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Guidelines

Guidelines for the peri-operative care of people with dementia

Guidelines from the Association of Anaesthetists

S. White,[1] **R. Griffiths,**[2] **M. Baxter,**[3] **T. Beanland,**[4] **J. Cross,**[5] **J. Dhesi,**[6] **A. B. Docherty,**[7] **I. Foo,**[8] **G. Jolly,**[9] **J. Jones,**[10] **I. K. Moppett,**[11] **E. Plunkett**[12] and **K. Sachdev**[13]

1 Consultant Anaesthetist, Royal Sussex County Hospital, Brighton, UK and co-Chair, Association of Anaesthetists Working Party
2 Consultant Anaesthetist, Peterborough and Stamford Hospitals Foundation NHS Trust, Peterborough, UK and co-Chair, Association of Anaesthetists Working Party
3 Consultant Geriatrician, University Hospital Southampton, Southampton, UK and British Geriatrics Society
4 Head of Knowledge Management, Alzheimer's Society, London, UK
5 Advanced Nurse Practitioner, Guy's and St. Thomas' Hospitals NHS Trust, London, UK and Royal College of Nursing
6 Consultant Geriatrician, Guy's and St. Thomas' Hospitals NHS Trust, London, UK and British Geriatrics Society
7 Clinical Research Fellow/Specialty, Registrar, Department of Anaesthesia and Critical Care, University of Edinburgh, Edinburgh, UK
8 Consultant Anaesthetist, Western General Hospital, Edinburgh, UK and Age Anaesthesia Association
9 Alzheimer's Society and Patient/Carer Representative
10 Co-founder, John's Campaign, London, UK
11 Professor of Anaesthesia and Peri-operative Medicine, University of Nottingham, Nottingham, UK and Royal College of Anaesthetists
12 Consultant Anaesthetist, University Hospitals Birmingham, Birmingham, UK and Association of Anaesthetists Trainees
13 Consultant in Older Adult Psychiatry, Homerton University Hospital NHS Foundation Trust, London, UK

Summary

Ageing populations have greater incidences of dementia. People with dementia present for emergency and, increasingly, elective surgery, but are poorly served by the lack of available guidance on their peri-operative management, particularly relating to pharmacological, medico-legal, environmental and attitudinal considerations. These guidelines seek to deliver such guidance, by providing information for peri-operative care providers about dementia pathophysiology, specific difficulties anaesthetising patients with dementia, medication interactions, organisational and medico-legal factors, pre-, intra- and postoperative care considerations, training, sources of further information and care quality improvement tools.

Correspondence to: S. White
Email: igasbest@hotmail.com
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What other guideline statements are available on this topic?

This guideline should be read in conjunction with the 2014 Association of Anaesthetists guideline 'Peri-operative care of the elderly' [1]. Similarly, more specific anaesthetic advice can be found in relation to older patients with hip/fragility fracture in the 2011 Association of Anaesthetists guideline 'Management of proximal femoral fractures' [2]. The medicolegal implications of impaired mental capacity are described further in the 2017 Association of Anaesthetists guideline 'Consent for anaesthesia' [3].

Why was this guideline developed?

To produce a concise document designed to help peri-operative physicians and allied health professionals provide multidisciplinary, peri-operative care for people with dementia and mild cognitive impairment.

How and why does this statement differ from existing guidelines?

There is no national guidance on how people with dementia, and their relatives/carers, might best be supported through an episode of surgery and anaesthesia. In common with other Association of Anaesthetists guidelines, this guideline was developed by a Working Party consensus review of current evidence about not only best practice in peri-operative care but also recommends best practice in circumstances where evidence is controversial or incomplete.

Recommendations

1. People with cognitive impairment should receive the same standards of, and access to, healthcare as people without cognitive impairment.
2. Pre-operative assessment processes should identify people with cognitive impairment so that their management and follow-up can be tailored to their needs.
3. Pre-operatively, the risk of peri-operative cognitive changes should be explained to people and their relatives.
4. Rigorous assessment and management of cognitive impairment should apply equally to people requiring elective or emergency surgery.
5. Carers and relatives should be involved appropriately in all stages of the peri-operative process.
6. Carers or relatives should be invited to accompany a person with cognitive impairment into the operating department before and after surgery.
7. Anaesthesia should be administered with the aim of minimising peri-operative cognitive changes.
8. Anaesthetists should participate fully in multidisciplinary care and communication about people with cognitive impairment at all stages of the surgical process.
9. Each department of anaesthesia should have a lead anaesthetist for cognitively impaired adults.
10. All relevant staff should receive training in the assessment and treatment of pain in people with cognitive impairment.

Details of how to implement these recommendations are specifically provided in the text below.

Definitions

Several terms are used to describe altered cognitive function in the peri-operative period. These include the following.

Mild cognitive impairment (MCI) is characterised by mild but measurable changes in cognitive abilities, including memory and thinking. The changes may be very subtle and noticeable only to the person affected, or their family and friends, without significantly affecting the person's ability to carry out everyday activities. Cognitive impairment is greater than expected for their age, but they do not show signs of dementia, such as impaired judgement or reasoning, or impact on activities of daily living. Progression of MCI to dementia occurs in 20–70% of people (depending on the population studied) at a rate of ~10% per year but cannot currently be predicted to occur [4]. Throughout these guidelines, 'dementia' refers inclusively to people with MCI.

Dementia is a syndrome characterised by progressive, irreversible worsening of memory, thinking, behaviour, personality and ability to perform daily activities, without impairment of consciousness. These symptoms should have been present for at least 6 months before diagnosis.

The definition of **postoperative cognitive decline** (POCD) is historical, inconsistent and based on research criteria. Generally, POCD describes significant, postoperative decline in comparison with baseline/pre-operative cognition (i.e. in one or more domains using a series of validated neuropsychological tests), which occurs between 7 days and one year after surgery and may persist beyond that. There may be peri-operative alteration in mental status or awareness. Older age and pre-operative cognitive impairment are risk factors. Postoperative cognitive decline is not yet recognised in the International Classification of Disease (ICD-10) or the Diagnostic and Statistical Manual of Mental Disorders (DSM-V). Postoperative cognitive decline is associated with increased mortality, impaired quality of life and loss of employment [5, 6].

