# Preventing Postoperative Cognitive Decline in the Elderly





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# Subtle Perioperative Brain Injury

- Emergence Delirium
- Postoperative Delirium
- Postoperative Cognitive Decline

# Postoperative Delirium

**An acute brain disorder that has a fluctuating course and characterized by disturbance of attention, memory, orientation, and perception**

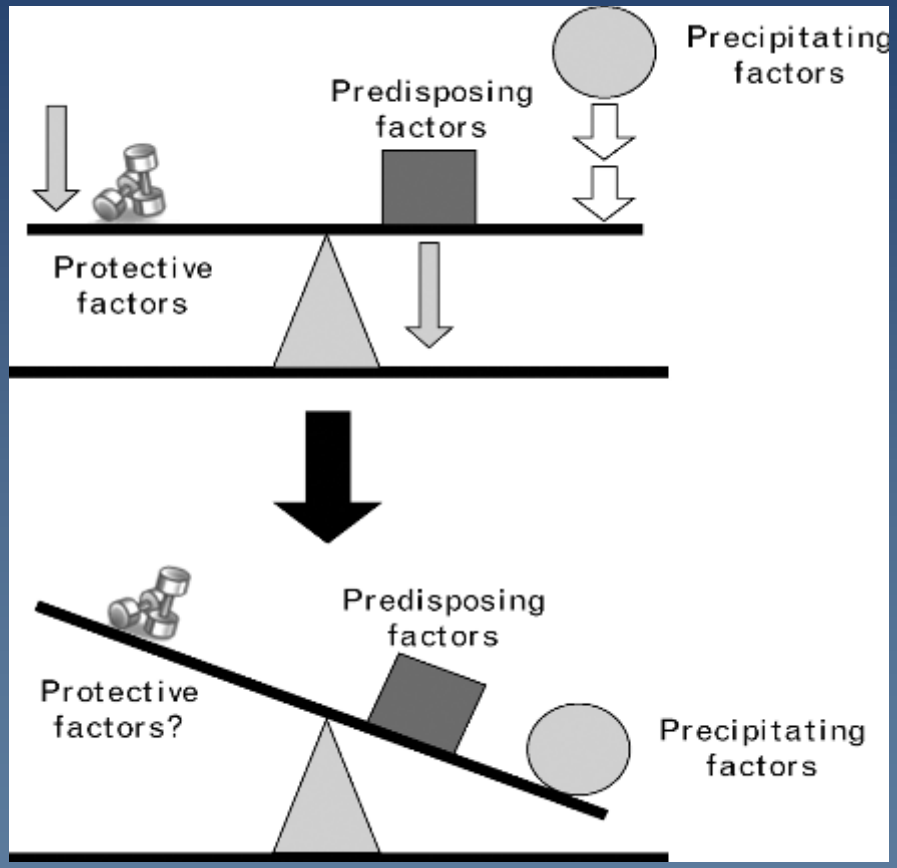
**Incidence (in elderly)**

**Noncardiac surgery: 10%-40%**

**Cardiac surgery: 20%-70%**



# Interplay of Factors Leading to Delirium




Steiner L, Eur J Anaesth, 2011

# Predisposing Factors

- Age
- Functional impairment
- Cognitive impairment
- Medical co-morbidity
- Drugs
- Genetic factors (sigma 4 allele of apolipoprotein E4)

# Precipitating Factors

- Admission to ICU
- Drugs
- Concomitant illness
- Primary neurologic disease
- Pain
- Use of physical restraints
- Prolonged sleep deprivation

# Can Delirium be Prevented in the Postoperative Period?

- Pharmacological prevention
- Non-pharmacologic multicomponent strategies
  - Good nursing care
  - Regular orientation
  - Early mobilization
  - Reduce modifiable risk factors

