

What Do They Want?

HOW TO ASSESS PATIENT RISK FOR
NON-CARDIAC SURGERY

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No Financial conflicts to
disclose

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Learning Objectives

- At the conclusion the learner will be able to:
 - Determine the risk to patients needing surgery/anesthesia with respect to cardiac disease, including (but, not limited to): MI, HF, Valvular disease, arrhythmias, and pulmonary hypertension
 - Determine the risk to patients needing surgery/anesthesia with respect to pulmonary disease
 - Determine the risk to patients needing surgery/anesthesia with respect to diabetes
 - Determine the risk to patients needing surgery/anesthesia with respect to sleep apnea

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Cardiac Risk

- **Cardiac Disease in Non-cardiac Surgery Patient**
 - Coronary Artery Disease
 - Heart Failure
 - Heart Valve Disease
 - Arrhythmia
 - Cardiac Implanted Electronic Devices

2014 ACC/AHA Guideline on Perioperative Cardiovascular Evaluation and Management of Patients Undergoing Noncardiac Surgery

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Coronary Disease

- **15,130 patients over age 50 having non-cardiac surgery requiring an overnight stay.**
 - Isolated Troponin T >0.02 mg/dl occurred in 11.6% of the patients
 - Within that cohort, 30 day mortality was 1.9%
- Major Adverse Cardiac Event (MACE)
 - Often an association with a prior cardiac event
 - Stability and timing impact periop mortality and morbidity

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Time From MI to Surgery (Old Data)

<ul style="list-style-type: none">• Post op MI Rate<ul style="list-style-type: none">○ 0-30 days= 32.8%○ 31-60 days= 18.7%○ 61-90 days= 8.4%○ 91-180 days= 5.9%	<ul style="list-style-type: none">• Post op Mortality Rate<ul style="list-style-type: none">○ 0-30 days= 14.2%○ 31-60 days= 11.5%○ 61-90 days= 10.5%○ 91-180 days= 9.9%
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Risk is modified by revascularization: CABG or PCI

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Time From MI To Surgery

- Data now suggests that at least 60 days should lapse before having non-cardiac surgery in the absence of a coronary intervention.
- **But!**
 - IARS still says wait 6 months.
 - Recent MI (within 6 mos.) of surgery is an independent predictor of perioperative stroke.
 - ✦ Associated with an 8 fold increase in perioperative mortality.

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Time From MI To Surgery

- **The Aging Patient:**
 - Rising incidence of Cerebrovascular Disease, Diabetes Mellitus, Coronary Artery Disease.
 - Age 62 years and greater is an independent predictor of stroke.
 - Age 65 and greater associated with non-cardiac surgery has a greater risk of perioperative ischemic stroke.

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Heart Failure

- **Emphasis on history of heart failure**
 - Pulmonary Edema
 - Paroxysmal Nocturnal Dyspnea
 - Bilateral Rales or S3 Gallop
 - Chest Xray consistent with Pulmonary Vascular Redistribution

Did not include orthopnea and dyspnea on exertion.

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Heart Failure

- 30 day mortality 50%-100% higher than in patients without HF or CAD.
 - Non-ischemic HF: 9.3%
 - Ischemic HF: 9.2%
 - Atrial Fibrillation: 6.4%
 - Coronary Artery Disease: 2.9%

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Heart Failure

- Stable HF associated with non-cardiac surgery does not have a greater perioperative mortality than control.
- Will have:
 - Longer hospital stays
 - Greater readmission rate
 - Higher longer term mortality.

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Heart Failure

- **Risk Assessment for Heart Failure**
 - Decompensated HF has the highest risk
 - LVEF less than 30% is an independent contributor to perioperative risk and long term risk for death.
 - HF+Low EF > HF+Preserved EF > No HF

Diastolic Dysfunction with and without Systolic Dysfunction is associated with an increased incidence of MACE, prolonged length of stay, and an increased rate of postoperative Heart Failure.

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Heart Valve Disease

- **Significant valve lesions should be assessed prior to non-cardiac surgery if:**
 - No prior echocardiogram within 1-2 years
 - Significant change in patient clinical status

If the patient meets criteria for valve replacement or repair, then this should be done before elective non-cardiac surgery.