Postoperative delirium (POD); as defined in DSM-V, delirium is a clinical diagnosis characterised by a fluctuating disturbance in attention and awareness that develops over a short period of time (hours to days) as a direct physiological consequence of a general medical condition, surgery [7], an intoxicating substance, medication use or more than one cause. The disturbance and any associated changes in cognition are not better accounted for by pre-existing, established or evolving dementia. Older age and dementia are risk factors for developing POD. It is associated with prolonged postoperative hospitalisation, institutionalisation, mortality [8] and onward cognitive decline [9, 10]. It is distressing to the patient, their families and friends, has long-term psychological sequelae and impacts on staff and other patients on the ward.

The International Nomenclature Consensus Working Group has recently published recommendations for new terminology and clinical diagnostic criteria for the cognitive impairment temporally associated with anaesthesia and surgery [11]. This work aims to overcome inconsistencies and inadequacies in terminology by aligning peri-operative cognitive disorders with the definitions and criteria outlined in DSM-V. The Working Group recommended that 'peri-operative neurocognitive disorders' should be used to describe cognitive impairment identified in the peri-operative period, including before surgery ('neurocognitive disorder'), as an acute event ('POD') or up to 30 days ('delayed neurocognitive recovery') or 12 months ('postoperative neurocognitive disorder') after surgery. The new terminology is not used in these guidelines for the sake of familiarity but will be used in future updates.

Comprehensive guidelines detailing the diagnosis, prevention and management of POD recognise the importance of early, standardised, multi-component interventions in preventing consequent cognitive decline in the elderly [12, 13].

Background

In the UK, approximately 850,000 people have dementia (55,000 in Ireland), a figure expected to rise to one million by 2025. The current 'cost' of dementia in the UK is estimated to be £23 billion sterling annually.

People with dementia aged > 65 years occupy a quarter of hospital beds. Forty-five percent of people > 75 years admitted to hospital in the UK for emergency treatment have dementia; most are admitted after falls, a stroke or for urinary tract or chest infections. Of these, approximately 90% are admitted as inpatients. The number of people with dementia who have surgery in the UK is uncertain. Patients and carers often presume cognitive changes are a consequence of normal ageing, older patients are less likely to seek medical care due to cognitive impairment, sensory impairments and cultural behaviour, and there is no robust pre-operative screening test for cognitive disorders in routine clinical care. Dementia, therefore, is underdiagnosed in the surgical population. However, as the prevalence of both dementia and the majority of degenerative, neoplastic and vascular conditions requiring major elective or emergency surgery increases with age, it is likely that a significant proportion of patients presenting for surgery will have dementia or MCI.

The prevalence of people with MCI or dementia is higher in emergency compared with elective surgery. The prevalence of dementia is ~20% among people with hip fracture [14], ~8% with chronic limb ischaemia [15] and ~5% with cataracts [16, 17]. The prevalence of MCI is ~80% among people > 65 years requiring emergency general surgery [18], ~60% among people > 60 years presenting for elective vascular surgery [19], ~20% for elective total joint replacement [20] and ~14% (75–84 years) for uro-gynaecological surgery [21].

People with dementia undergoing surgery are re-hospitalised more commonly, generally have longer inpatient stays and poorer outcomes, and an increased likelihood of moving into a care home, compared with surgical patients without dementia. One-third of people with dementia admitted to hospital for an unrelated condition never return to their own homes.

There are a number of types of dementia, which vary according to the region of the brain primarily affected, and therefore the spectrum of neurocognitive change experienced (Table 1). The incidence of 'mixed dementia', where a person has more than one type of dementia (usually Alzheimer's and vascular dementia) at the same time, increases with age. Less common causes of dementia include Parkinson's disease (2%), Creutzfeld–Jakob disease, normal pressure hydrocephalus, Huntington's disease and Wernicke–Korsakoff syndrome. In practice, the principles of peri-operative care recommended below apply to all types of dementia and MCI.

Diagnosis of dementia

Dementia is not a diagnosis that should be made by anaesthetists. However, patients may present during pre-operative assessment with concerns about or signs of MCI or dementia, but without formal diagnosis. A simple screening tool, such as the Abbreviated Mental Test Score, MiniCog, Qmci or clock-drawing test [22, 23], in

Table 1 Types of dementia and their symptoms.

Type of dementia	UK prevalence	Histopathology	Symptoms include
AD	62%	Beta-amyloid plaques between neurons Tau protein clumps (neurofibrillary tangles) within nerve cell bodies Loss of cholinergic neurons	Early: memory loss, depression Later: confusion, behavioural changes, impaired communication
Vascular dementia	17%	Secondary to acute/chronic small and large blood vessel disease of the brain. People usually have cerebrovascular changes related to co-morbidities: atrial fibrillation, hypertension, diabetes	Chronic changes dependent on the region of brain affected, and/or stepwise reductions in neurocognitive function with successive infarcts
Mixed dementia	10%	Most commonly a mixture of AD and vascular changes	Most commonly a mixture of AD and vascular symptoms
Dementia with Lewy bodies	4%	Alpha-synuclein aggregations in the brain cortex	Similar to AD, but with earlier/initial sleep and visual disturbances or Parkinsonian features
Frontotemporal dementia	2%	A variety of changes, often involving protein aggregations, that primarily affect the frontal and temporal lobes of the brain	Changes in personality and behaviour, difficulties with language Develops at a younger age than AD, with a shorter survival

AD, Alzheimer's disease.

combination with direct questioning (e.g. 'do you have any concerns about your memory?'), can help identify cognitive impairment in the pre-operative assessment clinic, but results can be affected by anxiety, pain and medication. A positive screen should alert the anaesthetist to follow clear institutional referral pathways back to the person's General Practitioner (GP) either before or after surgery, depending on the risks/benefits of operative delay. People should be invited to have their carers or relatives support them through the assessment process, who may be able to provide further information about subtle changes in memory, behaviour or perception that they have noticed in the person.

