

Postoperative cognitive dysfunction

About a third of surgeries involve elderly patients; however, postoperative cognitive dysfunction is an important adverse outcome in such patients. Doctors should be aware of this condition and consider the risk–benefit ratio when referring elderly patients for surgery.

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A third of surgical operations involve elderly patients, with one in two people aged older than 65 years undergoing surgery at some point in their life.¹ This group accounts for 16% of the total UK population, a figure which is predicted to increase because of declining fertility and mortality rates.² Cognition is a broad term that includes perception, memory, reasoning, and problem solving. Good cognitive function allows a person to acquire and react to environmental stimulation, perceive problems, and plan for the future—activities required for daily living.³

Many studies of cognitive dysfunction in elderly people after surgery have been done, and there is increasing evidence that long-term or even permanent neurological changes can occur. In cardiac surgery, prevalence of cognitive dysfunction is well documented with stroke (1.5–5.2% of patients) and short-term cognitive decline at the time of surgery varies widely (33–83%).⁴ In the International Study of Post-Operative Cognitive Dysfunction (ISPOCD1) study⁵ of 1218 non-cardiac surgery patients older than 60 years of age, about 25% of patients had cognitive dysfunction at 1 week, and 10% at 3 months after surgery. Follow-up of affected patients showed

that cognitive problems eventually reduced towards that seen in matched controls, but about 1% had unresolved cognitive dysfunction for up to 2 years after their operation.

Patients older than 80 years had a higher incidence, approaching one in three, and further studies have shown a corresponding reduced risk in younger patients.⁶ Anaesthesia might contribute to age-related cognitive decline, and all professionals caring for older adults should be aware of this factor.

Predisposing factors

The cause of post-operative cognitive dysfunction is probably multifactorial, with risk factors classified into two broad categories: those that are associated with the patient, and those that are related to the procedure (box 1). Age is not only the most important risk factor for persistent cognitive dysfunction, but it is also non-modifiable.⁷

Pathophysiology

Age and emboli

Older patients undergoing coronary artery bypass grafting have extensive atherosclerosis in their vascular systems. Diffusion-weighted imaging has shown that both new microembolisation and macroembolisation result in detectable small-capillary and arterial dilatations, as well as infarction associated with stroke and cognitive dysfunction.^{8–10} In patients undergoing percutaneous invasive procedures there is no evidence of postoperative cognitive dysfunction after 5 years.¹¹

Physiological disturbances

In the ISPOCD1 study⁵ hypoxaemia that was monitored for 24 hours before and for 2–3 days after the operation was not associated with postoperative cognitive dysfunction.

Second operation, postoperative infections, and respiratory complications

These factors were associated with increased incidence of

Box 1: Risk factors

Patient-related factors

- Age
- Low educational status
- Increased duration of anaesthesia
- Repeat anaesthesia
- Postoperative respiratory and infectious complications
- Widespread atherosclerosis

Procedure-related factors

- Use of cardiopulmonary bypass
- Manipulation of aorta (especially by cross-clamping)
- Hypoperfusion
- Hyperthermia in perioperative period

Table 1: Differences between delirium and dementia

	Delirium	Dementia
Onset	Acute—develops over hours to days	Develops in weeks or months
Course	Fluctuating with diurnal variation	Progressive deterioration
Consciousness	Disoriented	Not disoriented until late stage
Psychotic ideation	Present and simple	Uncommon
Attention	Loss of attention	Not lost

cognitive dysfunction in the acute phase but no long-term relationship was seen.⁵

Cellular-level factors

Anaesthetic agents might have an effect on the brain cells, which could initiate cognitive dysfunction. Isoflurane (a volatile anaesthetic agent) induces accumulation of amyloid- β , oligomerisation, and apoptosis. This action may contribute to the risk of postoperative cognitive dysfunction and might be a pathogenic link between delirium and dementia. The importance of this factor is currently unknown.¹²

Other factors

Pharmacogenetic variation, changes in the normal adrenal response to stress, and genetic predisposition to cognitive dysfunction might have a role. No good evidence is available to support any of these theories.⁶

Clinical features

Clinicians should differentiate between postoperative cognitive dysfunction and acute delirium (table 1) because of differences in management. Acute delirium, which has a short course, can be managed by providing support, orientation, unambiguous environment, antipsychotics (haloperidol), and benzodiazepines (particularly if delirium is due to alcohol withdrawal). Dementia, however, needs long-term management.^{6,15} Delirium affects 10–15% of people after surgery, and most often there is a serious reason behind the delirium, such as an undiagnosed infection (eg, chest or urinary tract), failure to recognise anticholinergic effects of a drug, or withdrawal (ie alcohol, caffeine). Delirium is regarded as a risk factor for development of dementia. Patients or their carers often describe postoperative cognitive dysfunction as ‘senior moments’, and patients often cannot remember names and dates accurately.

Measuring cognitive dysfunction

Unfortunately, no single test can diagnose postoperative cognitive dysfunction sensitively and specifically, and

experts disagree about the appropriate diagnostic tests.³ One of the assessment techniques used in dementia is the mini mental state examination, but subtle changes might be missed and a clinician using this test will not pick up early cognitive decline. More detailed and more sensitive assessment of cognitive function is therefore needed. A useful method for assessment of postoperative cognitive function is by neuropsychological testing.

The six tests used in the ISPOCD1 study⁵ can be taken as a standard for the assessment of postoperative cognitive dysfunction. These are verbal learning test, concept shifting test, trailmaking test from Halstead and Reitan’s neuropsychological test battery, Stroop colour word interference test, paper and pencil memory scanning test, letter-digit coding, and the four boxes test. The degree of change in a test deemed to indicate postoperative cognitive dysfunction is a deterioration of one standard deviation over the period of observation. Details of these tests can be found in a specialist neuropsychological textbook such as the Handbook of Neuropsychology.¹⁶

Prevention

Evidence for preventative measures against postoperative cognitive dysfunction is lacking—most interventions are based on common sense rather than on evidence. It might be prudent to avoid postoperative hypoxaemia and infective complications of surgery, and the benefits of each surgery should be weighed against the risk of consequent cognitive dysfunction and its effect. Likewise, no good evidence exists regarding different types of anaesthetic and development of cognitive dysfunction, or to suggest that one technique is superior to another.

Future research

Future research into sedation and cognitive dysfunction should be done. Currently no evidence shows cognitive dysfunction happening after sedation, but it is a possibility. Such research would be of great relevance to endoscopy units and other departments that frequently sedate patients.

Conclusion

Postoperative cognitive dysfunction can happen after cardiac or non-cardiac surgery, and all clinicians should be aware of this condition. Each surgery should be justified and weighted against the risk of cognitive dysfunction. No evidence-based methods of prevention or treatment exist at present. Further research is needed into the causative factors and treatment of this condition.

We have no conflict of interest

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