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Heart Valve Disease

- **Valve Stenosis**
 - Mod-Severe AS associated with increased 30 day mortality in non-cardiac surgery patient.
 - Predictors of 30 day mortality and postop MI:
 - High Risk Surgery (chest, intraperitoneal, suprainguinal vascular)
 - Symptomatic Severe AS
 - Coexisting mod-severe MR
 - Pre-existing CAD

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Heart Valve Disease

- **Valve Regurgitation**
- **Mod-Severe AR**
 - Greater In-hospital mortality (9% v. 1.8%)
 - Greater morbidity (16.2% v. 5.4%)
 - MI
 - Stroke
 - Pulmonary Edema
 - Intubation within 24 hours
 - Major Arrhythmia

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Heart Valve Disease

Mod-Severe AR

- Predictors of In-hospital death
 - Depressed LVEF
 - Renal Dysfunction (Creatinine greater than 2mg/dl)
 - High Risk Surgery
 - Lack of Pre-op Meds

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Heart Valve Disease

- **Valve Regurgitation**
 - Mod-Severe MR
 - 30 day mortality similar to non-MR
 - Predictors of adverse outcomes
 - LVEF less than 35%
 - Ischemic cause of MR
 - DM
 - Hx of Carotid Endarterectomy

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Arrhythmias

- **Asymptomatic arrhythmias (Couplets, Non-Sustained Vtach) are not associated with an increase in complications after non-cardiac surgery.**
 - Should still be investigated.
- AF is the most common tachyarrhythmia seen.
 - If stable, no special attention required other than adjustment of anticoagulation.

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Pulmonary Hypertension

- Risks associated with Pulmonary Vascular Disease:
 - 4-26% Mortality
 - 6-42% Morbidity (Cardiac and Respiratory Failure)
 - Surgical Stress/Anesthetic Technique → Increase/decrease BP → Increase Pulmonary Vascular Resistance → RV Failure → RV Ischemia → Malignant Arrhythmia

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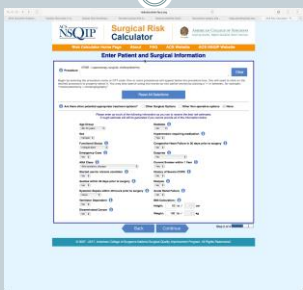
Cardiac Risk Assessment

- Goldman, Eagle, Lee, Detsky, CRI, RCRI, NSQIP
 - Common basis:
 - Risk of Surgery
 - Comorbidities
 - Functional Capacity

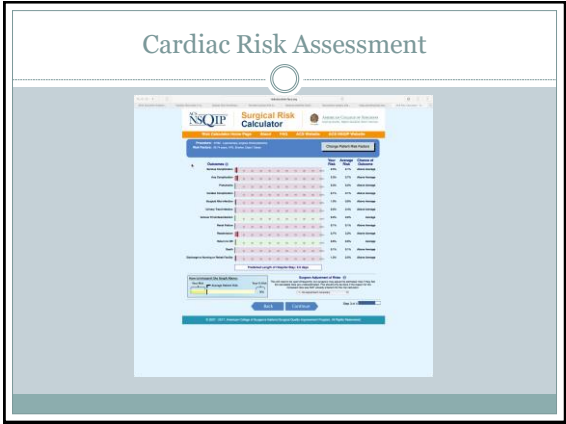
National Surgery Quality Improvement Project (NSQIP)
riskcalculator.facs.org

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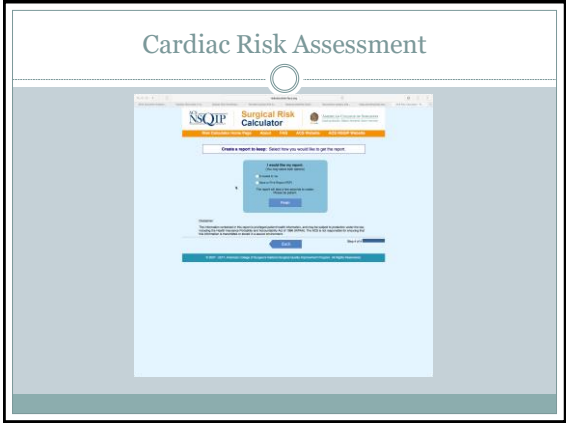
Cardiac Risk Assessment