People are usually seen initially by their GP when they or their family members report concerns about their memory or behaviour or perceptual changes. Although GPs can diagnose dementia after a brief memory assessment, physical examination and exclusion blood screening, more often the person is referred to specialist services (diagnostic memory clinic, geriatricians or neurology), who arrange more detailed cognitive testing and CT or MRI scanning, and feed their diagnosis back to the person and their GP, who then becomes the point of contact for ongoing support, periodic continuing assessment and medication prescription/review.

General Practitioners can help people newly diagnosed with dementia consider their medical plans for the future; for example, by recommending they appoint a Lasting Power of Attorney or write an Advanced Decision, although this varies internationally by jurisdiction. Pre-operatively, GPs and liaison psychiatry services are useful contacts for anaesthetists requiring information about a person's cognition, behaviour, likes, dislikes, communication difficulties, sensory impairments, alcohol use and medications.

Specific difficulties anaesthetising patients with dementia

When administering anaesthesia to people with cognitive impairment, the aim is to minimise cognitive change after surgery. Currently, there is no compelling evidence that general anaesthetic agents are causally implicated in dementia onset. However, evidence suggests that surgery and anaesthesia can affect a person's cognitive trajectory around the time of surgery.

Pre-operatively, cognitive assessment can help identify people at risk from cognitive change after surgery and anaesthesia. Communication about the neurocognitive risks of surgery and anaesthesia should form an integral part of the consent process in older patients. Intra-operatively, anaesthetic agents affect central neurochemistry, can interact with chronic dementia medications and alter cerebrovascular perfusion. There is conflicting evidence that neuro-cerebrovascular monitoring may improve outcome in people at risk of peri-operative cognitive decline. Postoperatively, the early identification and appropriate management of pain and acute cognitive change (POD/depression) can improve outcome. As it is a research diagnosis with no treatment known, the early

identification of POCD may enable strategies to be developed that may affect outcome; new nomenclature recommendations [11] will provide a clinical diagnosis of POCD that may enable early identification/management.

Does anaesthesia 'cause' dementia?

Laboratory and animal studies have provided credible evidence that general anaesthetic agents (primarily volatile agents) can trigger pathophysiological changes that are associated with Alzheimer's disease, but this does not mean a causal relationship exists, or that (repeated) exposure to volatile agents leads to dementia in humans.

Volatile anaesthetics increase production and aggregation of amyloid-beta (Aβ) peptides into larger oligomers, a key step in the formation of amyloid plaques; and induce hyperphosphorylation and accumulation of tau protein, which leads to the formation of neurofibrillary tangles [24]. Anaesthetic agents can cause neuronal apoptosis in developing rat brains. Nuclear magnetic resonance studies suggest that the molecular size of the volatile agent correlates with the degree of Aβ oligomerisation (aggregation), with desflurane causing the least.

Intravenous (i.v.) anaesthetic agents and opioids do not appear to alter the pathogenesis of dementia. Indeed, propofol inhibits Aβ aggregation at low concentrations (and enhances it only at very high concentrations) [24].

Volatile and i.v. anaesthetic agents, morphine and fentanyl antagonise central nicotinic and muscarinic acetylcholine receptors, decreasing acetylcholine release and so inhibiting central cholinergic transmission, producing loss of consciousness, analgesia, akinesia and amnesia. It is unclear whether this change is prolonged, additive to age and/or dementia related in cholinergic transmission or contributory to POD/POCD [25].

Clinically, it is difficult to disentangle the effects of co-morbidity, illness, surgery and peri-operative complications (including delirium) from any direct neurotoxic effects of anaesthesia and surgery that independently accelerate the rate of long-term cognitive decline [26].

Meta-analysis has found no significant association between exposure to general anaesthesia and the risk of developing Alzheimer's disease, concluding the number of high-quality studies published is insufficient to discount any relationship definitely [27]. Subsequent cohort studies have suggested an increased incidence of dementia after anaesthesia and surgery [28–30], but taken in total, evidence of a causative link between general anaesthetic agents currently appears inconclusive [31]. Future research requires better assessment of pre-operative cognition, trajectory and risk factors, longer follow-up periods [32] and isolation of the effects of anaesthesia from illness and surgery.

Medication interactions

Polypharmacy is prevalent within the age group of most people with dementia, which increases the likelihood of adverse interactions with drugs used in anaesthetic practice. Carers and relatives are often the best sources of up-to-date lists of current medications and allergies. Specifically, drugs used in anaesthetic practice can interact with drugs used either to treat dementia or to modify the behavioural symptoms of dementia (Table 2).

Cholinesterase inhibitors increase cholinergic transmission by inhibiting cholinesterase at the synaptic cleft. They are used to offer temporary and modest relief of cognitive symptoms in people with mild to moderate dementia. Cholinesterase inhibitors interact with muscle relaxants, prolonging the effects of depolarising neuromuscular blocking drugs (suxamethonium), and decrease or reverse the effects of non-depolarising neuromuscular blocking drugs [33]. Larger doses of non-depolarising muscle relaxants may be required to achieve satisfactory paralysis.

From an anaesthetic perspective, cholinesterase inhibitors should be stopped before elective surgery during which potential interactions with neuromuscular blockers might occur [34]. However, from a neuropsychiatric perspective, discontinuation risks worsening cognitive function, and suggests the risk of interaction should be managed, as it would be during emergency surgery. Even then, cholinesterase inhibitor use during emergency (hip) surgery does not appear to be associated with an increased risk of postoperative complications in general, and respiratory complications more specifically [33]. Cholinesterase inhibitors should certainly be continued before elective surgery when the likelihood of neuromuscular blocking agent administration is low. Decisions about discontinuation should be made on an individual basis rather than as an institutional policy and should be taken in discussion with the person with dementia (and their relatives/carers, as appropriate) [35].

