Avoiding Complications in Sinus Surgery: Did you check that?

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Complications

- **Major**
  - Intracranial
  - Intra-orbital
  - Blood loss requiring blood transfusion

- **Minor**
  - Synechiae
  - Atrophic rhinitis
  - Crusting
  - Epiphora
  - Hyposmia/anosmia
  - Nasal obstruction
  - Iatrogenic sinusitis
Incidence of Complications

• <0.05%
• Most common – hemorrhage, orbital complications, CSF leak
• Populations at increased risk:
  - Revision surgery
  - Polyps and extensive disease
  - Anatomic variation

Stankiewicz et al.
Laryngoscope (2011)
“By failing to prepare, you are preparing to fail”

Benjamin Franklin
Preoperative Checklist

• Established the right diagnosis?
• Documented “failed medical management”?
• Performed the appropriate preoperative workup?
  - History and physical exam, labs, consultations
• Documented informed consent?
• Explain the risks, benefits, and alternatives and complications
• Teach back
Preoperative Checklist

• Review sinus/skull base anatomy imaging (CT/MRI)
• Maxillary-to-ethmoid sinus ratio
• Slope of the skull base
• Anterior and posterior ethmoid artery
• Lamina papyracea (prior orbital fracture?)
• Optic nerve and carotid artery in sphenoid
• Anatomic Variants
Preventing Complications

- Try to minimize intra-operative bleeding
- Poor visualization = complications
Pre-operative steroids – Decrease mucosal inflammation

• Extensive nasal polyps
  - Asthmatic sinusitis, AFS, Aspirin triad
  - Preoperative oral steroid if no contra-indications
  - Prednisone 30mg po QD for 3-7 days
  - Postoperative oral steroid after FESS
  - Consider effects of oral steroid

Minimal effects on total blood loss but significant effects on visual fields

Peri-operative antibiotics (EBM?)

- Start 1 week prior and continue for 2 weeks after
- Levofloxacin, moxifloxacin – gram-negative coverage, QD dosing
- Clindamycin - gram positive, gram negative, anaerobe, bone penetration
- Clarithromycin/erythromycin – low dose macrolide for anti-inflammatory due to infection (remember Q-T prolongation and predisposition to Torsade de pointes and Ventricular tachycardia)

- Please consider side effects of antibiotics (C. difficile, effects on nasal and pulmonary biome)
Bleeding in FESS; Anesthesia Factors

• Hypotensive anesthesia
• Orthopedic literature
• Revision hip replacement – 30% reduction in blood loss using IV propofol infusion versus inhaled anesthetics
Anesthesia Factors

• Key to limit bleeding = Decrease in venous bleeding

• Physiologic way to do so = decreased central venous pressure

• Communicate with anesthesia team to control blood pressure
Decrease CVP

- Decrease fluid intake
- LMA vs. Endotracheal tube
  - Decrease catecholamine surge in initial 15 minutes of surgery with LMA vs ETT
- Maintain HR < 60
- Preoperative clonidine (alpha 2 agonist/imidazoline receptor agonist) – acts centrally

- **TIVA** (Total Intravenous Anesthesia) –
  - Total intravenous propofol infusion with remi-fentanyl infusion

Reverse Trendelenburg reduces CVP

30 degrees
Preparation

• Position – arterial flow
• 38.3% reduction of nasal blood flow with head elevation (at head of IT)
• 4.7% change with PPF injection

Intra-op Maneuvers

• Topical Thrombin/epinephrine
  • -2 ampules thrombin (1:10,000) in 1 ampule of epinephrine (1:1000)
  • Plain epinephrine (1:1000)
  • Not used in children, diluted (1/2 or 1/4 in patients with cardiac history)

• Warm/hot saline flushes
  • Though to stimulate intrinsic coagulation cascade (tissue thromboplastin)
Orbital Hematoma
Orbital Hematoma

- Peri-orbital Injury
- Incidence has direct correlation with surgeon experience
- 1-20 cases 8.3%
- 20-100 cases 4.7%
- 100-200 cases 2.5%
- 200-300 cases 0.2%
- Stankiewicz (1999)
- 15/3500
Orbital Bleeding

- Three types of orbital hematoma
  - Spontaneous
  - Traumatic
  - Iatrogenic associated with endoscopic sinus surgery

Intra-operative bleeding
- Arterial bleed
  - Acute process
  - Anterior or posterior ethmoid artery
- Venous bleed
  - Slow process
  - Several hours after FESS
Slow Orbital Bleed

- Slow (venous) orbital hematoma
- Injury to orbital or ophthalmic veins
  With slow accumulation of blood or
  Defect in lamina papyracea with
  Blackflow of bleeding
- Gradual onset
  - Ecchymosis, proptosis,
  Pupillary dilation, decreased
  Vision
  Rise in intraocular pressure
- Ophtho consult – measure IOP
- Observation

Most common cause:
- Inadvertant entry into orbit during maxillary antrostomy or ethmoidectomy
How to prevent orbital injury: Understand relation of the uncinate process to medical orbital wall:
Understand the Maxillary sinus Ostium and relation to the lamina

- Maxillary Ostium is typically
- Located between the inferior 1/3 and superior 2/3 of the uncinate process along the maxillary line

- Visualize line prior to uncinectomy

- Move uncinate away from orbit using back end of ball tip probe to create space between orbit and uncinate
Understand Relation between Uncinate and Lamina
Early Detection

• Fat Exposure
  Microdebriders can suck a lot of fat and muscle very rapidly
• Do not manipulate or remove fat
  -Do not use a monopolar cautery to “shrink fat”
  -If fat is obstructing further dissection, use bipolar
• Minimize nasal packing
• Avoid noise blowing or sneezing
Ethmoid Arteries

