Medicine and Anesthesia for the Oral and Maxillofacial Surgery Patient: A Case Based Discussion

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Richard C. Robert, DDS, MS

Introduction

Format
• Sample cases
  – Audience participation = CRITICAL
Purpose
• Discuss medical material as relates to OMFS
Unable to cover every topic in medicine
Not the expert, you may disagree with presentation, speak up
Handout

Most Common Medical Diagnosis
Systemic Diseases of Importance by System

• Cardiovascular
• Respiratory
• Hematopoietic
• Genitourinary
• Gastrointestinal
• Neurologic
• Endocrine
• Other

ASA classification
Risk assessment tool for patients planned for anesthesia
1. No systemic disturbance
2. Mild and controlled systemic disease
3. Severe systemic disease
4. Severe systemic disease posing constant threat to life
5. Moribund
6. Brain dead (organ harvest)

Most Common Medical Diagnosis
And getting worse (bigger)!!

Update on Obesity
Gurpreet Dhaliwal, MD
The Obesity Epidemic

BMI = (kg) / (m)²

Overweight 25-30
Obese 30-40
Severe Obesity 40+

BMI = (pounds) x 4.88 / (feet)²

OBESITY

Diabetes mellitus
Dyslipidemia
Hypertension
CAD
Stroke
OSA / lung disease
DVT

Pathophysiology of Obesity

Calories
Activity
Socio-economics
Psychology
Genetics
Environment

Diabetes mellitus
Osteoarthritis
Dyslipidemia
Gout
Hypertension
Gallstones
CAD
GERD
Stroke
Cancer
OSA / lung disease
Cancer
DVT
Chronic Kidney Disease
Insulin Resistance

Obesity → Metabolic Syndrome → Diabetes

2x Risk → 4x Risk → Cardiovascular disease


Obstructive Sleep Apnea

Obesity
Apnea
Symptoms

Obesity Hypoventilation Syndrome

OSA
Daytime hypercapnia
(>45 mmHg)
= OHS

Cardiovascular System

MOVE ALONG
NOW
Nothing to See Here
Obesity is a pro-thrombotic state.

Summary

- Co-morbidities (can’t fix)
- Co-morbidities (can optimize)
- Complex and complicated

Peri-operative Challenges
From an Anesthesiologist’s Perspective

Solmaz Poorsattar, MD

Peri-operative Challenges
From an Anesthesiologist’s Perspective

- Assess severity of comorbidities & optimize
- Cardiac, OSA, Airway day of surgery assessments
- Venous access
- Pharmacology and drug management
- Positioning & thromboprophylaxis
- Airway management

Smoking and obesity

- Smoking is a major additional risk for postoperative morbidity
- Stopping smoking 8 weeks before surgery improves cardiovascular parameters and reduces post pulmonary complications
Cardiovascular Assessment

Heart sounds muffled, JVD difficult to assess, peripheral edema chronic, breathless with minimal exertion or activity restriction due to OA.

Revised Cardiac Risk Index validated in obese & non-obese patients for non-cardiac surgery.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Risk of Major Postoperative Cardiac Complication</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.4%</td>
</tr>
<tr>
<td>1</td>
<td>0.0%</td>
</tr>
<tr>
<td>2</td>
<td>7.7%</td>
</tr>
<tr>
<td>≥3</td>
<td>11.0%High Risk</td>
</tr>
</tbody>
</table>

Adapted from reference 19.

OSA Assessment STOP- BANG

Snore loudly
Tired daytime
Observed obstruction
Blood Pressure HTN
BMI > 35
Age > 50
Neck > 43 cm males
Gender = Male
Score ≥5 = significant sleep disordered breathing
Increased risk hypoxia, hypercarbia, AFib, PE, unexpected death

Airway Assessment: Neck circumference

Airway Assessment: Mallampati score

Pharmacotherapy & Drug Choice

Physiologic changes of obesity:
- Increased plasma volume, body water and muscle mass
- Increased cardiac output
- Increased volume of distribution (especially for lipophilic drugs)
- Increased total body clearance
- Increased sensitivity to respiratory depressants!

Dose adjustments vary by drug:
- Propofol induction at IBW, maintenance at TBW
- Midazolam at IBW
- Most opioids at Adjusted body weight (ABW)
- ABW = IBW + 0.4(TBW- IBW)

Rec. = Initial doses based on lean or adjusted body weights and dose to affect.
Avoid respiratory depressants.
Use short-acting reversible drugs.
Use regional anesthesia!

Aspiration Precautions

Despite increased GERD, no evidence of increased aspiration in properly NPO obese patients.
- Clear liquids 2h
- Breast milk 4h
- Non-human milk & formula 6h
- Light meal (plain toast) 6h
- Heavy meal 8h

Antacid and pro-motility premedication can be used.
RSI not routinely indicated for obesity.
Airway Management: Prepare!

Airway Management: Position!

Airway Management: Preoxygenate!

Ventilation Techniques
- Head elevated to improve FRC
- Periodic alveolar recruitment to reduce V/Q mismatch
- Titrated PEEP
- Expect increased airway pressures
- Volume controlled ventilation is more efficient at eliminating CO2 in morbidly obese patients
- Volutrauma should be avoided in the pursuit of normocarbia
- Prolonged spontaneous ventilation with sedation leads to increasing hyprcarbia

Extubation
- Complete reversal of neuromuscular blockade
- Wide awake and responsive
- Sitting up to maximize FRC
- CPAP/BiPAP
- Maintain upright position throughout recovery
- Full monitoring in recovery
- Monitor oxygen saturation until mobile post-op.
- Consider stepdown or ICU with CPAP for prolonged recovery
Positioning Concerns

- Table to support weight
- Hover mat
- Increased nerve compression injury
- Increased rhabdomyolysis (23% in bariatric surgery, clinical significance uncertain)

Thromboprophylaxis

Obesity is a risk factor for VTE

Thromboprophylaxis is recommended for all non-mobile patients

- Low molecular weight heparins
- Early ambulation
- Mechanical compression devices
- TED stockings

A Closed Claims View of Obesity and the Obesity Paradox

Rich Robert

Our cases...

- Closed claims cases obtained from OMSNIC.
- We received 57 cases which represented the full spectrum of anesthetic deaths resulting from complications such as myocardial infarction, cardiac dysrhythmias, bronchospasm, emesis with aspiration, etc.
- Of those 57 cases 45% of the patients were obese or morbidly obese.
- These data would suggest that obese patients represent a high risk patient population.
- If that is the case, how do our numbers compare to those seen in medical anesthesia?

Pulmonary Risk Stratification

- Cardiac risk index in 1977, but no comparable pulmonary risk index until 2006 – American College of Physicians
- Post-operative pulmonary complications equally prevalent.
- May be more likely to predict long-term mortality.
Risk factors for Postoperative Pulmonary Complications

<table>
<thead>
<tr>
<th>Factor</th>
<th>Risk Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHF</td>
<td>A</td>
</tr>
<tr>
<td>Advanced age</td>
<td>A</td>
</tr>
<tr>
<td>Functional dependence</td>
<td>A</td>
</tr>
<tr>
<td>ASA class &gt; II</td>
<td>A</td>
</tr>
<tr>
<td>COPD</td>
<td>A</td>
</tr>
<tr>
<td>Cigarette use</td>
<td>B</td>
</tr>
<tr>
<td>Diabetes</td>
<td>C</td>
</tr>
<tr>
<td>Obesity</td>
<td>D</td>
</tr>
<tr>
<td>Asthma</td>
<td>D</td>
</tr>
<tr>
<td>Obstructive sleep apnea</td>
<td>I</td>
</tr>
</tbody>
</table>

I = Probable increased risk, but data inconclusive

Yet on the other hand, Gurpreet showed us that within 1½ decades we went from...

To this...

Especially here

The rankings are out...

...and once again, the South dominates.
But for us, the obesity paradox does not appear to hold – possibly our open airway?

So what can we do?

- It certainly appears that we should assign a higher risk to obese and morbidly obese patients than do anesthesiologists in a hospital or outpatient surgery setting.
- If this is the case, what can we do to minimize the risk?

BMI Distribution of Patients 2011 AAOMS Benchmark Study

<table>
<thead>
<tr>
<th>BMI Category</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal &lt;24</td>
<td>45</td>
</tr>
<tr>
<td>Heavy 25-29</td>
<td>31</td>
</tr>
<tr>
<td>Obese 30-39</td>
<td>20</td>
</tr>
<tr>
<td>Morbidly obese ≥ 40</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>

CDC statistics: the prevalence of obesity is 35 – 36% in the US population.

Adhere to a Special Obesity/OSA Protocol for Your Practice

- Obtain height and weight and calculate BMI for all patients. Then establish a cutoff above which you will treat the patient under local alone, or take him/her to the hospital or an outpatient surgery center.
- Carefully assess the airway with multiple means of evaluation – e.g. Mallumpati, upper lip bite test, thyromental distance, maximal incisal opening, neck extension, etc.
- Use the Stop/Bang questionnaire.
- Check for important co-morbidities such as GERD with prophylaxis PRN.

Be proactive (not reactive) in managing the airway – use airway adjuncts

- Nasopharyngeal airway
- Tongue suture
- LMA
The Perioperative Component of Your Obesity/OSA Protocol

- Always monitor ventilation with a piezo pretracheal stethoscope
- Position patient in a semi-upright or semi-Fowler’s position.
- Modify drug dosing appropriately for the patient’s habitus. Let the patient know that he/she will be sedated and comfortable, but not totally asleep.
- Proceed slowly!

