BEYOND AGE: OPTIMIZING ANESTHESIA IN THE ELDERLY

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Financial Disclosures

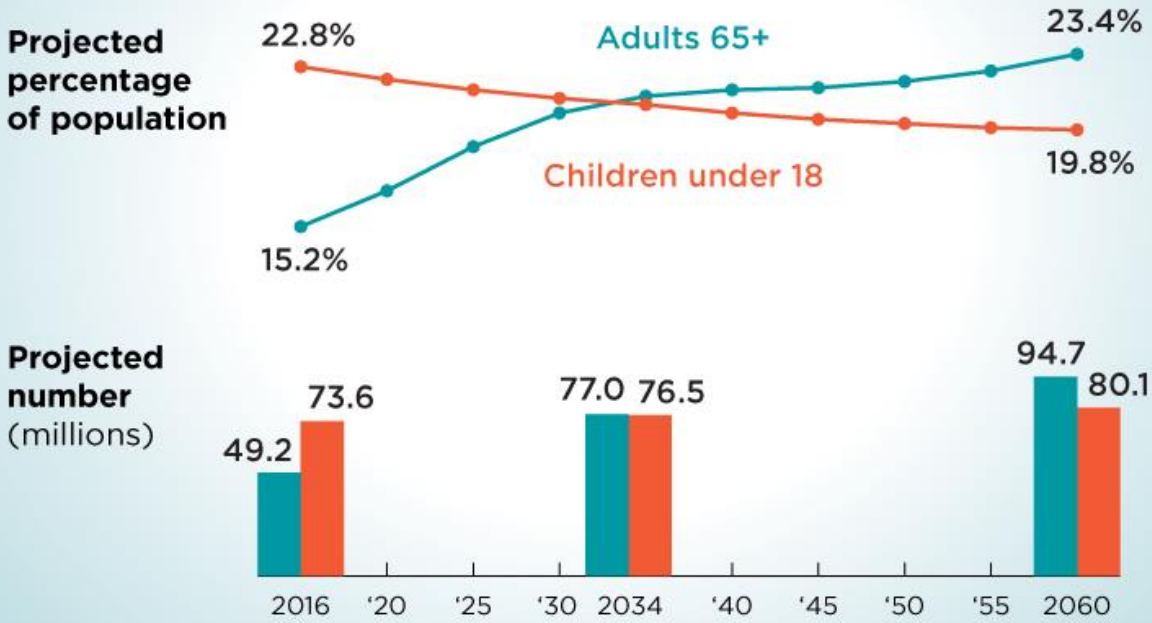
- None


Elderly
people

An Aging Nation

Projected Number of Children and Older Adults

For the First Time in U.S. History Older Adults Are Projected to Outnumber Children by 2034



Note: 2016 data are estimates not projections.

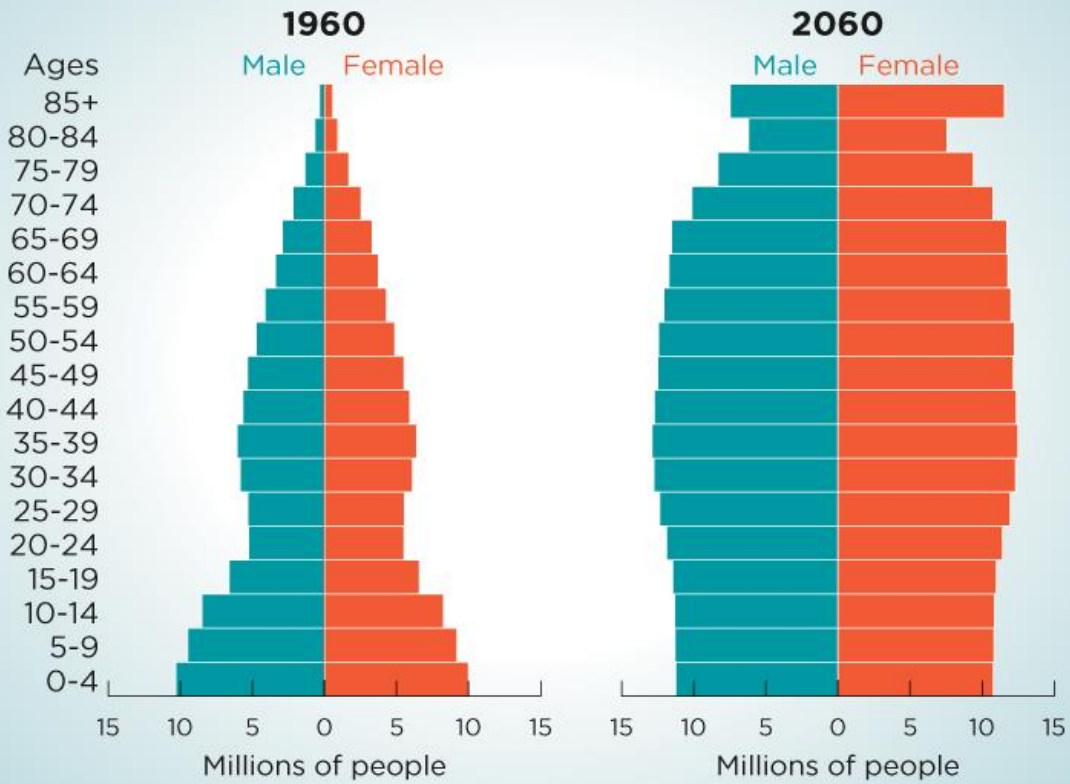
United States® Census Bureau

U.S. Department of Commerce
U.S. CENSUS BUREAU
census.gov

Source: National Population Projections, 2017
www.census.gov/programs-surveys/popproj.html

From Pyramid to Pillar: A Century of Change

Population of the United States



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Source: National Population Projections, 2017
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Economic Impacts

- Over 65 = 18% of the population
  - 1/3 of health care costs
  - 38% of hospital bed stays
  - 21% of inpatient surgical procedures
  - 40% suffer a minor or major medical, surgical, or anesthesia-related complications during hospitalization for non-cardiac surgery
  - 4 % die in the perioperative period

Surgical specialty growth

- Ophthalmology
- Orthopedics
- Cardiology
- Urology
- Cardiothoracic
  - Increase in interventional procedures

The Elderly

- Currently, represent 35 – 50 % of all surgical patients (IP & OP)
- Specific concerns
  - Increased pulmonary complications
    - Depends on duration of anesthesia, obesity, age > 70
  - Females >65 have higher morality (6.7%) as compared to males when adjusted for surgical risk
  - OA, HTN, RA, DM complicate anesthetic management.

