

# Geriatric Considerations in Anesthesia

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# Our aging Population

- Baby boom of the 1950's is now 55+
- Decreases in adult mortality
- The U.S. population of persons 65 & older will increase by 17% from 1995-2010, and by 76% from 2010-2030
- The U.S. population of persons 85 & older will increase by 56% from 1995-2010, and by 116% from 2010-2030
- Since 1925, the life expectancy of those living in the U.S. has increased by a full generation.

*Siegel J, and the Administration on Aging, U.S. Department of Health and Human Services. Aging into the 21st Century. Washington, DC: National Aging Information Center, May 31, 1996.*

# Statistics on Growth of Older Patients (Dept. of Health & Human Services)

- Persons 65 years or older--numbered 35.9 million in 2003 - (12.3% of the U.S. population, about one in every eight Americans)
- This number is expected to grow to be 20% of the population by 2030
- In 2002, Pennsylvania was one of 9 states with over 1,000,000 citizens over 65, 8% of these people lived below the poverty line
- In addition, this number represented 15.5% of our state's population in 2002 (a number exceeded only by Florida {17.1%})
- Good news - PA population over 65 increased by only 1.8% from 1992-2002 (NV experienced an increase of 63.8% in the same period)

# Increased efficacy in treating disease

- ESRD
- Late 1972, Congress amended the Social Security Act to allow dialysis and renal transplantation to be covered by Medicare
- Longer transplant waiting list for about the same number of available organs
- 1972 - 10,000 dialysis patients
- 1982 - 80,000 dialysis patients
- 2002 - > 300,000 dialysis patients

# Physiologic Changes Relevant to Perioperative Care

- Nearly linear increase in systolic blood pressure from age 30 to 84 yr
  - 50%-75% increase in arterial stiffness
  - 25% increase in systemic vascular resistance
  - Increased sympathetic nervous system activity
  - Decreased peripheral [beta]-adrenergic responsiveness
- LVH --> Decreased ability of the heart to adjust stroke volume *Cleroux J, Giannattasio C, Bolla G, et al. Decreased cardiopulmonary reflexes with aging in normotensive humans. Am J Physiol 1989; 257: H961-8*
- Conduction defects from fatty infiltration and fibrosis of the heart
- -> disposition to either congestive heart failure or hypotension

# Pulmonary Changes

- Thorax becomes stiffer -> increased work of breathing and reduced maximal minute ventilation along with loss of muscle
- Residual volume  $\uparrow$  5%-10% and functional residual capacity  $\uparrow$  1%-3% per decade
- FEV<sub>1</sub> is reduced approximately 6% to 8% per decade
- Reduced elastic recoil-> closing volume increases such that it exceeds FRC by age 65. In the supine position, closing capacity may reach FRC by 44 yr of age.

# Pulmonary changes (Cont.)

- Inspiratory and expiratory functional reserve decrease with aging, and the normal matching of ventilation and perfusion decreases.
- The respiratory response to hypoxia diminishes
- Ciliary function decreases, and cough is reduced.
- Pharyngeal sensation is decreased
- Motor function required for swallowing is increased

Marik PE. Aspiration pneumonitis and aspiration pneumonia. *N Engl J Med* 2001; 344: 665-71

- The risk of aspiration is relatively high in elderly persons
- Increased incidence of dysphagia and gastroesophageal reflux in this population.
- Elderly persons frequently receive poor oral care, resulting in oropharyngeal colonization by potential respiratory tract pathogens, including *Enterobacteriaceae*, *Pseudomonas aeruginosa*, and *Staphylococcus aureus*
- In patients with stroke, the prevalence of swallowing dysfunction ranges from 40 to 70 percent

# Neurologic Changes

- Cerebral atrophy
- Spinal cord neuronal loss and demyelination
- Decreased proprioception and changes in spinal reflexes
- Decreased hypoxic and hypercarbic drive
- Decreases in visual and auditory function
- Neuronal loss in the autonomic nervous system
- Increased plasma catecholamine concentrations
- decrease in strength, coordination, and fine motor control