Anesthetic Dosing in the Morbidly Obese

- Dosing scalers based on total body weight (TBW) are only valid for normal weight Pts.
- With the obese and morbidly obese the majority of CO goes to the vessel rich groups.
- Therefore, lean body weight (LBW) is the ideal weight scaler.

Lean body weight vs total body weight

A Lean Body Weight Chart

<table>
<thead>
<tr>
<th>Height in feet &amp; inches (cm)</th>
<th>Small Frame</th>
<th>Medium Frame</th>
<th>Large Frame</th>
</tr>
</thead>
<tbody>
<tr>
<td>5'10&quot; (178cm)</td>
<td>63.6-66.7</td>
<td>65.0-68.0</td>
<td>69.4-75.0</td>
</tr>
<tr>
<td>5'11&quot; (180cm)</td>
<td>64.0-67.1</td>
<td>66.4-70.5</td>
<td>70.8-77.8</td>
</tr>
<tr>
<td>6'0&quot; (183cm)</td>
<td>64.4-67.6</td>
<td>66.8-71.7</td>
<td>72.2-79.4</td>
</tr>
<tr>
<td>6'1&quot; (185cm)</td>
<td>64.8-68.2</td>
<td>67.2-73.4</td>
<td>73.6-80.2</td>
</tr>
<tr>
<td>6'2&quot; (188cm)</td>
<td>65.2-68.7</td>
<td>67.6-73.9</td>
<td>74.0-80.8</td>
</tr>
<tr>
<td>6'3&quot; (191cm)</td>
<td>65.6-69.2</td>
<td>68.0-74.5</td>
<td>75.4-81.4</td>
</tr>
</tbody>
</table>

- The “Medium Frame” column can be utilized for the average male patient.
- The “Small Frame” column can be utilized for the average female patient.

Without question there is plenty of bad news here…

But is there any good news?

Yes!
Update on Hypertension

Gurpreet Dhaliwal, MD

Systolic BP = peak left ventricular contraction
Diastolic BP = resting resistance of the arterial system

Why Rx?
- ↓ Stroke by 40%
- ↓ MI by 25%
- ↓ CHF by 50%
- ↓ SBP by 12 mm Hg x 11 patients x 10 years = ↓ 1 death
What’s the target?

<table>
<thead>
<tr>
<th>Age &gt;60 + DM/HTN</th>
<th>&lt;140/90</th>
</tr>
</thead>
<tbody>
<tr>
<td>DM</td>
<td>&lt;140/90</td>
</tr>
<tr>
<td>CKD</td>
<td>&lt;140/90</td>
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<tr>
<td>CKD</td>
<td>&lt;140/90</td>
</tr>
</tbody>
</table>

| Age >60 no DM/HTN | <150/90 |

Which drug?

- Thiazide (HCTZ)
- ACE-I (lisinopril)
- ARB (losartan)
- CCB (amlodipine)
- Beta blocker (metoprolol)

Rx: 4 caveats

<table>
<thead>
<tr>
<th>DM</th>
<th>ACE-I / ARB</th>
</tr>
</thead>
<tbody>
<tr>
<td>CKD w/ proteinuria</td>
<td>ACE-I / ARB</td>
</tr>
<tr>
<td>African-American</td>
<td>Thiazide or CCB</td>
</tr>
<tr>
<td><em>Not first line</em></td>
<td>Beta Blockers</td>
</tr>
</tbody>
</table>

Hypertensive Urgency—Is This a Useful Diagnosis?

BP > 180/110 + No attributable symptoms
Hypertension update

- Massive # of trials
- JNC 8 – strict interpretation

- **Rx goal**: <140/90
- **Rx**: Dealer’s choice + 4 caveats

- Prehypertension – much ado about nothing?
- Hypertensive urgency – wrong name?

Dental Treatment and Hypertension

<table>
<thead>
<tr>
<th>Blood Pressure</th>
<th>Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>120-139/80-89</td>
<td>Treatment OK</td>
</tr>
<tr>
<td>140-159/90-99</td>
<td>Treatment OK, consider sedation, refer for medical consult.</td>
</tr>
<tr>
<td>160-179/100-109</td>
<td>Treatment OK, consider sedation, refer for medical consult.</td>
</tr>
<tr>
<td>180-209/110-119</td>
<td>No treatment w/o medical consult, refer for prompt medical consult</td>
</tr>
<tr>
<td>≥ 210, ≥ 120</td>
<td>No treatment, refer for emergency medical treatment</td>
</tr>
</tbody>
</table>


Management of a Dental Patient with Hypertension

- Identification
- Monitoring
- Stress and anxiety reduction
- Avoidance of orthostatic hypotension
- Avoidance of vasopressors
- Avoidance of drug interactions
- Avoid gag reflex
- Hemostasis
- Management of drug effects on the oral tissues

Management

- Decrease exposure to epinephrine
  - Exogenous (limit to 0.04 mg= 2.2 carpules 1:100,000)
  - Endogenous
    • POTENTIALLY A MUCH BIGGER PROBLEM
    • stress- adrenal medulla can produce 0.28 mg of epi./ min.
- Avoid topical vasoconstrictors
- Adverse drug reactions
  • epinephrine and beta blockers, rarely a problem if small doses of epi. used

Hypertension Take-Home Points

- Goal treatment of HTN is < 140/90mmHg for most patients.
- It is unsafe to treat a patient if their blood pressure is ≥ 180/110mmHg.
- It is unsafe to treat a patient if they have an elevated blood pressure (>160/100mmHg) AND have symptoms of organ damage (chest pain, confusion, etc.)
- Can take specific steps to limit risks in managing hypertensive patients.
Medications

Plavix: anti-platelet agent, can increase bleeding time. Prevents fibrinogen binding and decreases platelet aggregation and adhesion. Given following angioplasty with stent placement.


Nitrostat: Nitroglycerine- peripheral vasodilator. Decreases workload of the heart.

Additional Information

Primary Care MD
- Recent History and Physical?
- BP control

Cardiologist
- ECG/ CXR
- CBC with lipid profile (cholesterol)
- Bleeding time
- SBE prophylaxis
  - MVP with regurgitation
  - Safe to treat (MI 3 years ago)

Need for SBE Prophylaxis

Coronary artery stent placement
- No, only necessary during immediate post stent placement period, until mucosalization of stent (4 weeks to 3 months).
- New drug-eluting stents
- Confirm with cardiologist

Mitrail Valve prolapse with regurgitation
- No, most recent AHA recs.

Treatment Following MI


- “Coronary revascularization before non-cardiac surgery to enable the patient to “get through” the non-cardiac procedure is appropriate for only a small subset of patients at very high risk.”
- “…it appears reasonable to wait 4 to 6 weeks after MI to perform elective surgery.”
- “In this way, the separation of MI into the traditional 3- and 6-month intervals has been avoided.”

Importance of PTCA with Stent Placement

Indicative of progressive CAD, no special precautions are needed

SBE prophylaxis is recommended only immediately post-stent placement, until mucosalization complete

Postpone elective procedures to allow completion of mandatory anti-platelet regimen and decrease concerns over stent thrombosis and post-op bleeding (drug-eluting stents)
Update on Coronary Artery Stents
Gurpreet Dhaliwal, MD

Percutaneous Coronary Intervention

Worry about…

#1 Stent thrombosis
(clot → MI)

#2 Stent stenosis
(hyperplasia → angina)

Stent Restenosis
Dual anti-platelet therapy (DAPT)

- Aspirin
- Clopidogrel (Plavix®)

<table>
<thead>
<tr>
<th></th>
<th>Minimum</th>
<th>Preferred</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bare Metal Stent</td>
<td>1 month</td>
<td>12 months</td>
</tr>
<tr>
<td>Drug Eluting Stent</td>
<td>6 months</td>
<td>12 months</td>
</tr>
</tbody>
</table>

Peri-operative management of DAPT: simple & realistic

Temporary Discontinuation

Stents and Surgery

- Stents need DAPT
- Fear: thrombosis > stenosis
- 1, 6, 12, 18+ months
- Sure, know those dates
- Know your cardiologist even better

Management

Take blood pressure
Consider nitrous oxide
  - anxiolysis
  - decreased endogenous catecholamine release
  - increased oxygen delivery
Limit use of LA with vasoconstrictor
  - AHA recs. 0.04mg epi. per appointment
  - = 2.2 carpules of 1:100,000 epi.
Local measures to control bleeding
  - remove all granulation tissue
  - topical agents and suturing
Patient is a 59 year old male with a history of angina who was cleared for surgery by anesthesia. In the recovery room s/p iliac crest graft to the mandible the patient complains of chest pain, dyspnea, nausea and is diaphoretic with palpitations.

