Postoperative Cognitive Challenges in the Elderly Patient

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Overview

- What’s the problem?
- How can we manage it?
- How can we communicate it?
Case study – Mrs NP

- **Plan**
  - WLE Perineum / Inguinal nodes (est 4 h duration)

- **Preoperative**
  - 79 years old
  - Obese
  - Vague historian, checking with daughter (carer)
  - Hearing aids
  - Limited socialisation
  - Daughter noted memory deterioration last 6 months
  - Prior procedures (umbil hernia / cataract)
    - confused and forgetful (up to 1 wk)
    - ‘lost her words’
Preoperative cognition and Postoperative Delirium

Over 65 years of age

Mild cognitive impairment in 10 – 20%
Dementia in 13%


- Delirium in Elderly patients 30 – 60%
  - Orthopaedic # NOF 35 – 65%
  - Cardiac & Vascular Surgery 37 – 52%

We all know delirium when we see it...don’t we?

- Hyperactive
  - Hypoactive
  - Mixed
- Sub-syndromal

<table>
<thead>
<tr>
<th></th>
<th>Hypoactive</th>
<th>Mixed</th>
<th>Hyperactive</th>
<th>Overall</th>
<th>Sub-syndromal</th>
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<tr>
<td>Cardiac +</td>
<td>77%</td>
<td>11%</td>
<td>12%</td>
<td>23.5%</td>
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<tr>
<td>General *</td>
<td>88%</td>
<td></td>
<td>12%</td>
<td>21%</td>
<td></td>
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<tr>
<td>Cardiac SVH</td>
<td></td>
<td></td>
<td></td>
<td>50%</td>
<td>35%</td>
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<tr>
<td>Non-cardiac</td>
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<td></td>
<td></td>
<td>33%</td>
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</table>

Delirium - DSM 5 Criteria

**Feature 1:** Acute change or fluctuating course of mental status

And

**Feature 2:** Inattention

And

**Feature 3:** Altered level of consciousness

Or

**Feature 4:** Disorganized Thinking
Delirium diagnosis

- CAM-ICU
- CAM
- 4AT
- 3D-CAM

Marcantonio E, Inouye S.
Delirium – The extent of the problem

- Affects > 50% of hospitalised elderly patients
- It is NOT a transient inconvenience
- Outcomes
  - Acute
  - Long term
- Costs
  - average of US$66,000 per patient
  - est. US$164 Billion (2011)

Inouye, Marcantonio 2016 – Alzheimer’s & Dementia epub
Impact: Delirium

- **Death**: 25% chance of death within one month.
- **Disability**: 2x increased risk of new admission to nursing home at 6 months.
- **Length of Stay (LOS)**: Length of hospital stay doubled.
- **Dementia**: Increased risk of dementia.
- **Complications**: Increased risk of complications (e.g., falls, pneumonia).

*O’Regan - International Journal of Surgery 11 (2013) 136-144*
Delirium - Risk

- **Identification of Risk**
  - Elderly
  - Pre-existing Cognitive Impairment or CVA

- Major surgery esp cavity/cardiac
- Emergency surgery esp NOF
- Increased by modifiable factors eg pain, fluids, medications, IDC, environment, deep anaesthesia...
Post-operative Cognitive Changes

- Delirium
  - Emergence Delirium (Agitation)
  - Post-operative Delirium
- Post-operative Cognitive Dysfunction (POCD)
  - Early POCD
  - Late POCD
- Long-term Cognitive Impairment (LTCI)
  - Mild Cognitive Impairment (MCI)
  - Dementia
    - Mild
    - Established
What is Post-operative Cognitive Dysfunction?

