

Postoperative Cognitive Dysfunction in Older Adults

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Postoperative Cognitive Dysfunction (POCD) is a decline in cognitive function detected days or weeks after surgery. It is usually subtle and lasts for weeks or months. The impairment must be evidenced by neuropsychological testing that is, unfortunately, associated with many problems related to its administration, statistical analysis and the interpretation of the test results. Risk factors for POCD are increasing age and type of surgery, with a very high risk after cardiac surgery (incidence 30–70% one week after surgery) and a low risk after minor, non-cardiac procedures, especially if performed on an outpatient basis.

Key words: cognitive function, postoperative, anesthesia, neuropsychological testing.

Definition

After surgery, many older patients have noticed a decline in their cognitive function, especially in memory. Usually, this is not apparent until the patient is discharged from hospital and tries to resume normal activities. The patient may then discover problems with recalling recent events and may tend to forget appointments, phone numbers and names. Doing crossword puzzles or playing cards may be much more difficult, and for those who have not retired this deterioration can have serious consequences for their ability to work. In some cases, the problem is only recognized by the patient's relatives, who may notice problems with memory or concentration and perhaps a loss of interest in intellectual challenges.

This condition is called Postoperative Cognitive Dysfunction (POCD) and it may be present for weeks or months after surgery. Unlike delirium, POCD is not associated with changes in level of consciousness and it does not fluctuate over the course of the day. Due to the subtle nature of POCD, neuropsychological testing is necessary for its detection. The condition can occur after surgeries that were considered uncomplicated, or even after minor procedures. Table 1 summarizes how POCD is characterized, based on the criteria for Mild Neurocognitive Disorder from the Diagnostic and

Statistical Manual of Mental Disorders, version IV.¹

Detection

The diagnosis of POCD is not based on the subjective symptoms alone, and no suitable questionnaire has yet been developed for this condition. Therefore, it is necessary to use a neuropsychological test battery that, according to research, must be administered both before and after surgery to maximize sensitivity in the assessment of cognitive function.

Unfortunately, in research numerous problems are associated with the use of such test batteries in surgical patients² (Table 2). Some of these problems can be minimized, such as the exclusion of patients undergoing emergency surgery in which a reliable baseline assessment usually is not possible. The test battery should consist of single tests with high sensitivity (ability to detect deficit, if present) and no, or at least a well-characterized, learning effect. The tests should match the studied population in order to avoid floor/ceiling effects. Unfortunately, it is not possible to avoid drop-out and it remains a major concern that the most affected individuals seem to be so reluctant to undergo follow-up testing. The effects of disease and hospitalization are also likely important factors, but these are not possible to separate from the effects of major surgery and anesthesia.

Another major problem is how the results should be handled in terms of statistical analysis. A deterioration in performance must be of a certain magnitude to be considered relevant, and most definitions of POCD are based on the detection of deterioration in several tests in a battery. It is recommended that a control group always be included for comparison purposes.²

Incidence

For more than 30 years it has been well known that neurologic complications are common after cardiac surgery, and this is also true for POCD. The reported incidence of POCD, however, varies enormously depending on the definition used, composition of the test battery and time for postoperative assessment. Accordingly, the incidence ranges from 30–70% a few weeks after cardiac surgery and from 10–40% three to six months post-surgery.^{3–6}

After non-cardiac surgery, it has been much more difficult to verify that POCD exists and many patients may not have been taken seriously when they described a cognitive decline after such surgery, especially if it was a minor procedure. The scientific studies have focused primarily on comparisons between regional and general anesthesia and it has not been possible to document any difference in neuropsychological test results between the two regimens.^{7–10} This may not be surprising since the test batteries and analyses have been the same as in cardiac surgery patients. The deficits are less pronounced after non-cardiac surgery and it will therefore not be possible to detect a postoperative deterioration or a difference between groups if neuropsychological tests with low sensitivity are used, even though these tests have been useful in cardiac surgery patients.