Inouye S, JAMA, 1998

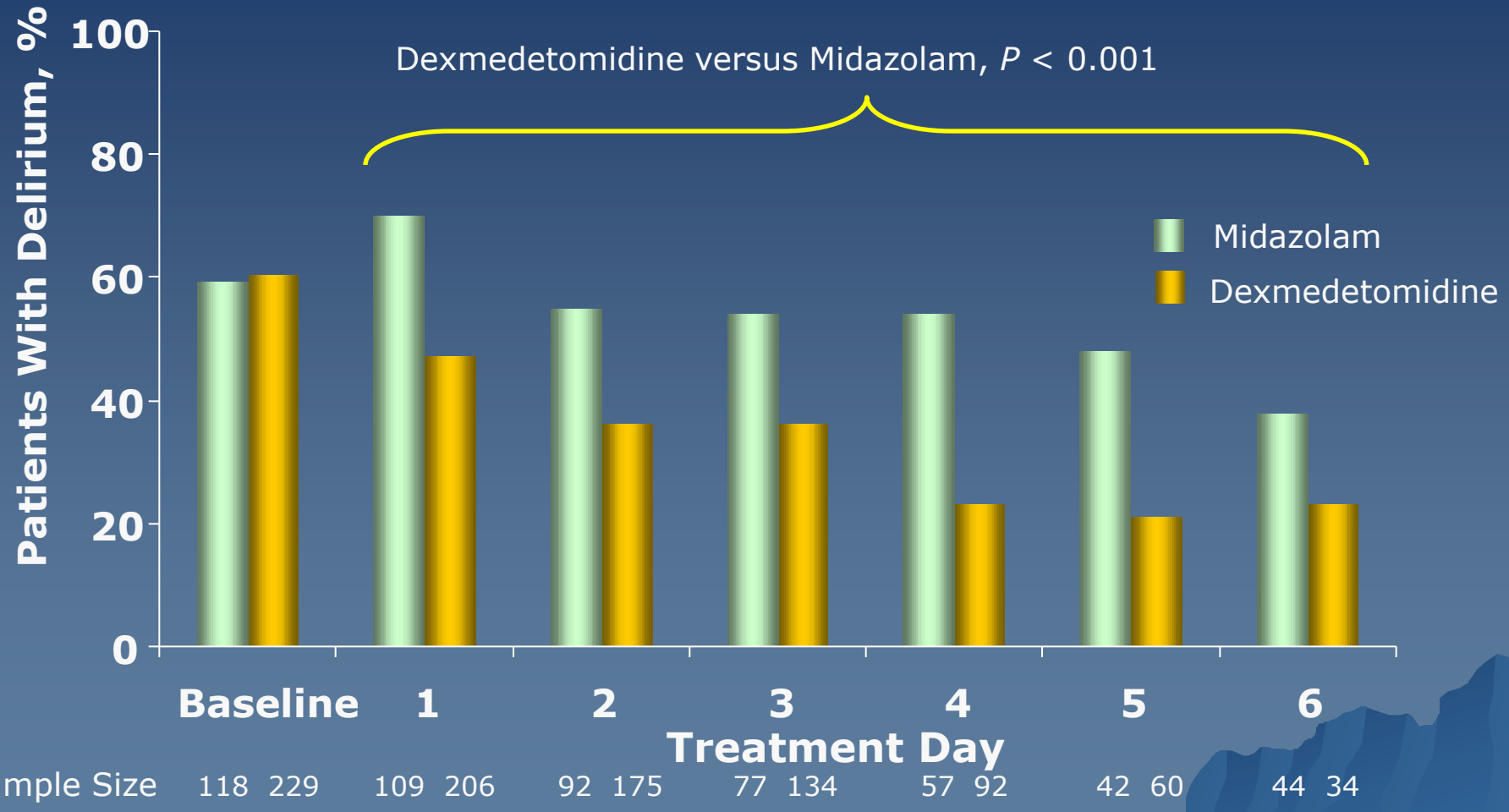
# Pharmacologic Strategies

- Dopamine → Haloperidol
- Serotonin → Risperidone/Quetiapine
- Acetylcholine → Rivastigmine/Donazepil
- Norepinephrine → Dexmedetomidine

- GABA → Benzodiazepines

# Reduced Delirium Prevalence with Dexmedetomidine vs Midazolam

## SEDCOM




Riker RR, et al. *JAMA.* 2009;301:489-499.

"The brain is not a sausage, it's more like a well tuned musical instrument"

