Anesthetic Techniques in Endoscopic Sinus and Skull Base Surgery

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Key Learning Points:

1. Understand specific areas of concern involved in preoperative evaluation for these surgeries.
2. Become familiar with the anesthetic goals for endoscopic sinus and skull base surgery.
3. Understand the steps that can be performed preoperatively to prepare the patient for the surgery and to facilitate anesthesia and recovery.
4. Recognize important considerations during and immediately after induction of anesthesia.
5. Be able to discuss the effects of maintenance anesthesia techniques on blood loss and surgical field.
6. Become familiar with some specific challenges during emergence of anesthesia for these surgeries.
7. Describe some postoperative problems that can affect recovery after surgery and how to best treat them.
Table 1. Some Indications for endoscopic sinus and skull base surgery

<table>
<thead>
<tr>
<th>Type of Surgery</th>
<th>Indications</th>
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<tr>
<td>Sinonasal surgery</td>
<td>Sinusitis, nasal polyposis, epistaxis, sinus mucoceles, tumors, turbinate reduction, septoplasty</td>
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<tr>
<td>Skull base surgery</td>
<td>Cerebrospinal fluid (CSF) leak closure, pituitary surgery, encephaloceles/meningoceles, tumors</td>
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<tr>
<td>Orbital surgery</td>
<td>Orbital decompression, dacryocystorhinostomy, optic nerve decompression</td>
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Specific areas of concern include:
- Coexisting medical manifestations of operative disease
- Staged surgery
- Risk of excessive intraoperative blood loss and transfusion
- Risk of prolonged intubation
- Risk of perioperative respiratory depression
- Cardiovascular status

Endoscopic pituitary resection:
- Evaluate neurologic deficits and endocrine function
- Adrenocorticotropic hormone (ACTH) secreting adenomas: obesity, hypertension, osteopenia, fluid retention and hyperglycemia
- Growth hormone secreting adenomas: careful evaluation of the airway
Advantages of local Anesthesia

- Patient able to signal pain should minimize surgical complications
- Less blood loss with better surgical field has been described for local anesthesia
- Better recovery profile with less incidence of nausea and faster discharge

Advantages of general anesthesia

- Less anxiety and discomfort
- Less blood loss and total immobility should provide a better surgical field and minimize surgical complications
- Improved control of airway with increased safety for the patient
- Decreased fire risk
Goals of anesthesia for endoscopic sinus and skull base surgery

- Provide a still and bloodless surgical field to minimize surgical complications
- Prevent cerebral ischemia
- Protect the patient’s airway during and after surgery from contamination by blood and gastric fluid and from respiratory depression and obstruction
- Facilitate early recovery, by optimizing pain and nausea control

Increased risk of perioperative respiratory depression

- Acromegaly
- Moderate to severe obstructive sleep apnoea
- STOPBANG* 5 or greater
- Body Mass Index of 45 or greater
### Table 2. Recommendations for patients at risk for perioperative respiratory depression

<table>
<thead>
<tr>
<th>Stage</th>
<th>Recommendation</th>
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<tbody>
<tr>
<td>Preoperative</td>
<td>Use non-opioid analgesics: acetaminophen, cyclo-oxygenase 2 (COX2) inhibitors</td>
</tr>
<tr>
<td>Induction of anesthesia</td>
<td>Careful positioning and prolonged preoxygenation of obese patients; use muscle relaxants to facilitate intubation; availability of additional tools for intubation such as videoscopes; consider use of ETT over LMA</td>
</tr>
<tr>
<td>Maintenance of anesthesia</td>
<td>Consider use of desflurane, remifentanil, dexmedetomidine; try to avoid long acting medications such as isoflurane, morphine, hydromorphone</td>
</tr>
<tr>
<td>Emergence of anesthesia</td>
<td>Verify complete reversal of muscle relaxation; consider awake extubation</td>
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**Cardiovascular evaluation for endoscopic sinus and skull base surgery**

- Formulate a perioperative plan for antiplatelet and anticoagulant therapy, in consultation with cardiologist and primary care physician
- Evaluate patient’s ability to tolerate local vasoconstrictors
- Evaluate patient’s ability to tolerate hypotension
## Preoperative Preparation

