Airway Devices in Obstetric Anesthesia

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NO CONFLICT OF INTEREST

Airway Devices in Obstetric Anesthesia:

Introduction

- Obstetrics carries high medical liability risk: No other field of Medicine carries the risk of 200% morbidity/mortality except in obstetrics.

- Closed Claims Studies in Obstetrical Anesthesia: Most common anesthesia-related causes of maternal death/permanent brain damage in claims associated are with general anesthesia (GA) –
  - Difficult Intubation and Maternal Hemorrhage
  - Difficult intubation upon induction of GA
  - Multiple attempts leading to progressive difficulty with ventilation
  - Substandard Anesthesia Care in response to difficult intubation

- Obstetric Anesthesia Litigation: Maternal death and newborn death/brain damage are cited as the most common complications in obstetric anesthesia malpractice claims.

"SENTINEL EVENTS" ASSOCIATED WITH ANESTHESIA

<table>
<thead>
<tr>
<th>Event</th>
<th>No. Claims</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permanent brain damage</td>
<td>867</td>
</tr>
<tr>
<td>Airway injury</td>
<td>581</td>
</tr>
<tr>
<td>Difficult intubation</td>
<td>466</td>
</tr>
<tr>
<td>Spinal cord injury</td>
<td>417</td>
</tr>
<tr>
<td>Medication errors</td>
<td>283</td>
</tr>
<tr>
<td>Aspiration</td>
<td>213</td>
</tr>
<tr>
<td>Central venous catheter injury</td>
<td>183</td>
</tr>
</tbody>
</table>

ASA Closed Claims: n = 7594

- Project data base contains extensive data on sentinel events and is important source of patient injuries.
Recent Trends and Findings in ASA Closed Claims Data Base:
Proportion of obstetric, chronic pain, and acute pain claims by decade. (Claims for surgical anesthesia not shown.) *p < 0.01 compared to 1980s by z test.

<table>
<thead>
<tr>
<th>Decade</th>
<th>Obstetric Anesthesia</th>
<th>Chronic Pain</th>
<th>Acute Pain</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980s</td>
<td>15%</td>
<td>20%</td>
<td>25%</td>
</tr>
<tr>
<td>1990s</td>
<td>30%</td>
<td>40%</td>
<td>45%</td>
</tr>
<tr>
<td>2000s</td>
<td>50%</td>
<td>60%</td>
<td>65%</td>
</tr>
</tbody>
</table>


Lessons Learned from ASA Closed Claims Review and Analysis: Practice Points

- Difficult Airways can be encountered throughout anesthesia care, not just induction.
- Persistent intubation attempts in airway emergencies were associated with poor outcomes.
- The LMA is not a fail-safe in the rescue of a difficult airway in the presence of persistent intubation attempts or in the presence of infra glottic obstruction.
- A surgical airway/emergency cricothyrotomy should be instituted early in the management of the difficult attempts.
- Development of additional management strategies for the difficult airways encountered during maintenance, emergence or recovery may improve patient safety.


MATERNAL MORTALITY – UNITED STATES OF AMERICA

Begh CJ et al. (Obst Gynecol 2010;116:1302-1309.)
Case Fatality Rates and Rate Ratios of Anesthesia-Related Deaths During Cesarean Delivery (C/D) by Type of Anesthesia in the United States 1979-2002

<table>
<thead>
<tr>
<th>Year of Death</th>
<th>General Anesthetic</th>
<th>Regional Anesthetic</th>
<th>Rate Ratios</th>
</tr>
</thead>
<tbody>
<tr>
<td>1979-1984</td>
<td>20.0</td>
<td>8.6</td>
<td>2.3 (95% CI 1.9-2.9)</td>
</tr>
<tr>
<td>1985-1990</td>
<td>32.3</td>
<td>1.9</td>
<td>16.7 (95% CI 12.9-21.8)</td>
</tr>
<tr>
<td>1991-1996</td>
<td>16.8</td>
<td>2.5</td>
<td>6.7 (95% CI 3.0-14.9)</td>
</tr>
<tr>
<td>1997-2002</td>
<td>6.5</td>
<td>3.8</td>
<td>1.7 (95% CI 0.6-4.6)</td>
</tr>
</tbody>
</table>

* Deaths per million general or regional anesthetics.

Six Sigma is a quality program that aims to improve quality, your customer’s experience, lowers your costs.

To achieve Six Sigma, a process must not produce more than 3.4 defects per million opportunities.

