Perioperative care of people with dementia

Abstract

As the population ages, there is a higher prevalence of both dementia and conditions that require major surgery. However, patients with dementia undergoing surgery have poorer outcomes than surgical patients without dementia. This article explores new guidance about delivering perioperative care for patients with dementia presenting for surgery. Management of patients with cognitive changes begins with developing an understanding of the classifications and pathophysiology of these disease processes, and addressing any modifiable risk factors for developing dementia, postoperative cognitive decline and postoperative delirium. Thorough preoperative assessment provides the opportunity to identify patients with and at risk of these cognitive impairments and to involve the appropriate multidisciplinary team in care planning. Once patients are identified, an individualised perioperative management plan addressing any issues surrounding capacity and consent, conduct of anaesthesia, possible polypharmacy and potential drug interactions, and postoperative pain management can improve quality of care and outcomes for these patients.

Key words: Anaesthesia; Consent; Cognitive impairment; Dementia; Perioperative medicine; Quality of care; Shared decision-making; Surgery

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Introduction

Around 850 000 people in the UK have a diagnosis of dementia and this number is expected to increase to over one million by 2025 (Alzheimer's Society, 2014). The World Health Organization has recognised dementia as a public health priority, endorsing the *Global Action Plan on the Public Health Response to Dementia 2017–2025* (World Health Organization, 2017).

Dementia is defined by the International Classification of Disease as a syndrome of chronic or progressive nature, in which there is deterioration of multiple higher cortical and cognitive functions beyond normal ageing, without affecting consciousness. Impairment to cognitive function can be accompanied by deterioration in motivation, emotional control and social conduct (World Health Organization, 2018). Table 1 outlines the pathology of the most common types of dementia. The Lancet Commission estimates that approximately 35% of cases of dementia are attributable to a combination of nine potentially modifiable risk factors (Livingston et al, 2017).

Table 1. Causes of dementia in order of prevalence in the UK

Type of dementia	Histopathology	Modifiable risk factors (account for 35% of all cases of dementia)
Alzheimer's disease	Loss of cholinergic neurons because of beta-amyloid plaques and tau protein tangles	■ Low educational attainment ■ Hypertension ■ Obesity ■ Hearing loss ■ Depression ■ Diabetes ■ Physical inactivity ■ Smoking ■ Social isolation
Vascular dementia	Secondary to disease of cerebral vasculature causing ischaemia or haemorrhage because of loss of vascular integrity	
Mixed dementia	Mixture of Alzheimer's and vascular changes	
Dementia with Lewy bodies	Presence of eosinophilic intracytoplasmic inclusions (Lewy bodies) containing alpha-synuclein aggregations in brain cortex	
Frontotemporal dementia	Protein aggregations affecting the frontal and temporal lobes of the brain	

From Alzheimer's Society (2014)

Cognitive changes

Other changes to cognition that can affect patients in the perioperative period include postoperative cognitive decline and delirium. Postoperative cognitive decline describes significant decline in cognition in comparison with preoperative cognition occurring between 7 days and 1 year after surgery. It may affect mental status or awareness. This condition is not recognised by the International Classification of Disease or the Diagnostic and Statistical Manual of Mental Disorders. Delirium is defined in the Diagnostic and Statistical Manual of Mental Disorders as a fluctuating disturbance in attention and awareness that acutely develops as a direct physiological consequence of a general medical condition, surgery (postoperative delirium), intoxicating substance, medication or combination thereof (American Psychiatric Association, 2013). Table 2 outlines risk factors for postoperative cognitive decline and delirium.

Perioperative considerations

This article explores challenges faced by patients with dementia, their families and carers, and the health-care teams in the perioperative period. It highlights specific issues and approaches to reduce the potential for further cognitive decline addressing organisational structure, preoperative optimisation, consent and capacity, anaesthetic conduct, polypharmacy, day case surgery and postoperative management.

