The Evolution of Sedation in Dental Practice: From the Ridiculous to the Sublime

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Disclosures

- No financial disclosures
- Representing the American Society of Dentist Anesthesiologist's Institute for the Management of Pain and Anxiety
  - ASDA/IMPA

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Overview

Presented by the ASDA's Institute for the Management of Pain and Anxiety

Cutting-Edge Education for the Cutting-Edge Dental Professional

- A brief history of anesthesia in dentistry
- Impact of the *Guidelines* on dental practice
- Identifying potentially reactive patients prior to sedation
- Problems specific to our aging population
- Sedation considerations for the elderly

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History of Anesthesia and Evolution of Sedation in Dental Practice

"A New Era in Tooth Pulling"

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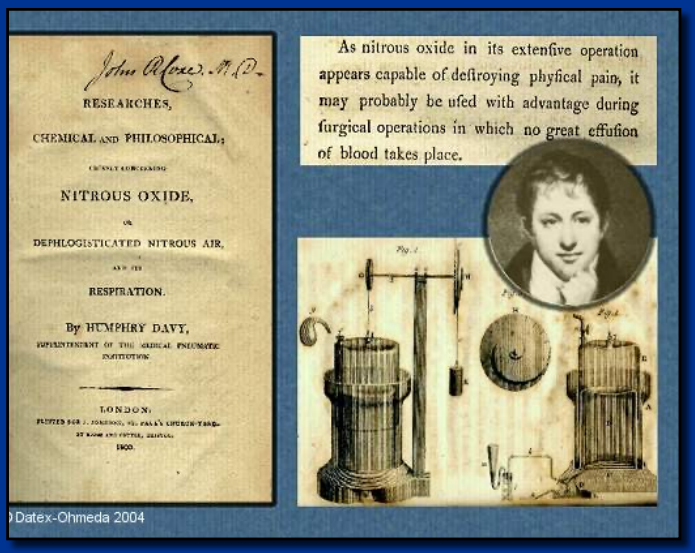
Sir Humphrey Davy

It All Began With Nitrous Oxide!



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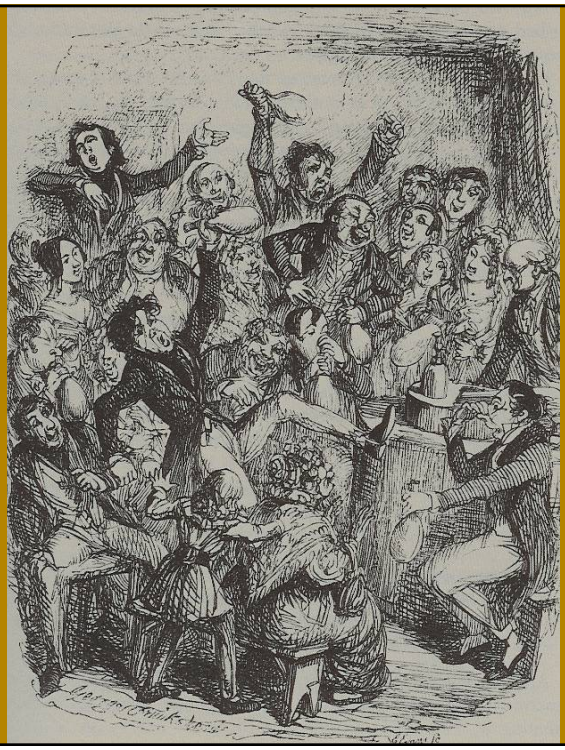
Nitrous Oxide "Frolics"

London, 1830's



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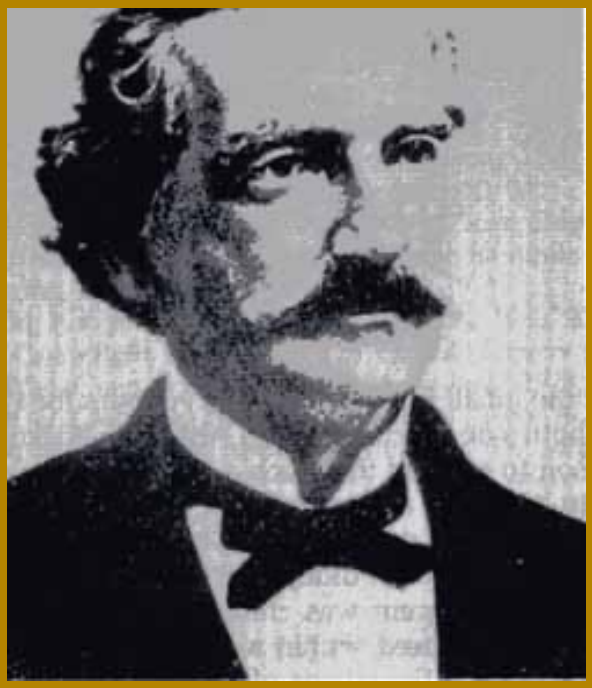
GARDNER QUINCY COLTON

Demonstrations of Nitrous Oxide for Public Entertainment



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A Grand Exhibition of the effects produced by inhaling Nitrous Oxid, Exhilarating or Laughing Gas! will be given at Union Hall, this (Tuesday) Evening, Dec. 10th, 1844. Forty Gallons of Gas will be prepared and administered to all in the audience who desire to inhale it. Twelve Young Men have volunteered to inhale the Gas, to commence the entertainment. The entertainment will close with a few of the most surprising Chemical Experiments. Entertainment to commence at 7 o'clock. Tickets 25 cents—for sale at the principal Bookstores and at the Door. Eight Strong Men are engaged to occupy the front seats, to protect those under the influence of the Gas from injuring themselves or others. This course is adopted that no apprehension of danger may be entertained. Probably no one will attempt to fight. The effect of the Gas is to make those who inhale it either Laugh, Sing, Dance, Speak, or Fight, and so forth, according to the leading trait of their character. They seem to retain consciousness enough not to say or do that which they would have occasion to regret. The Gas will be administered only to gentlemen of the first respectability. The object is to make the entertainment in every respect a genteel affair.

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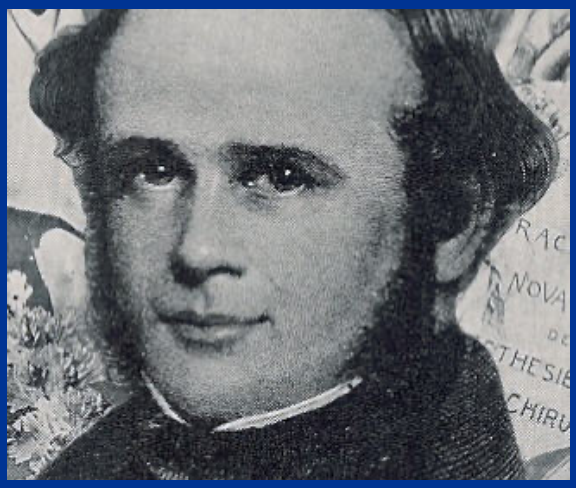
HORACE WELLS

- The Discoverer of Anesthesia



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December 10, 1844

" At length Sam Cooley took the gas and proved to be an interesting subject. He careened about the stage in an extraordinary manner when suddenly he espied in the audience an imaginary enemy and sprung over the ropes and after him. The innocent spectator, frightened out of his seven wits, summarily abandoned his seat and fled, running like a deer around the hall with Cooley in hot pursuit, the audience on its feet applauding in delight. The terrified victim finally dodged, vaulted over a settee and rushed down an aisle, Cooley a close second. Half way to the front the pursuer came to himself, looked about foolishly, and amid shouts of laughter and applause slid into his seat near to Dr. [Horace] Wells. Presently he was seen to roll up his trousers and gaze in a puzzled sort of way at an excoriated and bloody leg..."

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"A New Era in Tooth Pulling"

"I didn't feel as much as a pinprick"

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Dr. John Riggs

"Wells and I had a . . . conference that night & determination to try the gas on Wells the next morning. Wells went to the Hall & asked Colton to let him have a bag of gas as he wanted to take it and have a tooth pulled--& he invited the party, Colton, Cooley, and two others to come up and witness the operation. I was attending to a patient but was awaiting Wells' return. When I entered Wells' office, the said parties were there. Wells took his seat in the operating chair. I examined the tooth so as to be ready to operate without delay. Wells took the bag in his lap-held the tube to his mouth & inhaled till insensibility relaxed the muscles of his arms -his hands fell on his breast-his head dropped on the head-rest & I instantly, passed the forceps into the mouth onto the tooth and extracted it. Mr. Colton, Cooley and the two there stood by the open door ready to run out if Wells jumped up from the chair & made any hostile demonstrations. You may ask-Why did he not get up? Simply because he could not. Our agreement, the night previous was, to push the administration to a point hitherto unknown. We knew not whether death or success confronted us. It was terra incognito we were bound to explore-the result is known to the world. No one but Wells and myself knew to what point the inhalation was to be carried-the result was painfully problematical to us but the great law of Nature, hitherto unknown, was kind to us & a grand discovery was born into the world.

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THE DISCOVERER OF ANESTHESIA

☞ A dentist in Hartford, (Conn.) has adopted the use of nitrous oxide gas, in teeth pulling. It is said that after taking this gas the patient *feels no pain.*

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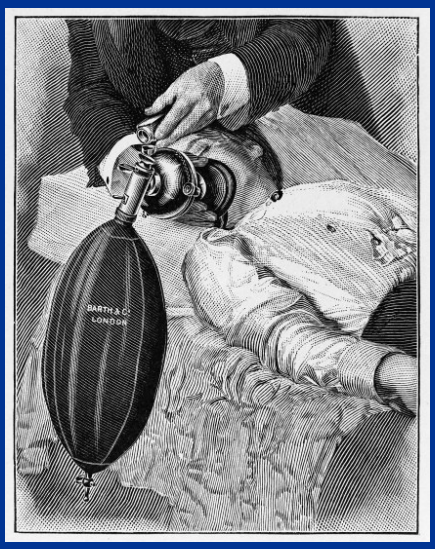
100% Technique

