Current Principles of Perioperative Medicine

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Disclosures:

- Physician Shareholder of Big Sky Surgery Center
- Physician Shareholder of Providence Surgery Center
- Medical Directorship – Providence St. Patrick Hospital
The Preoperative Clinic Visit
Words Matter

Patient Name: Jack Torrance

Diagnosis: Insane
Words Matter

Cleared for Surgery?

- [X] YES
- [X] NO
Words Matter

Nursing Communication

Patient is cleared for surgery
Then what should we be doing?

1) Identifying Dangerous Conditions
2) Surgical Risk Assessment
3) Risk Mitigation Plan
Dangerous Conditions for Surgery/Anesthesia

1. Stenotic Valve Disease
2. Pulmonary Hypertension/Right Heart Failure
3. Advanced Liver Disease
4. Uncorrected or Symptomatic Congenital Heart Disease
5. Williams’ Syndrome
6. Uncompensated Left Heart Failure
7. Advanced COPD
8. Interstitial/Fibrotic Lung Disease
9. Carotid Occlusion
10. Advanced Aneurysms
Stenotic Valve Disease

Aortic Stenosis

- Induction of Anesthesia Highest Risk
- Known Moderate/Severe AS – should have an echo within 12 months of surgery
- New Murmur – recommend getting an echo (esp. loud and harsh)
- Severe/Critical AS should be considered for valve intervention prior to surgery
Pulmonary Hypertension
Right Heart Failure

**Beware**
- Moderate Severe Pulmonary HTN
- Dilated Right Ventricle
- Reduced Right Ventricular Function

**Recommendations**
- Echo last 12 months
- O₂ Therapy
- Hypotension
- CPAP for OSA
- Sildenafil/Other indicated therapy
- Euvolemia
Advanced Liver Disease

Gastroenterology
2003;124:94.

Gastroenterology
Advanced Liver Disease
Uncorrected/Symptomatic Congenital Heart Disease
Uncorrected/Symptomatic Congenital Heart Disease

Good Oxygenation

Hypotension
Uncorrected/Symptomatic Congenital Heart Disease

Good Blood Pressure

Hypoxia
Williams’ Syndrome
Williams’ Syndrome

Aortic Valve Stenosis
- Supra-aortic
- Peri-aortic
- Infra-aortic

Pulmonic Valve Stenosis

Coronary Anomalies
- Small arteries
- Stenosis at Insertion Points

Plan
- Echo within 12 months
- Consult Congenital Cardiologist
- Consult Pediatric Anesthesiologist
Then what should we be doing?

- 1) Identifying Dangerous Conditions
- 2) Surgical Risk Assessment
- 3) Risk Mitigation Plan
Broad Surgical Risk Assessment

- Risk Calculators
  - Revised Cardiac Risk Index
  - NSQIP Surgical Risk Calculator

Both Validated... yet Discordant
Revised cardiac risk index (RCRI)

<table>
<thead>
<tr>
<th>6 independent predictors of major cardiac complications[^1]</th>
</tr>
</thead>
<tbody>
<tr>
<td>High-risk type of surgery (examples include vascular surgery and any open intraperitoneal or intrathoracic procedures)</td>
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<tr>
<td>History of ischemic heart disease (history of myocardial infarction or a positive exercise test, current complaint of chest pain considered to be secondary to myocardial ischemia, use of nitrate therapy, or ECG with pathological Q waves; do not count prior coronary revascularization procedure unless one of the other criteria for ischemic heart disease is present)</td>
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<td>History of heart failure</td>
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<td>History of cerebrovascular disease</td>
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<tr>
<td>Diabetes mellitus requiring treatment with insulin</td>
</tr>
<tr>
<td>Preoperative serum creatinine &gt;2.0 mg/dL (177 micromol/L)</td>
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### Lee Criteria