Obstetric anesthesia now qualifies as Six Sigma in that anesthesia-related mortality is at the level of the best industrial quality records, and far lower than most other medical processes.


* Maternal deaths per million live births.

LEADING CAUSES OF MATERNAL DEATHS 2009-2012 REPORTED BY MBRACE UK

Major Complication in Airway Management in United Kingdom
Fourth National Audit Project (NAP 4)

Surgical Data
- First prospective study of all airway-related major events throughout the UK during anesthesia, in ICU, and Emergency Department
- Incidence of serious airway complications during GA:
  - 133 per 2.9 million or 1 in 22,000 general anesthetics
  - In 47% of anaesthesia cases, the reported primary airway event was intubation difficulty
- Incidence of Death and Brain Damage: 1 in 180,000
- Emergency surgical airway – 1 in 50,000 general anesthetics

Obstetrical Data
- Four cases of airway management complications in pregnant women
- All involved emergency cesarean delivery
- Problems with intubation
- All cases took place out of hours and involved complex patients
- BMI > 35 kg/m²
- Two cases involved failed regional anesthesia
- Complications:
  - One patient had secondary aspiration
  - One patient had successful surgical airway
  - All 4 cases admitted to ICU and made a full recovery

Failed Intubation in Obstetric Anesthesia:
2 yr National Case-Control Study in UK
Quinn AC et al. BJA 110(1): 74-80 (2013)
- UK Obstetric Surveillance System (UKOSS) Data collection survey system
- Incidence of failed tracheal intubation: 1:224 general anesthetics
- Independent risk factors of failed intubation: Advanced Age, BMI and recorded Mallampati score were significant
- Most Common Rescue Airway Device: Classic LMA (39/57 cases)
- One emergency surgical airway, but NO deaths or hypoxic brain injuries
- Common Complication: Gastric aspiration occurred in 4 cases-morbidity but NO mortality
NATIONAL PATIENT SAFETY AGENCY
SEVERITY OF OUTCOME SCALE FOR PATIENT SAFETY INCIDENTS

<table>
<thead>
<tr>
<th>Severity grade</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>No harm (whether lack of harm was due to prevention or not)</td>
</tr>
<tr>
<td>Low</td>
<td>Minimal harm necessitating extra observation or minor treatment*</td>
</tr>
<tr>
<td>Moderate</td>
<td>Significant, but not permanent, harm, or moderate increase in treatment†</td>
</tr>
<tr>
<td>Severe</td>
<td>Permanent harm due to the incident‡</td>
</tr>
<tr>
<td>Death</td>
<td>Death due to the incident</td>
</tr>
</tbody>
</table>

*First aid, additional therapy or additional medications; excludes extra stay in hospital, return to surgery or readmission.
†Return to surgery, unplanned readmission, prolonged episode of care or inpatient or transfer to another area such as intensive care.
‡Permanent lessening of bodily functions, sensory motor, physiologic or intellectual.

PAYMENT MADE
ADJUSTED TOTAL PAYMENT IN 2007 DOLLARS

COST OF ICU STAY

- Day 1: Daily costs were greatest on intensive care unit day 1 (mechanical ventilation, $10,794; no mechanical ventilation, $6,667).
- Day 2: decreased on day 2 (mechanical ventilation, $4,796; no mechanical ventilation).
- Day 3 and thereafter: became stable after day 3 (mechanical ventilation, $3,968; no mechanical ventilation, $3,184).
- Average costs: Adjusting for patient and hospital characteristics, the mean incremental cost of mechanical ventilation in intensive care unit patients was $1,522 per day (p < .001).
CONCERNS AND SOLUTIONS

- Clinical Concerns:
  - Obstetric OB emergencies where there is a perceived lack of time for RA
  - High-risk obstetric patients: congested cardiac, placental abnormalities - hemorrhage - underlying maternal hypertension
  - Changing demographics - marked obesity on the rise
- Patient Safety concerns:
  - Incidence of Failed Intubation has not changed in forty years!
  - Approximately 1/3 of obstetric GA are now administered after Failed Neuraxial anesthesia
  - Focus on improving advanced airway management skills
  - Introducing modernized technological innovations into anesthesia airway management
  - Updating and standardizing airway management guidelines
- Educational Concerns:
  - Declining GA experience of anesthesia trainees
  - Educators opting for simulation-based training
  - Advanced Airway Rotation in targeted OR

Improvements in Practice:

Reducing Airway-Related Maternal Mortality

- Changes in Practice: Rates of GA during Cesarean delivery have decreased dramatically over the past 15 years
  - Resulting in less Airway intervention
  - Incidence of Failed Intubation has not changed
  - Two-thirds of failed intubations during C/S are due to failed Regional anesthesia
- Obesity: Continues to increase amongst parturients, so the prevalence of difficult airway is likely to increase
- Airway Skills: Imperative for Anesthesiologists to maintain basic and advanced airway skills despite the decreasing intubation rates
- Emergency Difficult Airway Equipment must be readily/immediately available in the L&D operating rooms

Projected prevalence of obesity in adults by 2025
### Incidence of Failed Intubation 1978 - 2015

<table>
<thead>
<tr>
<th>Author, Year</th>
<th>Data Collection</th>
<th>Incidence of Failed Intubation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Samsoon 1987</td>
<td>1982 – 1985</td>
<td>1 in 281</td>
</tr>
<tr>
<td>Glassenberg 1990</td>
<td>1980 – 1989</td>
<td>1 in 357</td>
</tr>
<tr>
<td>Prelleicht 1997</td>
<td>1995 – 2005</td>
<td>1 in 950</td>
</tr>
<tr>
<td>Santesson 1998</td>
<td>1990 – 1995</td>
<td>1 in 1150</td>
</tr>
<tr>
<td>Scuderi 2000</td>
<td>2000 – 2005</td>
<td>1 in 395</td>
</tr>
<tr>
<td>Madsen 2008</td>
<td>2008 – 2011</td>
<td>1 in 350</td>
</tr>
<tr>
<td>Nascimento 2002</td>
<td>2000 – 2001</td>
<td>1 in 250</td>
</tr>
<tr>
<td>Teoh 2004</td>
<td>2000 – 2001</td>
<td>1 in 240</td>
</tr>
<tr>
<td>Teoh 2006</td>
<td>2006 – 2007</td>
<td>1 in 210</td>
</tr>
<tr>
<td>Knight 2008</td>
<td>2008 – 2009</td>
<td>1 in 190</td>
</tr>
<tr>
<td>Quinn 2010</td>
<td>2010 – 2011</td>
<td>1 in 170</td>
</tr>
<tr>
<td>Teoh 2011</td>
<td>2011 – 2012</td>
<td>1 in 130</td>
</tr>
<tr>
<td>Nascimento 2012</td>
<td>2011 – 2012</td>
<td>1 in 110</td>
</tr>
<tr>
<td>Rajagopalan 2015</td>
<td>2011 – 2012</td>
<td>1 in 100</td>
</tr>
<tr>
<td>Nafisi 2014</td>
<td>2014 – 2015</td>
<td>1 in 90</td>
</tr>
<tr>
<td>D'Angelo 2014</td>
<td>2014 – 2015</td>
<td>1 in 80</td>
</tr>
<tr>
<td>Nafisi 2015</td>
<td>2015 – 2016</td>
<td>1 in 70</td>
</tr>
<tr>
<td>Rajagopalan 2016</td>
<td>2016 – 2017</td>
<td>1 in 60</td>
</tr>
<tr>
<td>Rajagopalan 2017</td>
<td>2017 – 2018</td>
<td>1 in 50</td>
</tr>
<tr>
<td>Rajagopalan 2018</td>
<td>2018 – 2019</td>
<td>1 in 40</td>
</tr>
<tr>
<td>Rajagopalan 2019</td>
<td>2019 – 2020</td>
<td>1 in 30</td>
</tr>
<tr>
<td>Rajagopalan 2020</td>
<td>2020 – 2021</td>
<td>1 in 20</td>
</tr>
<tr>
<td>Rajagopalan 2021</td>
<td>2021 – 2022</td>
<td>1 in 10</td>
</tr>
<tr>
<td>Rajagopalan 2022</td>
<td>2022 – 2023</td>
<td>1 in 5</td>
</tr>
<tr>
<td>Rajagopalan 2023</td>
<td>2023 – 2024</td>
<td>1 in 2</td>
</tr>
</tbody>
</table>

Incidence of Failed Average: 1:390 for Obstetric GA
1:443 for Cesarean Delivery
Maternal Mortality: One death per 90 failed intubations

### Concerns and Solutions

**Clinical Concerns:***
- GA necessary for OR management when there is perceived lack of time for RA
- High risk obstetric patients: congenital cardiac, placental abnormalities, hemorrhage undergoing cesarean hysterectomy
- Changing demographics: morbid obesity on the rise

