

Postoperative Cognitive Dysfunction in the Elderly



"By the time you're eighty years old
you've learned everything.
You only have to remember it!"

Susan Elczyna PhD, CRNA

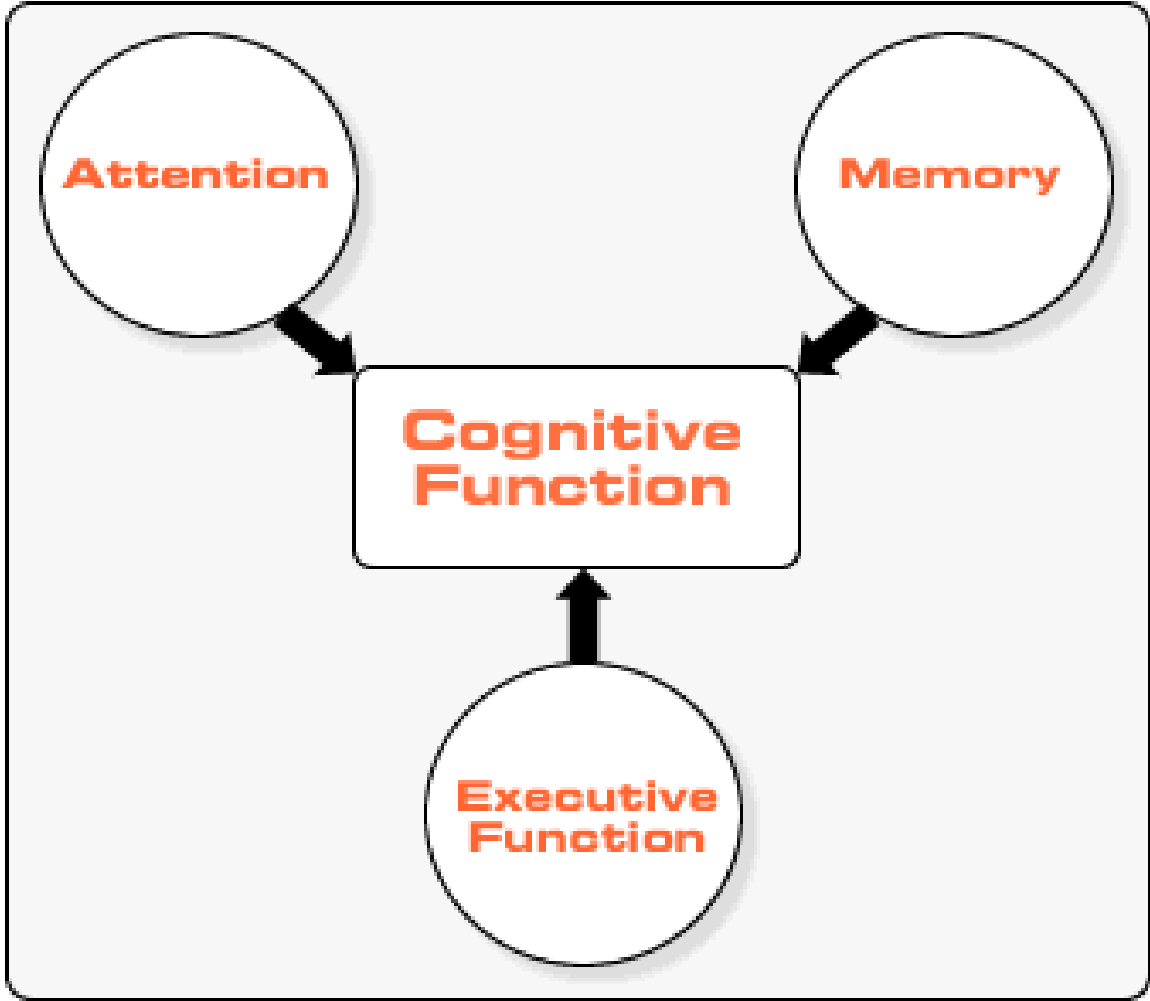
How I Got Started



Cognition

- The process of thought





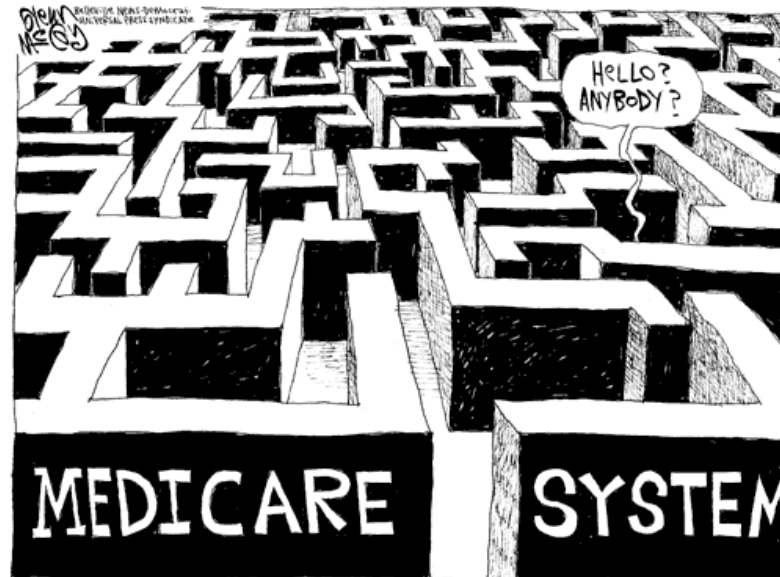


Cognitive Dysfunction

- Advances in surgery and anesthesia
- More elderly
- Multiple medical problems
- Undergoing complicated surgeries
- CNS dysfunction increasing post op
- polypharmacy

Two main categories

- Post op delirium
- Mild neurocognitive disorder – post op cognitive dysfunction (POCD)
- no diagnostic code for this condition





Original study

- Bedford 1955
- Retrospective observational report
- 251 elderly patients – surgery with anesthesia
- Anesthesia could have lasting effects on cognitive function
- 7% extreme dementia
- Conclusion “operations on elderly people should be confined to unequivocally necessary cases”



Delirium

- An acute change in mental status, with inattention and altered level of consciousness that tend to fluctuate during the course of the day
- Overall incidence post op 5 – 10 %
- Varies with type of surgery
- Occurs in 10 – 40% of elderly



Post op delirium

- Associated with increased morbidity and mortality
- Delayed functional recovery
- Prolonged hospital stay



Delirium - post op features

- Impaired cognition
- Fluctuating levels of consciousness
- Abnormalities in memory and perception

PO Delirium



- Costly to patient – morbidity and mortality
- Costly to Medicare - \$4 billion per year spent on diagnosis and treatment



PO delirium – clinical features

- Changes in consciousness and cognition over a brief period of time
- Disorientation
- Language difficulties