- Not (necessarily) associated with subjective changes
- Not a disease or syndrome (DSM V / ICD10)… yet

- **Change** (decline) in cognitive function
  - Following anaesthesia and surgery
  - Measured at specified time intervals
- **Measured** by *at least* 4 relevant neuropsychological tests
  - Repetition or parallel forms
- **Compared** to an appropriate control group
  - Reliable Change Index
- **Individual** change not group effect
Time-course of Cognitive change - Early to Late POCD

%
Impact of POCD

- Un-noticed ➔ subjective complaints
- Length of Hospital Stay Prolonged
  - No POCD 7.1 ± 3.4 days
  - POCD 8.3 ± 4.1 days (p=0.02)
    - Silbert B et al *Anesthesiology* 104(6): 1137-1145
- Quality of Life Reduced
- Decreased engagement with workforce
- Mortality Increased
  - 7.5 years - Evered, L et al (2016) *Anesthesiology* 125: *epub May*
POCD - Risk

- Identification of POCD Risk **at 3 months**
  - Elderly
  - Pre-existing Cognitive Impairment
  - Cognitive reserve

- Not: Major surgery versus minor surgery
- Not: Hypotension / desaturation
- Not: Regional versus general
- Unknown: Emergency surgery esp NOF
- Unknown: ? type of anaesthesia
The Ageing Brain ... The Ageing World Population

Population Reference Bureau
Proportion of population over 65 and anaesthetics administered

Australian Institute of Health and Welfare

1,023,052

48%
The ageing brain - vulnerable

- Progressive increase in cerebrovascular disease
  - Flow limitations
  - Embolic risk

- Over 65 years of age:
  - Mild cognitive impairment in 10 – 20%
  - Dementia in 13%
  - Progression rate over 3 years is between 23 - 47%


Alzheimer’s Disease Progression

- Abnormal
- Normal

Biomarker magnitude

Clinical disease stage

Cognitively normal

MCI

Dementia

Abnormal

Aβ

Tau-mediated neuronal injury and dysfunction

Brain structure

Memory

Clinical function

Amyloid-β

Tau

Memory Function
Perioperative Cognitive Care
Minimising Harm / Maximising Benefit

- Identify risk
- Modify practise
- Identify the problem
- Communicate

Acute
Delirium
POCD

Long-Term
? POCD
Dementia
The value of screening

- Advise on expectations – Informed Consent
- Reconsider elective procedures
- Critically evaluate non-elective procedures
  - Modify surgery
  - Modify anaesthesia
- Follow-up
  - Clinical Referral
  - Diagnostic opportunities
- Protective strategies
- Optimise perioperative care
Neuropsychological Assessment

- **Cognition**
  - Rey AVLT
  - Trails A&B
  - Pegboard
  - CERAD
  - COWAT
  - DSST

- **Dementia**
  - CDR / CDR-SOB
  - ADAS
  - Diagnostic Interview
  - Informant / partner
Baseline Testing Methods

- ‘Routine’ clinical interview
  - Diagnosis of Pre-dementia, MCI, Dementia
  - Risk for cognitive impairment
    - Vascular disease
    - Family history
    - Genetic (ApoE)
    - Prior head injury
    - Age

- Enhanced interview
  - ‘Any memory problems’
  - Level of education
  - Partner / informant information
Cognitive trajectory

Normal

Mild Cognitive Impairment

Dementia

Time…
Mixed methods

- GP Cog
- MMSE
- MoCA
- Clocks

Mazancova AF et al. The reliability of clock drawing test scoring … Assessment. 2016 Mar 1. [Epub ahead of print]
Mild Cognitive Impairment

1. The person is neither normal nor demented
2. Self and/or informant cognitive complaint or concern
3. Impairment on objective cognitive tasks
4. Preserved basic activities of daily living

Does Prior Anaesthesia and Surgery Increase the risk of Dementia and Alzheimer’s Disease?

- Since 1846, anaesthesia and surgery have been inextricably linked....
- The elderly brain may be more vulnerable
  - stress
  - inflammation
  - decreased cognitive reserve
  - Pre-existing cerebrovascular or degenerative disease
Any cause which will give rise to delirium may set up a more chronic form of mental disorder quite apart from any febrile disturbance. (a) The most common form of mental disorder which comes on in such cases is of the type of acute delirious mania; (b) though such mental disorder is generally of a temporary character, it may pass into chronic weak-mindedness, or it may pass into (c) progressive dementia which cannot be distinguished from general paralysis of the insane.

To return to the first group, the condition may arise from a drug. I am inclined to think that those who come of insane stock are very often unusually liable to infection, and that having contracted an acute disease, they are more likely to have early and severe delirium.