Perioperative medicine

Perioperative medicine is the coordination of the multidisciplinary team from contemplation of surgery to full recovery to improve patient outcomes (Royal College of Anaesthetists, 2015). The aim is to deliver best possible care for patients by optimising the perioperative period, the intraoperative period and the postoperative period. This includes recognition of these high-risk patients, shared decision making, preoperative optimisation, standardisation of perioperative hospital care, and enhanced recovery and rehabilitation.

A nominated lead clinician should be appointed to oversee the management of patients with dementia throughout the perioperative period and to be the key link between all involved personnel including medical and surgical specialties, nursing professionals, allied health

Table 2. Patient, pharmacological and perioperative risk factors for postoperative cognitive decline and delirium

Patient	Age >70 years
	Pre-existing cognitive impairment
	Visual impairment
	Severe illness
	Previous postoperative cognitive decline
	Alcohol excess
	Malnutrition
	Lower education
Pharmacological	Anticholinergics
	Opioids
	Benzodiazepines
Perioperative	Inhalational anaesthetic agents
	Perioperative hypotension
	Perioperative hypoxia
	Major surgery
	Cardiopulmonary bypass
	Emergency procedure

professionals, management and patient advocate groups. Ideally this clinician would be a consultant surgeon, anaesthetist or geriatrician with a particular interest in perioperative medicine. The Association of Anaesthetists recommends that the lead clinician is primarily involved in implementing national recommendations, including dementia pathways and documentation, and specific guidelines, including the perioperative care of people with dementia (White et al, 2019), perioperative care of the elderly (Griffiths et al, 2014) and management of hip fracture (Griffiths et al, 2012). These can be tailored to individual departments and the patient population they serve.

As discussed in this article, good quality evidence in best practice is lacking in this complex patient group. The lead clinician should remain up to date with the literature, attend relevant meetings and conferences, and contribute to improving care with local quality improvement projects.

Preoperative considerations

Identification of cognitive changes

Dementia in the perioperative period is often undiagnosed and unrecognised. Approximately 45% of patients admitted to hospital over the age of 75 years for emergency treatment have dementia (Sampson et al, 2009). In the UK there is no robust preoperative screening test of cognitive disorders in routine clinical care, and it is therefore difficult to quantify the number of patients with dementia who undergo surgery. With increasing age there is a higher prevalence of both dementia and conditions that require major surgery such as cancer and degenerative conditions. It is therefore more likely that a significant proportion of patients presenting for surgery will have dementia.

Patients with concerns or signs of dementia but without a formal diagnosis attending preoperative assessment should be referred to their GP, either before or after surgery as decided by the risks/benefit of operative delay. Cognitive tests for dementia and cognitive impairment have been primarily validated for use in primary care, not in the perioperative setting. However, a number of cognitive assessments are commonly used in the acute hospital environment. Table 3 outlines common cognitive tests, which do not require specialised equipment or training for administration and are available in multiple languages.

Table 3. Cognitive tests commonly used to assess dementia, cognitive impairment and delirium

Cognitive test	Time to administer	Description	Considerations
Montreal Cognitive Assessment (MOCA)	10 minutes	A 30-point assessment of short-term memory recall, visuospatial awareness, abstract reasoning, orientation, language, attention and verbal fluency tests	■ Directly assesses executive function ■ Specifically designed to detect mild cognitive impairment ■ A score of 26 or over is considered to be normal
Mini-Mental State Examination (MMSE)	7–10 minutes	A 30-point assessment of orientation, recall, attention, calculation, language, repetition, registration and complex commands	■ Most thoroughly studied cognitive test ■ Validated and reliable for the diagnosis and ongoing assessment of dementia ■ A general cut-point of 24 is deemed appropriate for most primary care populations ■ Affected by demographic factors
Abbreviated Mental Test Score (AMTS)	5–7 minutes	A 10-item assessment of orientation, memory, naming objects and attention tests	■ Culturally specific questions may vary based on region ■ A score of 7–8 or less suggests cognitive impairment at time of testing
4 A's Test (4AT)	1–2 minutes	A four-item assessment of alertness, orientation, attention change over time	■ Brief tool validated for detection of delirium, including postoperatively ■ All patients can be assessed, including those unable to communicate