Changes in Aging

- Max physiologic function @ 25-32 years
  - ⇑ body fat (in proportion to lean mass)
  - ⇓ skeletal muscle mass (by ~10%)
  - ⇓ Intracellular water
  - ⇓ bone density

Aging and Anesthetics

- Changes in distribution and elimination
  - ⇑ fat = ⇑ Volume distribution for lipophilic drugs)
    - Decreased plasma concentration and prolonged elimination
  - ⇓ muscle mass =
    - ⇓ TBW (⇓ Vd for hydrophilic drugs)
    - ⇓ O_2 consumption
    - ⇓ CO

Aging and Anesthetics

- MAC is ⇓ 4% per decade >40 years
- Rate of rise of alveolar [c] of inhalation anesthetics is increased by ⇓ CO
- Recovery from IAs may be prolonged d/t ⇑ Vd and ⇓ pulmonary exchange

Aging and Anesthetics

- Generally, elderly have lower dose requirements for medications
  - 80yo requires half the induction dose

TABLE 5
DRUG DOSING FOR THE ELDERLY

DRUG CLASS	Dose Adjustment	Comments
Induction Agents • Propofol • Thiopental • Etomidate	20-60% reduction, dose on lean body mass	Thiopental requires only about a 20% reduction; propofol more so (only 1 mg/kg for the very old). Primary cause for reduction is from a decreased initial volume of distribution and slowed redistribution, although increased brain sensitivity may be present with propofol.
Benzodiazepines • Midazolam • Diazepam	After age 60, dose reduction progresses rapidly to 75% reduction by age 90	↑↑ brain sensitivity seems to be main reason to reduce dose. Midazolam metabolic half-life roughly doubles with age, but diazepam half-life is markedly prolonged.

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| **Narcotics***
• Morphine
• Fentanyl
• Alfentanil
• Sufentanil
• Remifentanil | 50% reduction. (hydromorphone and methadone not studied, but assume 50% reduction). | ↑↑ brain sensitivity seems to be main reason to reduce dose. With morphine, remember time to peak effect is long, and the long-acting active metabolite morphine-6-glucoronide becomes important with large doses. |
| **Muscle relaxants**
• Vecuronium
• Mivacurium
• Cisatracurium
• Rocuronium
• Pancuronium | Slightly slower onset of action. | Metabolism not greatly prolonged except for vecuronium and pancuronium. |

ASA

Medscape Medical News

Elderly Receive Higher Than Recommended Doses of Anesthesia

Jim Kling

May 11, 2012

Comment Print

RELATED DRUGS & DISEASES

Local and Regional Anesthesia

General Anesthesia

Topical Anesthesia

May 11, 2011 (Seattle, Washington) — A new study suggests that patients older than 65 are being given higher than recommended doses of propofol for the induction of general anesthesia. The higher doses resulted in an increased incidence of significant hypotension in the postinduction period, but did not increase in-hospital mortality. The results were presented here at the American Geriatrics Society 2012 Annual Scientific Meeting.

Propofol is the most common agent used to induce general anesthesia, and older adults are more sensitive to the drug. High doses have the potential to cause hemodynamic instability and postoperative complications.

Previous research led to the recommendations that patients 18 to 65 years of aged classified as American Society of Anesthesiologists (ASA) physical status 1 or 2 receive 2.0 to 2.5 mg/kg of propofol, and that patients older than 65 receive 1.0 to 1.5 mg/kg.

"There has been some concern expressed by geriatric anesthesiologists about [older adults getting too much propofol]. We wanted to use a very large database to see if that was happening, and whether it was associated with any adverse outcomes," Adam Phillips, a medical student at Mount Sinai School of Medicine in New York City, who presented the research, told *Medscape Medical News*.

The researchers conducted a retrospective multivariate analysis of patients who underwent general

Aging and Maximal Performance

- Overall, aging produces small effects at normal performance
  - However, maximal performance and system ‘reserve’ are progressively reduced by aging

Aging and Pulmonary Function

Respiratory effects of aging	
Decreased compliance • Decreased alveolar surface • Decreased residual volume • Increased closing capacity • V/Q mismatch • Decreased PaO2 Chest wall rigidity Decreased muscle strength • Decreased cough	• Emphysema • Chronic bronchitis • Pneumonia • Lung cancer
Blunted response to hypercarbia and hypoxia	

Aging and Pulmonary Function

- The muscles of ventilation are unchanged, but Work Of Breathing is increased
  - d/t small airway closure
  - Increased risk for post-op vent failure!
- More stimulation for VC closure→ risk for asp
  - Compromised airway reflexes

Aging and the Airway

- Decreased cervical neck extension, and increased vertebrobasilar insufficiency with extension
- Reduced mouth opening
- Difficult mask fit in edentulous patients
- Cardiac effects during laryngoscopy may be less well tolerated
- Probable exaggerated increase in norepinephrine in response to intubation
- Loss of protective reflexes (increased passive aspiration)
- Presence of end-stage diseases such as rheumatoid arthritis

Aging and Cardiovascular Function

Cardiovascular effects of aging

Decreased arterial elasticity • Elevated afterload • Elevated systolic blood pressure • Left ventricular hypertrophy	• Atherosclerosis • Coronary artery disease • Hypertension • Congestive heart failure • Cardiac arrhythmias • Aortic stenosis
Decreased arterial elasticity • Decreased heart rate • Decreased baroreceptor reflex	

Aging and Cardiovascular Function

- "Physiologic beta blockade"
  - HR decreases 1 bpm over age of 50 years
- Diastolic dysfunction
  - LVH, ⇓ elasticity → dependant on atrial kick
- Fibrolysis in conduction and loss of SA cells
  - Dysrhythmias (SSS, hemiblocks, Premature beats)

Aging and Cardiovascular Function

- Decreased reserves
  - → exaggerated ⇓ BP on induction
- Prolonged circ times
  - WAIT before re-dosing!
- Silent MI is more common in elderly
- PVD is prognostic indicator for CAD

Aging and the Nervous System

- ⇓ brain size (18% by 80 years compared to 30 years)
- Physiologic β-antagonism
  - ⇑ catecholamines but ⇓HR & lower max HR response to stress
    - ⇓ chronotropy & inotropy to β-agonist (exogen) may be d/t ⇓ receptors, abnormal receptor affinity
    - Higher neo doses required
    - Impaired ability to maintain hemodynamic stability

Aging and Hepatic Clearance

- ⇓ Liver mass (40% decrease by 80 years)
- ⇓ Hepatic blood flow
  - Decrease in drugs with flow dependent metabolism

Aging and Renal Function

- 30% loss of renal mass by 70 years
- 50% loss of glomeruli by 80 years
- ⇓ max absorption of glucose
- ⇓ RBF (10% per adult decade)
- ⇓ GFR
  - Functional hypoaldosteronism, ⇓K+ stores
- ⇓ response to ADH
  - Poorly able to concentrate urine
- ⇓ Creatinine clearance

Aging and Cr Cl

- 1%/year after 40 years
  - ⇓ 40% by 80 yrs despite normal serum cr

Aging and Renal Function

- Fluid and electrolyte imbalances
- RBF is further compromised by
  - CHF, dehydration
    - Increased risk for ARF/renal ischemia
    - 1/5 anesth deaths in elderly r/t ARF
- Careful volume and electrolyte balance

Aging and Immune Function

- ⇓ B and T-Cell activity
- ⇓ IgE titers

- Increased risk of
  - pneumonia
  - sepsis
  - meningitis

Septicemia is #2 cause for M&M in elderly trauma!