**Patient Safety Concerns:**
- Incidence of Failed Intubation has not changed in forty years!
- Approximately, 1/3rd of obstetric GA are now administered after Failed Neuraxial anesthesia
- Focus on improving advanced airway management skills
- Introducing modernized technological innovations into anesthesia airway management
- Updating and standardizing airway management guidelines

**Educational Concerns:**
- Declining GA experience of anesthesia trainees
  - Educators opting for simulation-based training
  - Advanced Airway Rotation in surgical OR

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**Difficult Airway Algorithm**

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*Fig. 1. Difficult airway algorithm.*
STRATEGIES TO DEAL WITH DIFFICULT AIRWAY

- Evaluation of Airway: Anticipate difficult airway
- Having difficult airway/equipment readily/immediately available
- Being prepared to deal with difficult airway: Having a pre-formulated strategy
- Having the required advanced airway skills

PROBABILITY OF EXPERIENCING DIFFICULT INTUBATION FOR VARYING COMBINATIONS OF RISK FACTORS


- MP-I + SN + RM + PI
- MP-II + SN + RM + PI
- MP-III + SN + RM + PI
- MP-IV + SN + RM + PI

STRATEGIES TO DEAL WITH DIFFICULT AIRWAY

- Evaluation of Airway: Anticipate difficult airway
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### Surgical Safety Checklist

Ben Taub Hospital: Obstetrical Use Only

In the event of an emergent case, do not delay proceeding in an expeditious manner to complete this checklist; defer checklist until the appropriate clinical time.

<table>
<thead>
<tr>
<th>Task</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIGN IN</td>
<td>Surgeon completes during Time Out, with attending present</td>
</tr>
<tr>
<td>Indication and categorization (urgent, scheduled) of surgery confirmed</td>
<td>✔️ Yes</td>
</tr>
<tr>
<td>Consent signed with correct attending identified and all appropriate procedures documented</td>
<td>✔️ Yes</td>
</tr>
<tr>
<td>All team members have been introduced by name and role</td>
<td>✔️ Yes</td>
</tr>
<tr>
<td>Patient and team members have verified her identity, surgical site &amp; procedure</td>
<td>✔️ Yes</td>
</tr>
<tr>
<td>Known Allergy?</td>
<td>✔️ Yes</td>
</tr>
<tr>
<td>Has Antibiotic Prophylaxis been given within the last 60 minutes?</td>
<td>✔️ Yes</td>
</tr>
<tr>
<td>Fire Safety Assessment complete</td>
<td>✔️ Yes</td>
</tr>
<tr>
<td>Review current hemoglobin/hematocrit, platelets</td>
<td></td>
</tr>
<tr>
<td>Medications currently being administered and plan for intra-op and post-operative dosing is discussed</td>
<td>✔️ Yes</td>
</tr>
<tr>
<td>Airway and risk of aspiration have been evaluated and appropriate equipment is available</td>
<td>✔️ Yes</td>
</tr>
<tr>
<td>If risk of blood loss &gt;1000cc for cesarean delivery, blood products are readily available</td>
<td>✔️ Yes</td>
</tr>
<tr>
<td>Surgeon: Review critical and unexpected steps, operative duration, anticipated complications and patient–specific concerns (examples: arrest of descent may need a vaginal hand and/or consideration of dorsal lithotomy position)</td>
<td></td>
</tr>
<tr>
<td>Anesthesia: Review patient–specific concerns (including regional versus general anesthesia plan)</td>
<td></td>
</tr>
<tr>
<td>Nursing Staff: Review patient–specific concerns, equipment, supplies, sterility</td>
<td></td>
</tr>
<tr>
<td>All essential imaging studies have been reviewed (placental location, characterization verified)</td>
<td>✔️ Yes</td>
</tr>
<tr>
<td>Fetal lie verified (Leopold's maneuver sufficient)</td>
<td>✔️ Yes</td>
</tr>
<tr>
<td>Discuss: Is Neonatology needed at delivery</td>
<td>✔️ Yes</td>
</tr>
<tr>
<td>Team discusses post-operative recovery location, duration and anticipated post-op complications</td>
<td></td>
</tr>
<tr>
<td>Nurse Verbally Confirms with the surgeon and anesthesia providers</td>
<td></td>
</tr>
<tr>
<td>Instrument, Sponge and Needle counts are correct</td>
<td>✔️ Yes</td>
</tr>
<tr>
<td>Specimens are labeled and pathology request complete</td>
<td>✔️ Yes</td>
</tr>
<tr>
<td>Equipment and/or supply concerns have been escalated to charge nurse</td>
<td>✔️ Yes</td>
</tr>
</tbody>
</table>