- Impairment in learning and memory
- Emotional problems
- Intermittent labile symptoms - anxiety, fear, anger, irritability and depression



PO delirium

- Bedside tests
- Assess orientation, short term memory, language, perception, and motor function
- Mini Mental Status Exam
- Abbreviated Mental Test
- Confusion Assessment Method



Confusion Assessment Method (CAM)

- Developed to assist non-psychiatrically trained clinicians in the rapid and accurate diagnosis in the clinical setting
- Criteria provide standardized rating of delirium
- Can be used by any clinician or trained lay observer
- Most commonly used – adapted to DSMIV criteria
- High inter observer reliability
- Validated against psychiatric diagnosis
- Sensitivity of CAM vs psychiatric diagnosis is 94% to 100%, specificity is 90% to 95%

Table 71-5 -- DSM-IV Diagnostic Criteria for 293.0 Delirium

- A.** Disturbance of consciousness (i.e., reduced clarity of awareness of the environment) with reduced ability to focus, sustain, or shift attention
- B.** A change in cognition (e.g., memory deficit, disorientation, language disturbance) or the development of a perceptual disturbance that is not better accounted for by a preexisting, established, or evolving dementia
- C.** The disturbance develops over a short time (usually hours to days) and tends to fluctuate during the course of the day
- D.** There is evidence from the history, physical examination, or laboratory findings that the disturbance is caused by the direct physiologic consequences of a general medical condition

From American Psychiatric Association: Diagnostic and Statistical Manual of Mental Disorders, 4th ed, Text Revision (DSM-IV-TR). Washington, DC, American Psychiatric Publishing, 2000.