Aging and Temperature Regulation

- ⇓ Basal metabolism
- ⇓ lean mass
- ⇓ SQ fat
- ⇓ reflex cutaneous vasoconstriction

Co-existing disease

- Reduced functional reserve in systems
- Chronic disease (HTN, Diabetes, HD, Cancer)
- Dementia
- Parkinson's disease
- Polypharmacy (8/day)
- Malnutrition and dehydration
- Frequent falls

Pain

- By 65 y/o, 80-85% of individuals experience significant health problem that predisposes them to pain
- However the normal effects of aging on pharmacokinetics and pharmacodynamic can lead to sensitivity to opioids

Start Low and go slow

Common Problems in PACU

- Pain (multiple analgesia modalities, NSAIDs, opioids)
- Cognitive dysfunction (short term changes in cognition resolve in < 3 months)

Why are more geriatrics having surgery ?

- Increased life expectancy and more of the population
- Less invasive surgical procedures
- Safer anesthesia
- Better technology

Post op delirium

Risk factors for postoperative delirium

Predisposing Factors	Precipitating Factors
Age (>65 y)	Intraoperative
Neuropsychiatric conditions	• Blood loss/blood transfusion
• Cognitive dysfunction	• Surgery duration
• Dementia	• Surgical urgency
• Depression	• Surgical complexity
• Alcohol abuse	• Invasiveness of procedure
• History of postoperative delirium	• Depth of anesthesia
• History of stroke	Postoperative
Use of psychotropic medications	• Admission to an ICU
Poor physical status	• Increased hospital/ICU length of stay
Medical comorbidities	• Increased duration of intubation/mechanical ventilation
• Heart failure	• Postoperative complications
• Kidney failure	◦ Infection, stroke
• Diabetes mellitus	• Use of physical restraints
• Atrial fibrillation	• Sleep disruption
• Anemia	• Pain
• Atherosclerosis	• Psychotropic medication use
• Tobacco use	

Schenning K & Deiner, S. (2015) **Postoperative Delirium in the Geriatric Patient** Anesthesiology Clinics 33(3)

Detection of Delirium

Table 2.
Validated delirium screening instruments

Tool	Sensitivity (%)	Specificity (%)	Criteria
CAM[18]	94–100	90–95	9 criteria from DSM-III-R: acute onset and fluctuating course, inattention, disorganized thinking, altered level of consciousness, disorientation, memory impairment, perceptual disturbances, increased or decreased psychomotor activity, sleep-wake cycle disturbance
CAM for the Intensive Care Unit (CAM-ICU)[20]	95–100	89–93	4 items: acute onset or fluctuating course, inattention, disorganized thinking, altered level of consciousness
Delirium Symptom Interview[19]	90	80	7 criteria from DSM-III: disorientation, consciousness, sleep-wake cycle, perceptual disturbance, speech, psychomotor activity, fluctuating behavior
Nursing Delirium Screening Scale[21]	85.7	86.8	5 items: disorientation, behavior, communication, hallucinations, psychomotor retardation
Intensive Care Delirium Screening Checklist[22]	99	64	8 items: altered level of consciousness, inattention, disorientation, psychosis, psychomotor agitation/retardation, inappropriate speech/mood, sleep/wake cycle, symptom fluctuation
Neelon and Champagne Confusion Scale[23]	95	78	9 items in the following 3 domains: processing, behavior, physiologic control

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Improving surgical outcomes for older adults with adoption of technological advances in comprehensive geriatric assessment

Sydney F Tan MD, Benjamin Cher MD, Julia R Berian MD, MS

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https://doi.org/10.1016/j.scrs.2024.101060

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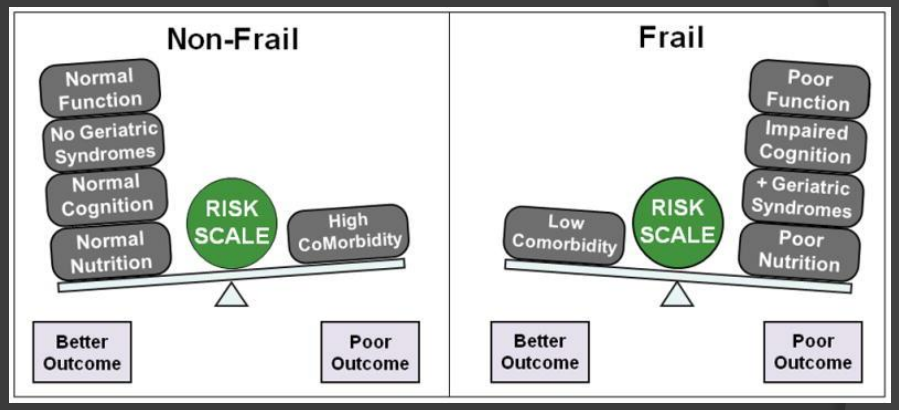
Frailty

- Broadly defined - decreased strength, reduced endurance, and decreased physiologic function
  - disability
  - functional deficits
  - multi - morbidity
  - advanced age
  - poor nutritional status
  - polypharmacy
  - cognitive impairment
  - mood disorders

- In multiple studies using frailty
  - useful pre-operative predictor of post-operative complications among patients with cancer beyond traditional risk scoring systems
  - possible predictor for postoperative morbidity
  - predict overall chemotherapy tolerance.
- Frail adults are more likely than non-frail adults to have surgical complications following elective surgery
- Increased risk of 30-day post-operative complications in frail adults
- Oncology patients, frailty > 65 is estimated at 42 % and pre-frailty is 32 %

Measuring frailty

- Multiple validated frailty measurement tools are available
- Weight loss, grip strength, self-reported exhaustion, walking speed, and activity level
- Most include a diagnosis of cancer as a positive correlation



Am J Surg. 2013 Oct; 206(4): 544–550.