Rudolfo Llinas

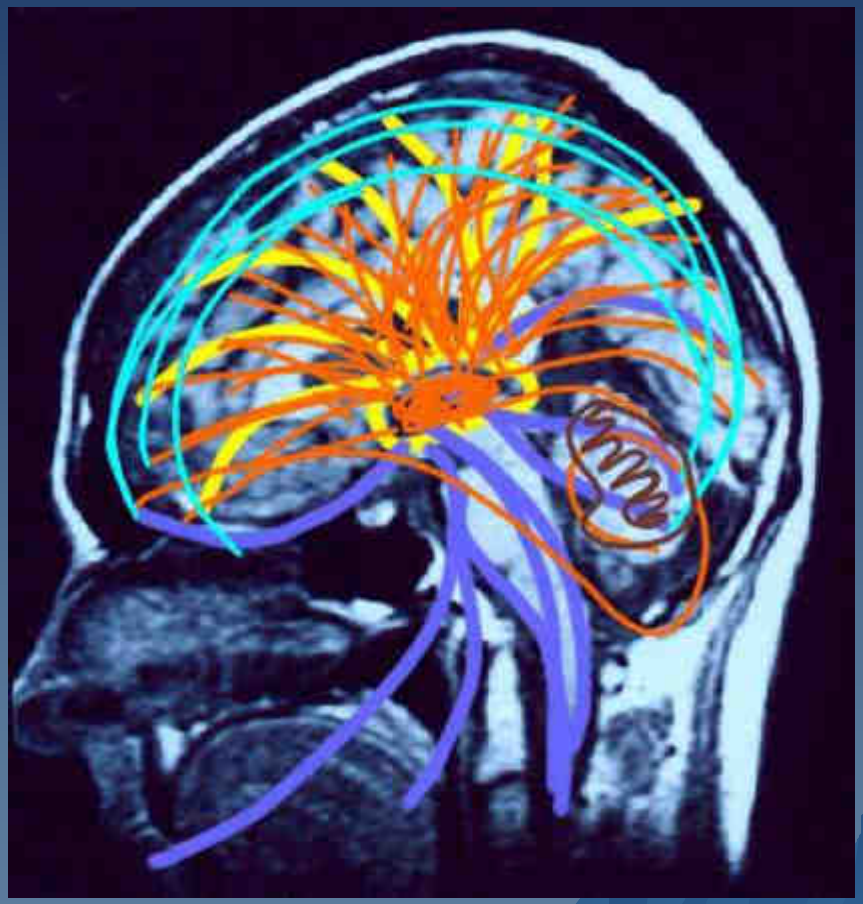
Endogenous sleep

↓

Loss of response to external stimuli

↑

Sedative component of anesthesia



# Monitoring Depth of Anesthesia and Postoperative Delirium

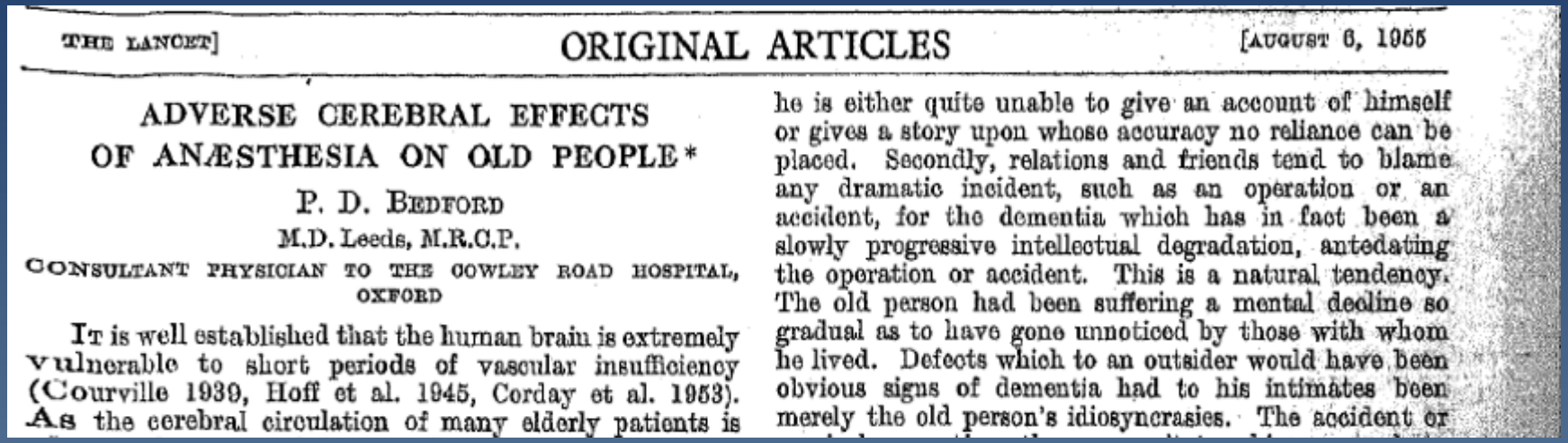
| Study | Routine Care | BIS-Guided | P-Value |
|---|---|---|---|
| Radtke F, Br J Anaesth, 2013 | 124/580 (21.4%) | 95/575 (16.7%) | 0.036 |
| Chan M, J Neurosurg Anesth, 2013 | 109/452 (24.1%) | 70/450 (15.6%) | 0.01 |