Donepezil has a longer half-life (70 h). It requires a period of 2–3 weeks to clear the body, during which time, without treatment, an irreversible decline in cognitive function may occur. The drug is associated with a small but significant increase in the risk of syncope and bradycardia [36]. There is no definitive guidance on whether donepezil should be continued or discontinued before elective surgery. We recommend continuing donepezil and

Table 2 Important drug interactions between dementia medication and drugs used in anaesthesia.

	Half-life; hr	Recommendation/effect
Cholinesterase inhibitors		
Galantamine	7	Discontinue[a] day before surgery
Rivastigmine	9	Discontinue[a] day before surgery
Donepezil	70	Not recommended
Memantine	60–100	Care with ketamine, anticholineric and dopaminergic drugs
Gingko biloba	4–6	Monitor blood loss
		Use atracurium; neostigmine may be ineffective/prolong neuromuscular blockade
		Use sugammadex to reverse rocuronium and vecuronium
Drugs used to modify non-cognitive symptoms in dementia		
SSRIs	Various	Risk of serotonin syndrome with fentanyl, ondansetron, tramadol
Cognitive stimulants	Various	Antagonise hypnotic anaesthetic drugs
Benzodiazepines ± antipsychotics	Various	Potentiate neuro- and cardio-depressant effects of anaesthetic drugs

SSRI, selective serotonin reuptake inhibitor.
[a]Discontinue only if appropriate (see text).

managing muscle relaxation accordingly, using neuromuscular monitoring (ideally acceleromyography).

Galantamine and rivastigmine have short half-lives and can be discontinued the day before surgery.

After emergency surgery involving neuromuscular blockade, neostigmine may be ineffective or prolong neuromuscular blockade. Short-acting neuromuscular blocking agents that are spontaneously inactivated (atracurium, cisatracurium) should be used. Alternatively, sugammadex can be used to reverse rocuronium or vecuronium predictably.

Memantine is an *N*-methyl-D-aspartate (NMDA) receptor antagonist given to people unable to tolerate the cholinergic side-effects of cholinesterase inhibitors, and for people with severe dementia. It may enhance the central nervous system toxicity of ketamine and may enhance the side-effects of anticholinergic and dopaminergic drugs.

Gingko biloba, an over-the-counter extract of which may be taken by people with cognitive impairment or dementia [37], is a dietary supplement that interferes with platelet function and promotes bleeding.

Drugs used for dementia should be re-introduced as soon as practicable in the postoperative period, in consultation with a specialist experienced in the management of dementia.

A number of drugs are used to modify non-cognitive symptoms, the interactions of which with anaesthetic drugs can be predicted from their pharmacological actions. For example, fentanyl, ondansetron or tramadol administered to a person with dementia taking a selective serotonin re-uptake inhibitor (citalopram, sertraline, escitalopram, paroxetine, fluoxetine) for depressive symptoms, can precipitate serotonin syndrome. Benzodiazepines, used to treat agitation, and atypical antipsychotics (e.g. risperidone), used to treat aggression and hallucination, can potentiate the effects of anaesthetic drugs [34]. Non-licensed modafinil, sourced by people with dementia or their carers to promote wakefulness and cognition, could antagonise the hypnotic effects of anaesthetic drugs.

Organisational factors

Although surgery and anaesthesia are risk factors for their peri-operative cognitive decline, people with dementia should not automatically be denied access to surgery.

A number of cognitive trajectories are possible around the time of surgery (Fig. 1). A peri-operative alteration in cognitive trajectory is not inevitable. When surgery is successful the first time, with minimal peri-operative derangements in physiology and without complication, a person's cognition can be expected to follow its pre-operative trajectory [38, 39]. Moreover, when surgery alleviates symptoms or pain and enhances quality of life, for example, by improving vision, hearing or mobility, cognition might be improved postoperatively, or further deterioration avoided [40, 41].

Involving relatives and carers

People with cognitive impairment are likely to experience further challenges to those normally experienced by people undergoing surgery and being in hospital. Key areas of support concern:

1 Knowing about the person with dementia, for example, making use of a '*This is me*' or similar document (see 'Sources of Further Information');

2 'Carer awareness' – carers and relatives can provide invaluable information and support for the person with cognitive impairment throughout the peri-operative process, from initial referral to returning home after surgery. Effective communication with these can help define what may or may not be medically achievable (and the risks and consequences) for the person with cognitive impairment, and empower them to help deliver specific cognitive care;
3 'Carer support' – caring for people with dementia in the community can be difficult, and inpatient care affords an opportunity to enquire after relatives' or carers' ongoing needs for support and further information;
4 Communication – not just the information to be communicated, but how that process occurs, which includes giving people with dementia (or their carers or relatives) time to communicate, thinking about body language and non-verbal communication, ensuring a quiet environment, using short, simple sentences, accommodating any sensory impairments and providing information in preferred formats. The Alzheimer's Society has provided useful guidance about communication (see also Supporting Information Data S1);
5 The hospital environment (see 'Intra-operative care').

Lead Clinician for peri-operative dementia care

The Association of Anaesthetists recommends that a consultant clinician (anaesthetist, surgeon or geriatrician) assumes the role of Lead Clinician responsible for the peri-operative care of people with dementia at their hospital. Ideally, the Lead Clinician would also coordinate implementation of the Association of Anaesthetists guidelines on Peri-operative Care of the Elderly [3] and Hip fracture [1]. The Lead Clinician should co-ordinate a number of strategies:

1 Leading a multidisciplinary group of senior clinicians with an interest in the peri-operative care of people with dementia;
2 Co-ordinating peri-operative dementia care across the institution with other nursing, allied health professionals, patient advocate, managerial and institutional dementia 'champions';
3 Training within and without the hospital peri-operative directorate on legal and clinical aspects of care for people with dementia, including recognition and management of pain/analgesia and delirium;
4 Implementing these guidelines;