Angina

- Mismatch between oxygen needs of the heart and delivery of oxygen to the heart.
- Relieved by oxygen, rest and vasodilators

Treatment of Angina

- Terminate therapy and position patient
  - upright 45 deg.
  - Trendelenburg if SBP < 100 mm Hg
- Calm patient
- 100% O2
- Sublingual Nitroglycerin 0.4 mg
  - should relieve pain in 3-5 mins
  - can repeat twice at 5 min. intervals
  - failure to relieve pain- suspect MI
- Aspirin (anti-platelet activity)
- Morphine (for pain relief and anxiolysis)

Differential Diagnosis

- MI
- CHF
- PE
- Pneumothorax
- Cholecystitis
- Pancreatitis
- Pericarditis
- Perforated peptic ulcer
- Ruptured esophagus
- Aortic dissection

Myocardial Infarction

- ischemia leading to death of myocardial muscle tissue
- Not relieved by oxygen, rest and vasodilators
Critical Dysrhythmias

Associated with MI
- PVC- Premature Ventricular Contractions
- VT- Ventricular Tachycardia
- VF- Ventricular Fibrillation
- Asystole

Treatment of ACS

Drugs
- Oxygen (New evidence may harm in non-hypoxemic ACS)
- Aspirin (ASA)
- Nitrates (nitroglycerin)
- Opiates
- Prompt diagnosis and therapy. **TIMING IS IMPORTANT FOR REPERFUSION THERAPY**
  - Fibrinolytic therapy, heparin
  - Angioplasty with or without stent placement

Treatment of MI cont.

- Beta blockers (be careful)
- ADP antagonists (clopidogrel, prasugrel, ticagrelor)
- ACE inhibitors

Other
- ECG (12 lead), ST segment elevation or depression
- CXR
- CCU or telemetry monitoring

Rule out MI

- Clinical history and examination
- Serial enzymes
  - Troponin
  - CPK/MB (infrequent/historic)
- Serial ECGs
- CXR
- Stress Test/Thallium scan

Stress Test

A 19 y.o. black female third molar patient presents to your office three weeks following surgery. She was feeling well until seven days ago. Since then she has a history of anorexia, malaise, myalgia, weight loss and low grade fever.
Physical Exam and Labs

- Lungs clear
- Abdomen soft, bowel sounds decreased
- Heart: NSR with grade II/VI late systolic murmur at left sternal border
- CXR normal
- H/H = 10.2/31, MCV = 85 (84-96), MCHC = 30 (30-35)
- WBC = 11,000. P 65, L 20, M 10, B 3, E 2
- Chem. = WNL except BUN = 24
- UA = 1.018, 3+ protein, 4+ RBC
- Sed rate = 85

Fever of Unknown Origin

FUO = Illness of 3 weeks duration w/ documented 101 degree fever (several)
- Infections - 40-50% (TB, SBE, CMV, Fungal, local abscesses)
- Neoplasm - 30% (lymphoma, leukemia, myeloma, hypernephroma)
- Connective tissue diseases - 15-20% (RA, Acute RF, Lupus, Temporal Arteritis)

Fever of Unknown Origin

- Drug Fever
- Inflammatory bowel disease
- (CNS)

Heart Sounds

- S1 = closing of the mitral and tricuspid valves
- S2 = closing of the aortic and pulmonary valves
  – may have physiologic splitting of S2 upon inspiration
- S3 = blood hitting the wall of a non-compliant ventricle
  – occurs during rapid ventricular filling
- S4 = Pre-systolic sound

Heart Valves
Heart Murmurs
Evaluate for
• timing
• location
• pattern
• pitch
• quality
• radiation
• effect of position
• change with Valsalva

Heart Murmurs
• Grade 1- very faint, heard only when paying close attention (cardiologist)
• Grade 2- faint but unmistakably present
• Grade 3- clearly louder than faint, no thrill
• Grade 4- loud, thrill
• Grade 5- loud, need stethoscope, thrill
• Grade 6- no stethoscope needed, thrill

Systolic Murmurs
Aortic and pulmonary stenosis
• early, crescendo- decrescendo
Mitral and tricuspid regurgitation,
Ventricular Septal Defect
• holosystolic, blowing
Mitral valve prolapse
• late

Diastolic Murmurs
Aortic and pulmonary regurgitation
• early, decrescendo
Mitral and tricuspid stenosis
• mid to late, low pitched

Murmur
Mitral valve prolapse
IS THIS MURMUR NEW??
YES

Types of Anemia
• Iron deficiency
• Chronic blood loss (LOOK FOR BLOOD LOSS)
• Chronic renal failure
• Chronic disease
• Megaloblastic, Vitamin B12 deficiency (pernicious)
• Hemolytic
• Thalassemia
• Sickle cell
• Aplastic
Microcytic Hypochromic Anemia
Iron deficiency
Thalassemia

Normocytic Normochromic Anemia
Blood loss (LOOK FOR BLOOD LOSS)
Chronic disease
Renal failure
Hemolytic
Sickle cell

Other Info.
Left Shift
• more than 20% bands
• chronic bacterial infection, toxemia, hemorrhage
• degree of nuclear lobulation of PMN’s an indication of age

Other Info.
Elevated BUN
• kidney disease
• dehydration
Elevated sed. Rate
• chronic inflammation
• rheumatoid diseases

What are you to Do?
Physical Examination
Blood culture
• before put on antibiotics
ECHO
• look for vegetation
• document murmur

Test Results
Blood culture = Alpha hemolytic strep.
• What if was Staph Aureus?
If put patient on antibiotics before obtaining blood culture, then culture will be negative
ECHO = mitral vegetation
Diagnosis = SBE (Subacute bacterial endocarditis)
Symptoms of SBE

- Low grade fever
- New cardiac murmur
- Arthralgias
- Splenomegaly
- Splinter hemorrhages
- Roth’s spots, Osler’s nodes, Janeway lesions
- CHF
- Neurologic changes
- Embolic episodes

Causes of SBE

- Any flow disturbance
- Rheumatic heart disease
- Congenital heart disease
- Mitral valve prolapse
- Degenerative heart disease
- IVDU

Treatment of SBE

PCN/CTX/Amp for 4 weeks
or 2 week therapy with any of the above combined with Gentamycin
LONG TERM IV ANTIBIOTIC THERAPY, Home care more common now than hospitalization

Poor Prognosis

- Staph infection
- CHF
- Aortic valve involvement
- Prosthetic valve
- Old age

AHA Recommendations

First Recommendation for BE prophylaxis by the AHA issued in 1955.

8 Modifications, Most recent in 2007.

Trends: Simplified, Shortened List of indications and Reduced Dose.

Antibiotic Update: Evidence-based Usage and Clinical Controversies

Antibiotic Prophylaxis in Cardiac and Prosthetic Joint Patients; Where is the evidence?

AAOMS 95th Annual Meeting
Orlando, FL
Wednesday, 9 October 2013

Norman J. Betts, DDS, MS
Private Practice, Chelsea & Ann Arbor, MI
Adjunct Associate Professor, University of Michigan
AHA Guidelines NOT Standards

“This statement represents recommended guidelines to supplement practitioners in the exercise of their clinical judgment and is not intended as a standard of care for all cases.


“This statement provides guidelines for prevention of bacterial endocarditis. It is not intended as the standard of care or as a substitute for clinical judgement.”

– Dajani, 1997

Effectiveness of Antibiotic Prophylaxis

Bacterial endocarditis can develop even when appropriate antibiotic prophylaxis is administered.

“...Endocarditis may occur in spite of appropriate antibiotic prophylaxis,...


Estimate of Risk

If dental treatment causes 1 percent of all cases of viridans group streptococcal IE annually in the United States, the overall risk in the general population is estimated to be as low as one case of IE per 14 million dental procedures.

– Pallasch 2003, Stechelberg 1993

Why not just give antibiotics?

“Against low incidence and questionable efficacy one must balance the rare but real risk for adverse reactions, including anaphylaxis and the possible occurrence of drug-resistant organisms.”

– Strom, 1998

“The risk of inappropriate use of antibiotics and widespread antibiotic resistance appear to be far more important than any possible perceived benefit.”

– Tong, 2000

Most Recent AHA recs.


JADA, Vol. 139, Jan.2008, 3S-24S (= Supplement)

How many of you have actually read this paper?
### Reasons for revision of the infective endocarditis prophylaxis guidelines

“The Committee believes that recommendations for IE prophylaxis must be evidence-based.

There are currently no randomized and carefully controlled human trials in patients with underlying structural heart disease to definitively establish that antibiotic prophylaxis provides protection against development of endocarditis during bacteremia-inducing procedures.”

Dajani 1990

“A placebo-controlled, multicenter, randomized, double-blinded study to evaluate the effectiveness of IE prophylaxis in patients who undergo a dental procedure has not been done.”

Wilson 2007

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### Recent AHA Recs.

**Previous infective endocarditis**

- Prosthetic cardiac valve or prosthetic material used for cardiac valve repair

**Congenital heart disease**

- Unrepaired cyanotic CHD, including palliative shunts and conduits
- Completely repaired congenital heart defect with prosthetic device, whether placed by surgery or by catheter intervention, during the first six months after the procedure
- Repaired CHD with residual defects at the site or adjacent to the site of a prosthetic patch or prosthetic device (which inhibit endothelialization)

**Cardiac transplantation recipients who develop cardiac valvulopathy**

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**Patients Already Receiving Antibiotics**

“If a patient is already receiving chronic antibiotic therapy with an antibiotic that is also recommended for IE prophylaxis for a dental procedure, it is prudent to select an antibiotic from a different class rather than to increase the dosage of the current antibiotic.”

Wilson 2007

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**Preventing Bacterial Endocarditis**

Improve the oral hygiene of individuals at risk

“Patients at risk for bacterial endocarditis should maintain the best possible oral health to reduce potential sources of bacterial seeding, because poor dental hygiene, or periodontal or periapical infections may induce bacteremia even in the absence of dental procedures.”