- Cyanosis means more working time



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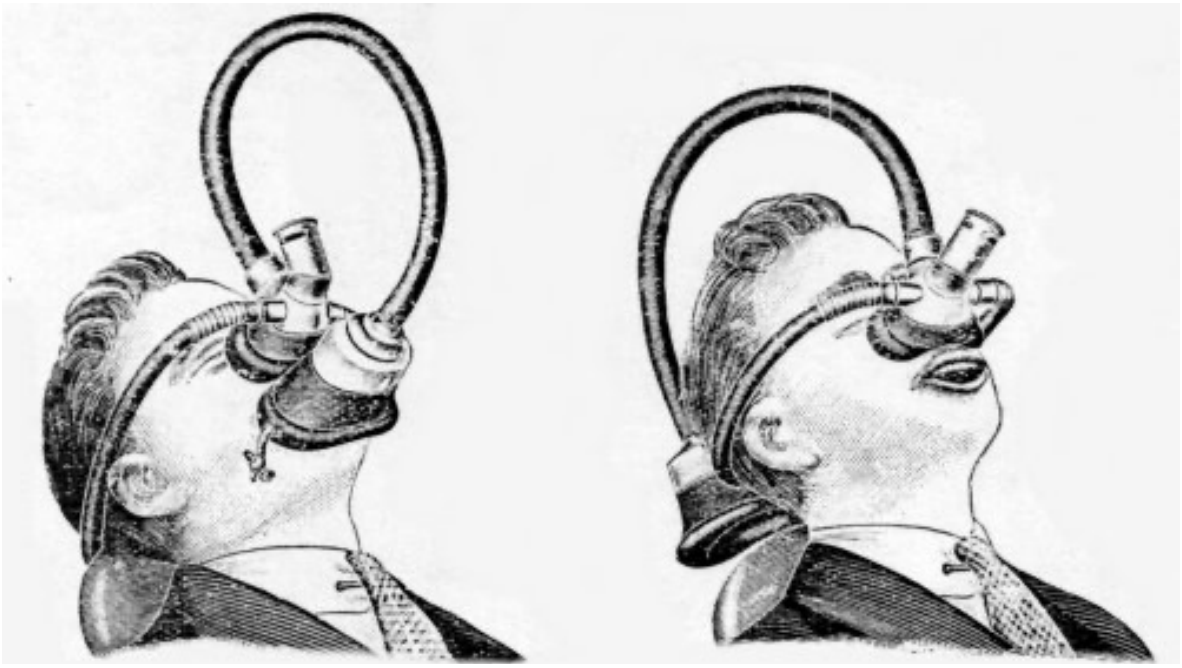

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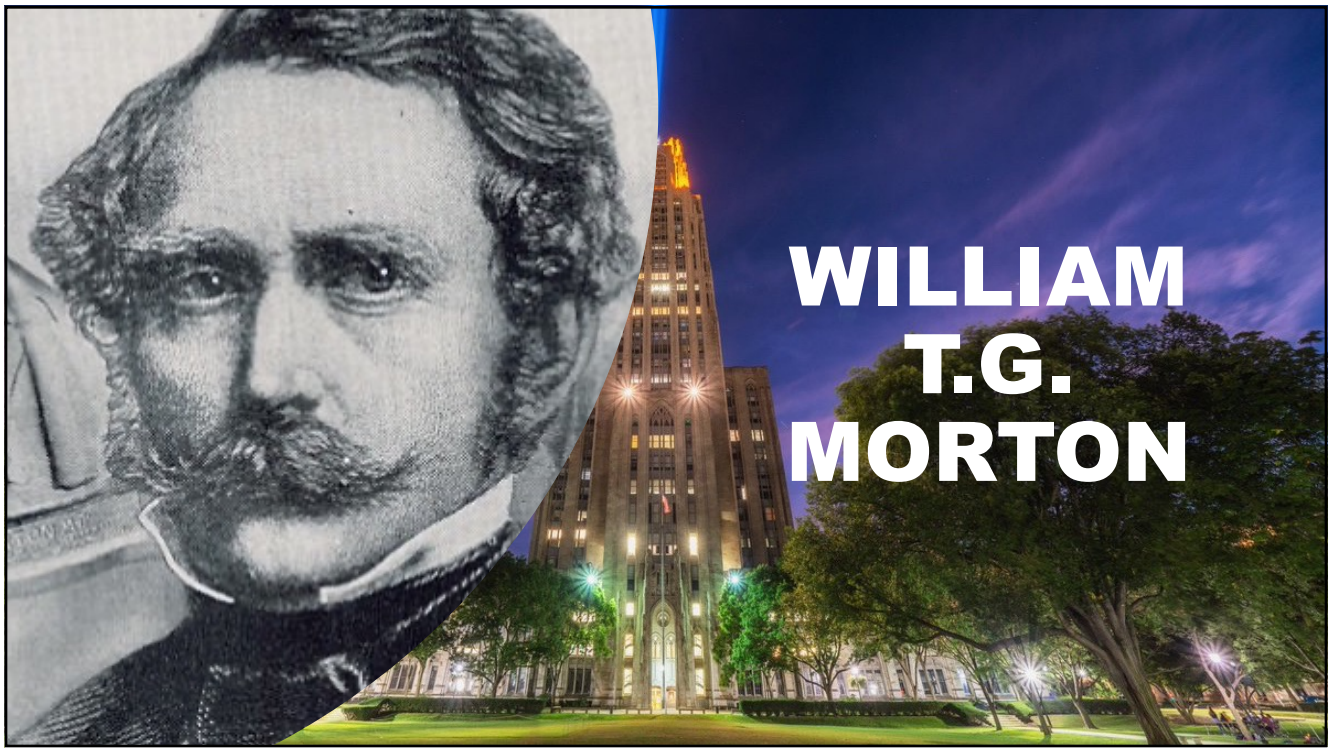

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Morton's Ether Inhaler

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Ether Day

October 16, 1846

"Gentlemen, this is no humbug!"

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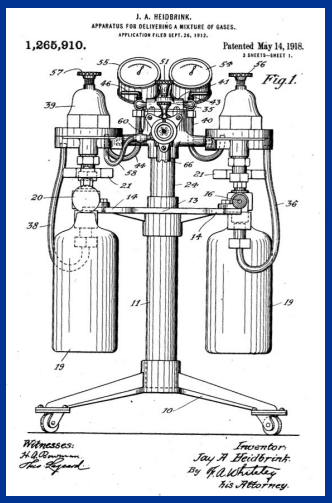
Dr. Jay A. Heidbrink

Developed the "Heidbrink Anesthetizer"

Invented the "pin index" system

Developed the carbon dioxide absorber

Introduced "reducing valves" into anesthesia machines



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Development of Intravenous Anesthesia

- Dr. Stanley L. Drummond- Jackson
- Edinburgh University Dental School, 1931
- Pioneered the use of intravenous barbiturates for dental surgery

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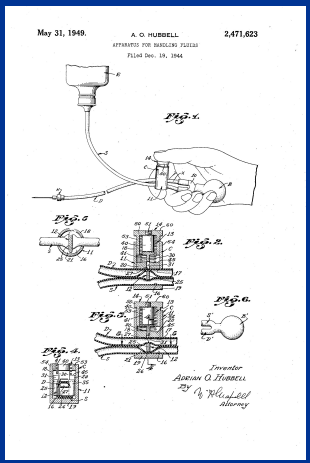
Development of Intravenous Anesthesia



- Dr. Adrian O. Hubbell
- University of Southern California School of Dentistry, 1937
- Adapted intravenous thiopental for oral surgery
- First infusion pump
  - Patented “Apparatus for Handling Fluids”
  - “Hubbell Bubble”

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Dr. Niels B. Jorgensen

Loma Linda University

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Dr. Leonard M. Monheim

University of Pittsburgh School of Dental Medicine

Began the dental anesthesiology and nurse anesthesia training programs

Classic texts on local and general anesthesia

"Sedalgesia"

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What Do We Call This?

- Intravenous analgesia
- Intravenous anesthesia
- Intravenous sedation
- Chemanesia
- Chemalgesia
- Sedalgesia
- Hypoesthesia
- Hypoalgesia
- Neuroleptanalgesia
- Sedoamnesia
- Lytic cocktail
- Twilight sleep

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Importance of Definitions

- Dr. Monheim suggested the term “sedalgesia”
  - Denoted a combination of sedation and local anesthesia
- Distinction between sedalgesia and anesthesia
  - Either the patients were conscious or they were not!
- Altering the patient’s mood while maintaining consciousness and protective reflexes was Dr. Monheim’s vision for the future of sedation in dentistry

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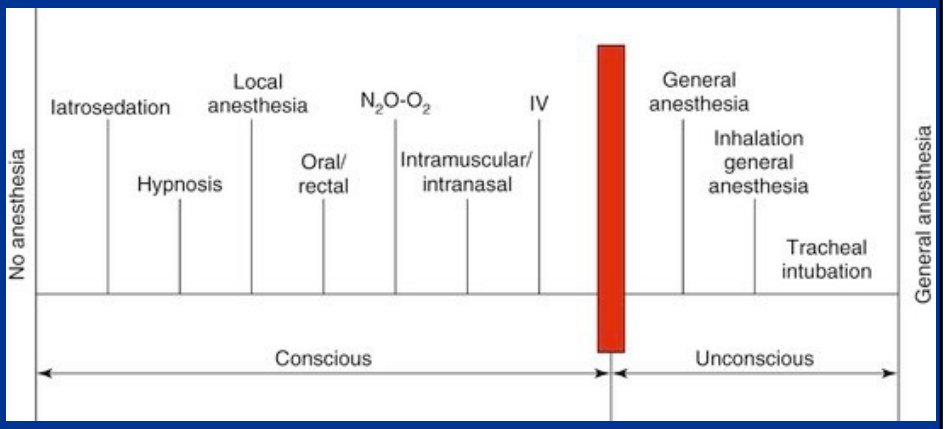
SPECTRUM OF PAIN CONTROL

Sedation continuum



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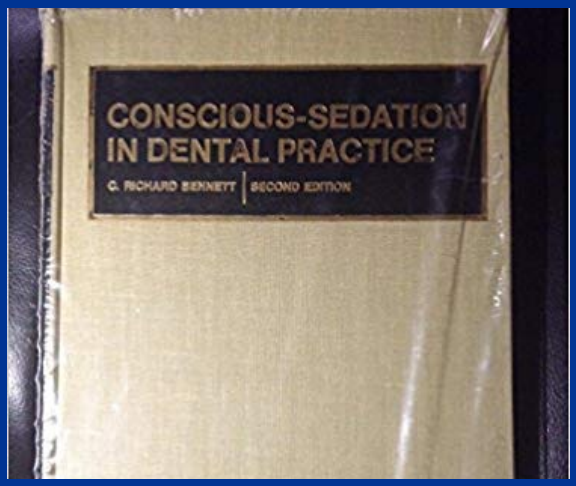
Dr. C. Richard Bennett

- Coined the term "conscious-sedation"
- Classic text, *Conscious Sedation in Dental Practice*



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Importance of Definitions and Terminology

Need to Standardize Terminology

Need for standardized descriptions of the changes that occur throughout the sedation continuum

Standard terminology is necessary for:

- Who should do it
- What training is required
- What drugs should be used
- What auxiliary personnel should be present
- State permit requirements
- Insurance reimbursement
- Accreditation standards
- Influence malpractice carrier standards

Conscious-sedation (Moderate Sedation) universally accepted terminology

- Definite distinction between consciousness and unconsciousness
- Alteration of mood while maintaining consciousness and protective reflexes

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Development of the ADA Guidelines

Establish Training and Practice Guidelines

Prior to first Guidelines there were no set educational requirements or practice parameters

- In some states a dental degree was sufficient to give general anesthesia

First Teaching and Use Guidelines established in 1971

- Standardized training requirements
- Standardized practice requirements

Dynamic document

- Revised 10 times (most recently in 2016)

Guidelines are disseminated to state dental boards

- Template for developing state anesthesia rules and regulations
- Help fulfill mandate to protect the public

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Development of the ADA Guidelines

Establish Training and Practice Guidelines

Why make changes?