From Lin et al (2013); Saller et al (2019)

Risk stratification

Of the 170 000 patients that undergo higher-risk non-cardiac surgery each year in the UK, 100 000 will develop complications and result in 25 000 deaths. Over 80% of these postoperative deaths occur in 15% of patients with advanced age and comorbid disease having undergone major and urgent surgery (Jhanji et al, 2008). Specifically, patients with dementia undergoing surgery have poorer outcomes than surgical patients without dementia (Kassahun, 2018). They are more commonly re-hospitalised, have longer inpatient stays and have an increased likelihood of requiring more supportive home care. With the aim to minimise cognitive change after surgery, preoperative assessment can help to identify patients at risk from cognitive decline after surgery and anaesthesia.

Shared decision making

The changing nature of surgical patients requires systems to be in place to protect the higher risk surgical patient. This requires integrated medical care aiming to optimise the care of the high-risk surgical patient by providing a clearer pathway of care from the moment the patient is considered for surgery until he/she has fully recovered. The multidisciplinary team should include relatives and carers, GPs, specialist nurses, pharmacists, old age psychiatrists, geriatricians, surgeons, and anaesthetists. Thorough preoperative assessment and preoperative planning can help patients and the health-care team to make decisions about best treatment, facilitate discussions around patient wishes, allow time for advanced decisions, and put plans in place in case of cognitive decline.

In shared decision making clinicians and patients work together to determine treatment or management goals. As no medical treatment is without risk, shared decision making should be used in every clinical situation that is not immediately life threatening, where there are options leading to different possible outcomes. A brief summary of the components addressed in the shared decision-making process is outlined in Table 4 (Coulter and Collins, 2011).

The process of consent in patients with cognitive changes

In all patients it is essential to assess capacity and ability to make decisions about their care and treatment. A diagnosis of dementia does infer a lack of capacity. Capacity can fluctuate and patients can demonstrate capacity to make some decisions but not others. Patients should be given all the support they require to understand information and use the information to make a decision. There are four components, outlined in Table 5, which must be evaluated by a physician in order for a patient to demonstrate capacity. It is important

Table 4. Essential components of shared decision-making conversations between clinicians and patients working together to determine treatment goals

Clinicians can:	■ Provide reliable and unbiased evidence-based information on the health condition including the prognosis with or without treatment ■ Discuss all treatment options or self-management possibilities ■ Outline benefits and hazards for all the options ■ Relay any uncertainty in the evidence or outcomes
Patients can:	■ Have the opportunity to clarify options and preferences ■ Discuss the impact of the health condition on their daily life ■ Share attitudes towards risk and personal values ■ Make fully informed decisions about their care

Table 5. Fundamental elements a patient must demonstrate in order to determine decision-making capacity

1. Understand information relevant to the decision
2. Retain the information given
3. Use the information to come to an informed decision
4. Communicate this decision to health-care staff, family or carers

to fully document who assessed the patient's capacity, how the decision was reached, and communicate this to family, carers and other health-care professionals involved in care of the patient.

If a patient is deemed not to have capacity, decisions should be made using guidance and legislation in the form of the Mental Capacity Act 2005 in England and Wales. Scotland has separate legislation (the Adults with Incapacity Act 2000) surrounding adults without capacity. This allows a doctor who has overall responsibility of the patient to assess the patient and if he/she is deemed not to have capacity at that time for that medical decision an adult with incapacity certificate can be completed.

Discussions should be sought with the patient, family, carers and the patient's GP in order to understand the patient's wishes and what treatment options are in his/her best interests. The neurocognitive risks of surgery and anaesthesia should be identified and form an integral part of the consent process.