# Postoperative Delirium in Older Adults: Best Practice Statements from the AGS

- Perform a preoperative and postoperative assessment of delirium risk factors
- Physicians should be trained in the recognition of delirium
- Anesthesiologists may use monitors of anesthetic depth
- Avoid medications that may induce delirium
- Use regional anesthesia for postoperative pain control
- Put into practice multicomponent interventions
- Do not prescribe antipsychotics or benzodiazepines to patients who are not a threat for personal harm

Expert Panel on Postoperative Delirium, JACS, 2014

# Grandma Never Was The Same…



THE LANCET] ORIGINAL ARTICLES [AUGUST 6, 1955

## ADVERSE CEREBRAL EFFECTS OF ANÆSTHESIA ON OLD PEOPLE*

P. D. BEDFORD
M.D. Leeds, M.R.C.P.
CONSULTANT PHYSICIAN TO THE COWLEY ROAD HOSPITAL, OXFORD

IT is well established that the human brain is extremely vulnerable to short periods of vascular insufficiency (Courville 1939, Hoff et al. 1945, Corday et al. 1953). As the cerebral circulation of many elderly patients is

he is either quite unable to give an account of himself or gives a story upon whose accuracy no reliance can be placed. Secondly, relations and friends tend to blame any dramatic incident, such as an operation or an accident, for the dementia which has in fact been a slowly progressive intellectual degradation, antedating the operation or accident. This is a natural tendency. The old person had been suffering a mental decline so gradual as to have gone unnoticed by those with whom he lived. Defects which to an outsider would have been obvious signs of dementia had to his intimates been merely the old person's idiosyncrasies. The accident or

**"He's become so forgetful since…"**
**"He can't concentrate on anything since…"**
**"She's become childish and unreliable since…"**
**"He's not just the same person since…"**

**CONCLUSION: Operations on elderly people should be confined to unequivocally necessary cases**

# Postoperative Cognitive Dysfunction (POCD):

**An impairment of functioning in several cognitive domains: memory, executive functioning, attention, and comprehension**

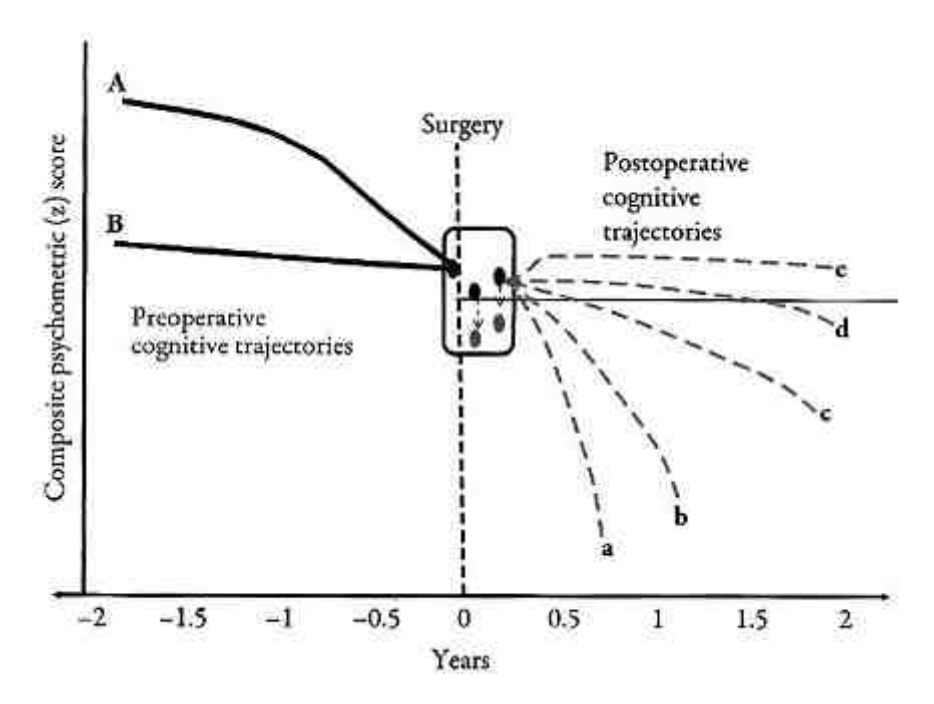


# Methodological Challenges

- Definition of POCD
- What tests should we use?
- Controls
- Learning effect
- Cognitive trajectory