PO Delirium

- Wide range of reported incidence – 0 – 73.5%
- Factors vary – age, type of surgery, diagnostic criteria, preop medical status

PO Delirium

- Emergence delirium – transient restlessness immediately post op (any age group)
- Interval delirium – most common, occurs between 2nd and 7th PO day
- Occurrence rate 10% in elderly
- High risk with elderly and ortho (joint replacement and hip fracture) 24-50%
- Cardiac surgery, 3-47%

Causes

- Global CNS dysfunction- 2 categories
- 1) Metabolic encephalopathy
- 2) Neurological injury



CNS functioning

- O₂ and nutrient delivery
- Effective removal of waste products
- Appropriate neurochemical milieu

Causes

- Drug induced or somatic disturbances
- Hypoxia, hyperglycemia
- Interference with supply for normal metabolism causes global dysfunction



Causes

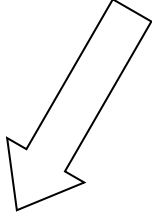
- Reduced cerebral oxidative metabolism may lead to abnormalities in the neurotransmitter systems
- Cerebral acetylcholine synthesis – sensitive to hypoxia
- Central cholinergic pathways – regulation of memory processing and alertness

Causes

Surgical Trauma



Stress related
neuroendocrine
disturbances



Decreased level of
active
thyroid hormone



Increased level of
cortisol



Release of
cytokinines



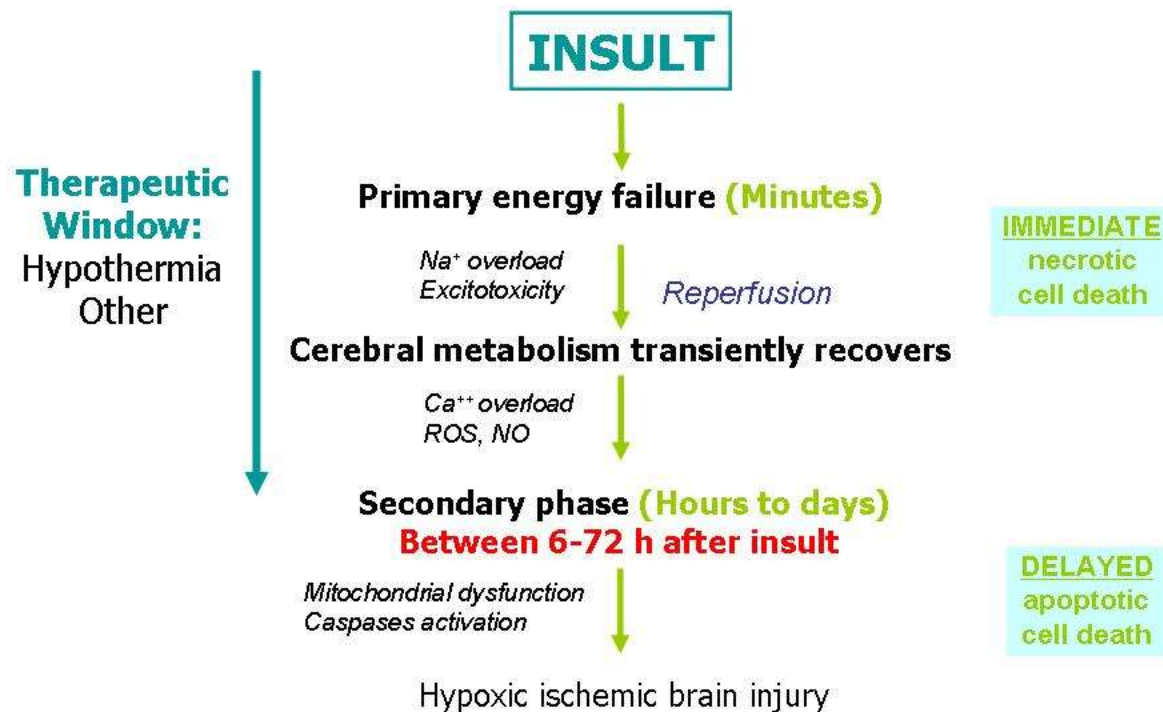
Causes

- Change in hormone levels alter neurotransmitter and amino acid concentrations in the brain
- Provokes delirium