Preoperative Exercise Fitness

- Cardiorespiratory fitness is reduced by 10% per decade of life
- > 50% of all cancer diagnoses and 71% of cancer deaths are in patients older than 65 years
- Cancer patients have markedly reduced cardiorespiratory fitness
  - Impacts acute and late-occurring cancer-related toxic effects , clinical outcome and may shorten survival Surgical procedures are associated with
  - functional limitations
  - prolonged periods of decreased or inactivity
  - deconditioning
  - pain
- Preoperative cardiopulmonary exercise testing might be useful to tailor pre-operative interventions or predict risk
- ** though limited prospective research published

A BIS Monitor is :

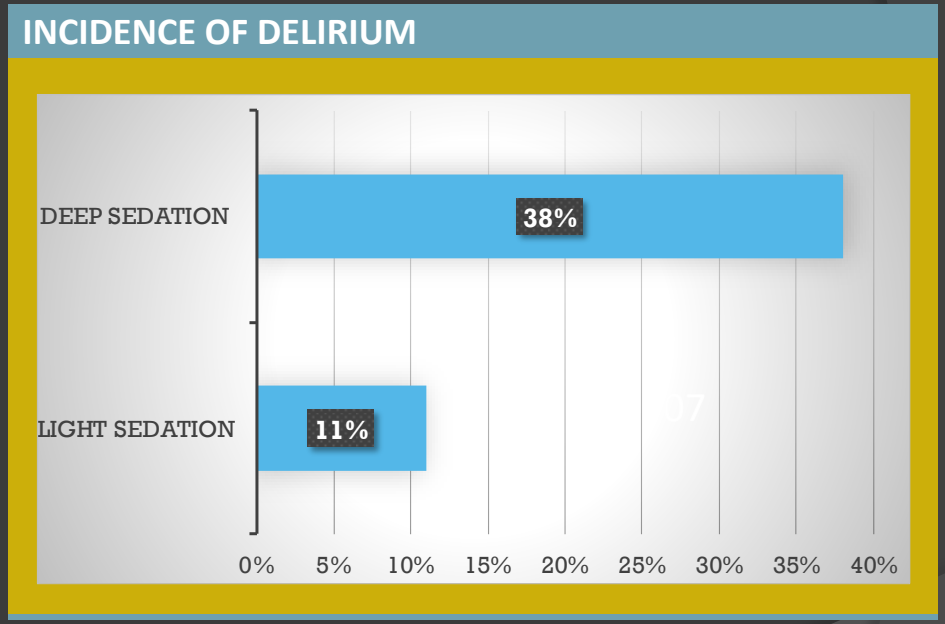
1. Taking up space in my OR
2. A required piece of equipment – hard stop
3. A useful tool in specific cases
4. None of the above

Cognitive Dysfunction

- Strong association between increasing age, a cancer diagnosis, and the need for surgical intervention
- Post-operative delirium (POD) occurs up to 50% of all surgical cancer patients
  - older patients at risk
- Prevention is most effective strategy
  - Up 30 – 40 % of cases are preventable
- Delirium
  - strongly associated with poor surgical outcomes
  - post-operative delirium (POD) is associated with a 2- to 5 X increased risk of major post-operative complications, including an increased risk of death

Sedation Depth and the Development of Postoperative Delirium

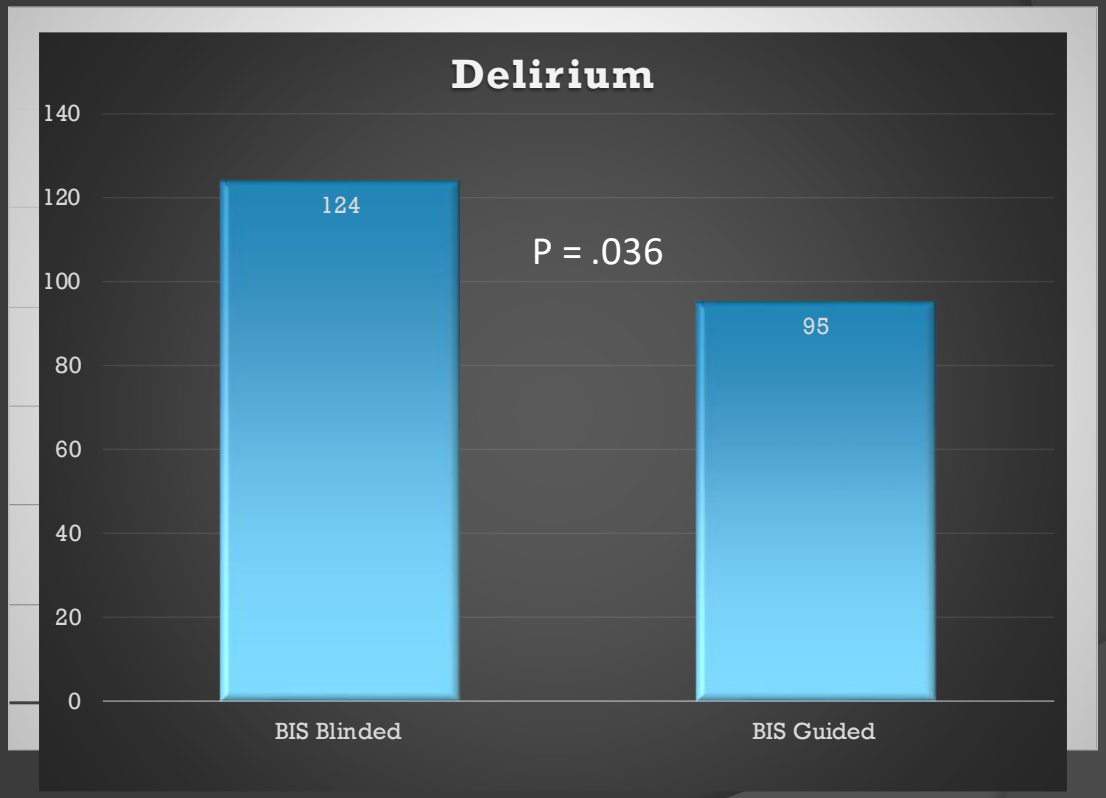
- Prospective, randomized trial ≥65 y/o for total hip arthroplasty receiving general anesthesia
  - w/o lumbosacral plexus block
  - With plexus block and light anesthesia
  - With plexus block and deep anesthesia
- 198 patients (66 per group)
- Protocol
  - Ropivacaine administered for plexus blocking
  - Propofol titrated to deep (BIS™ value 40 - 60) or light (BIS™ value 60 - 80)
- Assessed for delirium and POCD with CAM and MMSE POD 1 → 3



- Mei B et al. Peripheral Nerve Block as a Supplement to Light or Deep General Anesthesia in Elderly Patients Receiving Total Hip Arthroplasty A Prospective Randomized Study. Clin J Pain 2017;33:1053–1059.