- Improve safety and efficacy

Guidelines are scrutinized when morbidity and mortality occurs

Essential that *Guidelines* are current

- Update education and best practices using evidence-based criteria
- Reflect evolution of new medications and monitoring
- Incorporate knowledge gleaned from analysis of adverse outcomes

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Development of the 2016 ADA Guidelines

CDEL's Anesthesiology Committee

ADA Council on Dental Education and Licensure (CDEL) responsible for Guideline revisions

Anesthesiology committee is a subcommittee of CDEL

Composed of representatives from anesthesia-specific societies

- CDEL member, Chair
- American Society of Anesthesiologists
- American Dental Association
- American Academy of Periodontologists
- American Association of Oral and Maxillofacial Surgeons
- American Academy of Pediatric Dentists
- American Dental Society of Anesthesiology
- American Society of Dentist Anesthesiologists

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Development of the 2016 ADA Guidelines

Rationale for Revisions

- **Patient assessment**
  - Increasing medical complexity
- **Oral dosing beyond the MRD**
  - Dosing beyond the MRD is beyond minimal sedation
- **Route of administration vs. level of sedation**
  - Patient is in an identical state regardless of route of administration
  - Training requirements should be the same
- **Capnography for moderate sedation**
  - Early warning system for airway obstruction

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Development of the 2016 ADA Guidelines

Level of Sedation Vs. Route of Administration

- **2016 *Guidelines* make no distinction between route of administration to achieve a set level of sedation**
  - Previous *Guidelines* allowed for enteral moderate sedation and set separate training requirements
- **New *Guidelines* eliminate enteral moderate sedation terminology**
  - Moderate sedation is defined
  - Practitioner must manage the patient at that level regardless of how they got there
  - Training must be equivalent

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Development of the 2016 ADA Guidelines: Capnography

- For moderate sedation, the dentist must monitor ventilation and/or breathing by monitoring end-tidal CO2 unless precluded or invalidated by the nature of the patient, procedure or equipment. In addition, ventilation should be monitored by continual observation of qualitative signs, including auscultation of breath sounds with a precordial or pretracheal stethoscope.

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Impact of the Guidelines on Dental Practice

New Training Requirements

MINIMAL SEDATION

- Inhalation sedation
  - 14 hours
  - Clinical management
  - Demonstration of competency
- Enteral sedation
  - 16 hours
  - Clinical management
  - Demonstration of competency
- Combination enteral/inhalational sedation
  - Completion of both courses

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Impact of the Guidelines on Dental Practice

New Training Requirements

MODERATE SEDATION

- No distinction between enteral and parenteral sedation
- 60 hours of didactic instruction
- 20 individually managed cases
- Competency in venipuncture
- Competence in rescuing from deep level of sedation

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Impact of the Guidelines on Dental Practice

Increasing Medical Complexity

- 2016 *Guidelines* address medical complexity
  - Stresses evaluation of preoperative medical status
  - Implementation of ASA physical status classification
  - Consideration of airway assessment factors including BMI and obstructive sleep apnea

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Preoperative Anesthetic Evaluation

Everybody Ought to Treat a Stranger Right
—Blind Willie Johnson

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Overview

The preanesthetic evaluation identifies potentially reactive patients with the sole purpose of preventing, recognizing, and managing perioperative anesthetic urgencies and emergencies

- Components of a preanesthetic evaluation
- Cardiovascular system considerations
- Respiratory system considerations
- Diabetes considerations
- Neurological and developmental considerations

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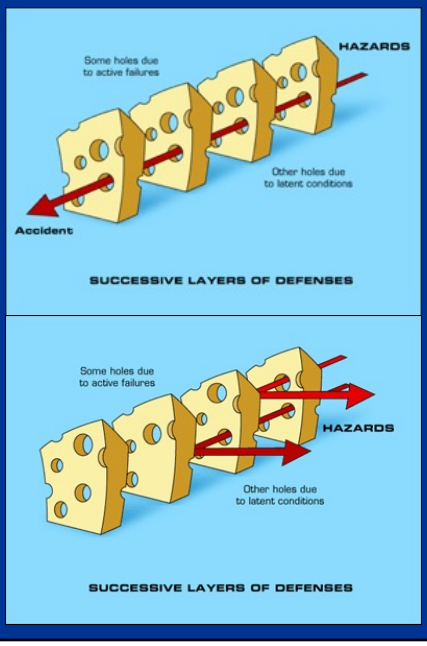
Components of a Preanesthetic Evaluation

- Medical history questionnaire
- Dialogue history
- Physical examination
  - Laboratory examination
- Medical consultation



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Past Medical History

- Systems review
- Medication history
- Allergies
- Previous surgical and anesthetic history
- Family history
- Social habits
- Pregnancy

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Medical History Questionnaire

- Complete annually
- Update on six-month intervals
  - Changes in health status
  - Current medical treatment
  - Current medications

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Dialogue History

- Diabetes

- Type?
- How controlled?
- Blood sugar levels?
- A1C?
- Hospitalization?

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Medications

- Medical status
- Purpose for taking the drug
- Recent prescription changes
- Compliance
- OTC, herbal products
- Drug classification
- Prescribed dose and schedule
- Side effects and adverse reactions
- Precautions w/dental care
- Drug interactions
- Treatment modifications indicated

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Addictive Habits

- Cigarette smoking
  - Cardiovascular, pulmonary systems
  - Hemostasis
- Alcohol
- Cocaine
- Psychotropic/illegal drugs

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Quantifying Anxiety and Fear: MDAS

- If you went o your dentist for TREATMENT TOMORROW, how would you feel?
  - Not anxious
  - Slightly anxious
  - Fairly anxious
  - Very anxious
  - Extremely anxious

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Quantifying Anxiety and Fear: MDAS

- If you were sitting in the WAITING ROOM (waiting for treatment), how would you feel?
  - Not anxious
  - Slightly anxious
  - Fairly anxious
  - Very anxious
  - Extremely anxious

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Quantifying Anxiety and Fear: MDAS

- If you were about to have a TOOTH DRILLED, how would you feel?
  - Not anxious
  - Slightly anxious
  - Fairly anxious
  - Very anxious
  - Extremely anxious

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Quantifying Anxiety and Fear: MDAS

- If you were about to have your TEETH SCALED AND POLISHED, how would you feel?
  - Not anxious
  - Slightly anxious
  - Fairly anxious
  - Very anxious
  - Extremely anxious

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Quantifying Anxiety and Fear: MDAS

- If you were about to have a LOCAL ANESTHETIC INJECTION in your gum, above an upper back tooth, how would you feel?
  - Not anxious
  - Slightly anxious
  - Fairly anxious
  - Very anxious
  - Extremely anxious

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Quantifying Anxiety and Fear: MDAS

- Not anxious
  - 1
- Slightly anxious
  - 2
- Fairly anxious
  - 3
- Very anxious
  - 4
- Extremely anxious
  - 5
- Total score
  - Range 5-25

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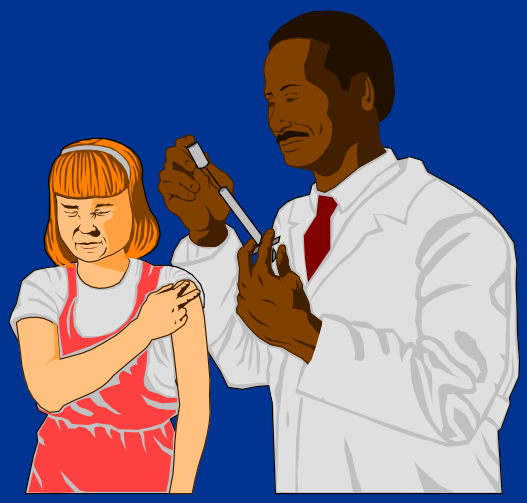
Physical Exam

- Visual inspection
- Exercise tolerance
- Heart and lungs
- Range of motion
- Nasal patency
- Dentition
- Tongue and neck size
- Vital signs



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Classification of Hypertension

	BLOOD PRESSURE (MM HG)	
CLASSIFICATION†	*SYSTOLIC*	*DIASTOLIC*
Normal	119 or lower	79 or lower
Prehypertension	120 to 139	80 to 89
Stage 1 hypertension	140 to 159	90 to 99
Stage 2 hypertension	160 or higher	100 or higher

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Medical Consultation

- Purpose of pretreatment evaluation is to assess the patient's current medical status, not to give medical clearance
  - Treatment to be rendered
  - Review of medical history
  - Request assessment of medical condition
- A physician can neither grant nor deny you the right to treat your patient in the manner you deem necessary
- Direct the consultant to address specific questions and issues
  - Stress test needed - delay treatment?
  - Anticoagulation - modify regimen?
  - Asthma management – pretreatment?

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Conditions Requiring Medical Consultation

Cardiovascular

- Unstable coronary syndromes (i.e. unstable angina)
- Severe heart failure (i.e. ankle edema, ascites, shortness of breath)
- Significant arrhythmias (i.e. atrial fibrillation, heart block)
- Severe valvular disease (i.e. audible murmur, decompensation with exertion)
- MI, bypass surgery, cardiac stenting within the past 6 months
- Stroke within the past 6 months
- Blood pressure > 160/100
- Pacemaker and/or implantable cardioverter/defibrillator
- History of prior subacute bacterial endocarditis
- Inability to walk up a flight of stairs with a bag of groceries (i.e. < 4 METS)

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Conditions Requiring Medical Consultation

Respiratory

- Significant COPD (i.e. chronic shortness of breath)
- Poorly controlled asthma (i.e. active wheezing or frequent use of rescue inhaler)
- Hemoptysis

CNS

- Uncontrolled or frequent seizures

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Conditions Requiring Medical Consultation

Metabolic/Endocrine

- Uncontrolled diabetes (i.e. blood glucose > 400, HbA1c > 10.5, history of hospitalizations or diabetic ketoacidosis)
- Clinically evident hyperthyroidism
- Pituitary disorders
- Adrenal suppression/insufficiency (i.e. Addison's disease)
- Morbid obesity (i.e. BMI >40)

Hepatic

- Cirrhosis
- Jaundice

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Conditions Requiring Medical Consultation

Renal	Renal failure
	Dialysis
GI	Bleeding within the past 6 months
Transplants	History of organ transplant

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Conditions Requiring Medical Consultation

Symptomatic Infectious Diseases	Hepatitis C
	TB
	HIV/AIDS
Allergy	Local anesthetics
Hematology	Bleeding disorders
	Sickle cell disease
	Thrombocytopenia
	INR > 3.0

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Contraindications to Dental Treatment

- Acute or recent MI
- Unstable or recent-onset angina
- Serious CHF
- Uncontrolled hypertension
- Uncontrolled dysrhythmia
- Uncontrolled diabetes
- Uncontrolled hyperthyroidism

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Assignment of Risk

ASA Risk Classification

ASA Class I

Healthy patient who is free of organic disease.