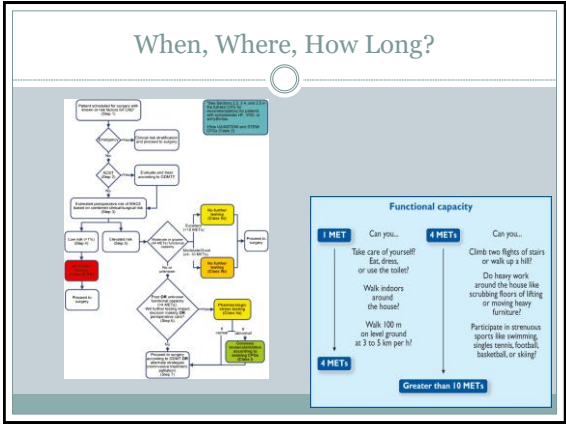
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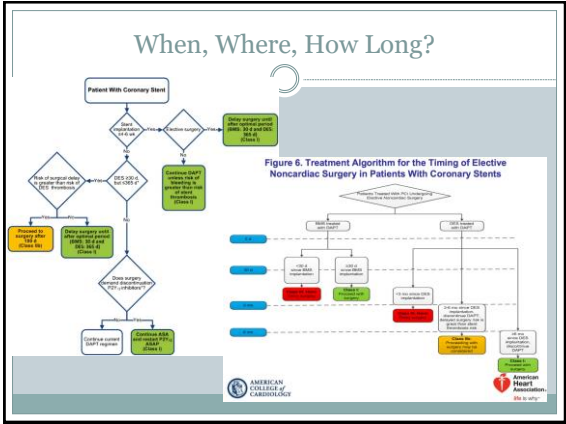
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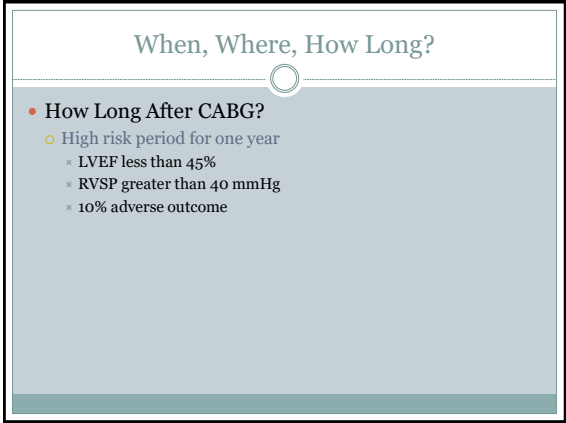
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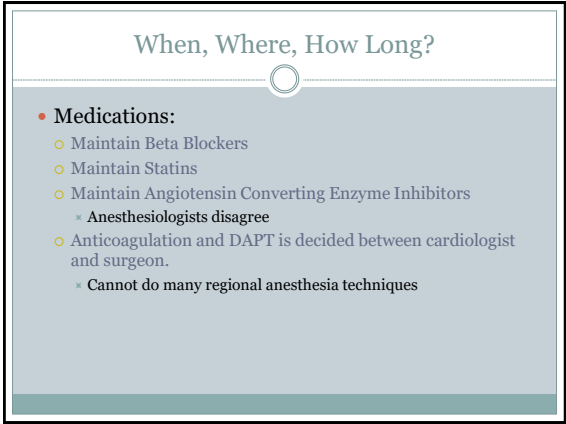
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What, Where, When, How Long?

- Hx of MI? HF? Interventions?
- Functional Capacity
- Is their condition stable?
- Refer to old ECG's, Echo's, Stress Tests, and Caths within two years.
- When in doubt, don't commit. Refer.