Shulman 1984

“The AHA guidelines for prevention of IE have resulted in an overemphasis on antibiotic prophylaxis and an underemphasis on maintenance of good oral hygiene and access to routine dental care, which are likely more important in reducing the lifetime risk of IE than is the administration of antibiotic prophylaxis for a dental procedure.”

Wilson 2007
Topical Antiseptic Rinses

“Topical antiseptic rinses do not penetrate beyond 3mm into the periodontal pocket and, therefore, do not reach areas of ulcerated tissue where bacteria most often gain entrance to the circulation... It is unlikely that topical antiseptics are effective to significantly reduce the frequency, magnitude and duration of bacteremia associated with a dental procedure.”

– Wilson 2007

Antibiotic Prophylaxis in General


- 8 medical conditions and devices associated with risk of infection resulting from dental procedures
- Systematic review of the literature
- GREAT PAPER, GET IT AND READ IT!!

8 Medical Conditions and Devices

- Cardiac: heart valve disease, prosthetic heart valves, pacemakers
- Hip, knee and shoulder prosthetic devices
- Renal dialysis shunts
- CSF shunts
- Vascular grafts
- Immunosuppression due to cancer and chemotherapy
- SLE
- IDDM (type I)

Orthopedic Prosthetic Joints

1997 ADA and AAOS, Antibiotic prophylaxis (Revised in 2003)

- w/in two years of joint replacement
- Malignancy
- IDDM
- Previous joint infection
- Malnourishment
- Hemophilia
- Rheumatoid arthritis
- SLE
- Disease or drug induced immunosuppression

2009 AAOS statement

- “Given the potential adverse outcomes and cost of treating an infected joint replacement, the AAOS recommends that clinicians consider antibiotic prophylaxis for all total joint replacement patients prior to any invasive procedure that may cause bacteremia.”
- This is a recommendation and not a standard of care.
- AAOS website, www.aaos.org, Dental work after joint replacement
- ADA and AAOS have not agreed on this recommendation
- OMSNIC rec. consider contacting the patient’s orthopedic surgeon to determine their recommendation and document it.
AAOM Response
(American Academy of Oral Medicine)

Given that the 2009 information statement of the AAOS is more of a statement than an official guideline; the AAOM believes that it should not replace the 2003 joint consensus statement prepared by the relevant organizations: ADA, the AAOS and the IDSA.

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Enrollment, 339 pts. (cases) with prosthetic hip or knee infections, 339 pts. with hip and knee arthroplasties without infections (controls)

Compared
- Differences in dental visits (exposure) in terms of high and low risk
- Differences in use of antibiotic prophylaxis

Results (odds ratio w/ 95% confidence interval)
- No statistically significant difference between groups
- Neither dental procedures or antibiotic prophylaxis prior to dental procedures were associated with risk of prosthetic hip or knee infections

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Recent Joint Statement of AAOS and ADA

Evidence based analysis

There is insufficient evidence to recommend the routine use of antibiotics for patients with orthopedic implants to prevent infections prior to having dental procedures because there is no direct evidence that routine dental procedures cause prosthetic joint infections.

- Rec. 1. Based upon limited evidence, practitioners consider changing their longstanding practice of prescribing prophylactic antibiotics for patients who undergo dental procedures. Dental procedures are unrelated to PJI.
- Rec. 2. There is no direct evidence that the use of topical antimicrobials before dental procedures will prevent PJI.
- Rec. 3. Consensus recommendation (weakest evidence), supports the maintenance of good oral hygiene.

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Other Evidence

Multiple high strength studies link oral procedures to bacteremia (surrogate risk for orthopedic implant infection).

Multiple moderate strength studies suggest that prophylaxis decreases the incidence of post-dental procedure bacteremia.

No studies explain the microbiological relationship between bacteremia and orthopedic implant infection.

The majority of the organisms found in implant infections are *Staphylococcus* and the majority of the organisms found as the cause of bacteremia are *Streptococcus*.

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Conclusion

- Antibiotic prophylaxis is highly controversial
- Practice is driven by long-standing dogma and habit, medicolegal concerns and potentially devastating consequences

The weight of evidence suggests that the practice should be stopped in most, if not all, of these eight patient groups.
Physician wants IE prophylaxis when not indicated

ADA recommendation that a dentist exercise independent clinical judgment in antibiotic prophylaxis guidelines.
• Consult with the physician, try to reach a consensus among professionals
  – Basis for physician recommendation
  – Why dentist disagrees
• If no consensus, answer lies with informed consent.
  – Present all treatment options with benefits and risks
  – Document well in record

Dentist, not patient is ultimately responsible for patient treatment. Therefore, the dentist is not obligated to perform a treatment he or she does not believe is in the best interests of the patient.

J.G. is a 82 y.o. male with a history of poorly controlled hypertension. He is in pain and has been up all night due to abscess tooth #14 which is causing some slight buccal space involvement. His pre-op. BP is 182/102. You administer nitrous oxide at 50% and his BP falls slightly to 172/98. You administer local anesthesia and he becomes confused, has difficulty speaking and develops facial droop on the side of your injection.

CVA (Stroke)

Signs and symptoms:
• Sudden weakness or numbness of face, arm, leg, especially on one side of body
• Sudden confusion
• Difficulty speaking or understanding
• Vision changes in one or both eyes
• Trouble ambulating, dizziness, loss of balance or coordination
• Severe headache

Cincinnati Prehospital Stroke Scale

Facial droop
• Have patient show teeth or smile
  – Have facial droop
Arm drift
• Close both eyes and extend both arms straight out with palms up for 10 secs.
  – One arm does not move or drifts downward
Abnormal speech
• Have patient say “you can’t teach an old dog new tricks”
  – Slurs words, uses wrong words or is unable to speak

Treatment

• Stop treatment
• Activate EMS ASAP, minimize time to hosp.
GIVE SUPPLEMENTARY OXYGEN, turn off nitrous oxide and 100% O2
• Make sure EMS takes patient to a “stroke center.” (Administers fibrinolytics or endovascular therapy)

In Hospital Care

• Provide O2
• IV access and obtain blood samples
• Check glucose and treat hypoglycemia
• Stroke scale (NIHSS)
• Activate stroke team
• EMERGENT CT scan and read promptly to see if is embolic or hemorrhagic stroke. DO NOT DELAY CT for IV, blood draw or stroke assessment
• Fibrinolytic or endovascular therapy ASAP if not hemorrhagic stroke
• If hemorrhagic admission to NICU with blood pressure control
How do you go about assessing risk in the treatment of a patient with cardiovascular disease?

New York Heart Association (NYHA) Functional Classification 1928

<table>
<thead>
<tr>
<th>NYHA Class</th>
<th>Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Cardiac disease, but no symptoms and no limitation in ordinary physical activity, e.g. shortness of breath when walking, climbing stairs etc.</td>
</tr>
<tr>
<td>II</td>
<td>Mild symptoms (mild shortness of breath and/or angina) during ordinary activity. Marked limitation in activity due to symptoms, even during light household activity, e.g. walking short distances (20–100 m). Comfortable only at rest.</td>
</tr>
<tr>
<td>III</td>
<td>Severe limitations, precedes symptoms even while at rest, mostly bedbound patients.</td>
</tr>
</tbody>
</table>

Index for the Prediction of Cardiac Risk for Stable Patients Undergoing Nonurgent Major Noncardiac Surgery - Lee et al 1999

Six independent risk correlates were identified:
- Ischemic heart disease
- Congestive HF
- Cerebrovascular disease
- High-risk surgery
- Preoperative insulin treatment for diabetes mellitus
- Preoperative creatinine greater than 2 mg per dL.

ACC/AHA Guidelines on Perioperative Cardiovascular Evaluation and Care

- Guidelines initially published in 1996
- Revised in 2002
- Second revision in 2007

Medical Guidelines for Perioperative Management and Risk Assessment of Patients with Cardiovascular Disease

- NEW YORK HEART ASSOCIATION – Functional Classification 1928
- LEE’S INDEX – Prediction of Cardiac Risk For Patients Undergoing Noncardiac Surgery 1999
  - Guidelines initially published in 1996
  - Guidelines revision in 2002
  - Guidelines second revision in 2007
  - Guidelines third revision in 2014
Patient with CV disease

So check – Does he have...