**There are no laboratory test or imaging study which can be used to predict or diagnose POCD**

# Preoperative and Postoperative Cognitive Trajectories




Sanders R, Neurologic outcomes of Surgery & Anesthesia, 2013

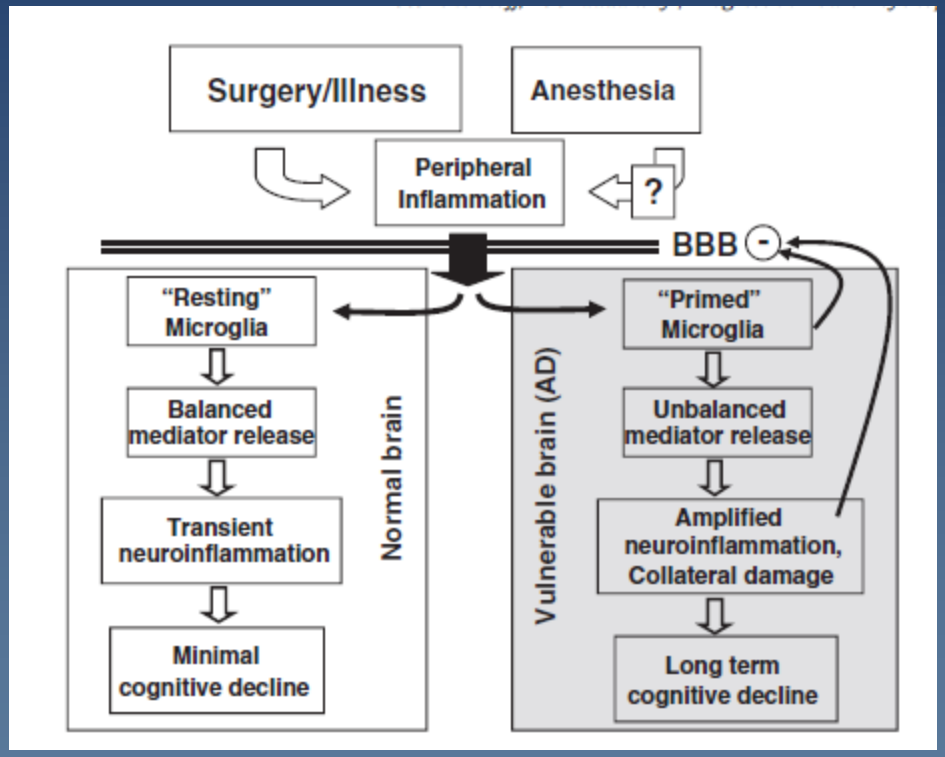
# Predisposing Factors : POCD

- **Age**
- **Preoperative cognition**
- **Type of surgery**
- **Vascular risk factors**
- **Apolipoprotein E genotype (?)**

# Possible causes of POCD Related to Surgery

- Altered cerebral perfusion
- Cerebral microemboli
- Anesthetics
- Inflammation
  - Surgery related
  - Patient related