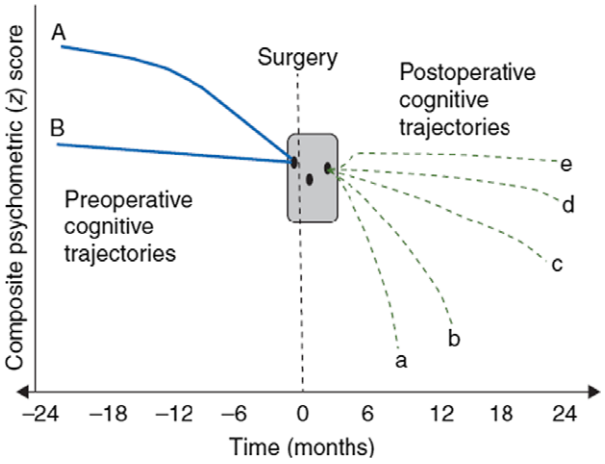

Figure 1 Pre-operative and postoperative cognitive trajectories. This figure illustrates possible pre-operative and postoperative cognitive trajectories for an individual patient. Curve A is representative of a patient who is experiencing cognitive decline before operation, and curve B represents a patient with a relatively stable pre-operative cognition. For Patient A, postoperative trajectory curve b would be an extension of the pre-operative trend. Curve A would be an acceleration of cognitive decline and curve C would be deceleration in cognitive decline, or cognitive improvement compared with the expected or extrapolated trajectory. Without the knowledge of this patient's pre-operative trajectory, all three curves (A–C) could reasonably be interpreted as POCD. In relation to patient B's pre-operative cognitive trajectory, curve C shows POCD, curve D represents a continuation of the pre-operative course and curve E suggests POCI. Interestingly, with the additional knowledge of the pre-operative cognitive trajectories, the same curve (curve C) that, in isolation, would be interpreted as POCD is now interpreted as relative cognitive improvement for patient A and relative cognitive decline for patient B. Figure modified from: Mashour GA, Avidan MS. 'Neurologic Outcomes of Surgery and Anesthesia'. Oxford: Oxford University Press, 2013.

5 Implementing the creation of a dementia-friendly operating theatre environment;
6 Implementing quality assessment/quality improvement (QAQI) measures of care within their directorate (see also Supporting Information Data S2).

Multidisciplinary care

Developing and implementing these strategies will require involvement of patients and carers, to ensure the co-design and coproduction of peri-operative services specific to the needs of people with cognitive impairment.

Lead Clinicians should encourage Trusts to use national documentation, such as the '*This is me*' document, to ensure a personalised approach from all staff for each

individual with cognitive impairment. This may include changes in routine practice, such as encouraging flexible visiting times for carers to have the opportunity to participate in delivery of care on the surgical wards. Furthermore, the implementation of quality care for people with cognitive impairment requires multidisciplinary and multispecialty collaboration beyond the traditional model of surgical care [42]. Pathways need to be developed to facilitate early referral and targeted management of complex patients by geriatricians, older age psychiatrists and specialist dementia nurses.

Medicolegal factors

People with dementia requiring surgery and anaesthesia can exhibit the full spectrum of decision-making capacity and should not be assumed to lack decision-making capacity based solely on a diagnosis of dementia. Indeed, the Working Party recommends that people with dementia, who are at high risk of postoperative cognitive change, are helped and encouraged to make cognitively-demanding decisions pre-operatively, with particular regard to treatment alternatives or escalation in the event of treatment complications. Emergency care does not abolish this duty.

The decision-making capacity of a person with dementia can fluctuate and requires continual re-assessment in the peri-operative period. Requests for further information, time to consider or further help/input from carers and relatives should always be respected.

For a person to possess the appropriate capacity to decide whether or not to have each proposed medical intervention, they must be able to understand the information a doctor gives them about the intervention, retain it and use the information to come to a decision (and communicate that) at the time they are required to do so. The assessment of their capacity by the doctor (usually) is binary (they either have capacity or they do not) and issue-specific (the decision applies to the proposed treatment, not all treatments). In some cases, the patient may have the capacity to make a decision but needs support to do so, which should be provided if possible.

The Working Party recommends that both POD and POCD (being more prevalent after surgery and having longer term consequences) represent material risks that people with dementia (and/or their relatives/carers) must be informed about before deciding whether to have surgery or not.

In accordance with the provisions of the Mental Capacity Act 2005, if the patient does not have decision-making capacity, then a decision to proceed with treatment must be made for them by a third party or parties, acting in the person's best interests. There may be an Advance Decision made by the person proscribing circumstances under which they would want to refuse future medical treatment (including cardiopulmonary resuscitation) once they lose capacity.

If the patient does not have the capacity to consent to a specific procedure and there is no valid and applicable Advance Decision, a relative or carer who is the donee of a Lasting Power of Attorney for Health and Welfare properly registered with the Office of the Public Guardian can make proxy medical decisions. Potentially, depending on the wording of the Power, this includes decisions about refusing resuscitation on behalf of a person with dementia. Such an attorney would need to make any decision in the person's best interests.

A personal welfare deputy appointed by the Court of Protection can make proxy medical decisions (excluding the decision to refuse resuscitation) on behalf of a person with dementia.

If no proxy can be identified, or in emergencies, doctors can proceed with medical treatment for people without decision-making capacity, provided the treatment is necessary and is in the patient's best interests (which are more than simply their medical best interests, determined through discussion with the person's relatives/carers).

In some cases, an Independent Mental Capacity Advocate may be involved or it may be appropriate to appoint one, particularly if the person has no-one else to advocate for them. While an Independent Mental Capacity Advocate will not make the decision, they can act as the voice of the person without capacity to decide for themselves and so can inform decision-making by third parties.

'Do not attempt resuscitation' orders differ from Advance Decisions to refuse resuscitation in that they are made about a person without capacity rather than by them and, ideally, only after wider discussion between the multidisciplinary team and relatives/carers [43] and the person themselves where possible.

The Mental Capacity Act 2005 allows restraint to be used (e.g. for a person with dementia/or POD who is agitated) but only in their best interests (e.g. to prevent falls or injury) and as a proportionate response to a risk of harm to the person. Anaesthetists may encounter people with dementia for whom extra legal safeguards are in place depriving them of their liberty (known as Deprivation of Liberty Safeguards, or DoLS), and should enquire about the provision of these from their hospital legal department, geriatricians or older age psychiatrists.