Besides alcohol and fever, I give one case in which delirium of belladonna proved sufficient in starting the insane process. A young girl belonging to a very neurotic stock took by accident a dose of belladonna liniment instead of a dose of cough mixture. For two days the medical man treated her delirious condition as due simply to the drug; but at the end of that time she remained still wild and delirious, and...
Does Long Term ‘POCD’ Exist?

EDITORIAL VIEWS

Anesthesiology 2016; 124: 255

The Fallacy of Persistent Postoperative Cognitive Decline

Michael S. Avidan, M.B., B.Ch., F.C.A.S.A., Alex S. Evers, M.D.

![Graph showing cognitive decline over time](image)
Dementia 7.5y post Cardiac Surgery

<table>
<thead>
<tr>
<th>Dementia 7.5y</th>
<th>OR</th>
<th>95%CI</th>
<th>p-value</th>
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<tbody>
<tr>
<td>PreCI</td>
<td>2.99</td>
<td>[1.09 – 8.20]</td>
<td>0.03</td>
</tr>
<tr>
<td>Lower IADL score</td>
<td>0.88</td>
<td>[0.81 – 0.96]</td>
<td>&lt;0.01</td>
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<tr>
<td>Lower IQ</td>
<td>0.98</td>
<td>[0.93 – 1.03]</td>
<td>0.46</td>
</tr>
<tr>
<td>Increasing Age</td>
<td>1.01</td>
<td>[0.94 – 1.08]</td>
<td>0.86</td>
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</tbody>
</table>

Cognitive Functioning after Surgery in Middle-aged and Elderly Danish Twins


- 8527 Danish Twins
  - 4309 < 70yo
  - 4218 ≥ 70yo
- 65% had prior surgery
- Composite cognitive function battery
  - standardised comparison

“Negligible comparative decline in cognitive functioning. Improved scores in Hip and Knee Patients”
Ketamine - Neuroprotective for Cardiac surgical patients
- 0.5 mg/kg at induction (n=29)
- Saline control (n=29)

Outcomes:
- CRP – no difference
- Delirium (ICDSC)
  - Ketamine 3% / Saline 31%
  - OR 12.6 (1.05 – 112)

Delirium and depth

Study design

<table>
<thead>
<tr>
<th>Study design</th>
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<tbody>
<tr>
<td>BIS &gt; 80 vs BIS ~ 50</td>
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<tr>
<td>BIS 40-60 vs Routine</td>
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<tr>
<td>BIS 40-60 vs Routine</td>
</tr>
<tr>
<td>BIS 40-60 vs ETAC</td>
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</tbody>
</table>

**Figure 2.** Meta-analysis of randomized controlled trials assessing postoperative delirium with intraoperative Bispectral Index (BIS) guidance of anesthesia compared with an alternative approach (i.e., usual care or an alternative protocol). Odds ratios <1 favor BIS guidance.

Whitlock et al Anesth Analg 2014
Sedatives

The association between nurse-administered midazolam following cardiac surgery and incident delirium: An observational study

Priscilla G. Taipale, Pamela A. Ratner, Paul M. Galdas, Carol Jillings, Deborah Manning, Connie Fernandes, Jaime Gallaher

- N=122 – Cardiac surgery
- Midazolam dose: 0 mg (22%) – 83 mg (25% > 6 mg)
- Delirium Incidence: 37.7 – 44.3%
- Regression: Delirium increased 8% per 1 mg midazolam
Delirium: Prevention

- Identify at-risk
- Perioperative strategies
- Avoid:
  - Excessive anaesthesia depth
  - Benzodiazepines
  - (?) central cholinergics / AchE
- Maybe:
  - Ketamine
- Postoperative environment
- Assess post-operatively

via www.anzca.edu.au
Dementia, Anaesthesia and Surgery

- There is an **association** between prior anaesthesia and surgery and increased risk of dementia **in at risk individuals**
- This may be **progression or acceleration** of existing disease
- **Animal evidence** is suggestive
- **Strategies for Anaesthesia:**
  - Identify at risk and plan if possible
  - ? avoid sevoflurane/volatiles
  - avoid delirium triggers
- **Monitor post-operatively**
- **Long term cognitive support**
  - Improve **Quality of Life** likely decreases risk…
Anaesthesia and cognitive decline in adults

Deterioration in memory, thinking ability and concentration—collectively referred to as cognitive decline—has been reported to follow anaesthesia and surgery. This particularly affects the elderly.