Active Cardiac Conditions?
- Unstable coronary disease
- Decompensated HF
- Significant dysrhythmia
- Severe valvular disease

No
- OK for surgery

Or does he need more...
- Hx Ischemic Heart Disease
- Hx Compensated HF
- Hx CVA
- Diabetes Mellitus
- Renal Insufficiency (creat. ≥2.0)

Evaluation and Treatment

OK for surgery

Respiratory

A 60 y.o. obese female had a left iliac crest graft to the anterior mandible three days ago. She has refused to ambulate since her surgery because of pain. You are called to the floor because she has developed dyspnea, pleuritic chest pain, cough and tachycardia.
Differential Diagnosis

- PE
- Angina
- MI
- CHF
- Pneumothorax
- Bronchospasm
- Pneumonia
- ARDS

Treatment

- 100% O2
- VS, pulse= 120, BP= 90/60, pulse ox= 85
- Clinical examination
  - neck veins, auscultate chest, percuss chest
- ABG, pO2 <80, pCO2= normal
- ECG
- Spiral CT with contrast
- V/Q scanning
- Pulmonary angiography

Pulmonary Embolism

Virchow’s Triad

Treatment of PE

- Anticoagulation
- Thrombolysis
- IVC Filter
Anticoagulation

1.0
IV heparin
Warfarin

Anticoagulation

1.0
IV heparin
Warfarin

Anticoagulation

1.0
IV heparin
Warfarin

2.0
LMWH
Warfarin

Anticoagulation

1.0
IV heparin
Warfarin

2.0
LMWH
Warfarin

3.0
LMWH
DOAC

Treatment

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Provoked PE</td>
<td>3 months</td>
</tr>
<tr>
<td>Unprovoked PE</td>
<td>3 months+</td>
</tr>
<tr>
<td>Cancer + PE</td>
<td>Lifelong</td>
</tr>
</tbody>
</table>

“A PE is seen on CTA…”

Low Risk PE
Isolated Sub-segmental PE

Singulair (Montelukast Sodium)
Leukotriene receptor antagonist
Uses
- Chronic asthma
- Exercise induced asthma
- Seasonal allergic rhinitis
- Perennial allergic rhinitis
Not an acute medication- prophylaxis

Singulair (Montelukast Sodium)
Adds to the effects of inhaled corticosteroids, can gradually taper off
Decreases use of Beta agonist inhalers by > 25%
Mechanism of action and metabolism
- Blocks cysteinyl leukotrienes
- 99% bound to plasma proteins
- Metabolized by cytochrome p450 enzyme system in liver

Asthma
Obstructive lung disease
- Normal lung volumes
- Air in, but difficulty getting air out
Types
- Extrinsic
- Intrinsic
- Exercise induced
- Drug induced
Extrinsic Asthma

Allergen induced
• IgE, mast cells, histamine, SRS-A, prostaglandins

Children
Often regresses at puberty
Good prognosis

Extrinsic, Intrinsic Asthma

Intrinsic Asthma

Upper respiratory irritants or infection
Adults (> 35 years of age)
Chronic cough
Worse prognosis

Exercise and Drug Induced Asthma

Exercise induced
• exercise
• cold weather
Drug induced
• Aspirin, NSAIDs
• association with nasal polyps

Pathophysiology of Asthma

• Initiating factor(s)
  – stress
  – irritants
• Allergic- IgE (mast cells), Histamines, SRS-A, prostaglandins
• Constriction of bronchial smooth muscle
• Mucosal edema
• Mucus plugging of the bronchi

Pathophysiology of Asthma
Obstructive Lung Diseases (COPD)

- Asthma
- Bronchitis
  - blue bloater
- Emphysema
  - pink puffer

Restrictive Lung Diseases

Lung volumes are decreased
- Space occupying lesions (TB, tumors)
- Interstitial fibrosis (asbestosis, etc.)
- Myasthenia Gravis
- Severe scoliosis

Lab Studies

- Match test
- PFTs (spirometry)
  - FEV1
  - FVC
  - VC
  - FEV1/FVC
  - w/o and with bronchodilators
- ABGs

Lung Volumes

- Vital capacity- maximum volume exhaled following full inspiration
- Tidal volume- air inspired and exhaled in a single breath during normal breathing
- Inspiratory reserve volume- air that can be inspired after a normal inspiration
- Expiratory reserve volume- air that can be expelled after a normal expiration
- Residual volume- air remaining in the lungs after maximal expiratory effort

PFTs

- FVC = Maximum volume expelled. Normal in obstructive disease (volumes are the same, decreased rate of expiration)
- FEV1 (normal = 80% of predicted), asthma = 50%
- FEV1/FVC = >70% in restrictive dx.
  - <70% in obstructive dx.
  - <40% in severe dx.
Complication
Following the delivery of local anesthesia, the patient begins to wheeze and complains of shortness of breath. You note she is taking shallower breaths and is breathing more frequently. She begins to cough, becomes anxious and confused.

Differential Diagnosis
- Asthma
- Bronchospasm
- Laryngospasm
- Foreign body obstruction
- Congestive heart failure

Sounds of Respiratory Difficulty
- Wheezing- Asthma, bronchospasm, partial tracheal obstruction
- No sound, deep movements (rocking boat)- total airway obstruction, laryngospasm
- Crowing sound- partial upper airway obstruction
- Moist wet- congestive heart failure, acute pulmonary edema
- Normal but rapid and deep- hyperventilation

Signs and Symptoms of Asthma
- Paroxysms of dyspnea
- Productive cough and wheezing
- Tachypnea with prolonged expiration
- Cyanosis
- Mental confusion, fatigue, anxiety
- Normal to increased BP, rapid and full pulse

Treatment of Asthma
- Eliminate precipitating factor(s)
- Position patient (often will sit upright)
- Oxygen
- Beta 2 specific inhalers (e.g. Albuterol)
  - bronchodilation
  - decreased mucus secretion
- Call emergency services
- Epinephrine - 0.3 mg sub Q10-15 mins x 3
  - IM and IV doses not equivalent

Management of Asthma Attack
Treatment of Asthma (cont.)

- Intubation and ventilation
- Corticosteroids- work best for prevention, inhaled, 4-12 hours to work

Anesthetic Plan in Asthma

Optimize
- Wait 4 weeks after URI
- Stop smoking???? Treat GERD.

Avoid Bronchospasm
- Anxiolytic (Dexmedetomidine)
- Avoid airway instrumentation, excessive deep suctioning, cold inspired gases
- Avoid histamine-releasing and muscarinic drugs (meperidine, neostigmine)
- Well-tolerated agents: propofol, sevoflurane

Treat Bronchospasm (high PIP, prolonged expiration)
- Confirm: Assess compliance with bag, auscultate chest
- Deepen anesthesia, rapid-acting beta-2 agonist
- Low dose epinephrine (0.5-2 mcg/min)

Laryngospasm

Do you use Succinyl Choline or not?
Dr. Richard Robert

Muscle Relaxants in OMS

We keep muscle relaxants in our fridge for:
- Treatment of laryngospasm not responsive to positive pressure ventilation and other maneuvers.
- Muscle relaxation for intubation.

The depolarizing muscle relaxant
Succinylcholine (Anectine®)

Dose:
- Partial 10-20 mg; Compl. 20-40 mg IV.
- 2nd dose 40 mg IV w/ atropine.

Disadvantages:
- Hyperkalemia.
- Bradydysrhythmias (esp. children).
- Trigger for malignant hyperthermia – dantrolene may be required.
The non-depolarizing muscle relaxant rocuronium:

Dose:
- 0.6 – 1.2 mg/kg
- Onset 1-2 min.; Duration 20-60 min.

Disadvantage:
- None of those noted for Sux.
- However, prolonged ventilatory support is required.

Sugammadex – Side Effects and Untoward Reactions

Adverse effects are very rare and consist of:
- Bucking and movement.
- Metallic or bitter taste.
- Bronchospasm.
- Allergic reactions – exceedingly rare.
- QT prolongation has not been noted.

All that sounds good, but how expensive is it to use?

- Standard reversal dose: 4 mg/kg
  4 mg x 70 kg = 280 mg
- For rapid recovery: 16 mg/kg
  16 mg x 70 kg = 1120 mg

Cost
- 500 mg vial = $210 ($.42 /mg)
- Standard reversal cost: $118
- Rapid recovery cost: $470
- Required minimum order from Southern Anesthesia – box of 10
  500 mg vials = $2100
- Shelf life – 3 years

But what if you only want one vial?

If there is sufficient interest by the CALAOMS membership, Hals will make the medication available on a per vial basis.
- The cost would be approximately $240 for a 5 mL vial (500 mg). There is a three year shelf life, which means it would cost you about $80 a year.
- Could we have a show of hands for who would be interested in ordering a vial.

50 year old very anxious female planned for sinus lift and mandibular buccal onlay bone grafting with general anesthesia in the operating room. The patient is planned for implants in the future.
Medical History
Smoker, 2+ ppd x 20 years, recently decreased to 1 ppd
Morning non-productive cough, some dyspnea on exertion, @ baseline independent functional capacity
Medications
• Advair diskus 250/50 mcg (Fluticasone propionate = Flonase/ Salmeterol = Serevent), 1 inhalation BID
• Proventil (Albuterol) prn
• Vitamin D and calcium

Physical Examination
BP = 135/90, P = 84
R = 24, O2Sat = 96% (Room Air)
Ht. = 5’4” (162.5cm) Wt. = 115 lbs. (52kg)
No dyspnea @ rest
Distant breath sounds
Hyper resonant to percussion

Lab Values
ABG
• pH = 7.39 (7.38-7.44)
• pO2 = 77 mm Hg (80-100)
• pCO2 = 50 mm Hg (35-45)
• HCO3 = 32 mmol/L (21-28)

Metabolic Acidosis and Alkalosis
Normal pH = 7.40
Normal PaCO2 = 40 mm Hg
• pH < 7.40, PaCO2 > 40, then Respiratory Acidosis
PaCO2 < 40, then Metabolic Acidosis
• pH > 7.40, PaCO2 < 40, then Respiratory Alkalosis
PaCO2 > 40, then Metabolic Alkalosis

Advair Diskus
Combined medication
• Fluticasone propionate (Flonase) = inhaled corticosteroid & Salmeterol (Serevent) = long acting beta adrenergic agonist
• Used after failure of inhaled corticosteroids
Not indicated for acute bronchospasm
3 doses= 100/50, 250/50, 500/50

Clinical Manifestations of Emphysema
• Caused by smoking, air pollution, occupational exposure to toxic gasses and recurrent pulmonary infections
• Loss of air spaces and vascular structures in lungs
• Minimal V-Q mismatch
• Thin body habitus, rosy-cheeked, typically acyanotic
Clinical Manifestations of Emphysema