Further guidance about decision-making for patients with cognitive impairment can be found in '*Consent for anaesthesia*' [3], with reference to the British Medical

Association's guidance pertaining to patients in Scotland under the Adults with Incapacity (Scotland) Act 2000 [44].

Pre-operative care

Pre-operative cognitive impairment is a significant risk factor for POCD. Routine assessment of pre-operative cognition in patients > 60 years enables postoperative risk stratification, appropriate decision making about treatments and POD/POCD management planning [32]. Cognition may have been recently assessed as an outpatient, in which case it does not need to be repeated during pre-operative assessment.

Pre-operative assessment clinics, ideally multidisciplinary ones, provide an extended opportunity for assessing, planning and communicating the complexity of factors involved in managing people with dementia as surgical inpatients. Holistic comprehensive geriatric assessment methodology (to which anaesthetists can contribute) has been shown to reduce the incidence and/or severity of postoperative cognitive disorders, such as delirium [45].

Pre-operative assessment and intervention should include a full medication review, alcohol and drug history, identifying the potential for interaction with anaesthetic drugs and identifying medications whose peri-operative use or omission could have a detrimental effect on cognitive function [25, 46]. The use of personal aid devices (hearing aids, glasses, dentures) should be reviewed routinely. Detailed discussion of usual function, hearing and visual problems, cognition and behavioural or psychological symptoms, including agitation, aggression, wandering, psychosis, likes and dislikes should be undertaken.

People with dementia are often frail, and their frailty should be estimated using a validated scoring system (such as the Edmonton Frail Scale [47, 48]) and managed accordingly throughout the peri-operative period [49–51]. People with MCI or dementia should be accompanied, where possible, by a relative or carer who knows them to all pre-operative visits. Provisions should be made for relatives and carers to remain with the patient before surgery to the point of anaesthesia induction, and after surgery soon after emergence.

The existence of an appropriately constituted, registered Lasting Power of Attorney or Advanced Decision should be confirmed during the pre-operative assessment process.

Benefits of day surgery

Having dementia does not preclude a person from having day surgery, which returns them more quickly to their normal environment than inpatient stay, thus reducing POD. Day surgery involving anaesthesia for older people with dementia requires specific knowledge and skills, particularly related to patient selection, dosage and interactions of anaesthesia drugs, analgesia and recognition and management of postoperative cognitive change [17, 52, 53]. In general, the longer people with dementia remain in hospital, the greater the effect on their cognition. They are more likely to become temporarily/permanently institutionalised, and there is a greater chance of antipsychotic drugs having to be administered to them [54].

Intra-operative care

The operating suite is an unfamiliar environment for people with dementia, their carers and relatives. Undergoing anaesthesia can cause anxiety in people with normal cognition and particularly so in people with dementia. Strategies to alleviate the disorientation this can cause are similar to those used on elderly care wards and are shown in Table 3. Orientation can be further supported by introducing elements of the person's '*This is me*' document to theatre staff during the WHO Sign-in at the start of each operating list; particularly what name to use, what relaxes the person and any problems with vision or hearing.

If possible, people with dementia should be prioritised for surgery early in the day to reduce the disorientation associated with prolonged pre-operative fasting and hydration, sleep alteration and interruption of medication schedules. This may require communication within an MDT setting, or with scheduling managers.

Table 3 Strategies to alleviate disorientation in the operating suite.

- Welcome an accompanying relative or carer into the anaesthetic room before induction
- Welcome an accompanying relative or carer into the recovery room early after emergence
- Have staff wear legible name and role badges to ease identification
- Enable continued access to 'comforters' (blankets, toys, 'twiddle-muffs')
- Enable the person to sit upright if possible
- Have a large-face clock and 'anaesthesia room' and 'toilet' word and picture sign visible
- Provide considerate explanation of what is happening
- Provide gauze rolls to grip onto
- Remove visual and hearing aids only if necessary
- Use natural/natural effect lighting
- Minimise unnecessary noise
- Use colour contrasts to aid identification

Anaesthesia type

The few studies that have investigated the impact of surgery and anaesthesia on peri-operative changes in cognition in people with dementia have failed to find a consistent difference in cognitive outcome between those administered general or regional anaesthesia [55, 56]. People with dementia are proportionately under-represented in research studies on peri-operative cognition, and numerous confounding factors exist in such research. These include methodological problems, both measuring peri-operative cognitive change [38, 57] and distinguishing the effect of surgery per se, the definitions of 'general' and 'regional' anaesthesia incorporating a wide range of techniques and quantifying the effect of routinely co-administered (over)sedation with regional anaesthesia.

General or regional anaesthesia can be used, the type of anaesthesia probably being of minimal importance compared with how that anaesthesia is administered [58]. Regional anaesthesia may be technically more difficult without sedation.

In general, anaesthetists should aim to minimise the administration of 'deliriant' medication by using the lowest effective dose for the shortest time possible and expecting prolonged onset and offset times. This approach relates as much to good practice when anaesthetising older people as it does specifically to anaesthetising older people with dementia; in the latter, it remains uncertain whether there is altered sensitivity to general anaesthesia agents or not (i.e. whether people with dementia require less anaesthetic agent to produce anaesthesia) [59, 60].

Certain medications are possibly best avoided because they are centrally active, often with anticholinergic side-effects [25], and alternative drugs can be used. These include benzodiazepines (use propofol instead), cyclizine (use metoclopramide instead) and tramadol.

Increased 'anticholinergic burden' is associated with poorer long-term cognition, physical function and mortality in older people [61]. A number of risk scales are available to quantify anticholinergic burden, for example, the Anticholinergic Cognitive Burden scale [62], which lists drugs whose cumulative burden may be harmful [63]. However, the contribution of single, 'anaesthetic' doses of anticholinergic agents (atropine, chlorpheniramine, hyoscine, scopolamine, pethidine, cimetidine, codeine, diazepam, fentanyl, furosemide, hydrocortisone, morphine, prednisolone, ranitidine) to longer term outcome has not been quantified using these scales.