ASA Class II

Patient with mild systemic disease that does not limit activity

ASA Class III

Patient with severe systemic disease that limits activity, but is not incapacitating

ASA Class IV

Patient with an incapacitating systemic disease that is a constant threat to life

ASA Class V

Moribund patient not expected to survive 24 hours with or without surgery

ASA Class VI

Organ donor

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Preanesthetic Evaluation Note

- Age/Sex: 58 y.o. ♂ for full mouth extraction
- Past Medical History:Review of Systems
- Past Surgical and Anesthetic History:
- Past Family History:
- Allergies:
- Medications:
- Physical Exam:
  - Vital Signs
  - Height
  - Weight
  - BMI
  - Range of Motion
  - Dentition
  - Mallampati classification
  - Heart
  - Lungs
  - Labs
  - ASA classification
- Plan: GA, IV sedation, etc. Discussed anesthesia plan, risks explained, understood and accepted by patient (parent, guardian)

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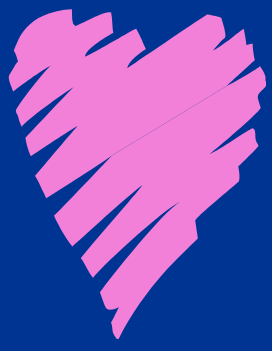
Cardiovascular System

- Coronary artery disease
- Hypertension
- Infarction
- Valve disease
- Dysrhythmia
- Heart failure



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Cardiovascular Stress Response

- Catecholamine release
- Increased cardiac output
- Increased myocardial oxygen demand
- Myocardial ischemia
- Acute congestive heart failure
- Cardiac dysrhythmias

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Cardiac Risk Index

Evaluation	Points
• History	
• Age > 70	5
• MI within 6 months	10
• Physical	
• 3rd heart sound/JVD	11
• Aortic stenosis	3
• EKG	
• Rhythm other than sinus or PAC	7
• > 5 PVC's / min	7

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Cardiac Risk Index

Evaluation	Points
• Poor general medical condition	3
• Surgical site	
• Intraperitoneal, aortic, intrathoracic	3
• Emergency	4

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Cardiac Risk Index

NYHA Classification	Points
• Unstable angina	10
• Class III	10
• Class IV	20

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Point Score vs. Risk

Points	Complications	Mortality
0-5	0.7%	0.2%
6-12	5%	2%
13-24	11%	2%
25	22%	56%

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Metabolic Equivalent (MET)

- 1 MET = 3.5 cc O2/kg/min
- Measure of exercise tolerance
  - Functional capacity
- Perioperative cardiac risk is increased in patients unable to meet a 4-MET demand during most daily activities

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Cardiac Functional Capacity

- Metabolic Equivalencies (METS)
- 1 - 4
  - Eating, dressing, walking about home, moderate housework
- 4 - 10
  - Stairs, walking briskly, light yard work, golf
- >10
  - Strenuous sports

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Questions to Ask With a Positive Cardiovascular History

- Chest pain?
- Shortness of breath?
- Dyspnea on exertion?
- Paroxysmal nocturnal dyspnea?
  - Wakes up at night with shortness of breath
- Orthopnea?
  - Needs extra pillows to improve breathing
- Recent hospitalization?
- Functional capacity?
  - MET level?
  - Change in exercise tolerance?
- If patient can perform at ≥ 4 METS and answers NO to these questions: Treatment may proceed

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CV Treatment Considerations

- Moderate sedation
  - Patient remains conscious
- Scheduling
- Chair position
- Local anesthetics
  - Smart injection
  - Vasoconstrictors
  - Beta blockers

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Respiratory Disease

- Asthma
- Chronic bronchitis
- Emphysema
- Obstructive sleep apnea

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Asthma

- Airway inflammation
- Airflow obstruction
- Intermittent symptoms
  - Wheezing
  - Chest tightness
  - Dyspnea
  - Cough
- Considerable variation in severity within and between individuals
- 3-5% of US population

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Chronic Bronchitis

- Clinical history of a productive cough
  - 3 months out of the year
  - 2 consecutive years
- Cigarette smoking is primary cause
  - 90%
- Inflammation of the airways
  - Mucosal thickening
  - Mucus hypersecretion
  - Diffuse obstruction with ventilation/perfusion mismatching
    - Hypoxemia

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Emphysema

- Abnormal permanent enlargement of the respiratory unit accompanied by destruction of the alveolar wall
- Loss of elastic tissue
  - Nonreversible
  - Loss of recoil support during expiration
  - Premature expiratory collapse (air-trapping)
  - Increased lung compliance
- Loss of alveolar surface area
  - Hypoxemia
- Loss of alveolar capillaries

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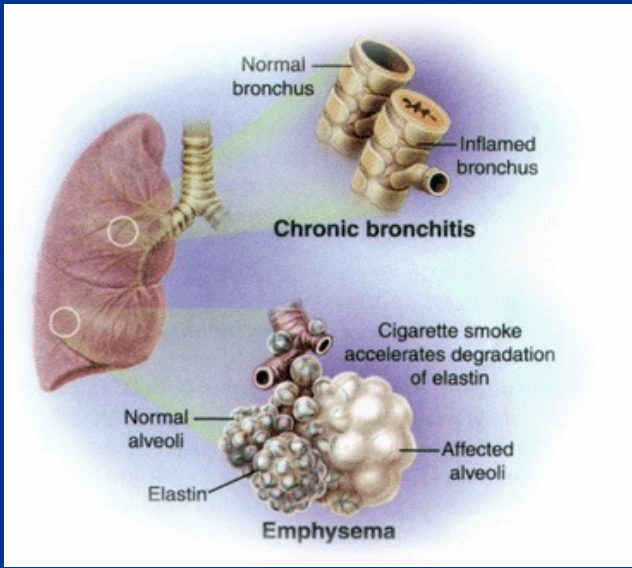
Obstructive Lung Disease



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COPD

- Approximately 24 million cases nationwide
- Third leading cause of death worldwide by 2020
- Incidence increases with age
- Smoking is primary cause
- Chronic inflammation and oxidative stress
  - Fibrosis, coalescence of alveoli, narrowing of small airways
  - Hypoxic pulmonary vasoconstriction and pulmonary hypertension

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Preoperative Assessment for COPD

- Identify risk factors
  - Smoking, aging, poor exercise tolerance
- Evaluate severity
  - Positive cough test
    - Deep breath and cough (followed by another cough)
  - > 40 pack-year history of smoking
  - Significantly impaired PFT's
- Medical optimization
  - EKG
  - Echocardiogram
  - Room air $SpO_2 \geq 92\%$
  - Smoking cessation

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Global Initiative for Chronic Obstructive Lung Disease (GOLD)

Measures respiratory impairment after bronchodilator treatment

GOLD 1 (Mild)	• $FEV_1 \geq 80\%$
GOLD 2 (Moderate)	• FEV_1 50%-80%
GOLD 3 (Severe)	• FEV_1 30%-50%
GOLD 4 (Very Severe)	• $FEV_1 < 30\%$

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Anesthetic Considerations in COPD

GOLD 1 and 2 patients in office

Minimal or moderate sedation

Supplemental oxygen

GOLD 3 and 4 patients

- Local anesthesia alone
- Hospital

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Obstructive Sleep Apnea

The New Normal

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Obesity and Obstructive Sleep Apnea

- Up to 90% of adult patients with OSA are obese
- OSA parallels the obesity epidemic
- Cessation of airflow for more than 10 seconds despite continuing ventilatory effort, 5 or more times per hour of sleep and a decrease of more than 4% in SpO2
- Sleepiness, nonrestorative sleep, fatigue, or insomnia symptoms
- Waking up with breath holding, gasping, or choking
- Habitual snoring, breathing interruptions, or both noted by a bed partner or other observer

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The New Normal

- Among middle-aged adults –
  - 4% of men & 2% of women
- Estimated that 80-95% are undiagnosed
- Testing increasing 124% every 3 years
- Diagnosis of OSA will increase 5 to 10-fold over next decade

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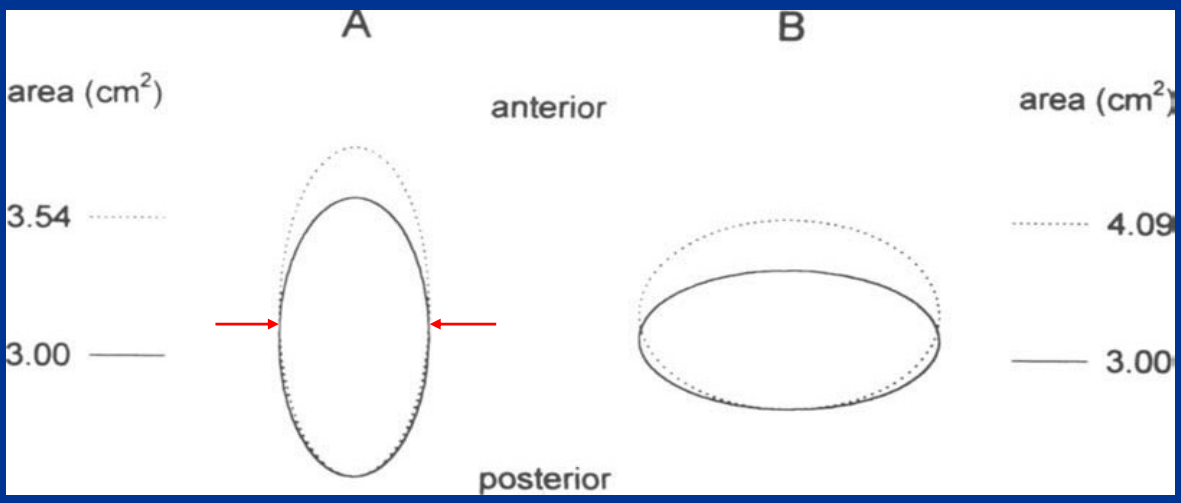

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STOP BANG (Screening for OSA)

S (snore)

- Have you been told that you snore?

T (tired)

- Are you often tired during the day?

O (obstruction)

- Do you know if you stop breathing or has anyone witnessed you stop breathing while you are asleep?

P (pressure)

- Do you have high blood pressure or on medication to control high blood pressure?

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STOP BANG (Screening for OSA)

B (BMI)

- Is your body mass index greater than 35?

A (age)

- Are you 50 years old or older?

N (neck)

- Are you a male with a neck circumference greater than 17 inches, or a female with a neck circumference greater than 16 inches?

G (gender)

- Are you a male?