**SURGEON, ANESTHESIA PROFESSIONALS AND NURSE REVIEW THE KEY CONCERNS FOR RECOVERY AND MANAGEMENT OF THIS PATIENT**

Team discusses post-operative recovery location, duration and anticipated post-op complications

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**DIFFICULT AIRWAY CART AND EQUIPMENT**

**USE OF AIRWAY RESCUE DEVICES IN OBSTETRIC EMERGENCIES**

- Eschmann Bougie
- Optical Stylet
- Supraglottic Airway Devices:
  - LMA
  - Combitube™
  - Laryngeal Tube
- Fiberoptic Bronchoscope
- Videolaryngoscope
  - Glidescope
  - C-MAC
- Critical Airway – CICV Increasing Hypoxemia: Cricothyroidotomy/Tray
**Cost of Airway Devices**

- Eschmann Bougie: $4.57
- Optical Stylet: Lumen: $2700 & Shikani: $2300
- GlideScope: $9,000
- A basic adult CMAC with 1 scope and 3 blades: $22,300
- McGrath Scope: $2900 and each disposable blade: $10
- Classic LMA: $220.00
- Intubating LMA: $1.452.00
- Supreme LMA: $277.00
- Pro-Seal LMA: $270
- Cricothyrotomy tray: $ 178.40
- King Laryngeal Tube: $100.00
- Cricothyrotomy tray: $ 238.67
- Jet Ventilator: $ 590

**STRATEGIES TO DEAL WITH DIFFICULT AIRWAY**

- Evaluation of Airway: Anticipate difficult airway
- Having difficult airway/equipment readily/immediately available
- Being prepared to deal with difficult airway:
  - Role of Anesthesia Tech
  - Having a pre-formulated strategy, Standardized Guidelines & Algorithm
- Having the required advanced airway skills

**Cost of Airway Devices**

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eschmann Bougie</td>
<td>$4.57</td>
</tr>
<tr>
<td>Optical Stylet</td>
<td></td>
</tr>
<tr>
<td>Shikani</td>
<td></td>
</tr>
<tr>
<td>GlideScope</td>
<td>$9,000</td>
</tr>
<tr>
<td>Basic adult CMAC</td>
<td>$22,300</td>
</tr>
<tr>
<td>McGrath Scope</td>
<td>$2900</td>
</tr>
<tr>
<td>Disposable blade</td>
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</tr>
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<td>Classic LMA</td>
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<td>Intubating LMA</td>
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- Having the required advanced airway skills
BURP (BACKWARD, UPWARD, AND RIGHT) MANEUVER

Difficult laryngoscopy made easy with BURP Maneuver
Optimal External Laryngeal Manipulation (DELIM)

Effect of Backward, Upward, Rightward Pressure (BURP) on the View of the Larynx at Laryngoscopy

Classification of Cormack-Lehane Grade III Laryngoscopic View

Cook TM. A New Practical Classification of Laryngoscopic View Am Anaesth. 2000; 45: 276–279
Call for help

Texas Anesthesia Conference of Obstetric and Regional Anesthesia

Plan C: Optimize Delivery
Scenario: Obstetric Failed Tracheal Delivery

Plan D: Optimize Oxygenation
Scenario: Can’t intubate; Can’t

Plan B: Optimize Best Attempt Induction
Scenario: Rapid Sequence Laceration

March 3–6, 2016

Master algorithm

A: Intubation Ventilate at Intubation General Anesthesia Emergent Ventilation

Grade III

Eschmann Bougie Guided Tracheal Intubation

Grade III

Fiberoptic Optical Stylet: Failed First Attempt at Intubation

Grade III A

Fiberoptic Optical Stylet

- Offered by multiple manufacturers – Shikani Seeing Optical stylet, Levitan, Airview

- Used as adjunct to laryngoscopy the tip of the loaded stylet is placed just beneath the tip of the epiglottis under direct vision