Based on experimental laboratory evidence, there may be theoretical benefits in administering i.v. anaesthetic agents (propofol) ahead of inhalational anaesthetic agents (desflurane is preferable to sevoflurane or isoflurane), although this has not been confirmed in clinical studies [25].

Sub-anaesthetic doses of ketamine administered intra-operatively do not prevent POD [64] in the elderly. Currently there is conflicting evidence both for [65–68] and against [69] using dexmedetomidine instead of propofol procedural sedation to reduce the prevalence of agitated POD in older people. Opioids can induce muscle rigidity in some patients with Parkinsonian dementia [70].

Brain monitoring

Some older people (including those with dementia) are more sensitive to the hypnotic and cardiovascular effects of anaesthesia, and so merit close intra-operative monitoring of depth of anaesthesia and cardiovascular physiology [1]. Comorbidities and polypharmacy can increase the likelihood of critical organ ischaemia during anaesthesia, but anaesthetists can counter the adverse pharmacodynamic effects of anaesthesia on oxygen delivery by monitoring simple physiological parameters in all older patients (non-invasive blood pressure at least every 2 min, or measured invasively, depth of anaesthesia using age-adjusted mnimum alveolar concentration (MAC) or minimum inhibitory concentration (MIC), and/or processed EEG (bispectral index/entropy), S_pO_2 and haemoglobin) and providing appropriate treatment.

Dementia can affect multiple brain regions and connections simultaneously. People with dementia have altered conscious and unconscious electroencephalographic characteristics. Processed EEG monitors (e.g. bispectral index, entropy), which measure frontal cortex activity, may be relatively unreliable measures of general anaesthesia in people with dementia. Patients with dementia may have a reduced 'awake' baseline bispectral index [71]. Processed EEG may have more benefit in reducing the dose of anaesthesia given rather than preventing awareness under anaesthesia (which is rare in older patients), but its appropriate use has been found to reduce the incidence of POCD at 3 months in older patients undergoing general anaesthesia [72], and the incidence of POD in older patients sedated for hip fracture repair under spinal anaesthesia [73, 74].

Blood pressure and processed EEG are proxy indicators of cerebral perfusion, but there is some evidence that more focused monitoring of cerebral physiology (cerebral oxygen saturation) in combination with functional monitoring (bispectral index), to guide protocolised maintenance of anaesthesia depth and cerebral oxygenation, might reduce the short-term prevalence of POCD in older patients [75], if not delirium [76, 77].

Postoperative care

Decisions about discharge destination after postoperative recovery should not deny patients access to high dependency or intensive care on the basis of their dementia or cognitive impairment alone. Advanced Decisions, relatives and carers can provide useful information when deciding on treatment escalation and more intensive care provision. A patient's '*This is me*' document should be used to hand over onward care after discharge from the recovery room [78].

A time-related spectrum of cognitive disorders occurs postoperatively, from emergence phenomena (hours) to delirium, medication alteration, alcohol and nicotine withdrawal (days), POCD (weeks or months) and persistent or permanent cognitive decline (months or years).

Hypoactive or, less commonly, hyperactive delirium can occur postoperatively, both manifest as acute changes in attention and awareness compared with a person's pre-operative baseline, the former characterised by drowsiness and inactivity [79], the latter by restlessness and agitation. Both can be diagnosed and quantified using simple scoring systems (e.g. 4AT [80–82]), which should be incorporated into institutional multicomponent intervention pathways (Appendix 2 [83]). Using awareness-raising factsheets, carers and relatives can be helped to identify early, subtle changes in cognition that might herald delirium.

Proactive multicomponent interventions (such as Hospital Elder Life Program (HELP www.hospitalelderlifeprogram.org) are currently the most effective form of managing POD [84], reducing its incidence, duration and severity in various surgical populations [85–88]. Such interventions involve standardised pathways for diagnosing and monitoring factors known to impair cognition after surgery and anaesthesia and treating these using both non-pharmacological and pharmacological methods.

Non-pharmacological interventions should be used in the first instance to manage patients with cognitive emergence phenomena or delirium [12, 13, 89], including strategies to orient the person in time and place, regular communication and explanation, seeking relative and carer help with this and 'normalising' postoperative care (e.g. regular meal and rest times).

Anaesthetists should actively identify and communicate predisposing and precipitating factors for delirium (Table 4) to postoperative care providers, and aim to prevent or treat factors resulting from anaesthetic intervention. For example, anaesthetists might avoid prescribing ondansetron for nausea in older patients at risk of constipation, or routinely prescribe laxatives alongside opioid analgesia.

Table 4 Peri-operative risk factors for postoperative delirium.

Predisposing factors
• Age • Comorbidities • Frailty • Severe illness • Dementia (especially executive dysfunction) • Emergency surgery • Type of surgery (hip fracture/open AAA repair) • Years of education • Previous episode of delirium • Laboratory measures (dehydration, CRP, abnormal sodium and potassium, low albumin, haematocrit) • Sensory impairment (vision, hearing) • Vascular risk factors • Depression • Alcoholism and cigarette smoking
Modifiable precipitating factors
Intra-operative
• Cumulative time with low bispectral index (BIS) values • Variance in blood pressure • Hypothermia • Greater intra-operative infusion volume • Anaemia • Glucose and electrolyte disturbances – hypernatraemia/hypokalaemia/hypomagnesaemia • Acid/base disturbance
Postoperative
• Dehydration • Sensory impairment • Sleep deprivation • Constipation and urinary retention Anaemia • Sepsis • Pain • Drugs (opioids, benzodiazepines, dihydropyridines)

Anaesthetists should take a proactive approach to pain management, prescribing a clear postoperative plan of how to record pain (visual analogue scale in people able to communicate, Abbey pain scale [90] (see also Supporting information Data S3) in people with dementia who cannot communicate verbally [91]), and which analgesics to use, correctly titrated according to the patients age, co-morbidities, polypharmacy and renal and respiratory function. Continuous nerve blockade using well-secured catheter techniques may provide relatively safe prolonged postoperative analgesia and avoid or reduce the need for supplementary opioid analgesia.