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Pulmonary

- COPD
 - Limited expiratory flow
 - Cigarette smoking
 - FAM13A genetic variant
 - Environmental and occupational exposures
 - Small airway obstruction
 - Obstructive bronchiolitis
 - Parenchyma Destruction
 - emphysema

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Pulmonary

- Advanced COPD
 - Combination of V/Q mismatch, decreased gas transfer, and alveolar hypoventilation leads to respiratory failure
- Common co-existing disease
 - Lung Carcinoma
 - Pulmonary Hypertension (1/3 of patients)
 - Weight Loss, Osteoporosis, Skeletal muscle dysfunction, CVD, Depression

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Pulmonary

- **Co-existing Disease cont.**
 - Pulmonary hypertension is an indicator of poor long-term survival.
 - Weight loss occurs in 50% of COPD patients and indicates poor prognosis.

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Pulmonary

- **COPD**
 - Increase risk for hospitalization
 - Increased mortality in the critically ill
 - Poor long-term survival in patients with severe COPD undergoing surgery
 - COPD is an independent predictor of intubation within 3 days of surgery
 - Unanticipated early intubation is an independent predictor of 30 day mortality

British Journal of Anaesthesia: COPD and Anaesthesia (2013)14(1)1-5
Andrew Lumb, MBBS FRCA, Claire Biercamp MPChB FRCA

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Pulmonary

- **Patient-related risk factors***
 - Age
 - COPD/Asthma
 - Smoking
 - Obesity
 - Obstructive Sleep Apnea
 - Pulmonary Hypertension
 - Heart Failure
 - General Health Status: DM, Functional Status, CA, ETOH, Renal Failure
 - URI
 - Metabolic and Nutritional Factors

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Pulmonary

- **Procedure-related Risk Factors***
 - Surgical Site
 - Duration of Surgery
 - Anesthetic Technique: GA v. Neuraxial v. Peripheral Block
 - Type of Neuromuscular Blockade

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Pulmonary

- **Preoperative Testing***
 - PFT
 - Assess degree of hypoxemia and/or hypercarbia
 - Chest X-ray
 - Exercise Tolerance

*Annals of Surgery:
Multifactorial Risk for Predicting Postoperative Respiratory Failure in Men After Non-cardiac Surgery.

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Pulmonary

- **Smoking Cessation**
 - Wound healing improves after 8 weeks
 - Carboxyhemoglobin decreases and Nicotine excitatory effects decrease after 48 hrs.
 - Respiratory symptoms improve after 4-6 weeks
 - FEV₁ increases in first year
 - Coronary and Cerebrovascular risk decreases in 2-5 years
 - Cancer Risk decreases in 5-9 years

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Pulmonary

- **Anesthetic Management of COPD Patient**
 - Peripheral regional block
 - Neuraxial anesthesia
 - General Anesthesia with Laryngeal Mask Airway
 - B2 agonist for patients with asthma or COPD with bronchospastic disease

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Pulmonary

- **Preoperative Evaluation and Medical Optimization**
 - Assess Clinical Severity of COPD
 - Full history with special attention to exercise tolerance
Dyspnea when dressing?
How many stairs can you climb before needing to rest?
 - Frequency of exacerbations
Timing of most recent exacerbation
Antibiotics and Steroids
Admissions
Previous requirement for Non-invasive Positive Pressure Ventilation

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Pulmonary

- Assessment of Clinical Severity
- Co-morbidities
 - Nutritional Status
 - Low BMI = Increased risk
 - Low Albumin is a predictor of Postoperative Pulmonary Complications
- Labwork and Studies
 - Usual bloodwork
 - ECG, consider right-sided leads
 - CXR not mandatory unless infection is suspected
 - Bullae? Pneumothorax risk.

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Pulmonary

- Modified British Medical Research Council (mMRC) Breathlessness Scale
- Grade 0: I only get breathless with strenuous exercise.
- Grade 1: I get SOB when hurrying on the level or walking up a slight hill.
- Grade 2: I walk slower than other people of the same age on the level because of breathlessness, or I have to stop for breath when walking at my own pace on the level.