- Glucocorticosteroids (steroids)
- Antibiotics
- Topical vasoconstrictors and local anesthesia
- Pain medications: acetaminophen and COX-2 selective inhibitors
- Inhaled bronchodilators if indicated
- Invasive monitoring, such as arterial line, if required
- For CSF leak repair: intrathecal fluorescein injection; consider lumbar drain

## Induction of Anesthesia

- Anxiolytics: midazolam, lorazepam
- Analgesics: fentanyl, remifentanil
- Hypnotics: inhaled anesthetics, propofol, etomidate
- Muscle relaxants: succinylcholine, non-depolarizing muscle relaxants (NMBDs)
- Other medications:
  - Dexamethasone
  - Tranexemic acid
Muscle Relaxation

- Used to facilitate intubation
- Not needed if LMA used
- Measure neuromuscular function at the end of the case
- Reverse residual effect of muscle relaxant in all patients
- Need special consideration if cranial nerves are being monitored

Table 3. ETT vs. LMA

<table>
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<tr>
<th>LMA advantages</th>
<th>Smoother emergence; faster recovery; avoidance of muscle relaxants; protection of glottis; less airway stimulation</th>
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<tr>
<td>ETT advantages</td>
<td>Secure airway for long surgery; ability to provide positive pressure ventilation at high pressures; proven protection of lower airways</td>
</tr>
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</table>
Preparation of the patient for surgery

- Elevate surgical field (reverse Trendelenburg position): risk of air embolism; blood pressure at the head lower than blood pressure measure at the level of the heart
- Patient’s eyes should be accessible to the surgeon during the procedure. Eyes are included in the surgical field
- Keep eyes in the surgical field
- Secure ETT or LMA in the midline
- Place stereotactic navigation system
- Use local anesthetics and vasoconstrictors

<table>
<thead>
<tr>
<th>Table 4. Controlled hypotension in endoscopic sinus and skull base surgery</th>
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</table>
| **Risks** | • Severe hypotension (MAP <60-65mm Hg) can cause ischemic organ failure.  
• If ICP is elevated, decreased BP will compromise cerebral perfusion |
| **Advantage** | Improved surgical conditions |
| Remifentanil infusion | Short half life, quick metabolism through serum sterases, fast recovery time |
Table 5. TIVA vs. inhalational anesthesia in endoscopic sinus surgery

<table>
<thead>
<tr>
<th>Agents of choice</th>
<th>Propofol and remifentanil</th>
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<tbody>
<tr>
<td>Advantages</td>
<td>Less blood loss, better surgical field, smoother emergence, less PONV</td>
</tr>
<tr>
<td>Disadvantages</td>
<td>Potential for delayed emergence, inability to use BIS monitors, propofol shortage, cost</td>
</tr>
</tbody>
</table>

**Awake extubation**

<table>
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<tr>
<th>Advantages</th>
<th>Return of laryngeal reflexes allowing lower airway protection. Smooth LMA removal</th>
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</thead>
<tbody>
<tr>
<td>Disadvantages</td>
<td>ETT removal can cause significant coughing, bucking and laryngospasm</td>
</tr>
</tbody>
</table>

**Deep extubation**

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Smooth ETT removal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disadvantages</td>
<td>Leaves an unprotected airway; presence of nasal packing exacerbates obstruction; not indicated in high risk patients</td>
</tr>
</tbody>
</table>

**Postoperative recommendations for patients at high risk for respiratory depression**

- Consider non opioid analgesics: acetaminophen, NSAIDs, COX2 inhibitors
- Consider shorter acting narcotics such as fentanyl as rescue pain medications
- Consider avoidance of home narcotic prescriptions
- Consider prolonged PACU observation if patient is to be discharged home the same day of surgery with a narcotic prescription
- Admit patient overnight if patient has signs of persistent respiratory depression
- Use CPAP as needed
Postoperative care

- Pain management: acetaminophen, COX-2 selective inhibitors, fentanyl, oxycodone
- PONV management: scopolamine, dexamethasone, ondansetron
- Patients with increased risk of postoperative respiratory depression need prolonged observation and may require overnight admission
- Patients who undergo endoscopic pituitary resection are at risk of developing diabetes insipidus