Causes

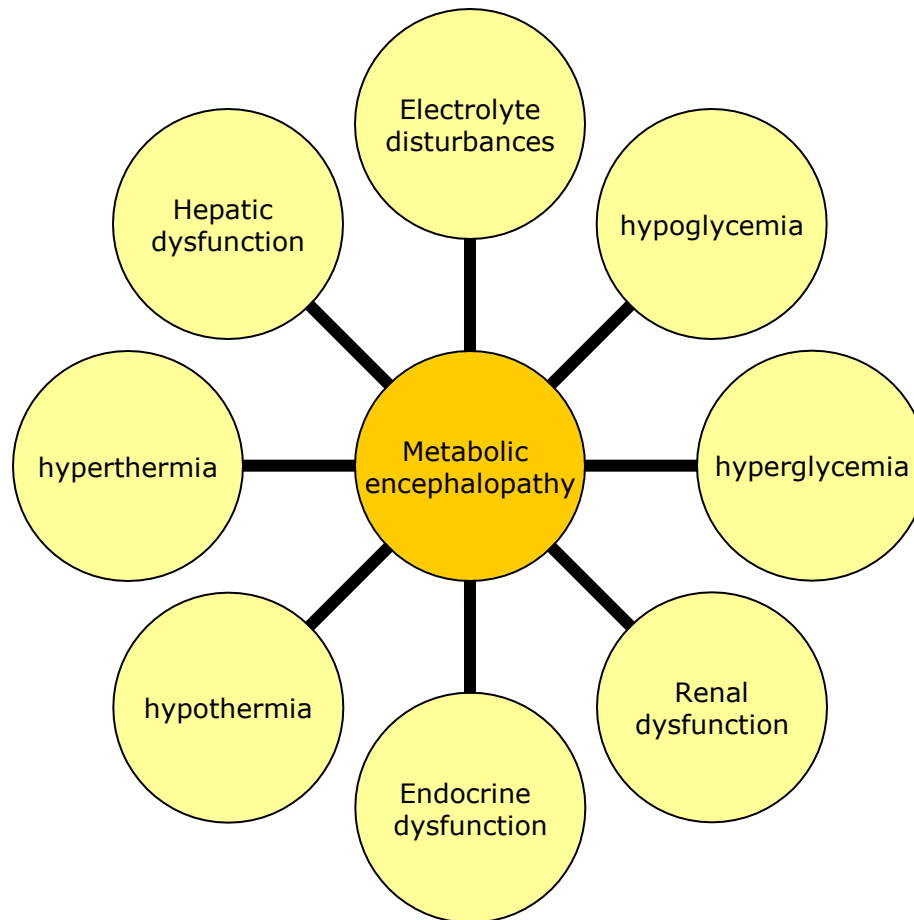
- Neurological injury
- Cerebral infarction – embolic or thrombotic vascular occlusion
- Diffuse loss of neuronal tissue without overt infarction