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Pulmonary

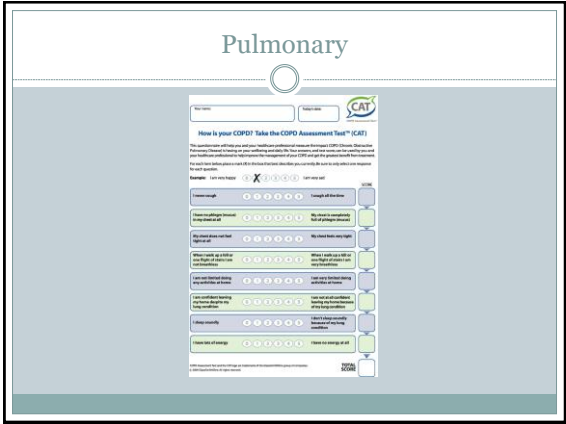
- mMRC:
- Grade 3: I stop for breath after walking about 100 meters or after a few minutes on the level.
- Grade 4: I am too breathless to leave the house or I am breathless when dressing or undressing.

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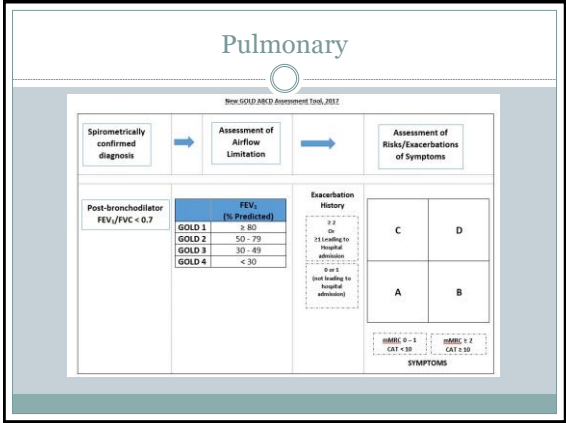
Pulmonary

- Classification of Airflow Limitation Severity in COPD:
- GOLD 1: mild FEV₁ > 80% predicted
- GOLD 2: mod FEV₁ 50-79% predicted
- GOLD 3: severe FEV₁ 30-49% predicted
- GOLD 4: very severe FEV₁ <30% predicted

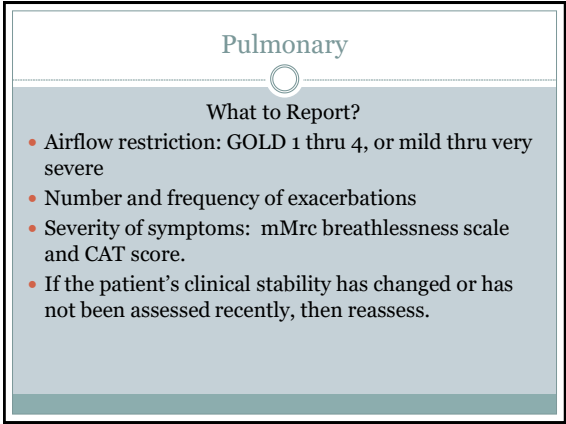
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Pulmonary

Treat wheezing aggressively
If there are signs of infection:
fever, purulent sputum, worsening cough and
dyspnea, then postpone surgery and treat the
infection.

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Diabetes Mellitus

- 12-25% of hospitalized patients are diabetic.
- 25% of diabetic patients will require surgery.
- Mortality for diabetic patient is estimated up to five times greater than non-diabetic patient.
- Infections account for 65% of postoperative complications and 25% of perioperative deaths in diabetic patients.

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Diabetes Mellitus

- Insulin drips were shown to decrease perioperative mortality with glycemic control in the range of 80-110 mg/dl. (2001)
- Some studies had similar results, yet there were also conflicting results that brought into question:
 - What degree of glycemic control is necessary?
 - Current consensus is 80-150 mg/dl

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Diabetes Mellitus

- British study supports good preop control determined by HgA1c is associated with a lowered incidence of systemic and surgical complications, decreased mortality, and shorter hospital stay.

Br J Anes 2014, 113 (6): 906-909
P. Aldain, N. Levy, G.M. Hall

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Diabetes Mellitus

- **Preop Management Key Points:**
 - Verify target blood glucose concentration with frequent glucose monitoring.
 - Use insulin therapy to maintain glycemic levels.
 - Hold oral diabetic meds.
 - Consider cancelling surgery if the patient presents with a metabolic abnormality or glucose above 400-500 mg/dl.