If a patient requires a medical procedure which may have serious consequences, and no family members are available, an independent mental capacity advocate should be sought. They are not able to make decisions on behalf of the patient but are able to act as an advocate to help health-care professionals reach a decision in the best interests of the patient.

Patients are able to appoint a health and welfare lasting power of attorney who is able to make decisions (excluding refusal of life-sustaining treatment) should the patient be deemed not to have capacity. A lasting power of attorney can only be appointed by a person who has capacity and therefore should be considered at the earliest possible time. The lasting power of attorney will only come into power once the patient is deemed to no longer have capacity. Patients can also draft an advance decision, a legally binding document outlining what treatments a patient would refuse, including refusal of life-sustaining treatment and decisions around cardiopulmonary resuscitation.

If a patient with dementia lacks capacity and requires treatment that forces the patient to remain in a certain place, the deprivation of liberty safeguards must be enacted. This offers protection, ensuring that restriction of freedom is absolutely necessary or in the person's best interest, and is done in the least restrictive way. To deprive someone of their liberty, medical staff (often referred to as the 'managing authority') contact the local authority to request an assessment. A standard authorisation can be gained within 21 days. If a decision is required more urgently than this then an urgent authorisation can be applied for that can last up to 7 days while a standard authorisation is being processed.

Conduct of anaesthesia

Both general and regional anaesthesia can be used depending on the procedure, urgency, severity of dementia, and other comorbidities or acute pathophysiology. Elderly patients demonstrate altered pharmacokinetics and pharmacodynamics, as well as polypharmacy, and will often require reduced doses, increased time for onset and offset and consideration of adverse drug reactions. Current evidence suggests that there is no difference in postoperative delirium or mortality when comparing general and regional anaesthesia (Patel et al, 2018).

General anaesthesia

There is conflicting evidence as to whether anaesthetic agents cause prolonged or additive cognitive change or contribute to postoperative cognitive decline or delirium. Evidence has shown that volatile anaesthetic agents can provoke the pathological changes within neuronal cells associated with dementia, but no causal relationship exists. Conversely, intravenous anaesthetic agents and opioids do not appear to alter the pathogenesis of dementia (Eckenhoff et al, 2004). The number of high-quality studies is currently insufficient to discount any relationship between exposure to general anaesthesia and development of dementia. Although cohort studies suggest an increased incidence of dementia after anaesthesia and surgery (Chen et al, 2014), there is similarly inconclusive evidence of a causative link between general anaesthetic and cognitive decline (Yang and Fuh, 2015). It is difficult to isolate the direct neurotoxic effects of general anaesthesia and surgery from other complex factors that independently influence cognitive decline.

During general anaesthesia, processed electroencephalography or bispectral index can be used alongside age-adjusted minimum alveolar concentration to deliver the lowest required level of inhalational or intravenous anaesthesia while reducing the risk of awareness. Caution is required using bispectral index in patients with dementia, as it has not been validated in this patient group because they have altered electroencephalography characteristics at baseline (Renna et al, 2003).

Regional anaesthesia

Regional anaesthesia can provide anaesthesia without the need for additional analgesia or sedation intraoperatively, but there is little evidence as to its effects on dementia. Regional anaesthesia can be challenging in patients with dementia who may be unable to cooperate with the procedure. Despite this, unless contraindicated, regional anaesthesia is recommended by the Association of Anaesthetists to reduce opioid requirements (White et al, 2019).

Polypharmacy

Polypharmacy is prevalent in older populations with dementia, which increases the likelihood of adverse or unwanted interactions with drugs used in anaesthetic practice. Of particular concern in anaesthesia are cholinesterase inhibitors, N-methyl-D-aspartate (NMDA) receptor antagonists and selective serotonin-reuptake inhibitors outlined in Table 6.

During preoperative assessment the risk of discontinuing these medications should be balanced against the risk of adverse drug reactions. Stopping these medications even in the short term can precipitate irreversible cognitive decline and increase the risk of delirium. This decision should be made on an individual patient basis with the patient, the relatives and/or carers, and the patient's dementia specialist team. Any dementia medication which is discontinued should be re-introduced in the postoperative period with advice from experienced dementia specialists.