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Snoring	Do you snore loudly (louder than talking or loud enough to be heard through closed doors)?	Yes No
Tiredness	Do you often feel tired, fatigued, or sleepy during the daytime?	Yes No
Observed apnea	Has anyone observed you stop breathing during your sleep?	Yes No
Pressure	Do you have or are you being treated for high blood pressure?	Yes No
BMI	BMI>35 kg/m2	Yes No
Age	>50 years	Yes No
Neck circumference	>40 cm	Yes No
Gender	male	Yes No
Fewer than 3 Yes = low risk of OSA; 3 or more Yes = high risk of OSA; 5-8 Yes = high probability of moderate-to-severe OSA		

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OSA Comorbidities

- **Hypertension**
  - Refractory hypertension is associated with OSA in 83% of patients
- **Stroke**
  - Chronic intermittent hypoxia is a key factor in vascular inflammation, atherosclerosis, and endothelial disease
  - Rise in sympathetic activity and blood pressure amplify the effect of inflammation
- **Atrial fibrillation**
  - Increased state of thrombosis, inflammation, and oxidative stress is pro-arrhythmogenic
- **Dementia**

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OSA Comorbidities

- **Pulmonary hypertension**
  - 15 – 70%
- **Heart failure**
  - OSA is the most common co-morbidity
  - 70%
- **Coronary artery disease**
  - 20– 25%
  - Major cardiac events more likely

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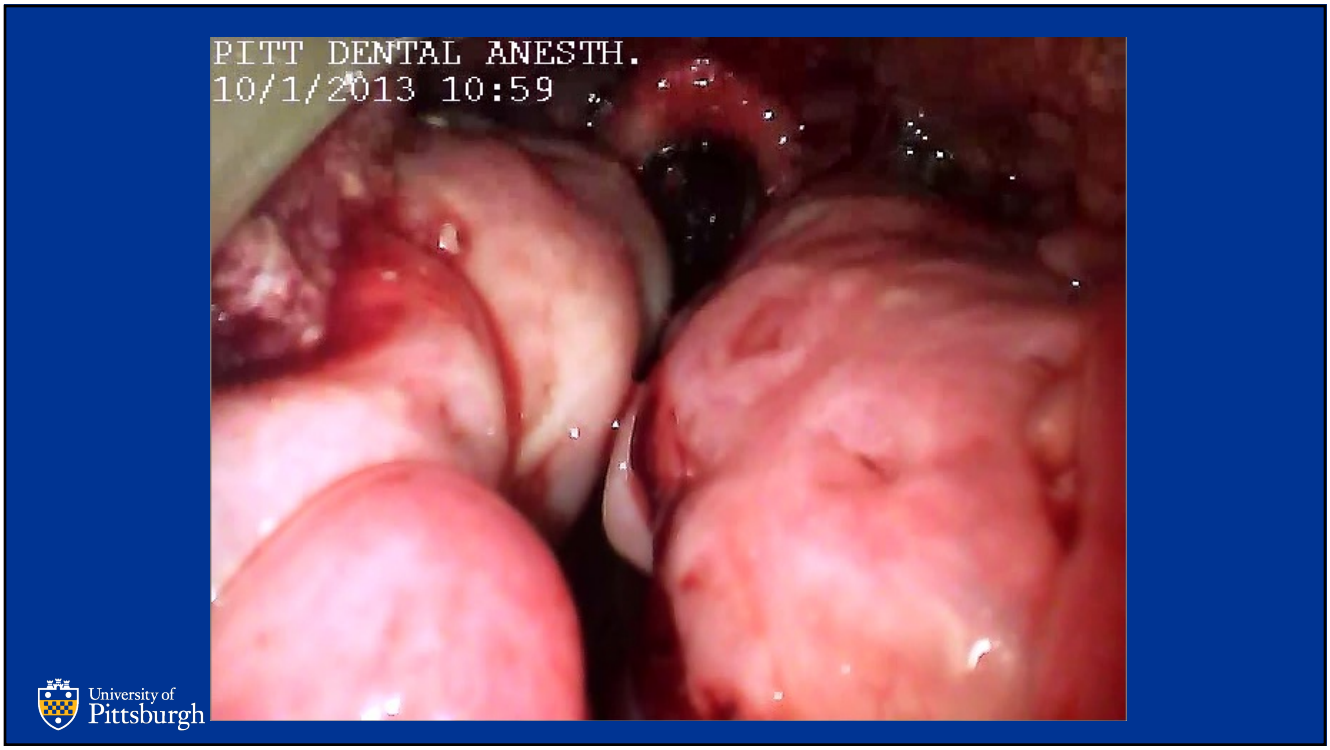

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Respiratory Treatment Considerations

- Moderate sedation
  - Patient remains conscious
- Afternoon appointments
- Pretreatment bronchodilation
- Consider CPAP for OSA

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Diabetes Mellitus

Type I

- B-cell destruction
- Insulin deficiency
- Autoimmune process
- 10% of cases

Type II

- Insulin resistance
- Relative insulin deficiency
- 10x more common than Type I
- 80% of cases associated with obesity

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Risk Factors For Type 2 Diabetes

- Age > 45 years
- Overweight or obese
- Parent, brother, or sister with diabetes
- African American, American Indian, Asian American, Pacific Islander, or Hispanic American/Latino
- Gestational diabetes, or birth to at least one baby weighing more than 9 pounds
- Blood pressure 140/90 or higher
- High cholesterol
- Inactivity, exercise fewer than three times a week

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Fasting Plasma Glucose

- Normal
  - ≤99 mg/dl
- Pre-diabetes
  - 100 to 125 mg/dl
- Diabetes
  - ≥126 mg/dl

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Comorbidities of Diabetes

Microvascular disease
- Retinopathy
- Nephropathy

Macrovascular disease
- Coronary artery disease
- Cerebrovascular disease
- Peripheral vascular disease

Neuropathic disease

Foot ulcers

Infections

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Comorbidities of Diabetes

Heart disease and stroke
- Accounts for about 65% of deaths
- Heart disease death rate 2 to 4 times higher than without diabetes
- Risk for stroke is 2 to 4 times higher among people with diabetes

High blood pressure
- About 73% of adults with diabetes have hypertension or use prescription medications for hypertension

Blindness
- Leading cause of new cases of blindness among adults aged 20-74 years
- Diabetic retinopathy causes 12,000 to 24,000 new cases of blindness each year

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Comorbidities of Diabetes

Kidney disease

- Diabetes is the leading cause of kidney failure
- 44% of new cases in 2002

Nervous system disease

- 60% to 70% of diabetics have mild to severe forms of nervous system damage
- Almost 30% aged 40 years or older have impaired sensation in the feet

Amputations

- More than 60% of non-traumatic lower-limb amputations occur in people with diabetes

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Preventing Diabetes Complications

Glucose control

- Every percentage point drop in A1C blood test results (e.g., from 8% to 7%) reduces the risk of microvascular complications (eye, kidney, and nerve diseases) by 40%

Blood pressure control

- 33% to 50% reduced risk of cardiovascular disease
- Risk of microvascular complications by approximately 33%

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Preventing Diabetes Complications

Control of blood lipids

- Control of cholesterol or blood lipids can reduce cardiovascular complications by 20% to 50%

Preventive care practices for eyes, kidneys, and feet

- Reduce severe vision loss by 50% to 60%
- Reduce amputation rates by 45% to 85%
- Lowering blood pressure can reduce the decline in kidney function by 30% to 70%
- Treatment with ACE inhibitors and angiotensin receptor blockers (ARBs) are more effective in reducing the decline in kidney function than other blood pressure lowering drugs

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Hemoglobin A1C

Glycated hemoglobin or glycosylated hemoglobin

Indicates a patient's blood sugar control over the last 2-3 months

- A1C formed when glucose in the blood binds irreversibly to hemoglobin to form a stable glycated hemoglobin complex
- Normal life span of red blood cells is 90-120 days
- A1C will only be eliminated when the red cells are replaced
- A1C values proportional to the concentration of glucose in the blood over the full life span of the red blood

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Hemoglobin A1C

Hb A1C	Mean Blood Glucose (mg/dl)	Interpretation
4	61	Non-
5	100	Diabetic
6	124	Range
7	**156**	**Target for Control**
8	188	
9	219	Action
10	251	Suggested
11	283	
12	314	

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Treatment Considerations for the Diabetic Patient

- Morning appointments
- Stress reduction protocol
- Blood glucose < 250 ml/dl
  - Maintain meal/insulin schedule
- If NPO
  - Reduce basal insulin by half
  - Skip fast acting insulin dose

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Neurological Disorders

- Spinal muscular atrophy
- ALS
- Muscular dystrophy
- Parkinson's disease
- Myasthenia gravis
- Cerebral palsy
- Alzheimer's disease/dementia
- Down syndrome

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Patients With Neurological Disorders Are Susceptible To:

- Airway obstruction
- Respiratory depression
- Hypoxia
- Aspiration
- Pneumonia
- GERD
- Cardiovascular comorbidities
- OSA

- If sedation is required, consideration should be given to hospitalization or use of a dedicated anesthesia specialist

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Problems Related to Aging

Considerations for the Elderly

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Overview

- Syndromes of aging
- Problems specific to aging
  - Obesity
  - Obstructive sleep apnea
  - COPD
  - Diabetes
  - Atrial fibrillation
  - Parkinson's disease
  - Cognitive impairment
- Geriatric pharmacology
- Anesthetic considerations

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Graying Of America

- More than 55 million people over the age of 65 in the United States
- In 2011, the first members of the "boomer" generation reached age 65
- By 2030, 70 million over the age of 65
  - One in five Americans
- By 2050, life expectancy projected to increase to 82.6 years

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Categories of Aging

Young old	• 65-74
Middle old	• 75-84
Old old	• 85-100
Elite old	• > 100

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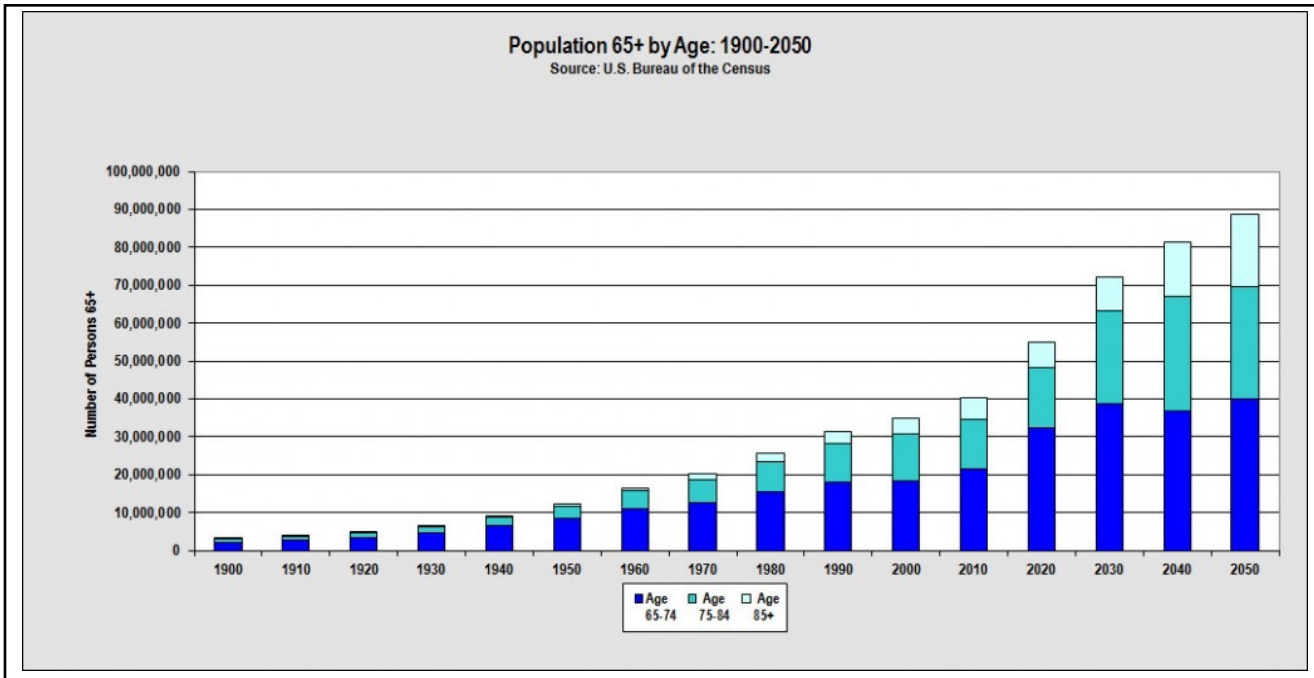