Monitoring Depth of Anesthesia Decreases the Rate of Postoperative Delirium

- 1155 pts ≥60 years old having surgeries of at least 60 minutes
- Neurologically and cognitively intact
- Routine care (blinded to BIS™ value) vs BIS™-guided value (Target BIS™ value 40-60)
- POCD screening at 7 days and 3 months
- Delirium screening AM and PM for first 7 days of hospital stay



- Radtke FM et al. Monitoring depth of anaesthesia in a randomized trial decreases the rate of postoperative delirium but not postoperative cognitive dysfunction. British Journal of Anaesthesia. 2012; 110 (S1): i98–i105.

BIS™-Guided Anesthesia ↓ Postoperative Delirium and Cognitive Decline

- 921 patients undergoing major non-cardiac surgery
- Randomized into BIS™ guided (n=462) vs non-BIS™ guided (n=459) anesthesia
- BIS™ guided range value: 40-60
- Neuropsychology battery of tests baseline, 1 week & 3 months after surgery

When BIS™ kept between 40 – 60

- **↓ Propofol delivery by 21%**
- **↓ Volatile agent by 30%**
- **↓ Risk of postoperative delirium during initial hospitalization by 35%**
- **↓ Risk of POCD at 3 months after surgery by 31%**

Chan MTV, et al. BIS-guided Anesthesia Decreases Postoperative Delirium and Cognitive Decline. J Neurosurg Anesthesiol 2013;25:33–4240.

	BIS	Standard Care	p
Delirium	15.6 % (70/450)	24.1 % (109/452)	.01*
1 week	21.7 % (83/382)	23.1 % (93/401)	.06
3 months	10.2 % (42/412)	14.7 % (62/423)	.02 *

Conclusions

For every 1000 elderly patients undergoing major surgery, anesthetic delivery titrated to a range of BIS™ value between 40 and 60 would prevent 23 patients from POCD and 83 patients from delirium.

Chan, M et.a l. (2013) BIS-guided Anesthesia Decreases Postoperative Delirium and Cognitive Decline *Journal of Neurosurgical Anesthesiology* 25 (1)

Cognitive Dysfunction

Treatment

- Non-pharmacologic
  - Screening
  - Reduce sleep disruption
  - Optimizing care environments
  - Addressing hydration, oxygenation, analgesia and polypharmacy
- Pharmacologic
  - Melatonin
  - Dexmedetomidine
  - Antipsychotics (+/-)
  - Cholinesterase inhibitors (-)

Major Risk Factors	Other Risk Factors
Pre-existing cognitive impairment	Older Age
Severity of Illness	Increased number of comorbidities
Visual Impairment	Increased functional dependency
Dehydration	History of falls in the last 6 months
	Pre and post surgical pain
	Increased White Matter Pathology

Return to baseline

- Functional outcomes following abdominal surgery of elderly patients (> 65 years of age)
  - 3 - months pre-operative levels of activities of daily living
  - 6 - months for independent activities of daily living
- Elderly cancer patients - may be double the length of time to return to baseline

Current debates

BMC Geriatrics

BMC

BMC Geriatr. 2025 Jul 5;25:493. doi: 10.1186/s12877-025-06096-0

Risk of dementia in older patients with different anesthesia: a systematic review and meta-analysis of cohort studies

Xixi Yang [1,#], Yan Wang [1], Fang Qian [2], lili lu [3], DongJun Bi [3,4,✉], Tao-Hsin Tung [5,✉]

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PMCID: PMC12228410 PMID: 40618084

Abstract

Background

news release | Minnesota news release

The answer is YES – give a little less

Future Directions

- Same day surgeries
- Advanced technologies (laparoscopy, robotic, cerebral oximetry)
- Geriatricians with multidisciplinary care teams *
- Cost- containment
- ERAS
- Wearables pre and post to help guide quality of recovery

Cerebral Oximetry

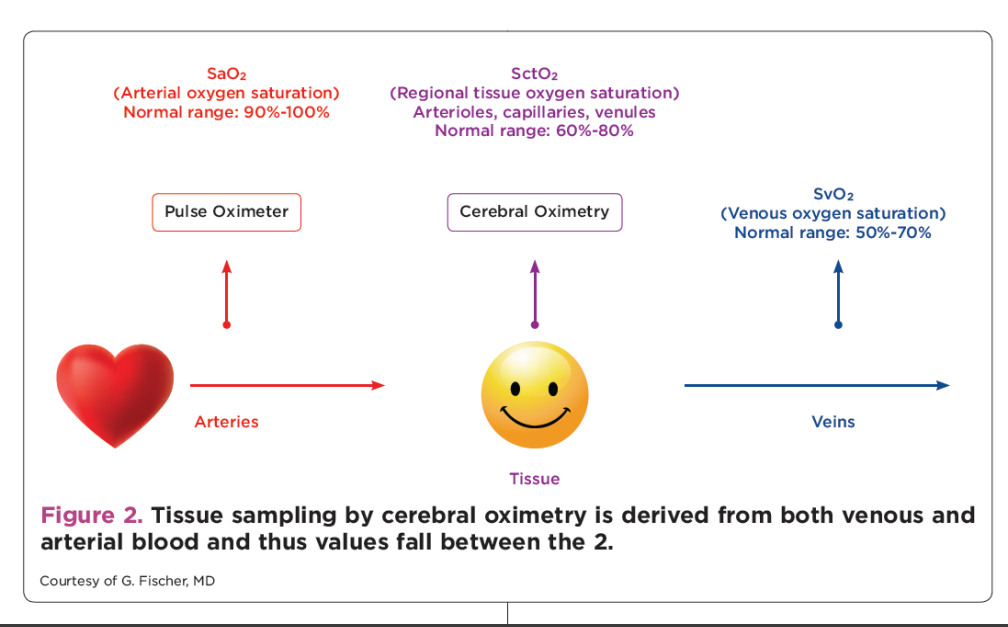

Figure 2. Tissue sampling by cerebral oximetry is derived from both venous and arterial blood and thus values fall between the 2.