This is different to the normal age-related period of general anaesthesia or sedation when you are allowed to sleep for a while, before waking up without significant decline of the level of consciousness and memory for 4-6 hours while the effects of the medications wear off.

Cognitive decline was not reported after heart surgery, but changes have been described in some patients after many types of surgery including minor procedures. However, not all changes in cognitive function are significant and some levels may even improve after certain procedures. It may take months to return to the pre-surgical baseline, and pharmacological treatment may offset the effects of anaesthetic drugs and general anaesthesia.

Cognitive decline may last for weeks or months after surgery and may affect daily living. This is a concern for older people and those with pre-existing cognitive impairment.

1. Do people recover from cognitive decline after anaesthesia and surgery?

Some cognitive decline after anaesthesia and surgery is inevitable and may be related to the surgery itself, the anaesthetic drugs used, and general anaesthesia. In other words, the individual can carry on with normal daily life, unaffected by anaesthesia.

However, in a small number of cases, the cognitive decline may be more severe and interfere with the ability to carry out daily activities. It is not clear what factors might increase the risk of cognitive decline.

2. Who is at risk of cognitive decline?

The risk is higher for older people. The older the individual, the more likely he or she is to suffer from post-operative cognitive decline. In a small fraction of cases, this can result in memory loss, confusion and personality changes. In some cases, this may persist for weeks or months after surgery.

3. If it occurs, how long does cognitive decline after anaesthesia and surgery last?

Cognitive decline usually occurs over one week. It may persist for at least three months after anaesthesia and surgery, but recovery usually will be expected within six months. In rare cases, it may continue and possibly last for several years.

4. What is the cause of cognitive decline?

The exact cause is unknown. There may be subtle cognitive decline before the surgery and anaesthesia, which is unnoticeable, and this may increase the likelihood of further decline. It may be caused by the anaesthetic, the surgery itself, or a combination of both. It is not clear whether cognitive decline is associated with cognitive decline during and after surgery, or whether cognitive decline is related to underlying brain problems.

5. What should I do if I experience cognitive decline after surgery?

Your doctor will help to assess your symptoms and provide appropriate care. In some cases, your doctor may recommend further medical evaluation or treatment. It is important to continue your regular health check-ups, and to consider seeking medical advice if you experience any cognitive decline.

6. Should I avoid anaesthesia and surgery?

In most cases, you should not avoid anaesthesia and surgery. Surgery is usually recommended to treat or help manage a condition or to improve your health. If you have any concerns about anaesthesia and surgery, you should discuss them with your healthcare provider.

But... POCD Confusion

- The literature is flooded with low quality studies
  - Heterogeneous patient groups
  - Little or no pre-operative cognitive assessment
  - Small numbers
  - Wide variety of tests
    - Some not suited for repeat administration
    - Insensitive or inappropriate e.g. MMSE
    - Limit comparability across studies
  - Wide variety of ‘decline’ criteria
    - > 1 to > 1.96 SD or 20% fall / 1,2 out of 3,4,5,6,7,8 tests
    - Cumulative scores; Group versus individual comparisons
    - Decline compared to baseline; No control groups
- Positive publication bias
Difficult to differentiate between the cognitive impairment and cognitive change associated with anaesthesia and surgery, with that occurring in the general population.
Communicating Cognitive Disorders

Community

- Delirium
- Preclinical Dementia
- Mild Cognitive Impairment (MCI)
- Dementia

Perioperative

- Confusion
- Delirium
- POCD
- Dementia
Recommended terminology for the cognitive impairment associated with anaesthesia and surgery which is consistent with other medical disciplines including neurology, psychiatry and gerontology
Core Working Group - 2013

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This work has been supported in part by ISTAART, International Alzheimer’s Association
International Working Party for Nomenclature of Perioperative Cognitive Disorders