Elective day case admission and discharge

For elective procedures, day case admission and discharge can be considered. This may help a patient returning to his/her own environment, reduce anxiety and mitigate worsening confusion or delirium. Offering day case admission and safe discharge home for patients with dementia requires a high level of expertise, significant pre-planning, risk assessment, consideration of appropriate anaesthetic choice, and postoperative analgesic options.

Techniques to reduce general anxiety levels and distress should be used for all patients. Patients should be prioritised on theatre lists to reduce fasting times or allowed to drink clear fluids until 2 hours before the procedure. Full explanations should be given to all patients and the use of visual aids, glasses or hearing aids may be required to assist communication. If appropriate, carers or relatives may accompany patients into the anaesthetic room to assist in communication and provide reassurance for the patient. Patients should also be encouraged to bring any comforters.

Table 6. Potential drug interactions between dementia medications and drugs commonly used in anaesthesia

Medication	Potential interaction
Cholinesterase inhibitors (e.g. galantamine, rivastigmine, donepezil)	Prolong depolarising neuromuscular blocker Decrease or reverse non-depolarising neuromuscular blocker
N-methyl-D-aspartate (NMDA) receptor antagonists (e.g. memantine)	Increase side effects of anticholinergics, dopaminergics and ketamine
Selective serotonin-reuptake inhibitors (e.g. sertraline, citalopram)	Increase risk of serotonin syndrome
Cognitive stimulants (e.g. modafinil)	Antagonise hypnotic anaesthetic agents

From Seitz et al (2011); Fox et al (2014); Richardson et al (2018)

Postoperative considerations

Postoperative complications

The postoperative pathway for these patients is complex and requires delivery of care from multiple specialties, including medical expertise to manage common postoperative medical complications, involvement of experts in rehabilitation and practical goal setting, proficiency in discharge planning and accessing appropriate community services, and ability to communicate with patients and carers regarding medical and functional issues.

The majority of complications are not a direct result of surgery – most are medical complications such as delirium, lower respiratory tract infections, urinary tract infections, acute myocardial ischaemia, thromboembolic events or acute renal failure. Patients with dementia are at significantly increased risk of postoperative complications, so these patients should have increased screening and clinical suspicion (Seitz et al, 2014). This includes the use of nationally recognised early warning scores, daily review by a consultant lead multidisciplinary team, regular communication with family members and carers to screen for subtle personality or cognitive changes, and monitoring of haemoglobin level and renal function if indicated. A rapid clinical test for delirium, the 4AT (Table 3), has been validated in the acute care setting and found to be effective and robust at detecting postoperative delirium (Saller et al, 2019). All hospitals should have access to national or regional guidelines and protocols for the management of postoperative complications with indications for referral to other specialties and recommended treatment. This is especially important for infective complications where local resistance patterns will alter antibiotic choices.

One major barrier to identifying postoperative complications is the potential difficulty in communication with a patient with advanced dementia. Patients may not be able to communicate new symptoms or may have difficulty in articulating what they are experiencing. Relatives or carers should be encouraged to be with the patient throughout their stay to help with communication and identification of any subtle changes. Wards could allow use of a 24-hour pass to enable them to visit outside normal visiting hours.

Postoperative pain management

Pain assessment is challenging in patients with dementia and is often poorly evaluated. The British Pain Society/British Geriatrics Society have published guidance on how to approach assessment of pain in patients who are unable to communicate – including observation for facial clues, physiological and behavioural changes (Schofield, 2018). All relevant staff should receive training in the assessment and treatment of pain in people with cognitive impairment.

Inadequate analgesia in elderly patients increases the risk of postoperative morbidity including delirium, cardiorespiratory complications and delayed discharge. Multimodal analgesia should be considered including non-pharmacological and pharmacological options.