Courtesy of G. Fischer, MD

Fischer, G (2008) **Recent Advances in Application of Cerebral Oximetry in Adult Cardiovascular Surgery.** *Seminars in Cardiothoracic & Vascular Anesthesia* (E-pub ahead of print)

Lee A ey. Al (2012) **Effect of Anesthetic Methods on Cerebral Oxygen Saturation in Elderly Surgical Patients: Prospective, Randomized, Observational Study.** *World Journal of Surgery* 36(10)

Pearls

- Pre-op comorbidities determines post-op complications more than anesthesia management
- Use shorter acting anesthetics & muscle relaxants
- ERP
- Appropriate consults
- Comprehensive management and post- op planning

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Post –polio syndrome & Anesthesia

SPECIAL POPULATIONS

Current US Incidence

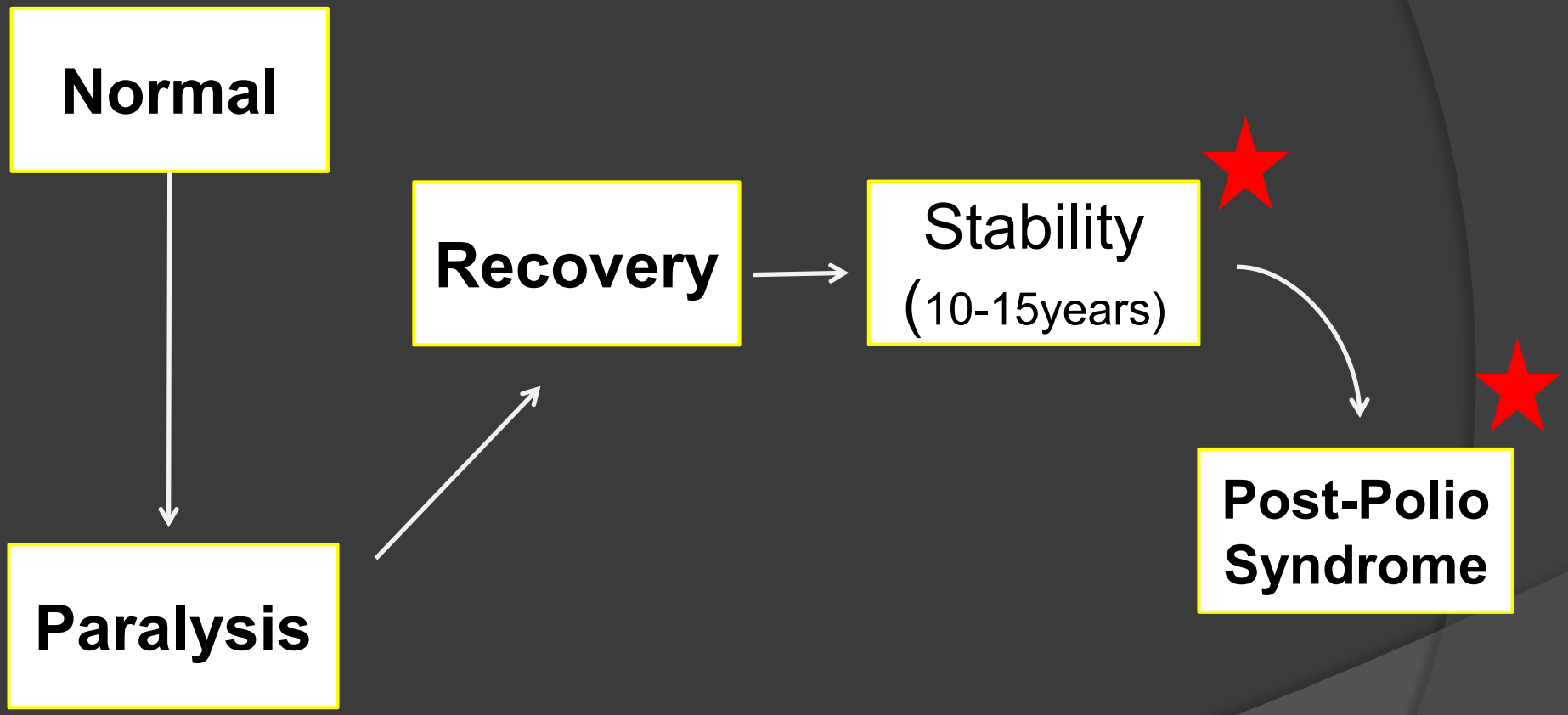
- 1987 National Health Interview Survey:
  - 1.63 – 1.8 Million American polio survivors
    - 58% Paralytic survivors
- Current estimates
  - Over 1 millions survivors
  - Actual unknown
    - More recent statistics are not available
    - Experts consider these estimates to be conservative
    - Stigma of polio during epidemics may have lead to underreporting of mild to moderate cases

Current Global Incidence

- ~ 20 *million* polio survivors world wide
- Still a risk to travelers who are going to certain countries

Afghanistan
Angola
Armenia
Azerbaijan
Bangladesh
Benin
Bhutan
Burkina Faso
Burundi
Cameroon
Central African Republic
Kenya
Kazakhstan
Kyrgyzstan
Liberia
Mali
Mauritania
Namibia
Nepal
Niger
Nigeria
Pakistan
Russia
Rwanda
Senegal
Sierra Leone
Somalia
Sudan
Tajikistan
Tanzania
Togo
Turkmenistan
Uzbekistan
Xinjiang Uyghur Autonomous Region of China
Uganda
Zambia