# Cerebral Atrophy

- Associated with alcoholism and dementia
- Patients with cerebral atrophy are more prone to subdural hematoma
  - Usually due to rupture of the bridging veins as the brain shifts during a rapid deceleration
  - Slow bleeding from the low-pressure venous system often enables large hematomas to form before clinical signs appear
- Chronic subdural hematoma can occur in the elderly after apparently insignificant head trauma. Often, the event causing the hematoma is never recognized. (highest incidence 50-80yr)

# Central and Spinal Cord neuron loss

- Increased risk of falls
- Postoperative delirium
- Adverse drug reactions



# Implications for Preoperative Assessment

- To alert the surgical care providers to physiologic conditions that may alter perioperative management
- To determine whether medical intervention is indicated before proceeding with surgery
- To provide an index of risk and therefore contribute to decisions about the most appropriate intervention
- To provide baseline data on which the success of a surgical intervention might be judged.

# Assessment

- Functional evaluation
- Is there depression or alcohol abuse
- Is there a minor cognitive change?
  - Perform a preoperative mental status examination

# Preoperative Mental Status Examination

- Cognitive assessment before surgery is vitally important to the issue of valid consent. A Mini Mental State Examination (MMSE) score of  $<19$  infers that the patient is incapable of making safe decisions and transfer of power of attorney may be necessary before proceeding with surgical intervention.

- 5 “What is the year? Season? Date? Day? Month?”
- 5 “Where are we now? State? County? Town/city? Hospital? Floor?”
- 3 The examiner names three unrelated objects clearly and slowly, then the instructor asks the patient to name all three of them. The patient’s response is used for scoring. The examiner repeats them until patient learns all of them, if possible.
- 5 “I would like you to count backward from 100 by sevens.” (93, 86, 79, 72, 65, ...) Alternative: “Spell WORLD backwards.” (D-L-R-O-W)
- 3 “Earlier I told you the names of three things. Can you tell me what those were?”
- 2 Show the patient two simple objects, such as a wristwatch and a pencil, and ask the patient to name them.
- 1 “Repeat the phrase: ‘No ifs, ands, or buts.’”
- 3 “Take the paper in your right hand, fold it in half, and put it on the floor.” (The examiner gives the patient a piece of blank

- 1 “Please read this and do what it says.” (Written instruction is “Close your eyes.”)
- 1 “Make up and write a sentence about anything.” (This sentence must contain a noun and a verb.)
- 1 “Please copy this picture.” (The examiner gives the patient a blank piece of paper and asks him/her to draw the symbol below. All 10 angles must be present and two must intersect.)



# Preoperative Testing

- In the general population, the bulk of routine tests are not indicated
- ? chest radiograph, electrocardiogram, and urinalysis
- The most important finding in the screening battery was unknown urinary tract infections
  - Sewell JM, Spooner LL, Dixon AK, Rubenstein D. Screening investigations in the elderly. *Age Ageing* 1981; 10: 165-8

■ Routine urinalysis may be a significant factor in reducing hip infection in elderly patients undergoing arthroplasty

- Sanders DP, McKinney FW, Harris WH. **Clinical evaluation and cost effectiveness of preoperative laboratory assessment on patients undergoing total hip arthroplasty.** Orthopedics 1989; 12: 1449-53

# Nutritional assessment

- Check the albumen level!
- Does your patient appear well nourished?
- Has your patient been losing weight?
- Is the planned procedure one where your data will be of use? (Cataract surgery versus major intra-abdominal procedures)

# Preoperative Assessment

- Age itself adds little additional risk in the absence of comorbid disease
- Unique risks:
  - Postoperative delirium
  - Aspiration
  - Urosepsis
  - Adverse drug reactions
  - Malnutrition
  - Falls
  - Failure to return to ambulation or to home

# Optimizing the Patient for the Planned Procedure

- Has the preoperative data indicated the need for intervention to give you the healthiest surgical candidate?
  - Cardiac and pulmonary improvement
  - Optimize nutrition
  - Hydration
  - Renal function
  - Do anticoagulants need to be discontinued?