- **Definitions** for cognitive impairment and cognitive decline associated with perioperative medicine
- Clinical and research criteria
- Appropriate and measurable endpoints
- Direct clinical interpretation and relevance
- Alignment with other cognitive disorders
Proposed overarching term

Perioperative Cognitive Disorders

- Introducing DSM-5 and NIA-AA terms
- Align language and diagnostic criteria
Cognitive Disorders - Consensus

2013 DSM-5: Neurocognitive Disorders (NCD)
Disorders where the primary clinical deficit is in cognitive function

- **Delirium**
  - Disturbance in attention
  - Fluctuating course
  - Disturbance in cognition
  - No alternative explanation

- **Mild NCD**  
  NIA-AA: MCI
  - Objective decline in cognition (1-2 SD below controls/norms)
  - Preserved ADLs
  - Cognitive concern
  - Not delirium nor otherwise explained

- **Major NCD**  
  NIA-AA: Dementia
  - Objective decline in cognition (≥ 2 SD below controls/norms)
  - Decline in ADLs
  - Cognitive concern
  - Not delirium nor otherwise explained
Important features of cognitive disorders

Timing
Magnitude of impairment
Cognitive concern
Objective decline
Group at risk
Associations
<table>
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<tr>
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<th>PreCI</th>
<th>POCD</th>
<th>Mild NCD</th>
<th>Major NCD</th>
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<tbody>
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<td><strong>Timing</strong></td>
<td>Before surgery</td>
<td>After surgery</td>
<td>Any time</td>
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<td><strong>Magnitude of impairment</strong></td>
<td>Subtle</td>
<td>Subtle</td>
<td>Subtle</td>
<td>Impact on daily life</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>No impact on daily life</td>
<td></td>
</tr>
<tr>
<td><strong>Cognitive concern</strong></td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td><strong>Objective decline</strong></td>
<td>2 SD (change)</td>
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<td>1 -2 SD (normative)</td>
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<td><strong>Group at risk</strong></td>
<td>Age&gt; 60 yrs</td>
<td>Age&gt; 60 yrs</td>
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<td>Age; Educational level</td>
<td>Age; Educational level</td>
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</table>
Important features of cognitive disorders

The main features which distinguish POCD from NCD are:
1. the timing of the testing, and
2. the cognitive concern

- cognitive concern from patient/informant/clinician; and
- add a specifier (such as “postoperative”)

Then we will be recording the temporal relationship to anesthesia and surgery
Delirium

- High incidence after surgery in elderly
- Diagnostic criteria
- **Specifier ‘postoperative’**
- May follow a lucid interval (ie after emergence)
Summary of Planned Nomenclature

**Preoperative:**
- Mild NCD
- Major NCD

**Immediate postop to ready to discharge:**
- Delirium - postoperative

**Discharge → point where the effects of A&S have resolved (30d – 3m):**
- Delayed neurocognitive recovery
Summary of Planned Nomenclature

Following expected (medical) recovery (or 3 months) – 12 months:

- Mild NCD (postoperative - POCD)
- Major NCD (postoperative - POCD)

Optional addition for research: (DSM-5/NIA-AA)

- MCI
- Dementia
When does this specifier phase out?

POCD variously reported at:
7 days, 3 months, 12 months, 5 years, 7.5 years

Attribute up to 12 months following surgery
(where new cognitive decline is not accounted for by any other medical condition)

Use beyond 12 months only if not new
Timeline

Pre existing Cognitive Impairment

-1wk t0 1wk 30d 3m 12m 2y 5y 7.5y

Postoperative Cognitive Dysfunction

Postop Delirium

Delayed neurocognitive recovery

Mild NCD ± MCI
Major NCD ± Dementia

Unless not new diagnosis

Mild NCD ± MCI (postoperative)
Major NCD ± Dementia (postoperative)
New Nomenclature

Perioperative Cognitive Disorders

- Recognise postoperative delirium
- Recognise broader context
- **Encourage communication** - diagnosis and referral
- Identify high risk patients
- Facilitate research and inter-disciplinary communication
- Encourage Perioperative preventive measures
- **Improved perioperative outcomes for the elderly**