# Conceptual Model of POCD



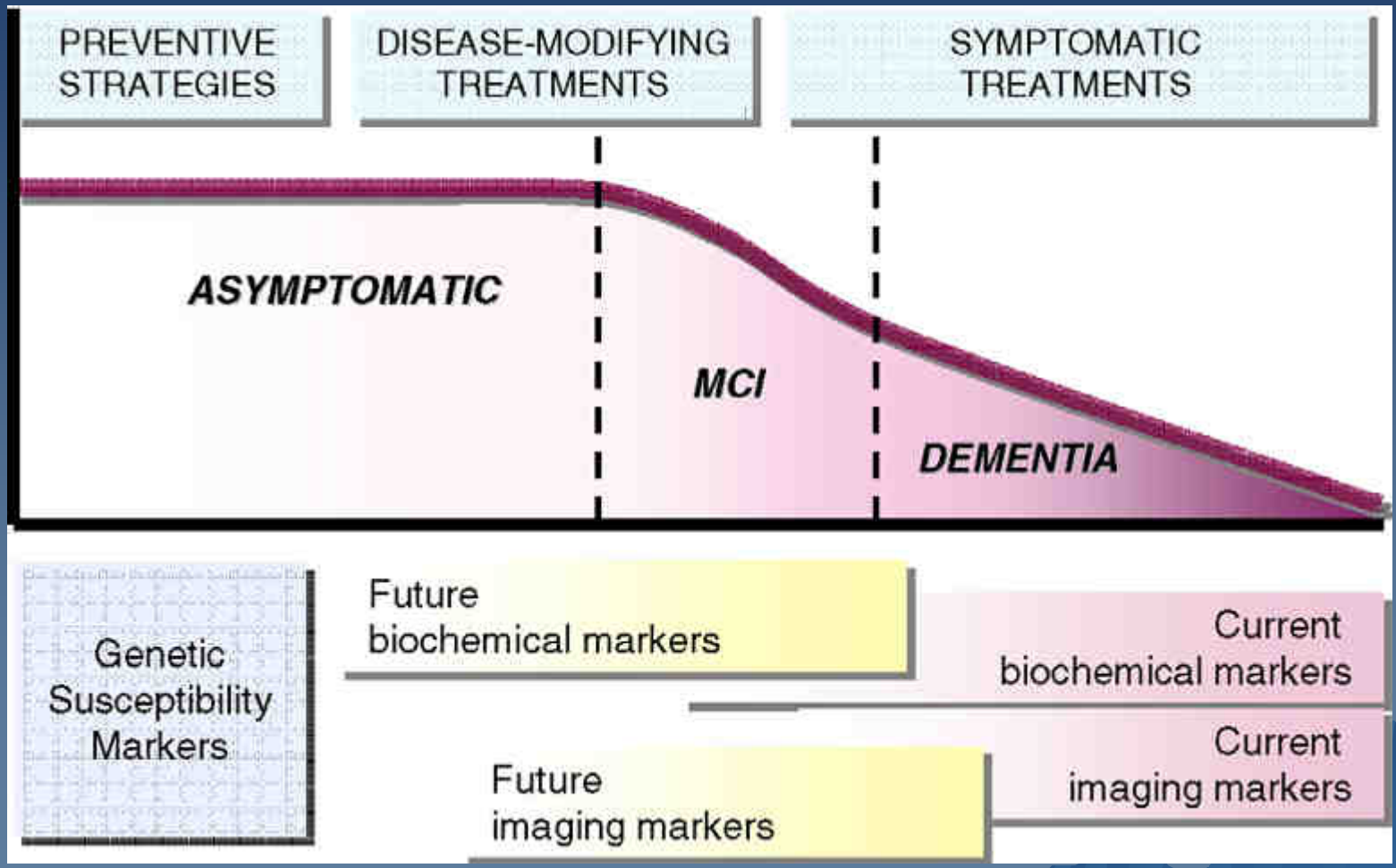

Eckenhoff R, Prog Neuro-Psychopharm & Bio Psych, 2012

# MCI: Diagnosis

- MCI is diagnosed when there is:
  - Evidence of memory impairment
  - Preservation of general cognitive and functional abilities
  - Absence of diagnosed dementia