- More useful in Grade III B view

Grade III B
MEAN TIMES TO SUCCESSFUL TRACHEAL INTUBATIONS AND PROPORTIONS OF SUCCESSFUL TRACHEAL INTUBATIONS

<table>
<thead>
<tr>
<th>Laryngoscopy View</th>
<th>Endotracheal Intubation N = 103</th>
<th>Fiberoptic Optical Stylet N = 103</th>
<th>Difference (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade III A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean time to success</td>
<td>31</td>
<td>29.2</td>
<td>1.5 (-2.5 to 6.1)</td>
</tr>
<tr>
<td>Success rate</td>
<td>103 (100%)†</td>
<td>101 (98%)]†</td>
<td>2 (0.7 to 4.6)</td>
</tr>
<tr>
<td>First attempt success</td>
<td>102 (99%)]†</td>
<td>93 (90%)]†</td>
<td>9 (2.7 to 14.7)</td>
</tr>
<tr>
<td>Grade III B</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean time to success</td>
<td>45.6</td>
<td>31</td>
<td>14.6 (-2.3 to 31.5)</td>
</tr>
<tr>
<td>Success rate</td>
<td>9 (9%)]†</td>
<td>101 (98%)]†</td>
<td>-92 (-95.4 to -83.3)</td>
</tr>
<tr>
<td>First attempt success</td>
<td>6 (6%)]†</td>
<td>90 (87%)]†</td>
<td>-84 (-94.4 to -73.7)</td>
</tr>
</tbody>
</table>

Observations were excluded for participants with 2 failed attempts before calculation.


CASE #1 AND CASE #2
NEAR MISSES: USE OF OPTICAL STYLET

- Optical Stylet (Levitan) assisted intubation: Successful in two failed intubation obstetric cases undergoing Cesarean Delivery

  - **Case #1** at Baylor: Anaphylaxis to Antibiotic - Stat C/S swollen airway:
    - 1st attempt Grade IV laryngoscopic view, failed intubation
    - 2nd attempt Grade III use of Levitan Optical Stylet – assisted intubation: Successful

  - **Case #2** at Baylor: Stat C/S failed intubation - Grade IV laryngoscopic view, rescued by Levitan Optical Stylet – assisted intubation: Successful
**Achiving Laryngeal View**

**Defining the View Axis**

- **McGrath Videolaryngoscope**
- **Glide Videolaryngoscope**
- **C-MAC Videolaryngoscope**

**McGrath, Glide and Storz C-MAC Videolaryngoscopes**

- Compared to direct laryngoscopy these videolaryngoscopes (VL) provide a look around the curve from 0 degrees to a visual axis of approximately 270 to 300 degrees.
- The distal tips of these video laryngoscopes point toward the 290 degrees.
- The cameras have a wide field of view: both up & down; left to right; including the distal tip of their blades.
- Result is supraglottic panoramic view of the larynx, from above the epiglottis & posterior to the base of the tongue.

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**Complications with GlideScope**

- Perforation of the right palatopharyngeal arch (two reports)
- Perforation of the right soft palate
- Perforation of the right anterior tonsillar pillar
- Diversion of attention from mouth to the monitor
- Practitioner unaware of the location of the ETT
- As the VL is advanced to achieve laryngeal visualization upward force stretches the tonsillar pillars making them taut
- Susceptible to perforation by an advancing ETT
- Glide VL should be introduced into the mouth in the midline under direct visual control
- To avoid injury, insertion of the ETT parallel to and as close as possible to the laryngoscope blade attempting to reproduce its course
- Introduce ETT in midline, with proximal end oriented towards the right & then rotate counter-clockwise 90 degrees to parallel to the blade
- Visually guide ETT go into the mouth and around the tongue
- If definite resistance encountered STOP do not use force.

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**Penetrating Injury of the Soft Palate During Intubation with GlideScope**

Use of C-MAC Video Laryngoscope in Obstetrical Cases

Case Series: 9 obstetrical cases emergencies or semi-elective; 8 of the 9 parturients were obese:

- In Cases 1 & 2, C-MAC VL was used in stat cesarean deliveries (CD) for obstetrical emergencies (cord prolapse, eclampsia).
- In Cases 3 – 6, C-MAC VL was used in CD when regional anesthesia was either contraindicated or had failed to provide adequate surgical anesthesia.
- In cases 7 & 8, C-MAC VL was in cesarean-hysterectomies
- In case 9, C-MAC VL was used in exploratory laparotomy performed for obstetric hemorrhage

All first attempt Successful Intubations: No adverse airway events occurred
**Key Features of Plan B**

- **Optimize Best Attempt at Intubation**
  - Advantages of head-up positioning and ramping are highlighted.
  - Preoxygenation is recommended for all patients.
  - Apneic oxygenation techniques with nasal cannula > 10-15L/minO₂ are recommended in high-risk/morbidly obese parturients.
  - The importance of neuromuscular block is emphasized.
  - Consider mask ventilation (Pmax 20 cmH₂O).
  - The role of videolaryngoscopy in difficult intubation is recognized.
  - All anesthesiologists should be skilled in the use of a videolaryngoscope.
  - A maximum of two attempts at laryngoscopy are recommended (2+1).
  - Cricoid pressure should be removed if intubation is difficult.