Anaesthetists should also take a proactive approach to managing non-cognitive aspects of intra-operative care relating to conditions that are common in the elderly population, and which can impact their cognitive function postoperatively, including frailty (positioning, pressure

care, nutrition), co-morbidity (inochronotropicity, volaemia, anaemia, sympathetic airway management, ventilation and blood gas control) and polypharmacy (appreciating and ameliorating interactions with anaesthetic drugs). Potential cognitive problems arising from intra-operative management (including any potential for sepsis) should be communicated fully to clinicians providing postoperative care.

If pharmacological approaches are required to reduce risk of harm to the person with agitated delirium, then haloperidol can be administered in incremental 0.5-mg doses. Benzodiazepines should be used for people with alcohol-related cognitive disorders or in people with Parkinsonian dementia. There is no evidence to support the use of prophylactic pharmacological measures (cholinesterase inhibitors, antipsychotics, melatonin) in routine peri-operative care for patients at risk of POD [88, 92].

The incidence of POCD varies according to the definition and sampling methods used, and the patient population studied; this makes pre-operative risk stratification difficult. Although systematic review has described an incidence of ~12% in the adult non-cardiac surgical population, this is undoubtedly an overestimation in younger adults and an underestimation in older people [93]. After cardiac surgery, the prevalence of POCD is higher in the short term (1 week), but not thereafter (> 3 months) [94]. Predisposing factors for POCD are similar to those for POD (although the evidence is weaker), and include increasing age, poorer education, comorbid cerebral or cognitive disease, poorer functional status, and longer surgery and postoperative complications [84, 95]. Likewise, future, formal peri-operative prevention strategies for POCD are likely to involve optimising chronic diseases and other modifiable predisposing factors. Possibly of greatest importance is that the cognition of people with dementia at risk of POCD is not followed after surgery; instead, the Working Party recommends that such people are referred (back) into their local cognitive services network (e.g. via their GP, memory clinic or specialist psychiatry services) for cognition assessment and management. The introduction of new nomenclature should help standardise these processes [11].

The care bundle shown in Table 5 is intended as an aide-memoire and can be printed as an adhesive sticker and attached to the anaesthetic chart. It can be developed further to include specific institutional policies.

Table 5 Peri-operative care bundle.

Is the patient taking cholinesterase inhibitors?		
Galantamine	Y	N
Rivastigmine	Y	N
Donepezil	Y	N
Carer/relative accompanied patient to anaesthesia room?	Y	N
Surgery and anaesthesia discussed with carer/relative?	Y	N
Anaesthetic considerations		
Opioid-sparing analgesia?	Y	N
Reduced anticholinergic load?	Y	N
Cerebral function monitoring?	Y	N
Appropriate postoperative pain assessment and treatment plan prescribed?	Y	N
Cognitive/functional aids returned		
Glasses?	Y	N
Hearing aids?	Y	N
Dentures?	Y	N
Comforters?	Y	N

Training

Capacity describes a person's ability to understand and use the information given to them when deciding whether or not to receive medical care. People with dementia may have the capacity to make some decisions but not others and this may vary over time; all anaesthetists, therefore, must be able to assess a person's capacity when a treatment decision needs to be made [3]. This should be undertaken as part of a doctor's mandatory training and revalidation cycle.

The Lead Anaesthetist for Dementia Care should coordinate an annual departmental training session on the peri-operative management of people with dementia, including assessment of mental capacity, and peri-operative strategies for reducing the risk of delirium.

Aspects of peri-operative dementia care are addressed in Annexes B, C and D of the Royal College of Anaesthetists curriculum for CCT in Anaesthesia [96]. Workplace based assessments planned around the peri-operative management of people with dementia encourage the development of knowledge, skills and attitudes at all training levels.

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Appendix 1: Six key peri-operative care points from a cognitively impaired person/their relatives/carers perspective

1. Support the person to make decisions if they are able to.
2. Provide information in the person's preferred format, using plain English.
3. Make use of resources to get to know the person and their preferences, such as the Alzheimer's Society's 'This is me' document.
4. Communication is important. Give the person time to understand and respond. Keep things simple, rephrase them as necessary. Make the most of non-verbal communication.
5. Think about the hospital environment. Is it suitable for people with cognitive impairment? What can you do to make the environment supportive? For example, colour contrast and signage.
6. Support carers and relatives; know and use their names, and offer food, thanks, parking and support. Share all relevant information, including patient assessment tools such as the Abbey pain scale [89] and 4AT score. Record and monitor how carers and relatives are coping with the process of inpatient care.

Appendix 2: Peri-operative delirium management flowchart

1. Individualise

- Identify people at risk of developing delirium (Table 1)
- Involve people with dementia, carers and relatives in care
- Rationalise medication
- Optimise sleep, nutrition, hydration, sensory aids, bowel/bladder care
- Frequently re-orientate and re-assure the person with dementia

2. Assess

Clinical indicators of delirium – new occurrence or change in:

- Cognition, concentration or perception
- Behaviour (including sleep, appetite, mood)
- Physical function (including falls)

3. Diagnose

- Using formal assessment tools (e.g. CAM, 4AT)
- Including collateral history and views of carers, relatives, other clinical staff
- Specifically assessing for both hypoactive and hyperactive forms of delirium

4. Manage

1. Non-pharmacological – identify and treat all causes:
   - Drugs, hypoxia, hypotension, pain, temperature, bowels/bladder
   - Glucose, electrolytes, acid/base
   - Infection
2. Pharmacological – single agent, lowest dose, shortest use
   - Haloperidol, incremental doses of 0.5 mg iv
   - Benzodiazepines (for alcohol or Parkinsonian-related symptoms)

Supporting Information

Additional supporting information may be found online in the Supporting Information section at the end of the article.

Data S1. Sources of further information.

Data S2. Quality assessment/quality improvement (QA/QI) toolkit.

Data S3. Abbey pain scale [90]