**Duceppe - Revision**

<table>
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<th>Rate of cardiac death, nonfatal myocardial infarction, and nonfatal cardiac arrest according to the number of predictors$^{[2]}$</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>No risk factors – 0.4% (95% CI 0.1-0.8)</td>
<td>3.9%</td>
</tr>
<tr>
<td>1 risk factor – 1.0% (95% CI 0.5-1.4)</td>
<td>6.0%</td>
</tr>
<tr>
<td>2 risk factors – 2.4% (95% CI 1.3-3.5)</td>
<td>10.1%</td>
</tr>
<tr>
<td>3 or more risk factors – 5.4% (95% CI 2.8-7.9)</td>
<td>15.0%</td>
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<th>Rate of myocardial infarction, pulmonary edema, ventricular fibrillation, primary cardiac arrest, and complete heart block$^{[1]}$</th>
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<tr>
<td>No risk factors – 0.5% (95% CI 0.2-1.1)</td>
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</tr>
<tr>
<td>1 risk factor – 1.3% (95% CI 0.7-2.1)</td>
<td></td>
</tr>
<tr>
<td>2 risk factors – 3.6% (95% CI 2.1-5.6)</td>
<td></td>
</tr>
<tr>
<td>3 or more risk factors – 9.1% (95% CI 5.5-13.8)</td>
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How Can We Make This Useful?

Don’t Focus on the absolute numbers

If unable to achieve 4 METs – get stress study if they have at least 1 risk factor

Revised cardiac risk index (RCRI)

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### NSQIP Surgical Risk Calculator

- **Procedure Specific**
- **Patient Specific**

### How Can We Use?

- **Compare Risk to Average**
- **Set Expectations**
- **Direct Goals of Care**

#### Predicted Length of Hospital Stay: 9.5 days
Individualized Surgical Risk Assessment

Risk Assessment: Patient **AND** Procedure Specific

Focus on Modifiable Risk Factors Use to Develop Risk Mitigation Plan
Case:

67 yo M presents with follow up for right Knee Pain

Tried conservative treatment – NSAIDS, PT, Joint Injection – without adequate relief

Medical History: BMI 42, HTN, Current Smoker, DM2 with last HbA1c 7.5, Anemia with Hct 32

Orthopedic Surgeon recommends Joint Replacement

Requests “Preop Clearance” – Proposed Surgery Date in 4 weeks
Individualized Surgical Risk Assessment

Case:

- 67 yo M presents with follow up for right Knee Pain

Risk Factors for Prosthetic Joint Infection

- BMI > 40
- Current Smoker
- DM2 (Hb 7.5 – controlled?)
- Anemia (HCT <36)
- Malnutrition? (albumin < 3.5)
- Metabolic Syndrome?
Individualized Surgical Risk Assessment

Prosthetic Joint Infection Risk Factors

- **BMI > 50:**
  - 21-fold increased risk of infection  
    J Arthroplasty. 2009;24(6 Suppl):84–8

- **BMI 40-49:**
  - 3-fold increased risk of infection  
    J Arthroplasty. 2009;24(6 Suppl):84–8

- **DM2 (HbA1c > 7.0):**
  - At least a 3-fold increased risk of infection  

- **Current Smoker:**
  - 1.8-fold increased risk of infection  

- **Malnutrition (Albumin < 3.5):**
  - 5 to 7-fold increased risk of infection  

- **Anemia (HCT < 36):**
  - 1.4 increased risk of infection  

- **Metabolic Syndrome:**
  - 17-fold increased risk of infection  
Concept: Surgical Complications are Typically due to...

- Impaired Blood Flow & Oxygenation to Compromised Tissue
- Impaired Functions of Daily Living
Impaired Blood Flow & Oxygenation to Compromised Tissue

- Reduced Blood Flow
  - Physical Barrier
- Impaired Oxygenation
- Impaired Blood Contents

- Adipose Edema
- Smoking - CO
  - Anemia
- Malnutrition
  - Hyperglycemia
  - Immune Deficiency
  - Excessive Inflammation
Impaired Functions of Daily Living

- Ambulation/Mobility
- Eating/Drinking/Nutrition
- Hygiene/Bathing/Dressing
- Toileting

- Ileus
- Wound Infection
- UTI
-Constipation
-Nausea/Vomiting

- Malnutrition
- DVT
- Pneumonia

- Frozen Joint
- UTI
- Constipation
Then what should we be doing?