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**Graphic Display of Complications by Intubation Attempts**

- Hypoxemia
- Severe Hypoxemia
- Esophageal Intubation
- Regurgitation
- Aspiration
- Bradycardia
- Cardiac Arrest

- Graph showing complications by number of intubation attempts:
  - 1 attempt
  - 2 or fewer attempts
  - > 2 attempts

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- **Plan A:**
  - Master Algorithm: Obstetric Anesthesia
  - Management Strategies: Difficult and Failed Intubation

- **Plan B:**
  - Optimize Best Attempt at Intubation
  - Scenario: Rapid Sequence Induction
  - Induction
  - Scenario: Obstetric Failed Tracheal Intubation
  - Delivery

- **Plan C:**
  - Optimize Ventilation
  - Scenario: Obstetric Failed Tracheal Intubation

- **Plan D:**
  - Optimize Oxygenation
  - Scenario: Can’t intubate; Can’t ventilate

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- **References:**
CASE REPORTS IN OBSTETRICS:
PROSEAL LMA: FAILED INTUBATION – C/S

- Use of the ProSeal LMA for airway maintenance during emergency C/S after failed intubation. Bellingham et al. ANA 2004; 92: 903-906
- The ProSeal LMA in failed obstetric tracheal intubation. Sladey et al., IJHA 2005;14:270-271
- Another case of use of the ProSeal LMA in a difficult obstetric airway. Vaida SJ et al, BJA 2004; 92:905
- The ProSeal LMA in failed obstetric tracheal intubation scenarios. Shinobu R et al., IJHA Vol 6, No 1

PROSEAL™ LMA FOR ROUTINE CESAREAN DELIVERY

- ProSeal LMA evaluated as a routine airway in 3000 patients undergoing elective Cesarean delivery
- All patients were fasted for at least 8 hours and were given ranitidine 50 mg intravenously
- Following modified RSI with propofol 2 to 3 mg/kg and rocuronium 0.9 mg/kg intravenously, the PLMA was inserted
- Results: Successful establishment of an effective airway on the 1st attempt in 2,992 (99.7%) patients
- In one patient (0.003%) and there was regurgitation and spillage of gastric contents into mouth and no case of aspiration
- No patient required rescue intubation

SUPREME LMA FOR ROUTINE CESAREAN DELIVERY

- The LMA Supreme™ is a single-use, supraglottic device created as an alternative to conventional, tracheal intubation
- Features that are similar to the Fastrach™ and some to the Proseal; it features a built-in drain to divert fluids away from the airway
- Used in elective and emergency 700 Cesarean Deliveries
- Mean BMI was 25.5 kg/m2, parturients fasted at least 6 hours in elective cases or at least 4 hours in urgent cases and had received antacid prophylaxis
- The success rate of first attempt insertion of LMA Supreme™ insertion rate 98% (686 parturients)
- Time to establishing effective airway was 19.5 seconds with maintenance of ventilation and oxygenation in all parturients
- No case of aspiration

USE OF INTUBATING LMA (ILMA) FASTRACH™ LMA IN OBSTETRICS

- ILMA /FASTRACH™ has been used in parturients after failed intubation

- ILMA life-saving rescue device in obstetrical patients in our institution (Baylor)
  - Eclamptic patient for stat C/S failed intubation (current case)
  - Failed regional block/GA and Failed Intubation
  - Failed Intubation /Stat C/S Fetal Distress
  - Failed regional failed Intubation

The two steps of the Chandy maneuver: (a) After insertion of the LMA-Fastrach, optimal ventilation is established by slightly rotating the device in the sagittal plane, until the least resistance is achieved. This helps to align the internal aperture of the device with the glottic opening. (b) Just before intubation, the LMA-Fastrach is slightly lifted (but not tilted) away from the posterior pharyngeal wall using the metal handle. This prevents the endotracheal tube (ETT) from colliding with the arytenoids and facilitates the smooth passage of the ETT into the trachea.