# Intraoperative Management

## Regional Versus General Anesthesia

- Much of the anesthetic research on elderly patients is from institutions that perform orthopedic procedures.
- Decreased DVT in regional anesthetics for hip procedures
- No difference in cardiac or pulmonary morbidity seen in a number of large studies

## A bit of history...

- 1980s, a randomized controlled trial by Yeager et.al. comparing general anesthesia with or without perioperative epidural anesthesia and analgesia **stopped by the ethics committee** after 53 patients had been studied, because the combined technique was associated with a significant improvement in postoperative outcome (16% mortality vs.. 0%)
- *Yeager MP, Glass DD, Neff RK, Brinck-Johnsen T. Epidural anesthesia and analgesia in high risk surgical patients. Anesthesiology 1987; 66: 729-36*

**Rodgers A, Walker N, Schug S, et al. Reduction of postoperative mortality and morbidity with epidural or spinal anaesthesia: results from overview of randomised trials. BMJ 2000; 321: 1493**

- 141 randomized trials (9559 patients)
- Reduction in 30-day mortality and DVT
  - pulmonary embolism
  - transfusion
  - respiratory depression
  - myocardial infarction
  - renal failure
- “Overall mortality decreased by 1/3 in patients allocated to neuraxial blockade”

- Neuraxial blockade reduced the odds of deep vein thrombosis by 44%, pulmonary embolism by 55%, transfusion requirements by 50%, pneumonia by 39%, and respiratory depression by 59% (all  $P < 0.001$ )
- No effect on mortality beyond 1 month
- Multiple small studies, quality of data not assessed, included heterogeneous surgical procedures

**Rigg JR, Jamrozik K, Myles PS, et al. Epidural anaesthesia and analgesia and outcome of major surgery: a randomised trial. *Lancet* 2002; 359: 1276-82.**

- 915 patients undergoing major abdominal surgery with one of nine defined comorbid states
  - Intraoperative epidural anesthesia using postoperative epidural analgesia for 72 h with general anesthesia (N=447)
  - Control (N=441)
- Death or major postoperative morbidity (endpoint)
- “No overall difference in mortality or major morbidity”
- “...a trial of 6000 patients at high risk would be required to give an 80% chance of declaring statistically significant an absolute difference of 3.6% in the rate of death or major complications”

**“Most adverse morbid outcomes in high-risk patients undergoing major abdominal surgery are not reduced by use of combined epidural and general anesthesia and postoperative epidural analgesia. However, the improvement in analgesia, reduction in respiratory failure, and the low risk of serious adverse consequences suggest that many high-risk patients undergoing major intra-abdominal surgery will receive substantial benefit from combined general and epidural anesthesia intraoperatively with continuing postoperative epidural analgesia.”**

**Park WY. Thompson JS. Lee KK. Effect of epidural anesthesia and analgesia on perioperative outcome: a randomized, controlled Veterans Affairs cooperative study. Annals of Surgery. 234(4):560-9; discussion 569-71, 2001 Oct**

- ? Does epidural anesthesia and postoperative epidural analgesia decrease the incidence of death after major abdominal surgery
  - better suppression of surgical stress
  - positive effect on postoperative nitrogen balance
  - more stable cardiovascular hemodynamics
  - reduced blood loss
  - better peripheral vascular circulation
  - better postoperative pain control
- Only found benefit for abdominal aortic patients
- Geriatric patients not specifically studied

No significant differences in:

- rate of postoperative complications
- in-hospital mortality
- discharge residence
- recovery of instrumental activities of daily living at 1 year

Carli F, Halliday D. **Continuous epidural blockade arrests the postoperative decrease in muscle protein fractional synthetic rate in surgical patients.** *Anesthesiology* 1997; 86: 1033-40

- Epidural anesthesia with local anesthetics is associated with postoperative attenuation of nitrogen loss
- “Twelve otherwise healthy patients scheduled for elective colorectal surgery”
- GA or epidural + GA
- “Epidural infusion of local anesthetics begun before surgery and continued during the first 48 h after operation significantly attenuates the decrease in the postabsorptive muscle protein synthesis rate associated with surgical injury. Effective block of nociceptive stimuli thus preserves tissue protein synthesis.”

