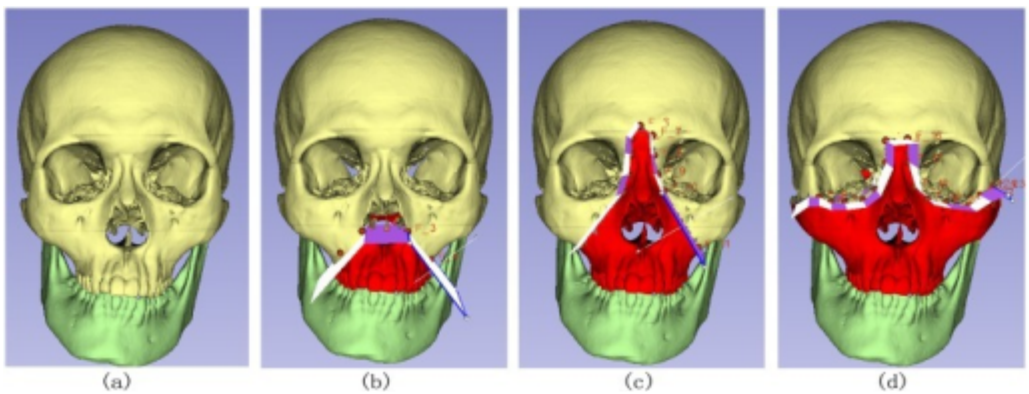
LEFORT OSTEOTOMIES

Surgical Specialty:	Oral and Maxillofacial Surgery
Author:	Prabhat Mishra, MD University of Arkansas for Medical Sciences, Little Rock, AR



Zhan Q, Chen X. "Boolean Combinations of Implicit Functions for Model Clipping in Computer-Assisted Surgical Planning." PloS one (2016). Open-I. Creative Commons License.

Background:

- General Considerations
  - The indication for surgery is midface hypoplasia causing airway and aesthetic concerns[2]
  - Lefort I (image b) maxillary bone is advanced forward from the face and fixated to the rest of skull[1]
  - Lefort II (image c) zygomatic bones are advanced with maxillary bone[1]
  - Lefort III (image d) ocular orbital bones are advanced with maxillary bone[1]
- Patient Considerations
  - The patients are usually preschool-age or younger in children with congenital midface hypoplasia associated with craniosynostosis but also in older patients with midface hypoplasia for other reasons such as previous cleft palate repair[2]
  - Lefort I for cleft palate patients[2]
  - Lefort II and III patients usually have congenital diseases with concomitant craniosynostosis - Apert, Crouzon, Treacher-Collins, Pfeiffer syndromes[2]
  - Difficult airway (Treacher-Collins), difficult intubation (Apert with tracheal stenosis), difficult mask ventilation (Pfeiffer, Crouzon, Treacher-Collins) associated with the midface hypoplasia[2]
  - Airway obstruction with midface hypoplasia and possible choanal atresia[2]
  - Possible congenital heart disease[1]

Anesthetic Planning:

- Pre-Anesthetic Evaluation
    - Airway evaluation – midface hypoplasia, enlarged tongue, small mandible, decreased jaw opening, decreased neck flexion, and extension. Patients with cleft palate receiving Lefort I procedures may not have congenital airway and cranial syndromes. Other syndromic patients will need airway evaluations based on the syndrome.[1]
    - Echocardiogram for congenital syndromes associated with cardiac disease[1]
    - Discussions to have with surgeon/family
        - Airway management – discuss with the surgeon regarding nasal vs. oral intubation vs. tracheostomy; surgical securing of ET tube; surgeon may request intraoperative airway change from oral to nasal after midface osteotomies in Lefort II and III[1,2]
        - Possible need to secure the airway with suture or wire to the mandibular dentition if oral intubation is performed for Lefort III procedures[1]
        - Lefort III may have edema and blood loss may result in airway and face swelling precluding extubation and compromised airway[1]
        - Nasal intubation for Lefort I[1,2]
        - Post-operative intubation and ICU stay if needed[1]
        - Possible cerebral spinal fluid leak postop[1]
- Specific or Unique Room Set-up Requirements
    - Difficult airway equipment – supraglottic airway, gum elastic bougie, video laryngoscopy, flexible fiberoptic[1,2]
    - Temperature maintaining equipment[1]
    - Drugs – antifibrinolytic if blood loss anticipated; antiedema steroid dose[1]
    - Blood availability indicated[1]
    - PICU bed availability if remains intubated for difficult airway, blood loss, or edema[1,2]
    - Wire cutters at the patient's bedside if maxilla fixed to mandible[2]

Intraoperative Considerations:

- General
    - Airway management is the biggest concern
    - If the patient appears to have a difficult airway due to craniofacial syndrome, spontaneous breathing intubation or intubation without muscle relaxant may be warranted[1]
    - Muscle relaxants can aid intubation in reducing hypoxemia and laryngospasm compared to spontaneous breathing patients[3]
- Induction
    - Inhalation induction is usually performed to maintain spontaneous ventilation and oxygenation unless difficult airway is suspected[1]
    - Prepare for difficult mask ventilation[1]
    - Intubation may require intubating LMA as adjuvant[1]
    - Nasal intubation may require a flexible fiber optic approach[1]
    - A tracheostomy may be necessary if preoperative upper-airway obstruction is severe[1]
- Positioning – Supine with bed possibly turned 90 to 180 degrees
- Monitoring

