge on the "normal'' pathway of the dynamics of cognitive function following the surgical process. So, it is still not well understood how different factors contribute to the normal recovery after a surgical intervention. Some proposals of this trajectory have already been made [16,17], but to really overcome this problem, it is necessary to identify a cognitive assessment instrument that is fast, objective, easily administered and scored, and has high interrater reliability [15].

Although the perfect instrument has yet to come, to label cognitive changes postoperatively as POCD, several instruments can be used. They can easily reveal some form of cognitive deterioration, but in order to classify them as POCD, it requires at least 2 measurements across the perioperative period. The timing of administration of these tests varies widely but the first test, the baseline, should be completed before surgery [18].

The present paper aims to review several cognitive evaluation methods, discussing their advantages and disadvantages as well as their potential clinical applications in evaluating the dynamics of the recovery of cognitive function after anesthesia and surgery.

Table I

Risk and precipitating factors for early/intermediate POCD. Adapted from [5] and [23]

Risk factors	Precipitating factors
Increasing age	Pain
Low education level	Postoperative infection
Burden of illness	Respiratory complications
Preoperative depression	Second operation within one week
Prior cognitive impairment	General Anesthesia vs regional anesthesia
Preoperative habits and drug use	Longer duration of anesthesia
Apolipoprotein E4	
Cardiac surgery	