# Intraoperative Management

- Overall, management of the patient during the anesthetic seems to have little or no impact on patient outcome after 30 days.
  - Arvidsson S, Ouchterlony J, Nilsson S, et al. **The Gothenburg study of perioperative risk. I. Preoperative findings, postoperative complications.** Acta Anaesthesiol Scand 1994; 38: 679-90

# What about Carotid Endarterectomy?

- Ferguson, GG et al **The North American Symptomatic Carotid Endarterectomy Trial: Surgical Results in 1415 Patients** AHA Journal 30(9) 1999pp 1751-175
- 93% of procedures were performed using general anesthesia
- The authors were unable to identify an independent effect of anesthetic technique on outcome

# Intraoperative Physiologic management

- Numerous studies have shown that physiologic management plays a modulatory rather than a primary role in outcome
- Technical issues during surgery and the risk factors that the patient brings to the operating room primarily determine how well the patient does
- Preoperative assessment and postoperative management seem to have the greatest impact on outcome

# Postoperative Respiratory Complications

- Pneumonia, ventilatory failure, and unplanned intubation
- Elderly patients experience disproportionately large numbers of respiratory complications
- Continued efforts are being made to abbreviate the time to discharge
- More elderly patients are undergoing conscious sedation outside the operating room, where the risk of death related to sedation is increased.

- Age-related alterations in pharyngeal function and diminished cough are aggravated by anesthetics, muscle relaxants, pharyngeal instrumentation, and upper abdominal or neck surgery.  
--> **Postoperative aspiration risk**
- Special vigilance is indicated in the assessment of recovery of muscle function after neuromuscular blockade.

# Pain

- Inadequate analgesia and perioperative ischemia
  - Mangano DT. *Perioperative cardiac morbidity*. Anesthesiology 1990;72:153-84
- Relationship of perioperative stress to inflammation

# Pain Management Regimens

- PCA
- Fixed dose administration
- Problems with altered mental status and struggles with technology if using PCA

# Other Problems

- The elderly are exceptionally susceptible to drug interactions
  - respiratory depression
  - urinary retention
  - ileus
  - constipation
  - postoperative falls
- ? Is route of administration an important factor in reducing drug interactions

# Rehabilitation

- Capdevila X, Barthelet Y, Biboulet P, et al.  
*Effects of perioperative analgesic technique on the surgical outcome and duration of rehabilitation after major knee surgery.*  
Anesthesiology 1999; 91: 8-15
- Can acute pain management improve functional outcome?

- Standardized general anesthesia
- N=56 adult scheduled for major knee surgery
- Randomly assigned to one of three groups
- Postoperative analgesic technique for 72h
- Continuous epidural infusion
- Continuous femoral block
- intravenous patient-controlled morphine (dose, 1 mg; lockout interval, 7 min; maximum dose, 30 mg/4 h)

- Continuous epidural infusion and continuous femoral block groups showed significantly lower visual analog scale scores at rest and during continuous passive motion
- Durations of stay in the rehabilitation center were significantly shorter
  - 37 days (range, 30-45 days) in the continuous epidural infusion group
  - 40 days (range, 31-60 days) in the continuous femoral block group
  - 50 days (range, 30-80 days) in the patient-controlled morphine group

# Polypharmacy

- Cullen DJ, Sweitzer BJ, Bates DW, et al. *Preventable adverse drug events in hospitalized patients: a comparative study of intensive care and general care units*. *Critical Care Med* 1997; 25: 1289-97
- The number of drugs a patient is taking bears a direct relationship to that patient's risk of adverse reaction
- Analgesic medications are implicated in the highest number of adverse reactions
- Drugs that attenuate coagulation

# Delirium

- A change in mental status characterized by confusion, disorientation, impaired reality testing, changes in level of consciousness, and changes in the sleep and wake cycle that usually is reversible

# Independent Risk Factors for Development of Delirium

- Prior cognitive impairment
- Age over 80 years
- Fracture on admission
- Symptomatic infection
- Male sex
- Neuroleptic use
- Narcotic use

Schor JD, Levkoff SE, Lewis LA, et al: *Risk factors for delirium in hospitalized elderly*. JAMA 267:827-831, 1992

# Edelstein, David M et.al. "Effect of Postoperative Delirium on Outcome after Hip Fracture"

Clinical Orthopaedics & Related Research. (422):195-200, 2004 May

- 921 "community dwelling" hip fracture patients over 65 Years of age
- followed for the development of postoperative delirium
- Forty-seven (5.1%) patients were diagnosed with postoperative delirium