- 1) Identifying Dangerous Conditions
- 2) Surgical Risk Assessment
- 3) Risk Mitigation Plan
Risk Mitigation Plan – Back to Our Case

- **Case:**
  - 67 yo M presents with follow up for right Knee Pain
    - Modifiable Risk Factors: BMI > 40, Anemia, Smoking, DM2,
      - He does have Metabolic Syndrome & Malnutrition (Albumin 3.2)
  - Surgery in 4 weeks
    - Is this timeframe attainable for risk reduction?
Risk Mitigation Plan

**Obesity**

- Will need more than 4 weeks for optimal risk reduction
- Discuss with patient and determine how they would like to proceed.
  - Diet is more effective than exercise for weight loss
  - Weight loss is likely to improve underlying knee pain
  - Structured Dietary Plans are Available - $$$
  - Could consider bariatric surgery as an option prior to knee replacement

- If decide to continue with surgery at 4 weeks
  - Eat Whole Fruits, Vegetables, Nuts & Legumes
  - Regular Exercise
  - Avoid Processed Food, Sugary Beverages, & Alcohol
Risk Mitigation Plan

- Anemia
  - Send Iron Studies to Help Determine Etiology
  - Is there a source of blood loss?
    - Melena
    - Abnormal Uterine/Vaginal Bleeding
Risk Mitigation Plan

- **Anemia**
  - Chemotherapy Related?
    - May need to wait it out for elective surgery
      - Weeks to Months
  - Nutritional (iron deficiency)
    - Oral Iron Supplements – Months, not well tolerated
    - Iron Infusion – benefit in 3 to 4 weeks
- **Anemia of Chronic Disease**
  - May benefit from Iron Infusion
  - Can consider Erythropoetein in select circumstances – consult Heme/Onc
    - Can increase VTE risk
Risk Mitigation Plan

- **Anemia**
  - **Iron Infusion Criteria**
    - Iron Deficiency - Ferritin of <100 and/or a Transferrin Saturation (tsat) <20%
    - Anemia of Chronic Disease - ferritin > 30 and a tsat of >20% in the setting of low or normal serum iron
      - Can give Iron Infusion if Ferritin < 500
      - IV Iron can overcome the hepcidin mediated blockage of iron absorption

Risk Mitigation Plan

- **Smoking**
  - Can see clinical benefit if cessation for 4 weeks or greater
    - Longer cessation is optimal
  - Better if quitting without Nicotine Replacement
    - Quitting with Nicotine is still better than Not Quitting
  - Quitting only during perioperative period is an option
    - 4 weeks before surgery and 4 weeks after surgery
Risk Mitigation Plan

- Diabetes
  - Can Track Control with Hba1c (Goal < 7.0)
    - Repeat Hba1c in 3 months...
  - Fructosamine is an option – will track glycemic control over 3-week period
    - Goal Fructosamine Level < 293
    - Fructosamine much more Predictive of Complications in Orthopedic Surgery
      - Fructosamine can be elevated in setting of Normal Hba1c – Metabolic Syndrome?

Risk Mitigation Plan

- Malnutrition
  - Can Consult a Dietician
    - Especially emaciated patients or albumin 2.4 or less
  - For Mild Disease (albumin 2.5-3.4)
    - Immunonutrition Protein Supplementation (IMPACT) 5 days prior to surgery and 5 days following surgery
    - Increase intake of whole fruits, vegetables, nuts, & legumes
Risk Mitigation Plan

- 67 yo M presenting for Total Knee Arthroplasty in 4 weeks

Plan:

- **Iron Deficiency Anemia** – preop iron infusion

- **Diabetes HbA1c 7.5** – dietary counseling and medication management
  - Check Fructosamine in 3 weeks to assess treatment efficacy
  - Surgery contingent on Fructosamine Level Goal of < 293

- **Smoking** - cessation plan with medication and/or nicotine replacement starting now and throughout perioperative period

- **Mild Malnutrition** – likely obesity related – immunonutrition supplementation before and after surgery; dietary counseling

- **Obesity/Metabolic Syndrome** – dietary counseling and perioperative exercise plan (swimming & upper extremity weight training)

6-8 weeks?
Then what should we be doing?

- 1) Identifying Dangerous Conditions
- 2) Surgical Risk Assessment
- 3) Risk Mitigation Plan
Consider optimizing patients prior to referral for surgical care

- Surgery is a unique time and patients are often motivated to improve health during this time period

Consider utilizing the expertise of local anesthesiologists

- Identify a few that are interested in this area of medicine. Can see wide variability of interest and expertise
Thank you

Any questions?