Mechanism of Brain Injury

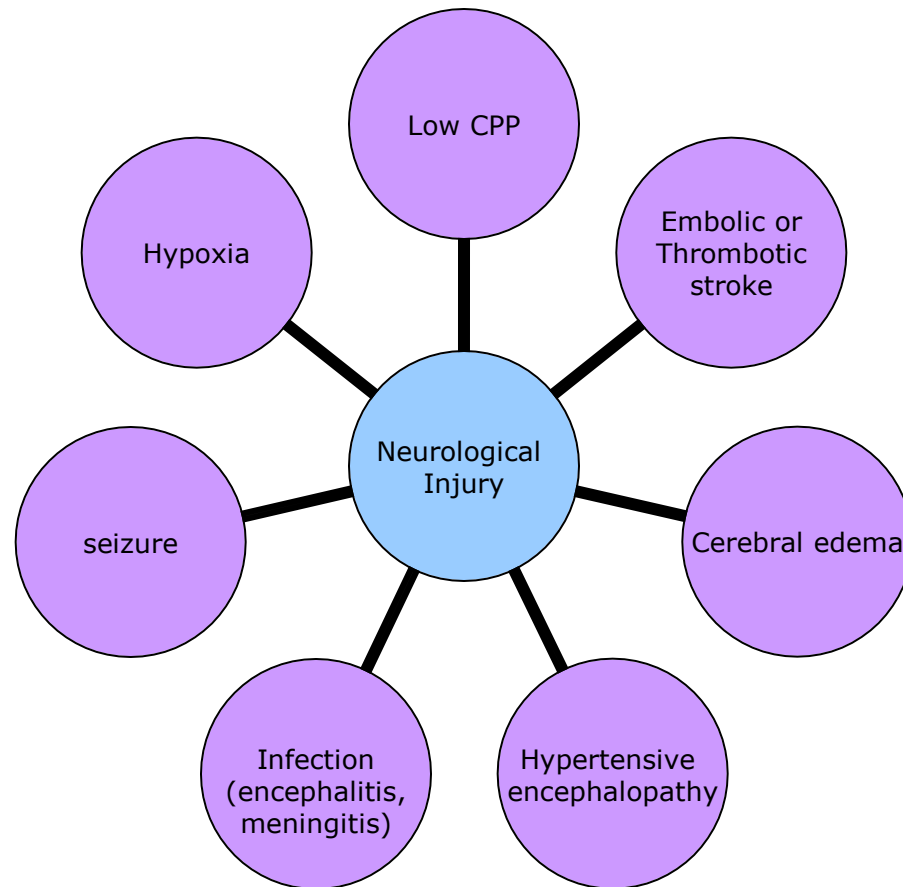


Interventions NEED TO BE WITHIN 6 hrs of insult

Mechanism of Brain Injury



Mechanism of Brain Injury



Risk Factors for post op delirium





Patients at Risk

- Severe illness - > ASA 2
- Diminished cognitive and physical functioning pre op
- Clinical indicators – abnormal electrolytes (esp. Na⁺), hx of dementia, depression, and cerebrovascular disease, low albumin levels
- Advanced age



Risk factors

- Increasing age (>75)
- Hx of psychosis
- Poor medical status - Parkinson's
- Psychiatric illness – dementia, depression, personality disorder
- Nutritional deficiency – thiamine
- ETOH and benzodiazepine withdrawal
- Head trauma
- Anticholinergic drugs



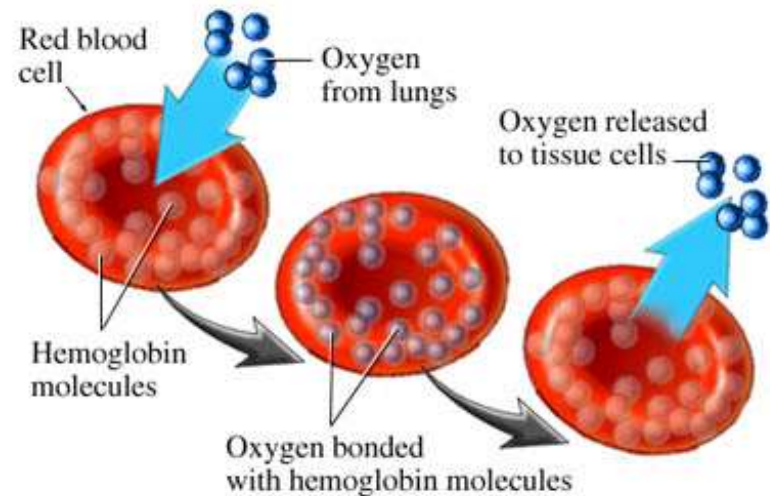
Table 71-6 -- Predisposing and Precipitating Factors for Postoperative Delirium

	Demographic characteristics—age >65 yr and male
	Cognitive impairment or depression
	Functional impairment
★	Sensory impairment, especially visual and hearing
	Decreased oral intake
★	Drugs—polypharmacy, alcoholism, psychoactive, sedatives, narcotics, anticholinergic
	Comorbidity—severe illness and neurologic disease
★	Some types of surgery—high-risk surgery (American Heart Association guidelines) and orthopedic
	Intensive care unit admission
★	Pain
	Sleep deprivation
	Immobility/poor physical condition

Adapted from Inouye SK: Delirium in older persons. N Engl J Med 354:1157-1165, 2006.