- Dyspnea with scant sputum production
- Chest percussion hyperresonant with decreased breath sounds
- Slightly decreased arterial PO2, RBC normal
- Terminal Cor pulmonale and pulmonary hypertension

Clinical Manifestations of Chronic Bronchitis

- Fibrosis and mucous plugging = severe V-Q mismatch
- Can have cyanosis
- Cough with copious sputum, often purulent
- Chest percussion normal with rales and rhonchi
- Arterial PO2 may be severely decreased, increased RBC
- Cor pulmonale early in course, recurrent infections

Lab Values

- WBC = 8000/mm (5-10,000)
- RBC = 7.0 mil/mm (4.2-5.9)
- Retic. = 1.9% (0.5-1.5)
- HCT = 52% (40-54%)
- Hgb = 16 mg/dl (14-18)

Secondary polycythemia

PFT’s

- FEV1 decreased
- FVC decreased
- FEV1/FVC decreased

Indicates obstructive disease pattern

Patients with COPD are three times more likely to have postoperative pulmonary complications

Anesthetic Management

ASA 3
- Irritable airway subject to laryngospasm, bronchospasm
- Subject to cardiovascular instability and barotrauma under GA
- Sensitive to respiratory depressive effects of benzodiazepines and opioids
- Residual neuromuscular blockade is deadly
- Always use regional/local anesthesia when possible
- Consider arterial line with GA.
- Be aware of air trapping - prolonged expiratory time…
- BUT this leads to hypercapnia, acidosis, pulm vasc resistance and hemodynamic instability
- Volatile agents produce bronchodilation
- Extubate at PaCO2 close to normal preoperative value
- Extubation to CPAP reduces reintubation rates

Hematopoietic
Anticoagulant Therapy

- Atrial fibrillation
- Prosthetic heart valve
- Venous thrombosis/ DVT
- Arterial occlusion (CVA)
- Pulmonary embolism
- Hypercoagulable state
- Dialysis
- Mitral valve disease with left atrial enlargement

Atrial Fibrillation

Risk of ischemic stroke
- in patients with non-valvular atrial fibrillation is 5% without anticoagulation.
  – You, 2012

Thromboembolic stroke from atrial fibrillation
- has a 20% mortality rate and 40% of strokes cause permanent disability.

Atrial Fibrillation

Embolic stroke that happens during cessation of anticoagulation is fatal or associated with severe neurologic deficit in over 60% of cases.

Mechanical Heart Valve

Risk of a thromboembolism is 4% per year if not anticoagulated.
1% per year with warfarin

Clotting Factors Affected by Coumadin

- II
- VII
- IX
- X
- Vitamin K dependent factors

INR

International Normalized Ratio
- Accounts for differences in reagents used to perform PT
- Does not correlate directly with PT (INR of 4.0 approx. = PT of 2.2)
- Related to clotting factors II, VII, IX and X
- Elevated with Coumadin therapy
- Most indications INR 2.0- 3.0
- Prosthetic heart valves INR 2.5- 3.5
Local Measures to Control Bleeding

Pressure
• Biting on gauze
• Biting on tea bag (tannic acid)

Suturing, primary closure

Oxidized cellulose

Topical thrombin

Tranexamic acid mouth rinse


• 150 patients, extraction removal all granulation tissue
• 3 groups managed with different local measures
• INR averaged 2.4 (1.5- 4.0)
• 13 patients post operative bleeding (INR 2.1-3.3)
• All bleeding was stopped with additional local measures only
• Best technique = gelatin sponge and suture
• Bleeding cases associated with severe periodontitis
• Bleeding more common after extractions in the maxilla
• Bleeding more common with multiple extractions


• Summarized all articles in this area
• Discuss the use of low molecular weight heparin (self administered) bridging therapy
• “The scientific literature does not support routine discontinuation of oral anticoagulation therapy for dental patients.”
• “Routine discontinuation of these drugs before dental care, however, can place these patients at unnecessary medical risk.”

Summary

• Cessation of anticoagulant therapy is not necessary prior to extraction. Dose reduction of anticoagulant medication is occasionally necessary.
• An INR < 3.0 is preferred and should not exceed 4.0
• INR > 5 contraindicate surgical procedures
• Cessation of anticoagulant therapy can lead to serious complications
• Granulation tissue must be removed at the time of extraction
• Local measures are effective in controlling post-op bleeding
• When encountered, post-op bleeding is associated with periodontally involved teeth, maxillary teeth and areas of multiple extraction (> 5 teeth), impacted teeth (bone removal), alveoplasty

Complication

Following extraction of tooth #14 the patient complains of continued bleeding. Local measures are employed and are temporarily successful. The patient calls you the next day and states that bleeding started again last night and has been on and off since the procedure. He did not want to disturb you last night, but he has lost a lot of blood.

Management

• Patient immediately to the office
• Examine site for bleeding
• Local anesthesia/ local measures
• Laboratory evaluation of hemoglobin and hematocrit (Hgb = 9.2, Hct = 27), ? Symptomatic, CVD
• Transfuse 2 units of PRBC’s
• Observe patient for an extended period of time.
• Consider reversing Coumadin therapy with primary care physician’s help
Reversing the Effects of Coumadin

Emergent
• Factor IX complex (Proplex, Konyne)

Severe
• Fresh frozen plasma (FFP)

Moderate
• Vitamin K 10 mg (IV or PO) works in approx. 24 hours

Update on Anticoagulants

Gurpreet Dhaliwal MD

Anticoagulant Therapy

Atrial fibrillation
Venous thromboembolism
Prosthetic heart valve

Warfarin
#Reversal
#Renal agnostic
#Cheaper pill
#Mechanical Valve

DOAC
#In the works
#Adjustment
#Less visits

New Anticoagulants

• Dabigatran (thrombin inhibitor)
• Rivaroxaban (factor Xa inhibitor)
• Apixaban (factor Xa inhibitor)
• Edoxaban (factor Xa inhibitor)

Coagulation cascade
The Coagulation Cascade

**Resumption of DOAC**

- NOACs: afib and DVT/PE
- Warfarin: mechanical valves
- Warfarin: R&R
  - Reversible
  - Renal agnostic
- NOAC: Shorter ½ life
- Compliance
- Surgery: interruption/resumption
K.P. is a 58 y.o. female with negative medical history. Her health history form indicates that she takes no medications. She has severe bone resorption of the anterior mandible. She is planned for cranial bone harvest and onlay bone grafting the anterior mandible in preparation for future implant placement.

During the procedure, she bleeds excessively to the point of needing 2 units PRBC’s following the completion of the procedure. Upon further questioning she states that she takes Gingko and Garlic but “they should not have any effects because they are not really medicines.”

Herbal Medication Use
1997- 42% Americans unconventional therapy including herbal products (~12% herbas: 380% increase from 1990)
Current estimate: 1:3 Americans use herbal medications -some surgeries (ortho, plastics, cancer) use higher

• JAMA Ang-Lee et al. 2001;286:206-216

Herbal Medicines: Pharmacological Effects, Side Effects and Treatment Concerns
Norman J. Betts, DDS, MS

Failure to Disclose Use
70% of patients failed to disclose herbal medication used during routine preoperative assessment

Reasons
• Belief doctors are not knowledgeable
• Doctors are prejudiced about their use
• Fear of admitting use
• Not considered to be medications
• Not considered to be part of medical care

MUST QUESTION PATIENTS CAREFULLY
Classified as Dietary Supplements

Dietary Supplement and Education Act of 1994
- Exempts herbal medications from efficacy and safety requirements, and regulations that over-the-counter medications must fulfill (no scientific scrutiny)
- Burden shifts to US Food and Drug Administration to show the product is unsafe before it can be removed from the market (can intervene once marketed)
- No predictable pharmacological effects
- No product label accuracy

Safety of Herbal Medications

Empirical evidence supports the notion that most herbal preparations are safe
Can cause serious harm
- 2621 adverse events
- 101 deaths
- likely these events are underreported

Herbs That Decrease Platelet Aggregation

Bilberry, Bromelain, Don qui
Feverfew, Fish oil, Flax seed oil
Garlic, Ginger, Ginseng, Ginkgo biloba, Grape seed extract


Herbs That Inhibit Clotting

Coenzyme Q
Goldenseal
St. John’s Wort
Chamomile
Dandelion root
Dong qui
Horse chestnut

Garlic

Uses (1999 WHO recommended use in monograph)
- Modify risk of developing atherosclerosis
- Lower serum lipid and cholesterol levels
- Reduce blood pressure and thrombus formation

Actions
- Inhibits platelet aggregation ? Platelet activating factor

Side effects
- Prolonged bleeding
Avoid- use with other platelet inhibitors
Discontinue 14 days prior to surgery

Ginkgo biloba

Uses
- Positive effects on cerebral blood flow, cerebral insufficiency, and memory, may improve cognitive performance in Alzheimer Disease
- Flavonoids- free radical scavengers
- Terpenes- inhibit platelet activating factor

Side effects
- prolonged bleeding
- headache, dizziness, heart palpitations, and GI and dermatological reactions
Discontinue 14d prior to surgery
Ginseng (root)

Uses
- lower cholesterol and blood sugar
- increased strength, endurance and mental acuity

Side effects
- Hypoglycemia may be 2/2 hormone receptor action
- Inhibit platelet aggregation
- Decrease in warfarin anticoagulation