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Polypharmacy of Aging

25 % of people ages 65 to 69 take at least five prescription drugs to treat chronic conditions

46% for those between 70 and 79

It is not uncommon to encounter patients taking more than 20 drugs

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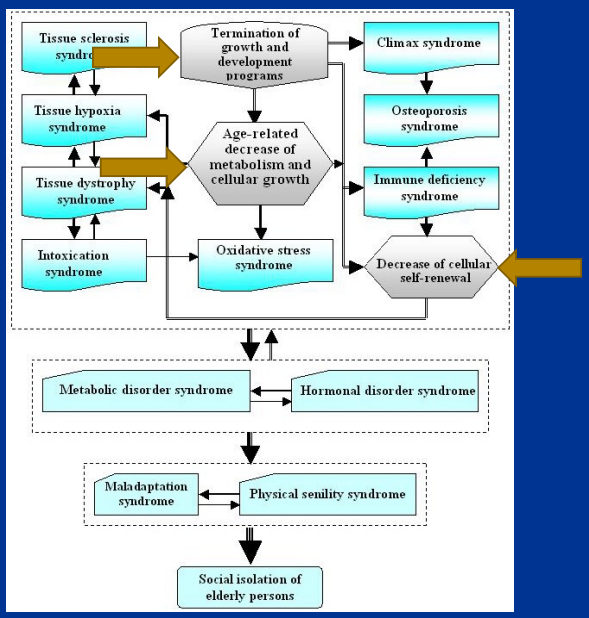

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Syndromes of Aging

Tissue dystrophy syndrome
- Reduction of metabolism
- Termination of growth and development
- Reduction of cellular renewal

Tissue sclerosis syndrome
- Connective tissue proliferation
- Vascular sclerosis and hemodynamic disorders

Tissue hypoxia syndrome
- Depletion of capillary network
- Hemodynamic instability
- Alveolar gas disturbances

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Krutko VN, Dontsov VI, Khalyavkin AV, Markova AM. Natural aging as as a sequential poly-systemic syndrome. Frontiers in Bioscience. 2018;23:909-20.

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Syndromes of Aging

Intoxication syndrome	• Environmental and endogenous intoxication
Oxidative stress syndrome	• Free radicals • Chronic stress
Immune deficiency syndrome	• Reduction in T-lymphocytes • Increase in immune complexes and autoantibodies

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Krutko VN, Dontsov VI, Khalyavkin AV, Markova AM. Natural aging as as a sequential poly-systemic syndrome. Frontiers in Bioscience. 2018;23:909-20.

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Syndromes of Aging

Maladaptation syndrome
- Psychological and emotional stress
- Blood content changes
- Decline in viability

Physical senility syndrome
- Decreased cardiovascular function
- Malnutrition
- Muscle wasting
- Osteoporosis

Metabolic disorder syndrome
- Changes in lipid, carbohydrate, water/salt metabolism
- Obesity, atherosclerosis, ischemic heart disease

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Krutko VN, Dontsov VI, Khalyavkin AV, Markova AM. Natural aging as as a sequential poly-systemic syndrome. Frontiers in Bioscience.

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Syndromes of Aging

Hormonal disorder syndrome

- Thyroid dysfunction
- Sexual dysfunction
- Termination of growth processes

Social isolation and neurocognitive dysfunction

- Retirement
- Loss of peer group
- Cognitive impairment
- Sleep disorders

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Krutko VN, Dontsov VI, Khalyavkin AV, Markova AM. Natural aging as as a sequential poly-systemic syndrome. Frontiers in Bioscience. 2018;23:909-20.

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Obesity

Global population of individuals aged 60 years and older is expected to nearly double from 12 to 22% between 2015 and 2050

Obesity exacerbates aging-associated inflammation by impairing insulin responsiveness

Redistribution of adipose tissue to the abdominal compartment associated with increased risk of chronic disease

Buffering of dietary lipids declines with age

- Low-grade state of inflammation
- Insulin resistance
- Metabolic syndrome

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"Inflammaging"

Chronic low-grade inflammation in the absence of infection

Inflammatory state increases risk of cardiovascular disease, type 2 diabetes, arthritis, among others

Disrupt insulin receptor signaling cascades and promote insulin resistance

Decline in autonomic nervous system function

- Enhanced activity results in NE reduction
- Increase in adipose tissue
- Insulin resistance
- Endocrine dysfunction

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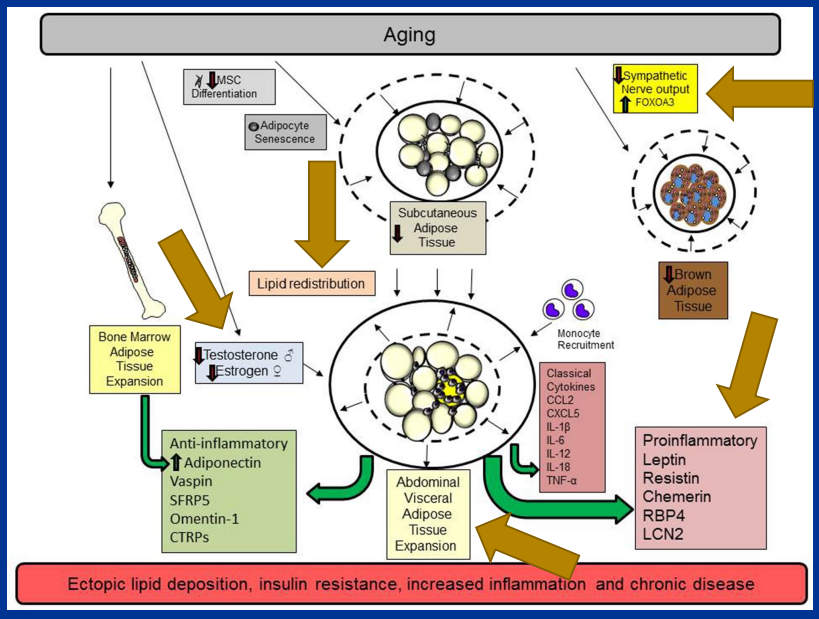

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Summary

- Age-related lipid redistribution and obesity promotes a chronic inflammatory state
- Appetite suppression
- Decreased energy
- Muscle wasting
- Insulin resistance
- Type II diabetes
- Cardiovascular disease

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Problems Specific to Aging

Obstructive Sleep Apnea

- Up to 90% of adult patients with OSA are obese
- Obesity becomes more prevalent with age
- Comorbidities exacerbated by age
  - ***Hypertension***
  - ***Mood disorder***
  - ***Cognitive dysfunction***
  - ***Coronary artery disease***
  - ***Stroke***
  - ***Congestive heart failure***
  - ***Atrial fibrillation***
  - ***Type 2 diabetes***

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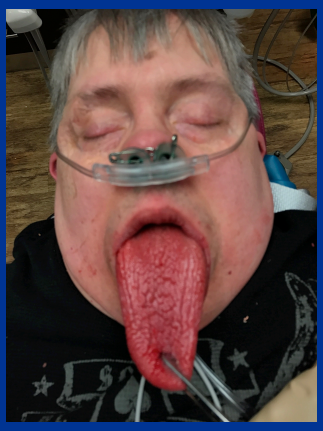
Obesity Adversely Impacts Airway Anatomy



- Inverse relationship between obesity and pharyngeal area
- Fat deposits in uvula, tongue, tonsillar pillars, aryepiglottic folds and lateral pharyngeal walls
- Decrease in normal muscle function
- Susceptible to airway collapse
- Risk of OSA increases with neck obesity vs. general obesity

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Increased Upper Airway Length (UAL)

Increased length in men, increased with age

- Increased pharyngeal length predisposes to airway to collapse during inspiration (negative pressure)

UAL is directly proportional to AHI-OSA severity

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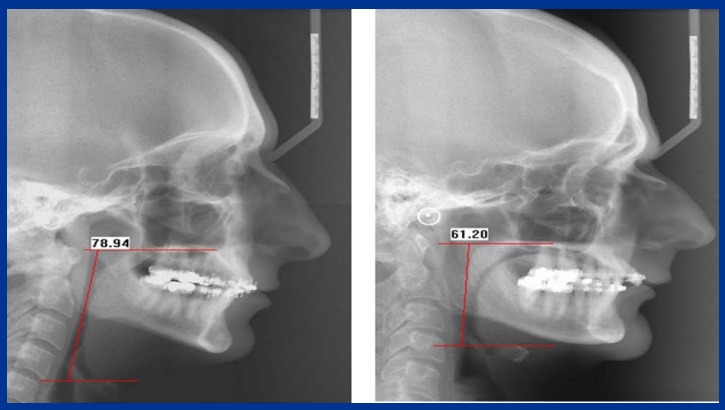
Increased UAL: "Lowering of the Hyoid"



OSA

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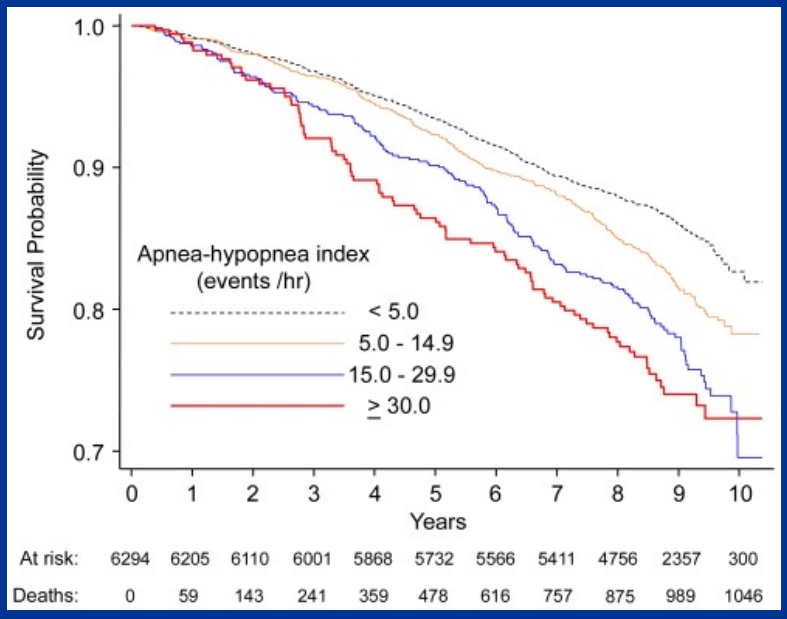

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COPD

- Approximately 24 million cases nationwide
- Third leading cause of death worldwide by 2020
- Incidence increases with age
- Smoking is primary cause
- Chronic inflammation and oxidative stress
  - Fibrosis, coalescence of alveoli, narrowing of small airways
  - Hypoxic pulmonary vasoconstriction and pulmonary hypertension

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Preoperative Assessment for COPD

Identify risk factors

- Smoking, aging, poor exercise tolerance

Evaluate severity

- Positive cough test
  - Deep breath and cough (followed by another cough)
- > 40 pack-year history of smoking
- Significantly impaired PFT's

Medical optimization

- EKG
- Echocardiogram
- Room air $SpO_2 \geq 92\%$
- Smoking cessation

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Global Initiative for Chronic Obstructive Lung Disease (GOLD)