Non-pharmacological options include ensuring patient comfort, pressure care, and adequate food and fluid intake. Pharmacological options include paracetamol, non-steroidal anti-inflammatory drugs and opioids. Paracetamol should be used as first-line analgesia as it has few contraindications and side effects. Caution should be exercised in dosing to reduce the risk of paracetamol-induced liver damage. Patient weight and risk of malnutrition, which may deplete glutathione stores, should be considered. Non-steroidal anti-inflammatory drugs can be considered on a short-term basis. Proton pump inhibitor cover should be used and the patient should be monitored for deterioration of renal function. Opioids are effective for moderate to severe pain, but patients with dementia are at much higher risk of side effects including confusion, respiratory depression and constipation. Reduced doses are usually required, and patients should be closely monitored for signs of opioid toxicity.

Conclusions

Patients with dementia requiring elective or emergency surgery pose significant individual and organisational challenges. Over the coming years, with the ageing population and rising prevalence of dementia, these patients will present more frequently. The care of the high-risk surgical patient can be optimised by providing a clear pathway of care from the

Key points

- In the perioperative period patients with dementia should be managed by a multidisciplinary team involving relatives and carers, GPs, specialist nurses, pharmacists, old age psychiatrists, geriatricians, surgeons and anaesthetists. A lead clinician should oversee this and be the key link between all involved personnel.
- Preoperative assessment provides an invaluable opportunity to identify patients with cognitive impairment and those at risk of cognitive decline after surgery and anaesthesia to discuss and tailor management and care to individual patients' needs using shared decision making.
- A diagnosis of dementia does not infer lack of capacity. Patients should be given all the support they require to understand information and use this to make a decision. If a patient is deemed not to have capacity, decisions should be made using local legislation.
- Anaesthesia should be administered with the aim of minimising perioperative cognitive changes. Current evidence suggests that there is no difference in postoperative delirium or mortality when comparing general and regional anaesthetic techniques.
- The postoperative pathway for these patients may be complex, requiring delivery of care from multiple specialties, but may also include elective day case admission and discharge.

moment a patient is considered for surgery until full recovery. Developing and implementing strategies through the pre-, intra- and postoperative phases requires a perioperative medical approach, involving the multidisciplinary team and shared decision making between patients, relatives and clinicians.

The Association of Anaesthetists has recently published a national guideline on the perioperative management of dementia (White et al, 2019). It is clear there is still a lack of good quality evidence in this area and research and implementation of perioperative care pathways in patients with dementia should be actively encouraged.

Author contribution

Jennifer L Proc and Helen Jordan contributed equally to this project.

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Conflicts of interest

The authors declare no conflicts of interest.

References

Alzheimer's Society. Dementia UK: Update. 2014. London: Alzheimer's Society

American Psychiatric Association. Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5). 2013. Arlington, USA: American Psychiatric Association

Chen PL, Yang CW, Tseng YK et al. Risk of dementia after anaesthesia and surgery. Br J Psychiatr. 2014;204(3):188–193. https://doi.org/10.1192/bjp.bp.112.119610

Coulter A, Collins A. Making shared decision-making a reality: no decision about me, without me. 2011. London: The Kings Fund

Eckenhoff RG, Johansson JS, Wei H et al. Inhaled anaesthetic enhancement of amyloid-beta oligomerization and cytotoxicity. Anaesthesiology. 2004;101(3):703–709. https://doi.org/10.1097/00000542-200409000-00019

Fox C, Smith T, Maidment I et al. Effect of medications with anti-cholinergic properties on cognitive function, delirium, physical function and mortality: a systematic review. Age Ageing. 2014;43(5):604–615. https://doi.org/10.1093/ageing/afu096

Griffiths R, Alper J, Beckingsale A et al. Management of proximal femoral fractures. Anaesthesia. 2012;67:85–98. https://doi.org/10.1111/j.1365-2044.2011.06957.x

Griffiths R, Beech F, Brown A et al. Peri-operative care of the elderly 2014: Association of Anaesthetists of Great Britain and Ireland. Anaesthesia. 2014;69(Suppl. 1):81–98. https://doi.org.10.1111/anae.12524