Avoid
- Diabetics
- Patients on warfarin or at risk for bleeding

Discontinue 14 days prior to surgery

Kava

Uses
- Anxiolysis
- Sedation
- Antiepileptic

Side effects
- Increase sedative effects of anesthetics
- Tolerance, ? addiction & withdrawal, hepatotoxicity

Discontinue 14d prior to surgery

Valerian

Uses
- Sedative, insomnia, in virtually all herbal sleep aids

Actions
- Acts at the GABA receptor (gamma amionbutyric acid)
- Sites thought similar to benzodiazepine sites

Side effects
- additive to sedatives
- patients can become dependent
- acute benzodiazepine withdrawal but little evidence for valerian- can taper to stop 14d prior to surgery

Summary

- Most patients will not disclose herbal medication use – therefore must question carefully
- 1 in 5 patients is unable to identify the preparation they are taking – bring herbal medications to appointment
- More likely to avoid conventional diagnosis and therapy – suspect presence of undiagnosed disorders
- Should discontinue herbal medications prior to invasive procedures most often 14 days recommended

12 year old male who presents for the removal of a radiolucent lesion of his left mandible that will require hospitalization and OR for treatment. Adopted at birth, no previous hospitalizations, bruises easily, otherwise healthy.
Labs

Hgb = 12
Hct = 38
Plts = 150 K
INR = 1.1
PTT = 60 secs (30-45 secs)
Isolated elevated PTT

Evaluation for a Bleeding Disorder

History
- bruising
- nose bleeds
- heavy menstrual bleeding
- bleeding following trauma or surgery
- family history

Medical status
- drugs
- alcohol use

Physical examination
- petechiae and ecchymosis

Lab tests
- INR/PTT
- Platelet count
- Bleeding time (not really useful now)
- Others
  - specific factor assays
  - fibrinogen levels
  - platelet adhesion and platelet aggregation tests

PT-INR/PTT

INR = International Normalized Ratio
- differences in reagents
- does not correlate directly with PT
- II, VII, IX, X
- Coumadin therapy

PTT = Partial Thromboplastin Time
- Intrinsic pathway prior to activation of factor X
- Heparin therapy

Clotting Cascade

Intrinsic pathway

Extrinsic pathway

Elevation of PTT

- Heparin therapy
- Hemophilia A and B
- Von Willibrands Disease

If PT is normal but PTT is prolonged are limited to VIII, IX, XI, XII
Platelets

Platelet function
- platelet adhesion
- platelet aggregation

Bleeding time
- Not sensitive or specific
- Replaced by functional assays (e.g. PFQ-100)

Hemophilia A, B and Von Willibrands Disease

Hemophilia A
- Factor VIII deficiency, X-linked recessive

Hemophilia B
- Factor IX deficiency

Von Willibrands Disease
- Factor VIII deficiency and deficiency in Von Willibrands factor

Treatment of Hemophilia A and Von Willibrands Disease

(mild) DDAVP (synthetic antidiuretic hormone) increases release of Von Willibrands factor

(moderate) Cryoprecipitate (VIII + Fibrinogen)

(severe) Factor VIII concentrate (may not help with Von Willibrands disease)

(post-op) Amicar - inhibitor of fibrinolysis

Treatment of Hemophilia B

Factor IX deficiency

(mild) FFP

(severe) Proplex, Konyne (II, VII, IX, X)

Calculation of Allowable Blood Loss

Pre-op HCT - 30 x EBV = Allowable Blood Loss

Pre-op HCT

EBV = 40 kg x 80 ml/kg = 3200 ml

38 - 30 x 3200 = 673 ml

38

Normal Blood Volume (cc) per Kg

Female = 60
Male = 70
Child = 80
Infant = 100
A quick pediatrics review…

Child vs Adult: Cardiovascular Differences
• HR & BP vary with age
• Higher cardiac output and oxygen consumption
• CO is HR dependent — Bradycardia is bad
• Compensated shock: hypo-perfusion + normal BP
• Look at entire physical exam.. don't let normal vital signs fool you!
• Cardiac history? Feeding is a stress test. Playground endurance…

Child vs Adult: Pulmonary
• High oxygen consumption —> high RR and MV
• Rapid desaturation during apnea
• Fewer Type I endurance muscle fibers. Earlier fatiguing of diaphragm - the main muscle of respiration
• Chronic lung disease of premature babies lasts until at least 2 years old.

Child vs Adult: Airway
• Nasal breathers.
• Large occiput
• Large adenoids, tonsils and tongue
• Epiglottis is thick & stubby
• Vocal cords are angled
• Smaller diameter airways with more resistance - hyperreactive

Child vs Adult: Airway
• Higher rate of airway obstruction
• Higher rate of laryngospasm
• Higher rate of difficult airway
• The difficult airway algorithm doesn’t apply to kids!
• Awake FOI? Awake trach?
• Asleep FOI? ETT through LMA?
• Time to desaturation?
• Don’t miss difficult airway, respiratory distress

Child vs Adult
• UNHELPFUL: Reassurance, Apology, False control
• HELPFUL: Distraction, Humor, Controlled Choices
• Drug errors are common!
• Emergence delerium

Gastrointestinal
You complete maxillary and mandibular orthognathic surgical procedures on a 19 year old female without complications. On the fourth post-op. Day she experiences abdominal cramps and non-bloody diarrhea. Post-operatively she was placed on a cephalosporin antibiotic.

Differential Diagnosis

- Change in diet to liquids
- Viral
- Pseudomembranous colitis
- Laxative abuse
- Inflammatory bowel disease

Lab and Other Tests

Lab
- Fecal leukocytes
- Culture (aerobic and anaerobic)- C. Diff.
- C. Diff. toxin- positive
- Ova and parasites- negative
- Blood- negative
- K+

Guaiac stools- positive
Abdominal CT/ plain films = flat plate
Proctoscopic examination- yellow-white, raised, plaque-like pseudomembrane lining bowel.

Diagnosis

Pseudomembranous Colitis

Pathophysiology

Exotoxin produced by C. Difficile
- Anaerobe, indigenous to the bowel
- Proliferates when antimicrobials and other factors alter bowel flora.
- Particularly with extended spectrum PCN’s (Augmentin, Amoxicillin) and Clindamycin, has occurred with most antibiotics. New #1 are fluoroquinolones.
Symptoms and Progression of Disease

Fever
Cramps
Voluminous non-bloody diarrhea (5% bloody)
Develops 4-9 days after initiation of antibiotic therapy. Can take as long as 2 months to develop.
In bowel- edema and mucosal ulceration with white pseudomembrane

Treatment

Stop antibiotic
• Vancomycin 250- 500 mg PO, qid or
• Flagyl250- 500mg PO, tid
IV hydration
Watch K+
Refractory cases- Cholestyramine 4gms PO, qid x 5days
Antidiarrheal medications are contraindicated (retain toxin in bowel)
RELAPSE AS HIGH AS 30%
Best Treatment now fecal transplant = Above 95% cure rate

Neurologic

65 year old homeless man, brought into ER semiconscious, looks ill with a mandibular fracture. You are called to the ER to manage him. As you are examining him he loses consciousness

Differential Diagnosis for Unconsciousness

A = alcohol
E = epilepsy
I = insulin
O = opiates
U = uremia
T = trauma
I = infection
P = psychotic
P = poison
S = shock
C-spine Fracture

C4 - loss of spontaneous respiration
C5 - quadriplegia
C6 - paraplegia
C7 - flexion, but poor extension
T1 - good flexion and extension but weak

Initial Actions

ABCs
Oxygen
VS
Cervical collar
Exam
ECG
IV/ Blood draw

Labs

Na = 142 (135-145)
K = 3.3 (3.5-5.0)
Cl = 99 (100-106)
HCO3 = 18 (24-30)
Glucose = 463 (70-110 fasting)
U/A = 4+ sugar, 2+ ketones

Endocrine

Update on Diabetes

Gurpreet Dhaliwal, MD

Type 1 Vs Type 2 Diabetes
Classic manifestations

- Polydipsia
- Polyuria
- Polyphagia
- Weight loss
- DKA/HHS

Complications

- Cardiovascular
  - Stroke
  - MI
  - PAD
- Nephropathy
- Retinopathy
- Neuropathy
- Infections

Oral Complications of Diabetes

- Xerostomia
- ↑ Infection
- ↓ Healing
- ↑ Periodontal disease
- Burning mouth syndrome

DM management

<table>
<thead>
<tr>
<th>Lifestyle</th>
<th>Glucose Control</th>
<th>Organ specific</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Diet</td>
<td>• Oral</td>
<td>• Lipids</td>
</tr>
<tr>
<td>• Exercise ↑</td>
<td>• Insulin</td>
<td>• BP</td>
</tr>
<tr>
<td>• Weight Loss</td>
<td></td>
<td>• Kidney</td>
</tr>
<tr>
<td>• Smoking ↓</td>
<td></td>
<td>• Eye</td>
</tr>
</tbody>
</table>

Glucose control

<table>
<thead>
<tr>
<th>Metformin</th>
<th>Old agents</th>
<th>New agents</th>
<th>Insulin</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• glyburide</td>
<td>• GLP-1 (+)</td>
<td>• Ultra Short</td>
</tr>
<tr>
<td></td>
<td>• pioglitazone</td>
<td>• DPP4 (-)</td>
<td>• Short</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• SGLT2 (-)</td>
<td>• Medium</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Long acting</td>
</tr>
</tbody>
</table>

New drugs

<table>
<thead>
<tr>
<th>GLP-1 (+)</th>
<th>Exenatide (Byetta ®)</th>
<th>SQ</th>
<th>(+) insulin release</th>
</tr>
</thead>
<tbody>
<tr>
<td>DPP4 (-)</td>
<td>Sitagliptin (Januvia ®)</td>
<td>oral</td>
<td>Inhibits deactivator of GLP1</td>
</tr>
<tr>
<td>SGLT2 (-)</td>
<td>Canagliflozin (Invokana ®)</td>
<td>oral</td>
<td>Blocks renal re-absorption of glucose</td>
</tr>
</tbody>
</table>
Metformin Lactic Acidosis – mythical?