Measures respiratory impairment after bronchodilator treatment

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GOLD 2 (Moderate)	• FEV_1 50%-80%
GOLD 3 (Severe)	• FEV_1 30%-50%
GOLD 4 (Very Severe)	• $FEV_1 < 30\%$

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Anesthetic Considerations in COPD

GOLD 1 and 2 patients in office

Minimal or moderate sedation

- Low dose midazolam
- Low dose remifentanil
- Dexmedetomidine

Supplemental oxygen

- Maintain SpO_2 88%-92%
- Avoids hypoxemia and hypercarbia

GOLD 3 and 4 patients

- Local anesthesia alone
- Hospital

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Alzheimer's Disease

Neurodegenerative disease that typically affects older populations and is the leading cause of dementia worldwide

Prevalence is projected to triple by 2050

Cost of care for dementia is expected to increase from $818 billion in 2015 to $2 trillion by 2030

Characterized by the accumulation of Aβ and neurofibrillary tangles composed of hyperphosphorylated tau (P-tau)

Neuronal loss

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Alzheimer's Disease

- Modifiable risk factors associated with 1/3 of cases
  - Hypertension
  - High cholesterol
  - Obesity
  - Poor diet
  - Inactivity
  - Diabetes

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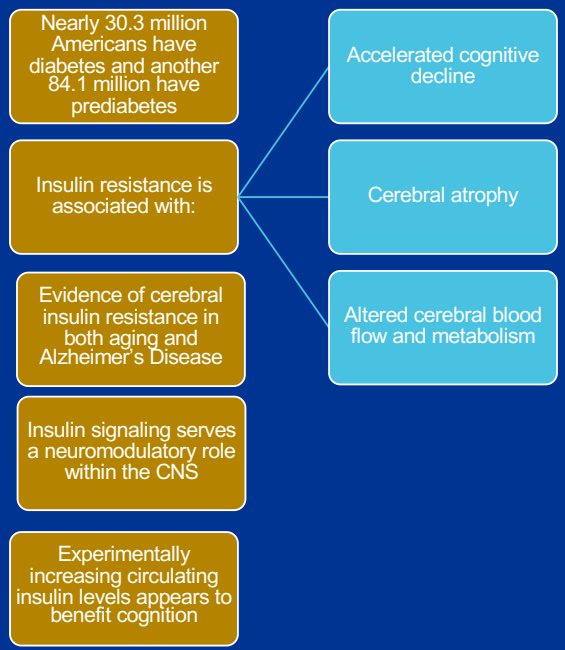
Type II Diabetes: Insulin Resistance and Cognitive Function



Williams VJ, Trombetta BA, Jafri RZ, et al. Task-Related fMRI BOLD Response to Hyperinsulinemia in Healthy Older Adults, JCI Insight, 2019, https://doi.org/10.1172/jci.insight.129700.

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Atrial Fibrillation

~1 in 4 people will develop A-Fib at some point in their life

As the patient ages, the risk of thrombus formation in the atria with subsequent stroke/PE increases

- Age 50-59: 1.5% risk
- Age 80-89: 23.5% risk
- Without anticoagulation prophylaxis, the 30-day mortality of AF related stroke is ~24%

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CHA_2DS_2-VASC

	Condition	Points
C	*Congestive Heart Failure*	*1*
H	*Hypertension*	*1*
A2	*Age > or = to 75 years*	*2*
D	*Diabetes Mellitus*	*1*
S2	*Prior Stroke, TIA, or Thromboembolism*	*2*
V	*Vascular Disease (Peripheral Artery Disease, MI, Aortic Plaque)*	*1*
A	*Age 65-74*	*1*
Sc	*Sex Category (Female)*	*1*

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CHA_2DS_2-VASC (Risk of Stroke)

Score	Stroke Risk %
0	0
1	2.0
2	3.7
3	5.9
4	9.3
5	15.3
6	19.7
7	21.5
8	22.4
9	23.6

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A-Fib and Dementia

- 6030 patients with no dementia and chronically anticoagulated
  - Later followed for dementia incidence
- AF cohort
  - 69.3 ± 11.2 years, 52.7% male
- Non-AF cohort
  - 69.3 ± 10.9 years, 51.5% male
- Dementia risk increased with increasing CHADS2 scores
- AF was associated with higher rates of dementia across all CHADS2 scores

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Graves KG, May HT, Jacobs V, et al. Atrial fibrillation incrementally increases dementia risk across all $CHADS_2$ and CHA_2DS_2VASc strata in patients receiving long-term warfarin. American Heart Journal, 2017;188:93-98.

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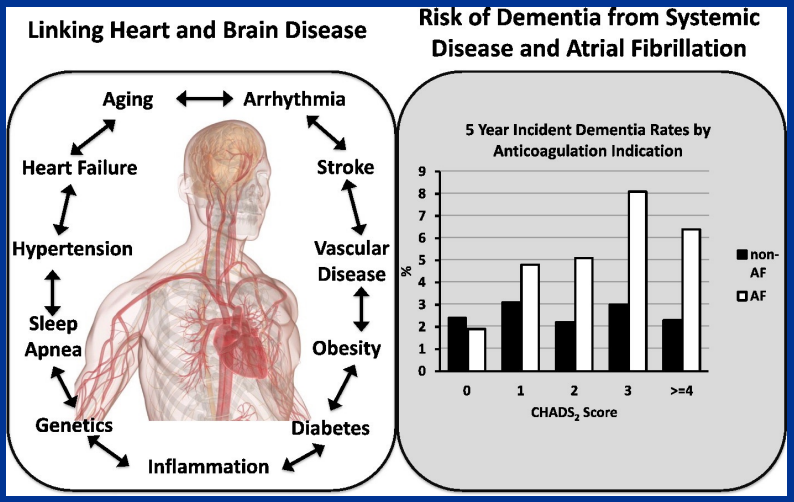
A-Fib and Dementia



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Parkinson's Disease

- Estimated 1 million in US
  - Number expected to double in next 30 years
- Dopaminergic neurons
  - Modulate the balance between ACh and GABA
  - Dopamine inhibits GABA output
  - ACh stimulates GABA output
- Selective degeneration of dopaminergic neurons in Parkinson's disease
- Increased GABA output produces akinesia and bradykinesia

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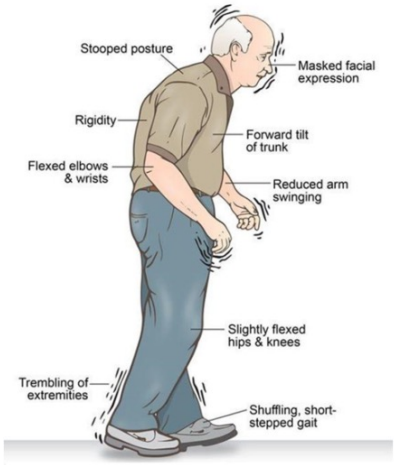
Parkinson's Disease



T Tremor: shaking, usually starting on one side

R Rigidity: stiffness of the limbs, neck, or trunk

A Akinesia: loss or impairment in power of voluntary movement

P Posture and balance

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Stages of Parkinson's Disease

Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
Slight tremors on one side of the body. Symptoms are often mild and include changes in walking, posture, and facial expressions.	Symptoms worsen and affect both sides of the body. Changes in walking and moving make daily tasks become more difficult.	Loss of balance and slowness of movement make falls more common. Symptoms significantly impair activities of daily living.	Symptoms are severe and limit the ability to live alone. Walkers or other aides are used daily to help support limited mobility.	Confine to a wheelchair or bed. A 24-hour caregiver is required. Many experience hallucinations and other non-motor symptoms.

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Treatment of Parkinson's Disease

- Anticholinergic drugs
  - Benztropine
- Cholinesterase inhibitors
  - Rivastigmine
  - Donepezil
  - Galantamine
- COMT inhibitors
  - Entacapone
  - Tolcapone
  - Opicapone
  - Nitecapone
- Dopaminergic drugs
  - Levodopa
  - Bromocriptine
  - Pergolide
  - Amantadine
- MAOI-B
  - Selegiline
  - Rasagiline

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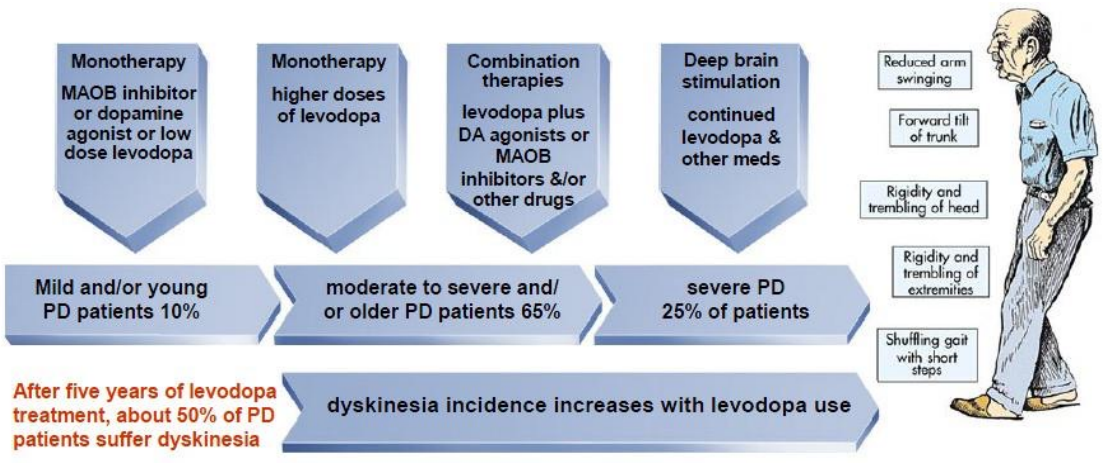
Treatment of Parkinson's Disease



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Anesthetic Considerations

- Levodopa therapy results in systemic cardiovascular system effects
  - Levodopa may result in depletion of norepinephrine stores in the autonomic nervous system
  - Depletion of norepinephrine may sensitize adrenergic receptors to the effects of exogenously administered catecholamines such as epinephrine administered with local anesthetics

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Anesthetic Considerations

- The renin-angiotension system is also inhibited by low concentrations of dopamine
- May result in reduced intravascular fluid volume and make patients susceptible to intraoperative and/or orthostatic hypotension
- Levodopa may induce PONV

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Geriatric Pharmacology

- Pharmacodynamic and kinetic changes
- Drug interactions with polypharmacy
- Neurologic changes
- More hypotension and hemodynamic instability
- Lower anesthetic requirements

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Pharmacokinetic Changes with Aging

Total body water decreases 10%-15%	Body fat increases by 20%-40%	Liver blood flow and mass are reduced	Renal mass and GFR decreases in patients with coexisting CV disease
•Drugs have smaller volume of distribution •Increased blood levels of drugs given by rapid bolus	•Sedatives may have prolonged clinical effects	•Plasma concentrations of highly cleared drugs are increased •Cytochrome P450 enzymes are preserved	•Less able to accommodate hemodynamic changes •More susceptible to fluid overload and pulmonary edema

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Anesthetic Considerations in the Elderly for Moderate Sedation Providers