Recently, POCD has been documented in older patients after non-

Table 1
Characterization of Postoperative Cognitive Dysfunction

Memory impairment as identified by a reduced ability to learn or recall information.
Disturbance in executive functioning (e.g., planning, organizing, sequencing, abstracting).
Disturbance in attention or speed of information processing.
Impairment in perceptual-motor abilities.
Impairment in language (e.g., comprehension, word finding).

cardiac surgery. The incidence after major surgery is 10–25% early after surgery, and after several months it can be detected in 5–15%.^{11,12}

Risk Factors

Type of Surgical Procedure

The type of surgical procedure is a very important risk factor. As mentioned, cardiac surgery patients are at particularly high risk, which has been attributed to the use of cardiopulmonary bypass whereby emboli consisting of air, lipid and other materials in the system are known to reach the brain.¹³ In cardiac surgery, well-established risk factors for POCD include the amount of time on cardiopulmonary bypass, age, poor cardiac function and arrhythmia.^{14,15}

Non-cardiac surgery carries a lower risk for POCD. Within this group, no significant differences have been found between the types of major procedures. After minor surgery, a very low risk of POCD has been reported, especially if performed on an outpatient basis, for which the incidence is probably no more than 4%.¹⁶

Age

Age has consistently been found to be an important risk factor for POCD, independent of type of surgery. After major non-cardiac surgery, for instance, the incidence has been found to be 7% in those 60–70 years versus 14% in those 70 years or older.¹¹ In middle-aged patients, the risk of POCD is lower and at three months the incidence of deterioration in neuropsychological test results is not significantly different compared with healthy volunteers, with approximately 6% demonstrating POCD.¹⁷

Type of Anesthesia

In the setting of orthopedic, gynecologic or urologic surgery, it is possible to offer general as well as regional anesthesia—typically spinal or epidural—for many procedures. Only one study has reported a difference in the incidence of POCD between anesthesia regimens, and only early after surgery when incidence was 21% for general anesthesia and 13% for regional anesthesia in a per protocol analysis.¹² Today, such randomized studies are difficult to conduct since many patients, surgeons and anesthesiologists have quite firm opinions concerning type of anesthesia to be used. Sedation during regional anesthesia does not seem to increase the risk of POCD.¹² No specific general anesthetic agent can be recommended on the basis of the current literature.

Other

Long duration of anesthesia and postoperative complications increase the risk of POCD, and low level of education also is a risk factor in older patients.¹¹ In middle-aged patients, those who avoided alcohol were at a higher risk for developing POCD, a result that can perhaps be explained by a particular sensitivity to CNS-acting substances.¹⁷ In this study, supplementary epidural analgesia was related to a higher risk of POCD at one week, results for which we currently have no explanation.¹⁷

Prevention

Due to the nature of the risk factors involved, it is difficult to reduce the incidence of POCD. Postoperative complications should always be avoided and age cannot be changed. The risk of POCD should be considered when the indication for surgery is evaluated, since a less invasive procedure may be preferable in a very frail patient who may not benefit from a major operation if cognitive function deteriorates profoundly after surgery.

In cardiac surgery, numerous studies have assessed how cardiopulmonary bypass can be conducted so that the risk of POCD is minimized. An

Table 2
Problems Associated With the Use of Neuropsychological Test Batteries in Surgical Patients

Problem	Explanation
Learning	All subjects should improve after repeated testing.
Variability between sessions	Tests are sensitive to small, unimportant changes.
Floor/ceiling effects	Test too easy or too difficult (no change detectable).
Drop-out	Inability or unwillingness to undergo follow-up.
Sensitivity of tests	Deterioration not detected if test is not sensitive.
Effects of disease	Influence on motivation and physical ability.
Effects of medication	Sedatives or analgesics may influence results.
Evaluation of baseline	Anxiety or pain give impression of poor baseline.
Time for postoperative test	Few days or several months after surgery?

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interesting possibility is the potential for coronary artery bypass without the use of cardiopulmonary bypass, or "off-pump" surgery. It was hoped that neurologic complications and POCD could be eliminated after coronary artery bypass. However, this was clearly overly optimistic considering that POCD also occurs after non-cardiac surgery and only the specific hazards related to the use of the bypass circuit would be avoided. It is therefore not surprising that few well-conducted studies have shown a significant benefit with off-pump cardiac surgery.^{18,19}

Consequences

Most patients seem to recover from POCD in a few months, and after one to two years persisting POCD after non-cardiac surgery is found in no more than 1%.²⁰ Nonetheless, it may be an annoying problem until it goes away and patients may have a temporary increased need for care, as indicated by such assessments as activities of daily living.¹¹ Luckily, dementia seems to occur infrequently after surgery but it should be taken into account that patients with preoperative cognitive impairment generally have not been studied. This is because studies of POCD make use of quite sophisticated neuropsychological test batteries that require a certain baseline performance, such that cognitively impaired individuals usually are excluded. In addition, it must be acknowledged that patients unwilling to undergo follow-up examination may do so because they have deteriorated considerably. ♦

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