• 5/100,000
• “indistinguishable from the background rate”
• Inzucchi SE. JAMA. 2014; Flory JH JAMA IM. 2015

Winning hearts and minds

• BS is not enough
• CV outcomes

GLP1 agonists

• Gila monster Heloderma suspectum
• Venom

Oral Complications of Diabetes

• Xerostomia
• Infection
• Poor healing
• Increased incidence and severity of periodontal disease
• Burning mouth syndrome
• Oral fungal infections (Candida, mucormycosis)

Dental Management of DM

• All dental procedures can be performed in patients with diabetes
• No special precautions unless acute complications present
  • Ketoacidosis (abd. pain, nausea/vomiting), Type I
  • HHS (thirst, confusion, weakness), Type II
• If concerning symptoms present, check blood sugar (if possible) AND refer for urgent evaluation (same day)

Medication Management

• In general, no major changes needed around the time of a procedure
• Type II, if NPO (sedation), hold oral agent on the morning of the procedure
• Type I, if NPO, give ½ of usual insulin dose on the morning of the procedure
Diabetic Patient with an Infection

• If on oral agents only, may require insulin
• If on insulin, may require increased insulin dose
• If feasible, can check blood sugar in clinic, refer if needed

Pre-op Management of Type I DM

• Ensure glucose is reasonably controlled (<300mg/dl)
• Early to mid-morning procedure
• NPO
• Give 1/2 of usual insulin dose
• Start infusion of D5 ½ Normal Saline

Post-op Management of IDDM

• Infuse D5 ½ normal saline
• Frequent blood sugar checks
• Manage with continuous infusion or sliding scale insulin
• Initiate diet and then restart their usual oral agent or insulin regimen

Diabetes Take-Home Points

• Diabetes leads to organ damage and can predispose to oral complications.
• Patients with severely elevated blood sugars will present with: abdominal pain & nausea/vomiting (type I) or confusion/weakness (type II)
• Most procedures require no change in oral or insulin regimen
• Patients with an active infection may have elevated blood sugars and need medication changes.

Diagnosis

Diabetic Ketoacidosis (DKA)

Management of DKA

• Fluid replacement
  – Isotonic fluids (0.9% or LR) at 1 liter/hr.
  – 0.45% at 150-250 cc/hr.
  – D5.45 when glucose falls below 400 mg/dl, try to maintain at 200-300
• Insulin
  – Continuous infusion with frequent monitoring
• Potassium
  – Initially K+ is high but drops with insulin treatment
• Bicarbonate
  – Acidotic, as raise pH, then K+ decreases
• Physical exam to find underlying cause
Common Complications of Management of DKA

- Hypoglycemia
- Lactic acidosis
- Cerebral edema
- Arterial thrombosis
- Hypokalemia

What changes in pregnancy?

- Hormones (i.e. progesterone)
- Mechanical displacement
- Increased metabolic demand (mom + fetus)

Cardiovascular Changes in Pregnancy

- More fluid: 30-40% increase blood volume, 6-8 L additional extracellular fluid
- Increased CO, HR, SV to pump it
- Heart distended, regurgitant murmurs, arrhythmias
- Relative anemia
- SVR (afterload) decreased
- PVR and pulmonary pressures decrease
- High Volume Low Resistance State

Aortocaval Compression

- Gravid uterus compresses aorta > 20 weeks and IVC > 16 weeks
- —> Supine hypotensive syndrome
- Left uterine displacement position (bump under right hip)

Airway/Respiratory Changes in Pregnancy

- Increased ventilation to meet metabolic demand
- Respiratory alkalosis, Increased PaO2
- Increased airway swelling: worse mallampati score, higher rate difficult airway
- edema, smaller glottic opening
- increased capillary engorgement (increased friability)
- Uterine compression upwards — decreased FRC
- Quicker desaturation

GI Changes in Pregnancy

- FULL STOMACH PRECAUTIONS > 20 weeks
- even with proper NPO, progesterone decreases motility and lowers LES tone
Other Changes in Pregnancy

- Prothrombotic state
- Reduced anesthetic drug requirements (progesterone?)

Pre-operative Workup

- OB consult — Ultrasound/ fetal monitor
- ECG
- CBC, electrolytes

Anesthetic Technique

Pregnancy
- Volatile anesthetic (Avoid N2O?)
- Oxygen
- Narcotic (Fentanyl, Hydromorphone)
- Non-depolarizing muscle relaxant

Most common complication
- Pre-term delivery

Breastfeeding after Anesthesia

If you are awake enough to breast feed, you can.
- “Mothers with normal term or older infants can generally resume breastfeeding as soon as they are awake, stable and alert.”
- “Resumption of normal mentation is a hallmark that these medications have redistributed from the plasma compartment.”
- Avoid meperidine and codeine
- Cautious with premies and apnea issues
- NO MORE PUMP & DUMP!

Physical Examination

- 104 kg, 170 cm, BMI 36
- BP = 165/93
- HR = 83
- O2 SAT = 95% (Room air)
- Neck 42 cm

28 y.o. male with mandibular retrognathia, retrogenia and anterior open bite. During the initial orthognathic work-up the patient complains of being tired all of the time and lack of attention/ poor performance at work. He falls asleep when inactive for a short period of time.
OSA
- Obstruction of the upper airway
- Apnea during sleep (> 10s w/ desat.)
- Repetitive
- Often associated w/ desaturation
  - *Loud snoring
  - *XS daytime somnolence

  *most common presenting symptoms

OSA
Adults: 26% (2-26%) 7/10 bariatric surgery pts plateau ages 55-65
Risk factors:
  - obesity
  - craniofacial abnormalities
  - current TOB
  - nasal congestion
Pediatrics: tonsil and/or adenoid enlargement

OSA
7/10 pts undergoing bariatric surgery
80% men & 93% women w/ moderate to severe sleep apnea = undiagnosed

Diagnosis
“Gold standard” polysomnography
  can have false negative results
  apnea-hypopnea index
  In-lab and $$$$

Components of Polysomnography
- EEG
- Electro-oculography (eye movement)
- Chin and leg electromyography
- ECG
- Nasal and oral air flow
- Thoracic and abdominal respiratory efforts
- Pulse oximetry

OSA
AHI
  Mild: 5-15/hr.
  *Mod: 15-30/hr.
  *Severe: > 30/hr.
  SaO2 < 90%, 20% of sleep time
  assoc. with significant morbidity
  80% men & 93% women w/ mod to severe sleep apnea = undiagnosed, increased postop M&M
Polysomnography Results
AHI = 32 (severe)
Several desaturations, SaO2 < 60%
Associated with cardiac dysrhythmias (PVC’s)

Importance of O2 Saturation Data
• Cardiac dysrhythmias with saturation below 60%, patient at risk for sudden cardiac events
• Significant component to excessive daytime sleepiness and fatigue
• Usually reported as a percentage of time at each 10% increment (100%, 90%, 80%, 70%, etc.)

Severe OSA
Polycythemia
HTN
Angina
Pulmonary HTN
“Cor pulmonale”
Mortality

STOP-BANG Scoring
Snoring (louder than talking, heard through closed doors)
Tired (during daytime)
Observed (stop breathing during sleep)
Pressure (high BP)

Anesthesiology 2008;108:812-21 Chung et al.

STOP-BANG Scoring
BMI (> 35)
Age (> 50)
Neck circumference (> 40cm)
Gender (male)

High risk OSA: yes to 3 or more items
Low risk OSA: yes to less than 3 items

Risk reduction
ASA: preoperative use of continuous positive airway pressure or noninvasive positive pressure ventilation may improve the condition of patients at increased perioperative risk from OSA (3mo. course may reverse OSA-induced CV dysfunction)
Confirm Diagnosis of OSA

Refer to multidisciplinary team
- Physical examination (emphasizing head and neck)
  - Obesity is a common feature of OSA
- Nocturnal polysomnography
- CXR
- ECG

Attempt to determine the site of obstruction
- Lateral cephalogram with analysis
- Fiberoptic pharyngoscopy with Mueller maneuver (inspiratory effort against a closed nose and mouth)

Patient Management

- Weight loss
- Mandibular positioning device
- CPAP/ BIPAP
- Pre-op anesthesia evaluation, difficult airway
- Endoscopic AW evaluation (if no diseased nasal passages, no coagulopathy, no aspiration)

*Rosenblatt et al. A&A 2011;112:602-7 [26% diff AW plan]*

Patient Management

- Orthognathic procedure (likely maxillary posterior impaction and advancement, mandibular advancement, advancement genioplasty)
  - Other options LAUP, UPPP, hyoid suspension
- Post-op CPAP and monitoring in ICU
- Post-op sleep study (6 months)