Associated Perioperative Factors

- **Impaired Cerebral Oxygen Supply**
- Hypotension
- Hypoxemia
- Anemia



O₂ delivery depends on CBF and arterial O₂ content



Associated Perioperative Factors

- **Medications and drug combos**
- Drugs with central anticholinergic action
- Anticonvulsants
- Inhalational anesthetics



Associated Perioperative Factors

- **Metabolic Abnormalities**
- Electrolyte imbalance – hyponatremia, hypocarbia, dehydration
- Hypoglycemia
- Endocrine disease

Associated Perioperative Factors

- **Infection/Fever** - sepsis
- **Medical complications/ICU environment**
- Sundowner's syndrome



Perioperative Factors

- Several large studies have found no difference between general and regional anesthesia in the incidence of delirium





Perioperative Factors

- **Cardiopulmonary bypass**
 - Depression of CBF – autoregulation impairment
 - Micro-emboli



Major Physiologic Changes in Elderly

- Loss of functional reserve in all organ systems
- Brain – decrease in gray and white matter (neuronal shrinkage)
- Brain weight decreases 2-3 GM/yr after age 60



Major Physiologic Changes in Elderly

- Increase space between surface of brain and skull
- Decrease in neurotransmitters – dopamine, serotonin, acetylcholine, norepinephrine
- Impaired vision, hearing

Major Physiologic Changes in Elderly

- Decreased motor speed





Major Physiologic Changes in Elderly

- CBF decreases, CMRO₂ remains stable
- Decrease in lean body mass
- Decrease in total body water
- Increase in body fat
- Chronic diseases



Sensitivity of elderly

- CNS effects of barbiturates
- Inhalationals
- Benzos
- Opioids
- Demerol – most delirigenic opioid



Anticholinergics

- inhibit parasympathetic nerve impulses by selectively blocking the binding of the neurotransmitter acetylcholine to its receptor in nerve cells
- nerve fibers of the parasympathetic system are responsible for the involuntary movements of smooth muscles present in the gastrointestinal tract, urinary tract, lungs
- Antidepressants
- GU antispasmodics

Anticholinergics

- H1 antihistaminics
- Anxiolytics
- Antiepileptics, antipsychotics





Anticholinergics

- Antiasthmatics
- Anti Parkinson drugs
- Atropine
- Scopolamine
- Non cholinergic antimuscarinics – antihistamines

Treatment

- Recognition and management of underlying causes
- Glucose, electrolyte levels, ABG, CXR, HgB, Hct, blood cultures
- Dehydration, malnutrition – assess fluid balance
- Provide adequate ventilation, oxygenation, hemodynamic support from the start
- Don't automatically sedate!!!



Treatment

- Control of post op pain
- Association between high pain levels and delirium
- Pharmacological treatment of choice is Haloperidol