Surgery Research and Practice Vol 2015 (2015) Article 1 284063: Guidelines for Preop Management of the Diabetic Patient, Sivakumar Sudhakaram, Salim R. Sarani, Texas A&M Division of Pulmonary, Critical Care, and Sleep Medicine

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Diabetes Mellitus

- **Intraop Management**
 - Maintain glucose 140-170 mg/dl
 - Take the length of surgery into account
 - For minor surgeries preop glucose protocols may be continued
 - I.V. insulin infusion is more efficient method for longer or more complex surgeries

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Diabetes Mellitus

- **Postop Management**
 - Target 140-180 mg/dl
 - If hypoglycemia is encountered begin dextrose at 5-10 g/hr
 - Ensure that basal insulin levels are met, especially in Type 1 DM
 - Tailor postprandial insulin to the mode in which the patient is receiving nutrition.
 - Insulin coverage to treat breakthrough hyperglycemia and return glycemic control to target range.

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Diabetes Mellitus

- **Metformin**
 - Insulin sensitizer, inhibits gluconeogenesis, does not cause hypoglycemia when used as the sole agent.
 - Risk of lactic acidosis is very low, more likely with renal impairment.
 - ✦ Guidelines have been to stop metformin before surgery, even 48 hrs before surgery.
 - ✦ Most centers still hold Metformin either the day before surgery, or day of surgery.
 - ✦ Just a lot of conflicting policies

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Diabetes Mellitus

- **UK Experience with Metformin:**
 - NHS guidelines for patients undergoing surgery with short duration starvation periods are to continue Metformin with omission of the lunchtime dose provided:
 - ✦ No Contrast Medium is used,
 - ✦ eGFR is above 50 ml/min

Yet, Royal College of Radiologists say metformin is okay as long as eGFR is above 60 ml/min

Confused yet?

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Obstructive Sleep Apnea

- **STOP BANG**
 - Loud Snoring
 - Tired after a night's sleep. Drowsy in the afternoon.
 - Observed obstruction of the airway while asleep.
 - Hypertension

 - BMI > 35 kg/m²
 - Age > 50 yrs
 - Neck Size >16
 - Male Gender
 - Low Risk 0-2, Mod Risk 3-4, High Risk 5-8

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Obstructive Sleep Apnea

- **Preoperative Preparation**
 - Initiate CPAP
 - Consider Mandibular Advancement Devices
 - Weight Loss of the patient is obese

 - S/P UPPP? Patient needs post UPPP sleep study to prove that OSA has been mitigated.

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Obstructive Sleep Apnea

- **Intraoperative Management**

- **Choice of Anesthetic**
 - Local Anesthetic or Peripheral Blocks
 - Consider using CPAP, Oral Appliances during case
 - Spinal or Epidural for peripheral procedures
- **Airway Management**
 - Avoid deep sedation → GA with secured airway
 - Full reversal of NM blockade
 - Extubate awake
 - If possible place patient in lateral, semi-upright, or other non-supine position

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Obstructive Sleep Apnea

- **Postoperative Management**

- **Pain Management**
 - Minimize or avoid opiates
 - Weigh risks of neuraxial analgesia
- **Ventilation Support**
 - Non-supine position through recovery
 - CPAP or NIPPV for frequent or severe obstruction or hypoxia
 - Continuous pulse oximetry in Tele or ICU until the patient is no longer at risk

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Obstructive Sleep Apnea

- **Criteria for Discharge**
 - At risk patients should not be discharged from PACU to an unmonitored setting.
 - Do not assume that the patient is safe going to an unmonitored environment with CPAP machine support
 - Do not assume that the patient is safe going to an unobserved bed with pulse oximetry.
 - The patient may require a longer stay.

 - Observe in an unstimulated environment on room air for the ability to maintain oxygen saturation.

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What Do They Want?

HOW TO ASSESS PATIENT RISK FOR
NON-CARDIAC SURGERY

QUESTIONS?

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