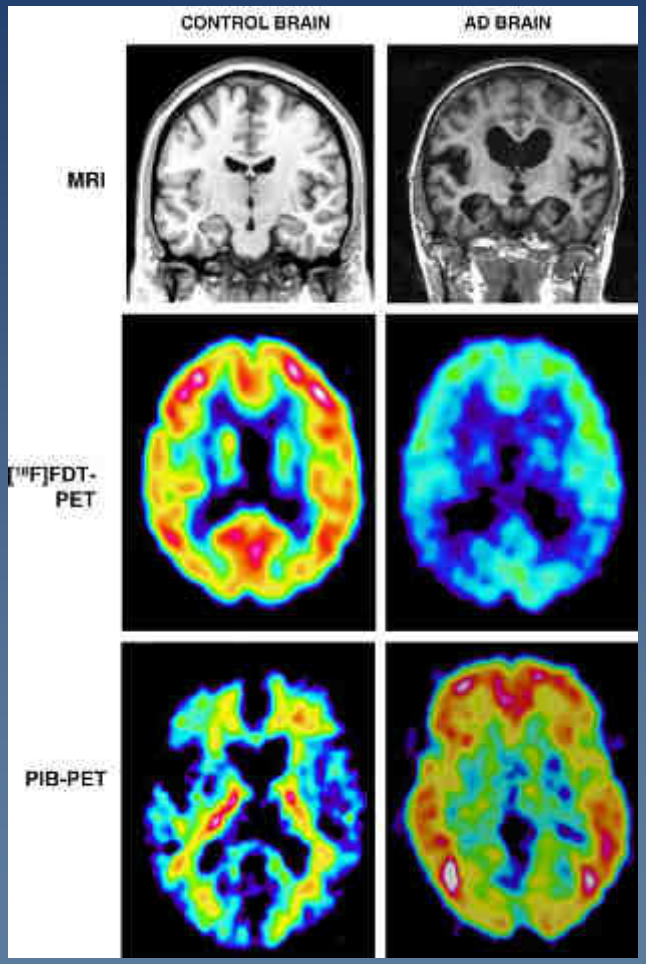
Morris J, Arch Neurol, 2001

# Diagnostic and Treatment Possibilities Along the Evolution of Dementia




Cedazo-Minguez A et al., Exp Gerontology, 2010

# Brain Images from Age Matched Cognitively Intact Individuals and AD Patients

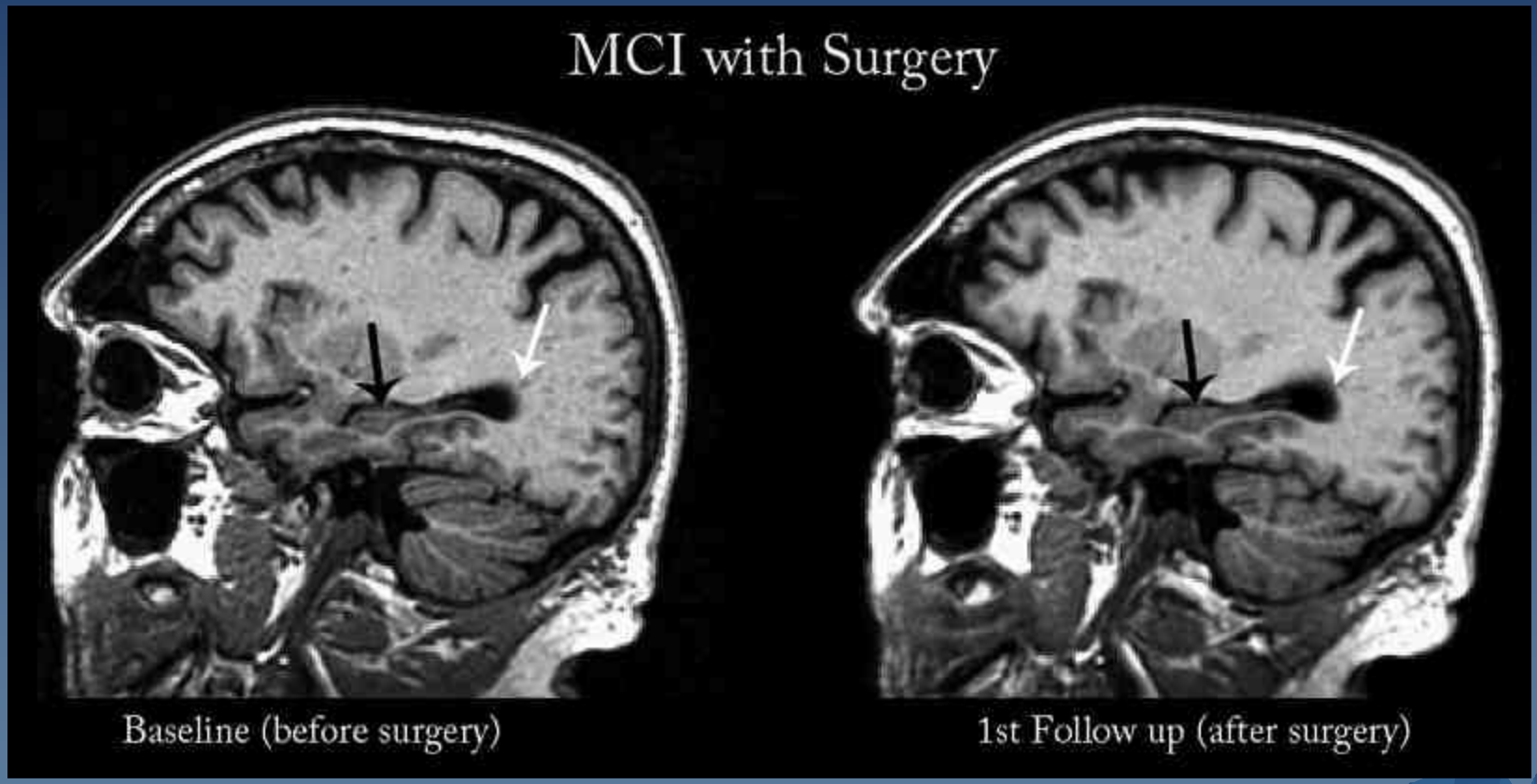



Cedazo-Minguez A et al., Exp Gerontology, 2010

# Study Design: Longitudinal Examination of Structural MRI From ADNI Database

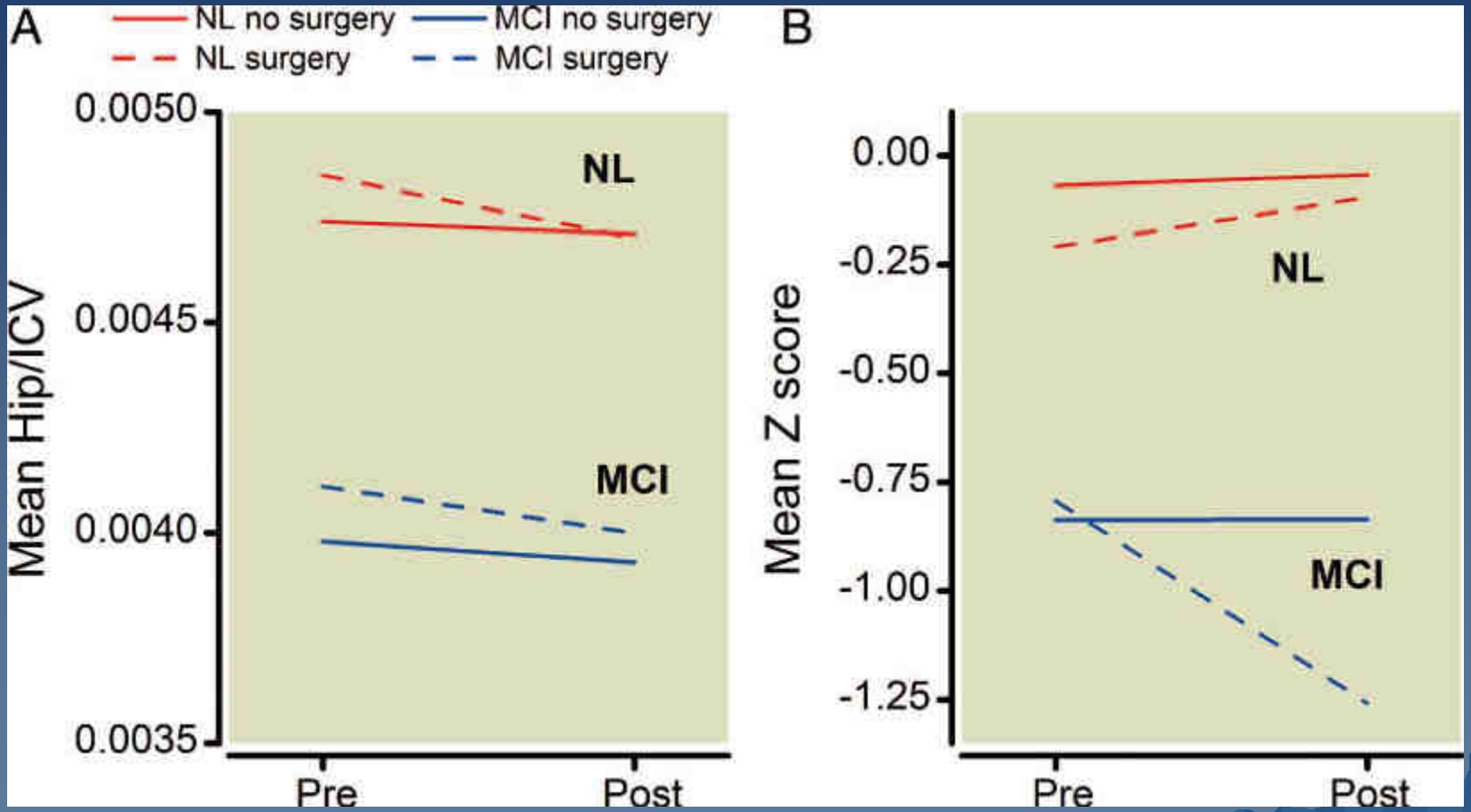
- Apply MRI to study perioperative cortical volume change in surgical subjects
- Examine hippocampus, gray matter, white matter and lateral ventricle.
- Examine composite cognitive score

# LV Volume Changes in a Surgical Patient with MCI




Kline R, Anesthesiology 2012

# Atrophy of Hippocampus in the Perioperative Period




Kline R, Anesthesiology 2012

# POCD: Concluding Remarks

- Standardization of diagnostic criteria
- Neuroinflammation
- Low intraoperative cerebral oxygenation
- Patient-related factors:
  - Age
  - Pre-existing cognitive impairment
  - Cognitive reserve
  - Priming of the immune system

# Low Tech Prescriptions for Longevity

**"Swim, dance a little, go to Paris every August and live within walking distance of two hospitals"**

**Horatio Lure, at 80**

**"Stay busy, get plenty of exercise and don't drink too much.**

**Then again, don't drink too little"**

**Herman "Jack Rabbit" Smith-Johannsen, at 103**

**"The secret to longevity is to keep breathing"**

**My observation**