MAC progressively decreases with age

- 6% per each decade after age 40
- Reduction in nitrous oxide dosing

Midazolam

- Increased sensitivity
- Longer duration
- POCD
- Avoid

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Anesthetic Considerations in the Elderly for Moderate Sedation Providers

Opioids

- Decreased receptor density, affinity and binding
- Respiratory depression increases with age
- Liver metabolism slowed

Fentanyl

- 50% increase in potency
- Dose reduction

Dexmedetomidine

- No respiratory depression
- Cardiovascular stability

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Anesthetic Considerations in the Elderly for Moderate Sedation Providers

Dose reduction
- 25%-75%

Maintain hemodynamic stability
- Both hypotension and hypertension associated with adverse outcomes

Post-induction hypotension
- Prolonged hospital stays and/or death

Intraoperative hypotension
- Increased risk for acute kidney and myocardial injury
- Even short duration (1-5 min)

"Start low and go slow"

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Postoperative Cognitive Dysfunction POCD

Disorders of orientation, attention, perception, consciousness, judgment following surgery and anesthesia

Occurs in 10%-54% of older patients
- 50% will have permanent dysfunction

Contributory factors
- Age
- Educational level
  - Higher levels reduce risk
- Mental health
- Comorbidities
- Length and complexity of surgery
  - Embolism, hypoperfusion, inflammatory response
- Extended postop fasting

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Comorbidities Associated with POCD

- A-fib
- Diabetes
- Hypertension
- Obesity
- Smoking
- Alcohol

- Age > 65 years
- Pre-existing CD
- Poor functional status
- Surgery time > 1.5 hours
- Risk of postoperative respiratory complications

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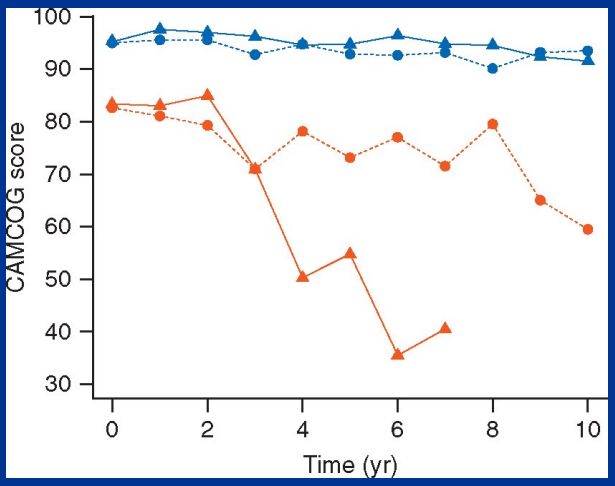
Surgery Affects POCD



No Cognitive Impairment
Solid = Surgery
Dashed = No surgery

Cognitive Impairment
Solid = Surgery
Dashed = No surgery

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POCD Anesthetic Considerations

- Dexmedetomidine preferred
- Low dose opioids
- Monitor depth of anesthesia
- Goal-directed fluid therapy
- Hemodynamic monitoring to prevent, recognize, and treat hypotension
- Multimodal, opioid-sparing analgesia
- Early resumption of oral intake
- Blood glucose monitoring

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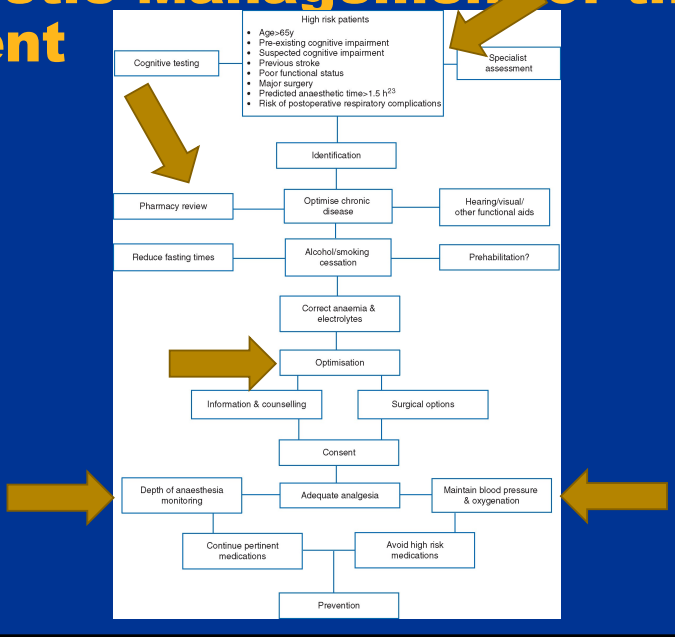
Ideal Anesthetic Management of the Elderly Patient



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Enhanced Recovery After Surgery (ERAS)

Developed to improve outcomes in complex abdominal, colorectal, pancreatic, hepatobiliary, gynecologic oncology, and urology surgeries

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ERAS Advantages

Reduces postoperative complications by 50% following major colorectal surgery

Decreases length of hospital stay by more than 2 days

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ERAS Patient Preparation

- Optimization of medical conditions
- Standard NPO requirements with carbohydrate loading (Gatorade®) up to 2 hours prior
- Aggressive PONV strategy
- Pre-emptive analgesia
  - Gabapentin 400 mg p.o.
  - Acetaminophen 1 g p.o.
  - Celecoxib 400 mg p.o.

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ERAS for Ambulatory Surgery

- Preoperative carbohydrate loading
- Perioperative multimodal analgesia
  - Acetaminophen 1 g (p.o. or IV)
  - Ketamine IV
  - Dexamethasone IV
  - Ketorolac IV
- Preferential use of monitored anesthesia care
- Local anesthesia
- Restriction of IV fluids < 500 ml

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Parrish AB, O'Neill SM, Crain SR, et al. An enhanced recovery after surgery (ERAS) protocol for ambulatory anorectal surgery reduced postoperative pain and unplanned returns to care after discharge. World J Surg 2018;https://doi.org/10.1007/s00268-017-4414-8

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ERAS for Ambulatory Surgery

Patients receiving the complete protocol had significantly lower pain scores

- 0.43/10 vs. 2.1/10

Postoperative pain was significantly reduced in patients receiving preoperative carbohydrate loading

Pain scores significantly reduced in those receiving multimodal analgesia

Pain scores significantly reduced in those receiving MAC sedation

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Parrish AB, O'Neill SM, Crain SR, et al. An enhanced recovery after surgery (ERAS) protocol for ambulatory anorectal surgery reduced postoperative pain and unplanned returns to care after discharge. World J Surg 2018;https://doi.org/10.1007/s00268-017-4414-8

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ERAS for Moderate Sedation for the Older Patient

- Low dose nitrous oxide
- Dexamethasone IV
- Low dose fentanyl or sufentanil
- ***Dexmedetomidine IV***
- ***Avoid benzodiazepines***
- Acetaminophen IV
- Ketorolac IV
- Ondansetron IV
- Supplemental bupivacaine local anesthesia
- Multimodal opioid-sparing postoperative pain control

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Neuroprotection with Dexmedetomidine

- Highly selective α-2 agonist
- Decreases activity of noradrenergic neurons in the locus ceruleus
  - Decrease in pro-inflammatory products from immune cells (IL-1β, IL-6, TNF-α)
- Increase in anti-inflammatory cytokines
- Possible anti-apoptotic mechanism during cerebral ischemia
- Protected neurons in glucose and oxygen deprived environments
- Cardiovascular stability
  - Reduces oxygen demand
  - Reduces catecholamine release

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Take Home Lesson

- Avoid drugs with anti-cholinergic properties
  - Atropine, scopolamine
  - Diphenhydramine
  - Midazolam
  - Meperidine
- Dexmedetomidine
- Low dose fentanyl or sufentanil
- Enhanced recovery protocols
- Include the risk in your consent process

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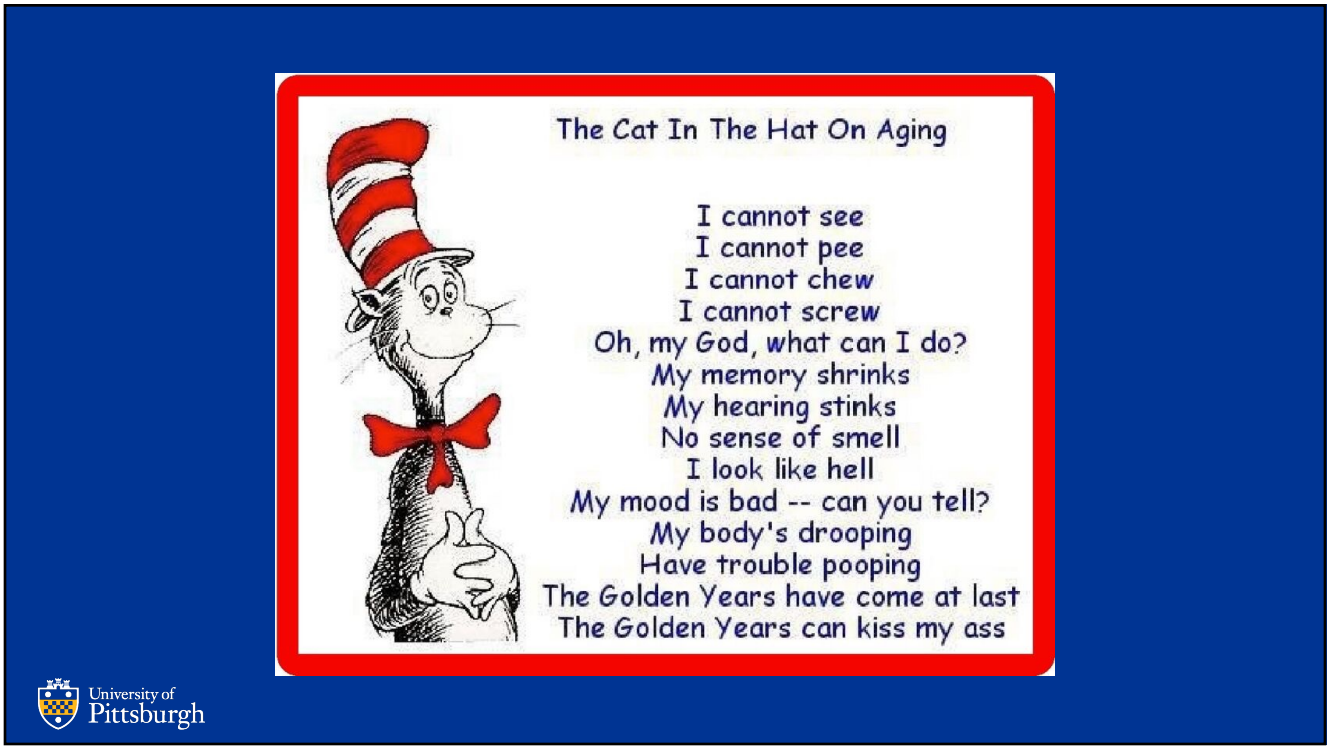
The Cat In The Hat On Aging
I cannot see
I cannot pee
I cannot chew
I cannot screw
Oh, my God, what can I do?
My memory shrinks
My hearing stinks
No sense of smell
I look like hell
My mood is bad -- can you tell?
My body's drooping
Have trouble pooping
The Golden Years have come at last
The Golden Years can kiss my ass
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