Prevention

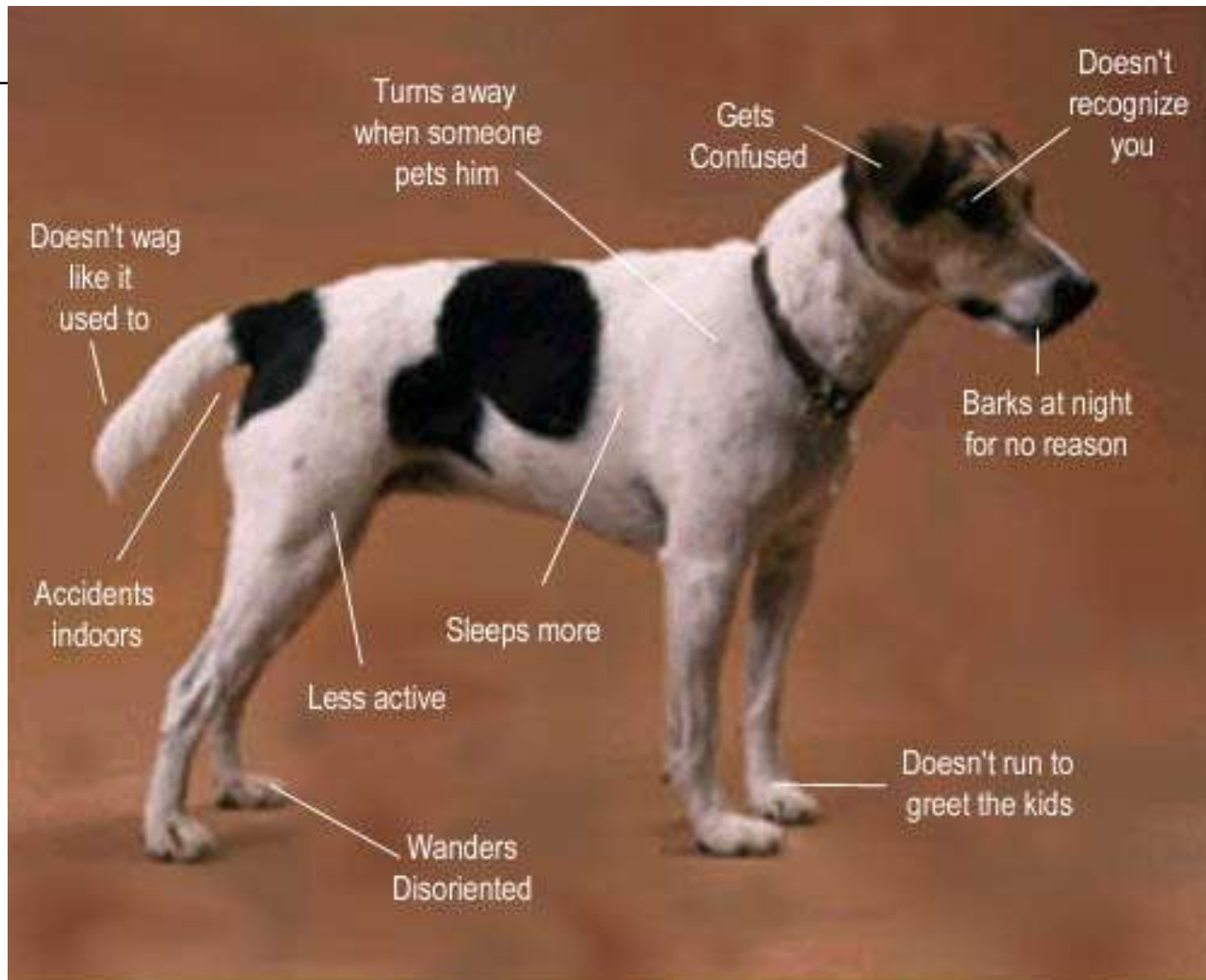
- Evaluate and assess – optimize medical condition prior to surgery
- Detailed history of medications
- Maintain good oxygenation, normal BP and electrolyte levels
- BIS
- Control post op pain
- Minimize polypharmacy
- Avoid anticholinergics



Post Op Cognitive Disorder (POCD)

- Characterized by impairment of:
- Memory
- Concentration
- Language comprehension
- Social integration
- May be detected days to weeks after surgery
- May remain as a permanent disorder

Cognitive Dysfunction Syndrome in dogs



POCD – socioeconomic implications

- Loss of independence
- Extra nursing care – high rate
- Discharge to LTC facility





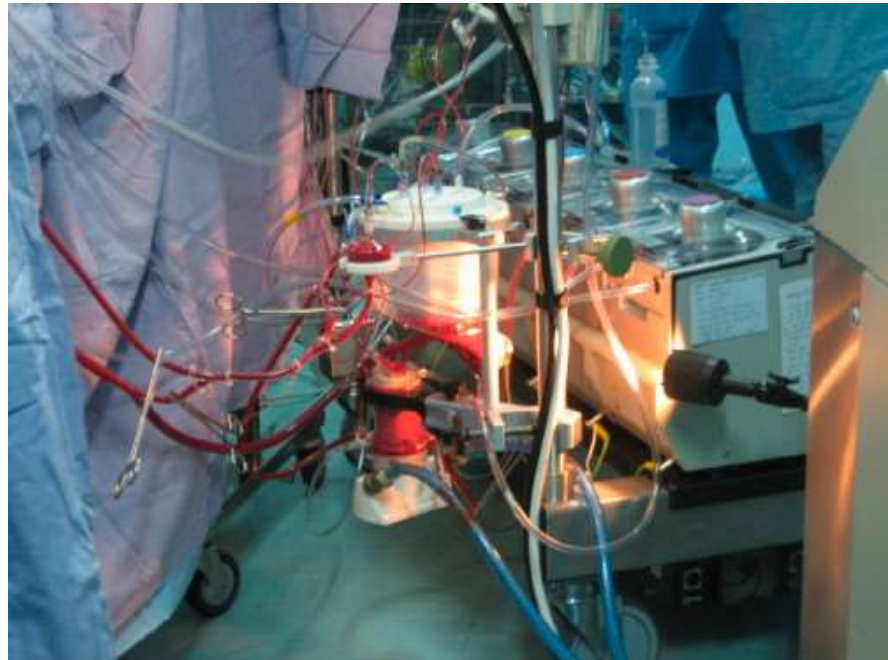
Post Op Cognitive Dysfunction

- **Diagnostic Criteria**
- Memory impairment – reduced ability to learn or recall information
- Disturbance in executive functioning – planning, organizing, sequencing, abstracting
- Disturbance in attention or speed of information processing
- Impairment in language (comprehension, word finding)