# Parameters evaluated

- postoperative complication rates
- in-hospital mortality
- hospital length of stay
- hospital discharge status
- 1-year mortality rate
- place of residence
- recovery of ambulatory ability
- activities of daily living 1 year after surgery

# Identified Risk Factors

- More likely to be male
- Have a history of mild dementia
- Had surgery under general anesthesia  
*“Anesthesiologists should inform patients and family members of this increased risk.”*
- *“A fracture on admission is an independent risk factor for development of delirium.”*

# Patients with Delirium

- higher rates of mortality at 1 year
- less likely to recover their prefracture level of ambulation
- more likely to show a decline in level of independence in basic activities of daily living at the 1-year follow-up
- In hip fracture patients, the incidence of perioperative DEL ranges from 28% to 41%

**Zakriya K. et.al *Brief postoperative delirium in hip fracture patients affects functional outcome at three months.***

Anesthesia & Analgesia. 98(6):1798-802

- prospective study
- Patients admitted to the geriatric hip fracture service were assessed every postoperative day by a geriatrician for the presence of DEL using the confusion assessment method (CAM) score.
- Patients were reassessed at 6 wk and 3 mo postoperatively for CAM score, current living situation, and activities of daily living.

# CAM Score

- 1) acute and fluctuating changes in mental status
  - 2) Inattention
  - 3) Disorganized or incoherent thinking
  - 4) Altered level of consciousness
- A CAM score is considered to be positive if the patient displays;
    - 1, 2, and 3
    - 1, 2, and 4)
    - 1, 2, 3, and 4)

# Results

- 220 patients admitted with hip Fx
- 47 patients (21%) had preoperative delirium
- 11 patients (5%) did not undergo surgery
- Of the remaining possible subjects, 56% ( $n = 96$ ) consented to participation in the study
- 28% of the study patients experienced delirium after operation
- In-hospital complications were similar in the patients with and without delirium. (ICU admissions were higher for patients with delirium)

“We conclude that even brief postoperative DEL is associated with poorer long-term functional outcome as evidenced by differences in living situation by three months. Brief postoperative DEL also significantly lengthens hospital and ICU LOS and is associated with increased medical comorbidity and complications.”

Parikh SS, Chung F. *Postoperative delirium in the elderly*. Anesthesia & Analgesia 1995;80:1223-1232

- High incidence (10%-60%) in the elderly (65 yr or older). Recent studies have been conducted in ophthalmic, orthopedic, and cardiac surgical populations.
- Some of these studies have revealed the preventive potential of:
  - A geriatric anesthesiology program
  - Correlation of postoperative delirium with perioperative hypoxemia and the possible benefit obtained from avoiding hypoxemia
  - Predictive value of intraoperative quantitative electroencephalographic monitoring

Rasmussen L.S. et.al ***Does anesthesia cause postoperative cognitive dysfunction? A randomised study of regional versus general anesthesia in 438 elderly patients***

Acta Anaesthesiologica Scandinavica. 03(47):260-6

- Hypothesis: POCD is less frequent after regional anesthesia than general anesthesia in cardiac and major non-cardiac anesthesia
- Patients over 60 years of age undergoing cardiac and major non-cardiac surgical procedures
- 4 psychological tests of neurologic function:preoperative and at 7 days and 3 months postoperatively
  - 7 days GAPOCD = 33/156 (21.2%) RAPOCD 20/158 (12.7%) P=0.04
  - 3 months GAPOCD = 25/175 (14.3%) RAPOCD = 23/165 (13.9%) P=0.93
- Mortality
  - General anesthesia - 4/217
  - Regional anesthesia - 0/211
  - P = 0.05
- “There is no causal relationship between general anesthesia and long term POCD. Regional anesthesia may decrease mortality and the incidence of POCD early after surgery.”

# Anesthetic Management and Development of Delirium

- Wollman and Orkin “extremes of hyperventilation are accompanied by a prolonged reaction time for 3-6 days...”
- Hypotension
- Hypoxemia
- Deep anesthesia

## In Conclusion

- Contract - “An agreement between two people to do something.”
- Covenant - “A binding agreement to do something. No requirement for the other party to reciprocate.”

Pure and lasting religion in the sight of God our Father means that we must care for orphans and widows in their troubles, and refuse to let the world corrupt us.