  - Standard ASA monitors of pulse oximetry, ECG, non-invasive blood pressure, CO2 capnography
  - With the possibility of blood loss in complex Lefort II and III surgeries, congenital heart disease, blood sampling, and tight blood pressure control, an arterial line may be needed
  - Length of surgery warrants temperature monitoring and maintaining equipment such as forced air heaters and IV fluid warmers
  - EEG monitoring can be used to titrate anesthesia medications while aiding hemodynamic control but may not be routine
- Medications
  - Inhalation or intravenous maintenance; Propofol infusion for intravenous anesthetic maintenance can be titrated to EEG with a usual dose range between 100-300 mcg/kg/min
  - IV opioids titrated for possible extubation; fentanyl 1-2 mcg/kg/hr titratable infusion vs bolus dosing of fentanyl 3-5 mcg/kg, morphine 0.1-0.3 mg/kg vs hydromorphone 0.01-0.02 mg/kg; remifentanil 0.1-2 mcg/kg/min maintenance intraoperatively with long-acting opioids titrated at the end of the case can also be an analgesic choice
  - Non-opioid pain adjuvants such as IV acetaminophen 15mg/kg, ketamine 0.2-1 mg/kg, and/or dexmedetomidine 0.3-1 mcg/kg or an infusion upwards of 1mcg/kg/hr can reduce opioid pain requirements and thus reduce post-operative nausea and vomiting
  - PONV prevention is important particularly if the mandible and maxilla are fixed or wired post-surgery. Ondansetron 0.15 mg/kg along with dexamethasone 0.15 mg/kg to start. The surgeon may request a higher dose of dexamethasone for edema prevention. Diphenhydramine 0.25 mg/kg and a dopamine-2-receptor antagonist like haloperidol 0.05 mg/kg IV or promethazine 0.25 mg/kg per rectum or per oral can be useful
  - The surgeon may request antifibrinolytic such as tranexamic acid loading dose of 15-50 mg/kg over 15 minutes followed by an infusion of 5-10 mg/kg/hr. Aminocaproic acid has been used with a loading dose of 100 mg/kg then an infusion of 40mg/kg/hr.[1]
- Hemodynamic/Physiologic goals
  - Prevent hypertension that may increase bleeding, particularly with bone manipulation
  - The surgeon may request controlled hypotension. Have vasodilators such as nicardipine 0.1 mg/kg bolus doses, opioids, and anesthetic medications available balancing with the possibility of spontaneous respirations and extubation at the end of the case.
- Transfusions
  - Blood transfusion considered with Lefort II and III[1]
  - The surgeon may use cell saver
  - Presurgical autologous blood donation has been described in patients as small as 8kg[1]
  - Type and cross-match of pRBCs and fresh frozen plasma may be warranted at a volume of 20 mL/kg for each blood product
- Surgical Considerations
  - Endotracheal tube damage due to proximity to the surgical site[1,2]
  - Accidental disconnect or damage or kinking of the ET tube can result in loss of ventilation, CO2 waveform, and room contamination with volatile anesthetic.
- Emergence/Disposition

- Suction the stomach prior to wiring and/or extubation to remove what blood may have entered the stomach via the nasopharynx; some surgeons may request a nasogastric tube to remain post-extubation.
- Extubation if audible airway leak present in the absence of laryngeal or periglottic edema[1]
- Plan a course of action with the surgeon for possible extubation failure. If the jaw is wired shut, wires may need to be cut to facilitate reintubation in the setting of facial edema post-surgery. Advanced airway equipment, including surgical airway equipment, may be needed. Mask ventilation may not be prudent post-operatively because of the pressure placed on the surgical site.
- Avoid hypertension that may increase bleeding during emergence. Vasodilators and anesthetic medications previously mentioned may be needed.
- ICU disposition may be needed in the setting of edema, significant blood loss, or a difficult airway[1,2]
- Disposition to PACU followed by a floor bed if the airway is maintained and pain is controlled after awake extubation in the operating room
- If maxillar-mandibular wired fixation is performed, wire cutters should be kept at the patient's bedside at all times and dispositions to prevent aspiration in the setting of vomiting.

- Post-op Pain
  - Titrated opioids and adjuvants to reduce opioid consumption
  - Sedated if in ICU with post-operative intubation[1]

Case-Specific Complications/Pitfalls

- Difficult airway, mask ventilation, and intubation in patients with congenital midface hypoplastic disease. Advance airway equipment and plan necessary.[1,2]
- Endotracheal tube damage would warrant intraoperative tracheal tube replacement.[2]
- Lingual, laryngeal, and glottic edema precluding post-operative extubation requiring ICU admission[1,2]
- Delayed extubation is also warranted in patients with known difficult airways[1]
- CSF leak post-operatively possible[1,2]
- Significant intranasal bleeding possible, precluding extubation[1]
- Transfusion of blood products and even massive transfusion with more complex Lefort III surgery
- Mandibular and/or maxillary distractors make post-operative mask ventilation difficult[1]
- Wire cutters should be present with the patient at all times in PACU and post-op bed if the maxilla and mandible are wired together[2]

References

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3.) Garcia-Marcinkiewicz AG, Adams HD, Gurnaney H, Patel V, Jagannathan N, Burjek N, Mensinger JL, Zhang B, Peeples KN, Kovatsis PG, Fiadjoe JE; PeDI Collaborative. A Retrospective Analysis of Neuromuscular Blocking Drug Use and Ventilation Technique on Complications in the Pediatric Difficult Intubation Registry Using Propensity Score Matching. Anesth Analg. 2020 Aug;131(2):469-479.

Reviewed by:

Reviewer #1: Alina Lazar, M.D., Lurie Children's Hospital

Reviewer #2: Amanda Redding, MD, Medical University of South Carolina

Reviewer #3: Titilopemi Aina, MD, MPH, FAAP, FASA, Texas Children’s Hospital/Baylor College of Medicine

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