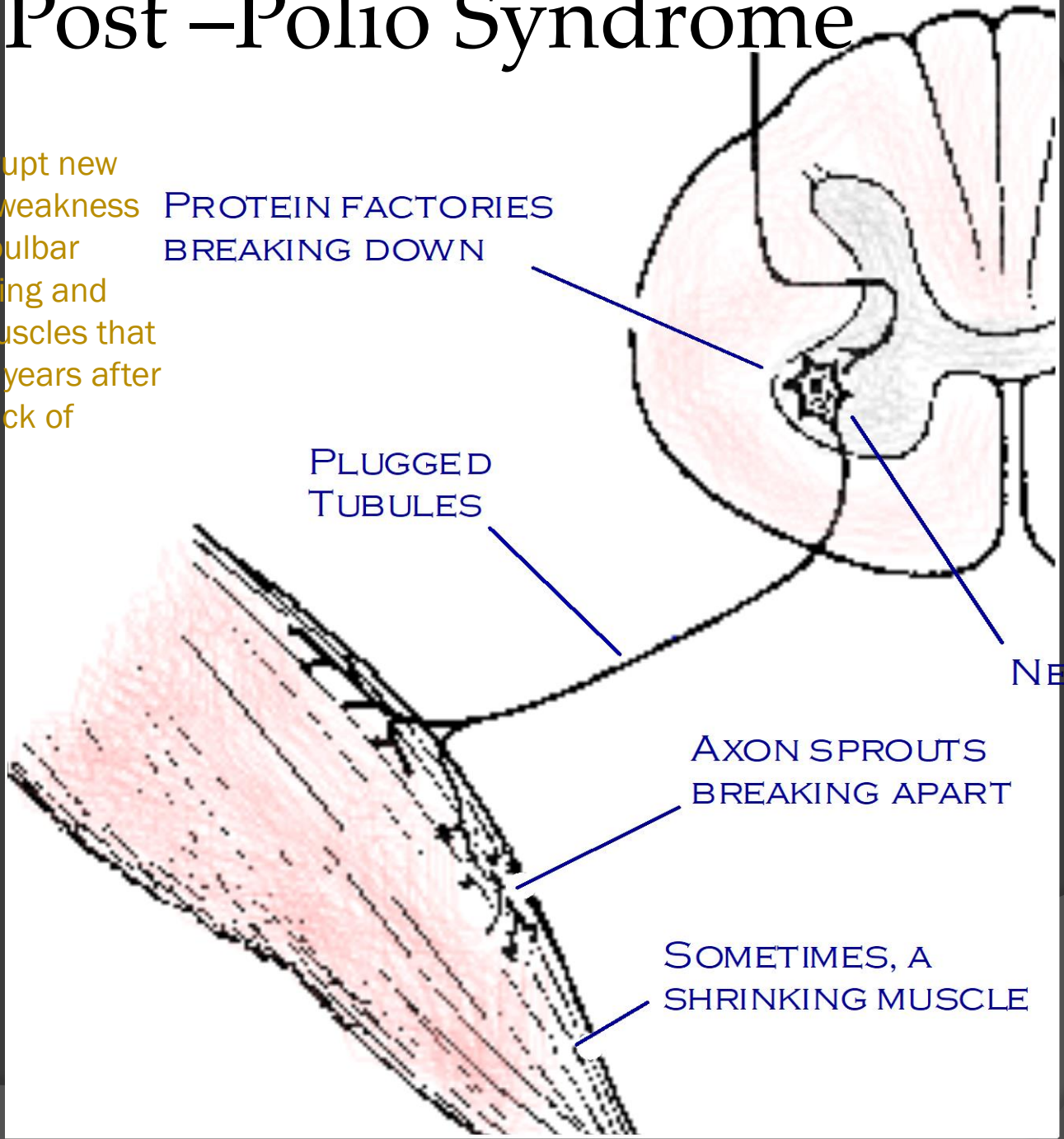
What is Post Polio Syndrome



Dalakas, 1995

Post –Polio Syndrome

Gradual or abrupt new onset muscle weakness in skeletal or bulbar (speech, chewing and swallowing) muscles that begin 30 - 40 years after and acute attack of poliomyelitis



PPS Prevalence

	Prevalence %	Years of Stability
Ahlström and Karlsson [7]	80	20–40
Aurlein et al. [8]	22 and 28.5	20–45
Bartfeld and Dong [9]	28.5	–
Dalakas [4]	–	25–30
Ivanyi et al. [11]	25–85 (60)	–
Johnson et al. [39]	78	–
Jubelt and Agre [10]	28.5–64	35 (8–71)
Julien et al. [47]	25–28	25–40
Kling et al. [38]	60–80	–
LeCompte [30]	25–40	40–50
NINDS [48]	25	10–40

Common symptoms

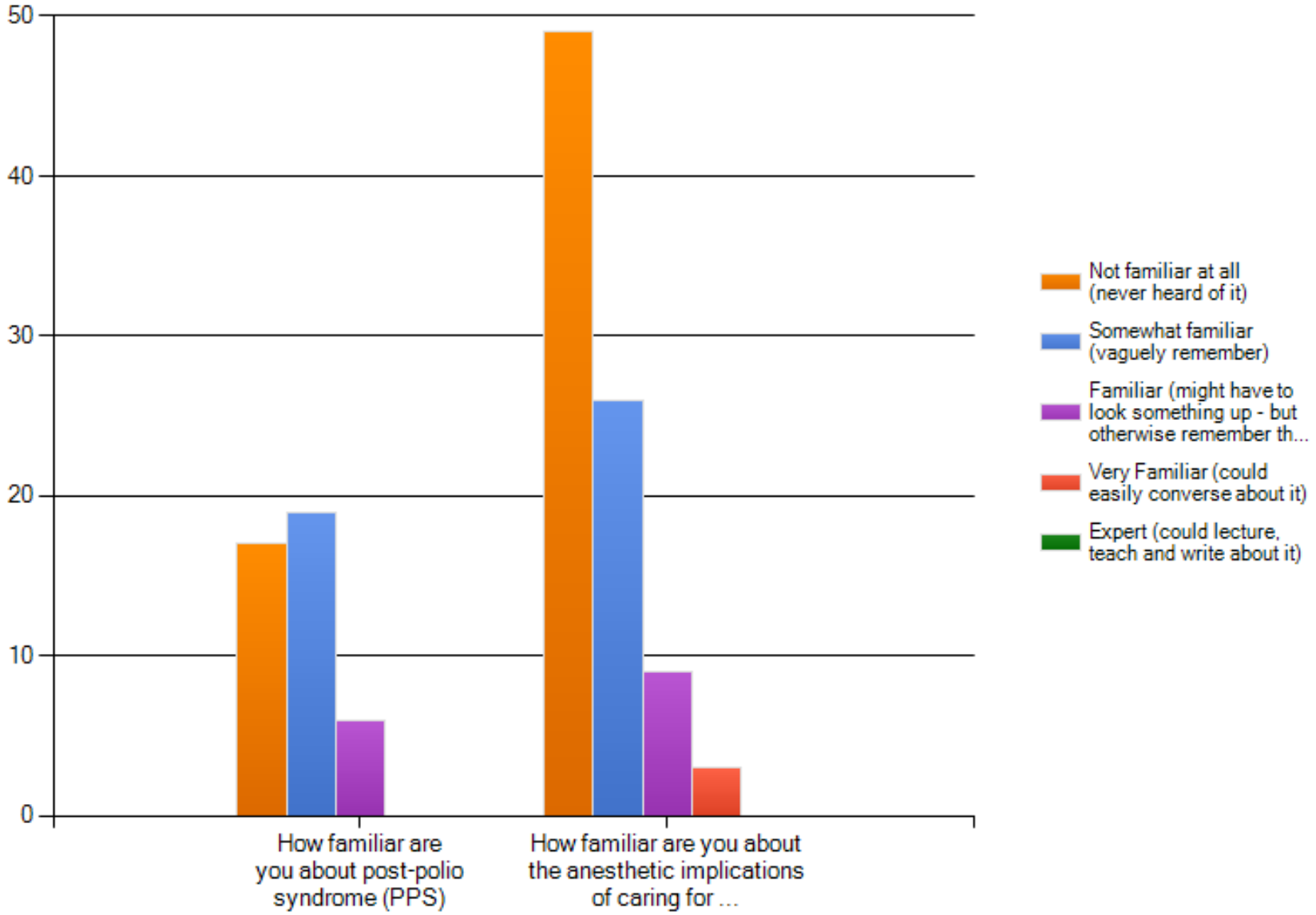
SYMPTOMS	PERCENT REPORTED ***
Fatigue	50 – 91%
Muscle Weakness	45 – 90 %
Muscle Pain	35 – 76 %
Joint Pain	75 %
Cold Intolerance	30 – 60 %
Sleep Related Breathing Disorders	10 – 50 %
Difficulty Swallowing	17 – 30 %
Compromised respiratory function	5 – 40 %