POCD

- Cardiac surgery
- Seen in 50 -80% at discharge
- Decrease to 20 – 60% several months later



POCD – Pump Head

- Duke University, published in the *New England Journal of Medicine* in February, 2001
- 261 patients having bypass surgery were tested for their cognitive capacity (i.e. mental ability) at four different times:
- before surgery, six weeks, six months, and five years after bypass surgery
- Patients were deemed to have significant impairment if they had a 20% decrease in test scores.

POCD

- Cognitive impairment does occur after bypass surgery
- The incidence of cognitive impairment was greater than most doctors would have predicted.
- 42% of patients had at least a 20% drop in test scores after surgery.
- The impairment was not temporary, as many doctors have claimed (or at least hoped)
- The decrease in cognitive capacity persisted for 5 years
- Study criticized for, among other things, not having a suitable control group

POCD

- **Non cardiac surgery**
- 25% of patients >60 demonstrated dysfunction 1 wk after surgery, 10% 3 months later
- Control group deteriorated by 3%

POCD

- First and Second International Study of POCD – 2 largest studies of noncardiac POCD
- International, multicenter studies
- Association between 1 yr mortality and POCD
- 1 yr after surgery some patients still exhibit impaired cognition

POCD

- **Anesthetic Techniques**
- Inpatient procedures
- Sevo vs Desflurane – no significant difference
- General vs spinal – no significant difference
- Hypotension during surgery – no significance

POCD

- POCD after noncardiac surgery associated with:
- Increased mortality
- Risk of leaving the labor market prematurely
- Dependency on social security payments

MY STUDY



POCD in Elderly (short stay surgery < 24 hrs)

- GA vs procedure in office
- Sample, n = 101 over 70
- TICS scores before, 1 wk after and 6 weeks after
- Scores significantly better at 6 weeks (home environment)

POCD in Elderly (short stay surgery < 24 hrs)

- Theory of cognitive reserve, activity, education, employment
- Scores better between younger groups and group 85 or >
- Large majority HS diploma



POCD - diagnosis

- Methods of detection and diagnosis are unreliable
- Neuropsychological tests with low sensitivity may not detect functional impairment



POCD

- Pathophysiology not clearly understood
- No clear strategy for prevention at this time

Who is at Risk??????



Risk Factors

- Elderly patients multiple health problems
- Low EF
- Preop meds
- Hypothermia
- Hypotension
- Hypoxia





Risk Factors

- Catecholamines
- Anticholinergics
- Cerebral hypoperfusion/microemboli
- Glycemic control
- Carotid endarterectomy – conflicting data
- CPBP



Prevention and Intervention

- No evidence it can be successfully treated
- Early recognition, early initiation of safety measures and supportive care
- Education of family members
- Early recognition (prevent injury) – driving, returning to work



Future Research

- Discovery of the mechanism responsible for age-related increased incidence
- Identify the phenotypic expression that predisposes elderly patients to the development of POCD
- Institution of preop intervention techniques – “mental exercise training pre op as well as post op therapy
- Multidisciplinary approach



References

- Newman, S., Stygall, J., Shshivadan, H., Shahzad, S. & Maze, M. (2007). Postoperative cognitive dysfunction after noncardiac surgery. *Anesthesiology*. 106(3), 572-90
- Ramaiah, R. & Lam, A.M. (2009) Postoperative cognitive dysfunction in the elderly. *Anesthesiology Clinics*. 27, 485-496
- Steinmetz, J., Christensen, K.B., Lund, T., Lohse, N. & Rasmussen, L.S. (2009). Long-term consequences of postoperative cognitive dysfunction. *Anesthesiology*. 110(3),548-55.