- Ethmoid arteries branches of ophthalmic artery
- Enter nasal cavity along the fronto-ethmoidal Suture
  - 24-12-6 rule from the anterior lacrimal crest
Anterior Ethmoid Artery 20% Below skull base
Posterior Ethmoidal Artery
Intra-op Orbital Hematoma

• Arterial orbital hematoma
  - Injury to anterior/posterior ethmoidal artery with retraction into orbit
• Within minutes of injury:
  - Proptosis, chemosis, pupillary dilation-----vision loss
  - Rise in intraocular pressure – 90 minutes of retinal artery occlusion results in permanent blindness

• Requires urgent treatment
Orbital Hematoma

- **Bulb Test**
  - Gently palpate globe
- **Examine lamina Papyracea with Endoscope**
- **Evaluate for movement of periorbita and/or fat**
Orbital Hematoma

- Ophthalmology Consult
  - Ascertain APD
  - Measure IOP of both orbits
  - 20mg Hg of MAP
  - Observe

- <20mm Hg of MAP or visual change
- Decompress
Orbital Hematoma

- Eye massage
- Redistributes intraocular and extraocular fluids
- Topical timolol (0.5%)
- Acetazolamide 500mg IV
- Mannitol 20% (1-2g/kg over 20-30 minutes)
- Steroids (Dexamethasone or Solumedrol)
- Remove any non-absorbable packs
- Surgical maneuvers
Orbital Hematoma

• Surgical Maneuvers
  - Canthotomy and Cantholysis
  Medial orbital wall decompression
Orbital floor decompression
Endoscopic artery ligation
External artery ligation
Lateral Canthotomy and Inferior Cantholysis
Extraocular Muscle Injury
Extraocular Muscle Injury

- Most common structures
  - Medial rectus > superior oblique > inferior rectus
- Forced duction to rule out entrapment or laxity
- If viable muscle found, repair per neuro-ophthalmology
- If not detected until post op period, then early exploration
- And repair advised
Blindness – causes

• Direct injection of cocaine or epinephrine
• Orbital compartment syndrome (OCS)
  - Retro-orbital hematoma
  - Orbital emphysema
• Retinal artery spasm
• Optic nerve transection
Onodi Cell
Epiphora

- Post-FESS epiphora
- -0.3-1.7% (Unulu, 2001)
- -15% occult injuries via cadaver study (Bolger 1992)
Iatrogenic Cerebrospinal Fluid Leak

• Frequency of iatrogenic CSF leaks
  - 1-20 FESS: 3.3-4%
  - 20-100 FESS: 1%
  - >100 FESS: 0.05%

• Increase in peri-orbital Complications in cases 31-180
Anatomy – Skull Base

Keros I
1-3mm deep

Keros II
4-7mm deep

Keros III
8-16mm deep

Danger
Anatomy – Skull Base

Keros IV
Asymmetric
## Maxillary to Ethmoid Ratios

<table>
<thead>
<tr>
<th>High Risk Feature/Variant</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maxillary-to-Ethmoid ratio 1:1</td>
<td>38.6</td>
</tr>
<tr>
<td>Maxillary-to-Ethmoid ratio 2:1</td>
<td>54.3</td>
</tr>
<tr>
<td>Maxillary-to-Ethmoid ratio &gt;2:1</td>
<td>7.1</td>
</tr>
</tbody>
</table>
Maxillary to Ethmoid ratio

Tip – Use roof of the maxillary sinus as vertical limit when moving anterior to posterior
Intraoperative Maneuvers – CSF Leak

• Step 1
• -Stop and Recompose
  -Hemostasis
  -Review the anatomy
  -Ct or MRI
  -Correlate to endoscopic Anatomy
  -Make sure you are honest with yourself regarding size and number of defects
Can’t identify site? Large Defect? Is brain in the defect?

- Step II
- Antibiotics
- Hemostasis
- Aspirate stomach
- Anti-emetics
- Quiet wake-up
- Stat Head CT/CT
- Angiogram if microdebrider
- entry

Can identify site

Lightly pack nose
Perioperative IV Antibiotics
Quiet wake up
CT of head

Consult colleague
Transfer to rhinologist

Can’t identify site

Repair if possible

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Intraoperative Maneuvers II

- Site preparation – don’t compound the problem
  - Maximally open surrounding sinuses
  - Prevent obstruction secondary to packing
  - Control bleeding
- Intracranial hematoma
Intraoperative Maneuvers II

- Step II
- Measure defect size
- Graft selection
- Multiple variables
- Location of injury
- Rarely need bone graft
Intraoperative Maneuvers - II

- Mucosa
  - Inferior turbinate
  - Middle turbinate
  - Septum
  - Nasal floor
  - Naso-septal flap if extremely large defect
- Closure with graft pressure using dissolvable nasal packing
- Multiple methods
Post-Op

• Full Disclosure – be honest with patient and family
• Expect bad headaches if brain has been bruised
• IV abx, head of bed 15 degrees
• Bedrest for 24 hours
• Keep packing in for 5 days
• Frontal sinus stent for 10 to 14 days
• Limit post-operative debridements
Summary of Complications

• Be prepared and plan ahead for each sinus case
• Study preoperative imaging
  - Ethmoid height, skull base position, anomalies
• Take time to have as bloodless of a field as possible
• When you the a complication, take a few moments to compose yourself, and execute
• Bring in a colleague or call a local rhinologist to help you think through things
Imhotep: Egyptian God of Medicine
Temple of Sobek and Haroeris, Aswan
It’s all about the nose