Jhanji S, Thomas B, Ely A et al. Mortality and utilization of cirtical care resources amongst high-risk surgical patients in a large NHS trust. Anaesthesia. 2008;63(7):695–700. https://doi.org/10.1111/j.1365-2044.2008.05560.x

Kassahun WT. The effects of pre-existing dementia on surgical outcomes in emergent and nonemergent general surgical procedures: assessing differences in surgical risk with dementia. BMC Geriatr. 2018;18:153. https://doi.org/10.1186/s12877-018-0844-x

Lin JS, O'Connor E, Rossom RC et al. Screening for cognitive impairment in older adults: an evidence update for the U.S preventive services task force. 2013. Evidence Syntheses, No. 107. Rockville (MD): Agency for Healthcare Research and Quality (US)

Livingston G, Sommerlad A, Orgeta V et al. Dementia prevention, intervention, and care. Lancet. 2017;390(10113):2673–2734. https://doi.org/10.1016/S0140-6736(17)31363-6

Patel V, Champaneria R, Dretzke J, Yeung Y. Effect of regional versus general anaesthesia on postoperative delirium in elderly patients undergoing surgery for hip fracture: a systematic review. BMJ Open 4. 2018;8(12):e020757. https://doi.org/10.1136/bmjopen-2017-020757

Renna M, Handy J, Shah A. Low baseline bispectral index of the electroencephalogram in patients with dementia. Anaesth Analg. 2003;96(5):1380–1385. https://doi.org/10.1213/01.ane.0000059223.78879.0f

Richardson K, Fox C, Maidment I et al. Anticholinergic drugs and risk of dementia: a case-control study. BMJ. 2018;361:k1315. https://doi.org/10.1136/bmj.k1315

Royal College of Anaesthetists. Peri-Operative Medicine: The Pathway to Better Surgical Care. 2015. London: Royal College of Anaesthetists

Saller T, MacLullich AMJ, Schafer ST et al. Screening for delerium after surgery: validation of the 4 A's test (4AT) in the post-anaesthesia care unit. Anaesthesia. 2019;74(10):1260–1266. https://doi.org/10.1111/anae.14682

Sampson EL, Blanchard MR, Jones L, Tookman A, King M. Dementia in the acute hospital: prospective cohort study of prevalence and mortality. Br J Psychiatr. 2009;195(1):61–66. https://doi.org/10.1192/bjp.bp.108.055335

Schofield P. The assessment of pain in older people: UK national guidelines. Age Ageing. 2018;47(Suppl. 1):i1–i22. https://doi.org/10.1093/ageing/afx192

Seitz DP, Gill SS, Gruneir A et al. Effects of cholinesterase inhibitors on postoperative outcomes of older adults with dementia undergoing hip fracture surgery. Am J Geriatr Psychiatr. 2011;19(9):803–813. https://doi.org/10.1097/JGP.0b013e3181ff67a1

Seitz DP, Gill SS, Bell CM et al. Postoperative medical complications associated with anaesthesia in older adults with dementia. J Am Geriatr Soc. 2014;62(11):2102–2109. https://doi.org/10.1111/jgs.13106

White S, Griffiths R, Baxter A et al. Guidelines for the peri-operative care of people with dementia: Guidelines from the Association of Anaesthetists. Anaesthesia. 2019;74(3):357. https://doi.org/10.1111/anae.14530

World Health Organization. Global Action Plan on the Public Health Response to Dementia 2017–2025. 2017. Geneva: World Health Organization

World Health Organization. International classification of diseases for mortality and morbidity statistics, 11th revision (ICD-11). 2018. https://icd.who.int/browse11/l-m/en (accessed 10 December 2019)

Yang CW, Fuh JL. Exposure to general anaesthesia and the risk of dementia. J Pain Res. 2015;8:711–718. https://doi.org/10.2147/JPR.S55579