Ardizzone, Laura L. & Bruno, Richard (2010) “Polio Survivors and Anesthesia Complications: Implications for the Clinician” [Abstract] *AANA Journal* 2010;78(5):421-426. Poster presented AANA meeting 2010.

- Surveyed 130 providers
- 87 % response rate (n = 113)

WHO CARES AND AM I THE ONLY WHO DOESN’T KNOW ABOUT THIS ?

Please use the below scale to answer the the next two questions. Examples are included to help you identify your level of familiarity.



Why is the perioperative period so special ?

Triggers:

- **Physical Overexertion (92%)**
- **Cold Exposure (62%)**
- **Emotional Stress (45%)**

Sounds a lot like our patient on the day of surgery ???

Bruno & Frick, 1987

Fatigue/Weakness

- ✓ ID pre-op functional level
- ✓ Regional may be controversial
- ✓ Careful administration of NMB
- ✓ Pre-op teaching
  - Brochures/handouts
  - Written instructions

Cold Intolerance

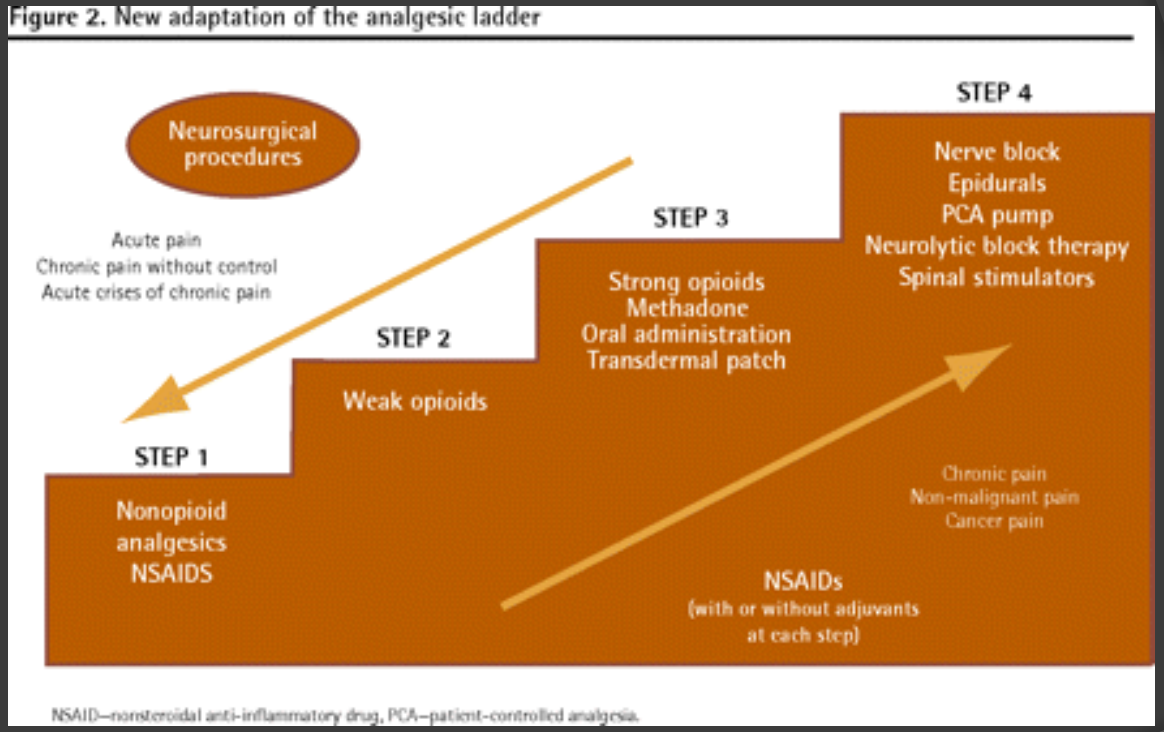
- ✓ Monitor temperature
- ✓ Multiple warming me
  - ✓ Room temperature
  - ✓ Fluid Warmer
  - ✓ Forced Air Warming Bl
  - ✓ Heat/Moisture Exchar

Respiratory Dysfunction

- ✓Up to 40 % of PPS
- ✓Conversation with patient ab
  ventilation
- ✓PFTs, pre-op ABG
- ✓Awake extubation
- ✓Encourage post-op pulmonar
- ✓Vigilant PACU monitoring
- ✓CPAP, BiPAP

Sensitivity to Pain

- ✓Multi-modal approach to post-op pain
- ✓Careful titration of opioids
- ✓Careful positioning
- ✓Consider Pain consult



Dysphagia

- Higher risk for aspiration
- Consider RSI
- Use of Succinylcholine is controversial
- Pre-op modified barium swallow exam or evaluation by a speech pathologist

Nausea & Vomiting

- ✓ Self-report
- ✓ Multimodal therapy
- ✓ Adequate hydration
- ✓ Adequate pain control

Summary PPS

- Preoperative
  - ✓ Careful ROS/PE
  - ✓ Utilize specialists
  - ✓ Careful review of respiratory system
  - ✓ Investigation of swallowing
- Perioperative
  - ✓ Regional controversy
  - ✓ Consider short acting NMB
  - ✓ Ensure complete reversal of anesthesia
- Postoperative
  - ✓ Only 2 case reports of death in post op period – related to – post op respiratory dysfunction and over-sedation
  - ✓ Consider not “fast tracking” patients to home or floor
  - ✓ Encourage coughing, deep breathing and incentive spirometry

Rule of “2”

- People with PPS usually need ½ the amount of medication
- People with PPS usually need 2 x longer to recover

* Good rule for all of geriatrics …..