Figure 20 LMA and Cricoid Pressure

Key Features of Plan C
SGA, supraglottic airway device

- Failed intubation should be declared
- The emphasis is on oxygenation via a SGA
- Second-generation SGAs are recommended/Consider ILMA
- A maximum of two attempts at SGA insertion are recommended
- During rapid sequence induction, cricoid pressure should be removed to facilitate insertion of SGA
- Blind techniques for intubation through a SGA are not recommended

Obstetric Failed Tracheal Intubation: OPTIMIZE VENTILATION

- After delivery attempt tracheal intubation via SGA (blind or fiberoptic)

DO YOU PROCEED WITH SURGERY AFTER SGA PLACEMENT

Graph of proportion of cases in which general anesthesia was continued after failed introcution attempt vs. cesarean section, reported per year.


Reprintions by Dollar, Rocklin, Baylor College of Medicine

Obstetric Failed Tracheal Intubation: OPTIMIZE VENTILATION

Master Algorithm: Obstetric Anesthesia: Management Strategies—Difficult and Failed Intubation

Rate proportion of general anesthesia continued after failed tracheal intubation at emergency cesarean section: proportion of general anesthesia continued after failed tracheal intubation at elective cesarean, plotted by year of publication. Dotted lines = 95% confidence interval.

3/1/2016
Note: Plan B – D should be time-limited, no more than 30–45sec per step (total < 5min)

Can’t intubate: can’t oxygenate: Priority Optimize

Declare Cannot Intubate/Cannot Oxygenate (CICO)

O₂ 100%; Call for Trauma/ENT Surgeon

Perform front-of-neck procedure

Emergency Pathway

Critical Airway

Scenario: Can’t intubate; Can’t Ventilate

Plan D: Optimize Oxygenation

Success

F AIL

Confirm oxygenation, anesthesia, CVS stability

Is oxygenation restored? Is it essential/safe to proceed with surgery immediately?

Confirm ETCO₂, O₂ saturation > 95%

Proceed with surgery - Maternal CPR - Perimortem CD

No

Yes

Not essential/safe to proceed with surgery - Wake patient

Perform front-of-neck cricothyroidotomy procedure

Details of Scalpel cricothyroidotomy – Cricothyroid membrane palpable scalpel technique (Fekk C BJA 2015, 1-22)

Continue attempts at rescue oxygenation via upper airway (intubation).

Stand on the patient’s left-hand side if you are right handed (reverse if left handed).

Perform a laryngeal handshake to identify the laryngeal anatomy.

Stabilize the larynx using the left hand.

Use left index finger to identify the cricothyroid membrane. Hold the scalpel in your right hand, make a transverse stab incision (Obese: vertical incision) through the skin and cricothyroid membrane with the cutting edge of the blade facing towards you.

Keep the scalpel perpendicular to the skin and turn it through 90° so that the sharp edge points caudally (towards the feet).

Swap hands; hold the scalpel with your left hand.

Maintain gentle traction, pulling the scalpel towards you (diagonally) with the left hand, keeping the scalpel handle vertical to the skin (not斜)
Key Features of Plan D
CICO, can’t intubate can’t oxygenate

CICO and progression to front-of-neck access should be declared
A didactic scalpel technique has been selected to promote standardized training
Placement of a wide-bore cuffed tube through the cricothyroid membrane facilitates normal minute ventilation with a standard breathing system
High-pressure oxygenation through a narrow-bore cannula is associated with serious morbidity
All anesthetists should be trained to perform a surgical airway
Training should be repeated at regular intervals to ensure skill retention

AIRWAY, MORBIDITY AND MANAGEMENT

2000-2006

OBTETRICAL EMERGENCY AIRWAY CASE #6

- Six year study period 2000-2005
- 98 parturients received GA
- Critical Airway case: A sentinel event of difficult intubation (HELLP Syndrome)
- MP class III airway
- Three attempts at intubation – severe contact bleeding
- Initial placement of LMA complicated by laryngospasm
- Cannot intubate / cannot ventilate situation – resulting in an airway code
- Successful cricothyroidotomy (Induction to establishment of airway, 5 mins)
- Five days later decannulation; DL revealed MP Class I


SUMMARY

- Anesthesia is a leading cause of maternal mortality – Airway related
- Anesthesia-related complications feature as a predominant cause of maternal morbidity & mortality
- Pregnancy-related changes are not the sole reason for difficulty with intubation, ventilation, and extubation; other reasons include lack of pre anesthesia assessment and preparedness, inadequate communication, loss of situational awareness, lack of clinical airway management skills
- Early preoperative assessment must include a thorough airway history and examination; a rescue plan for potential failed tracheal intubation
- Appropriate airway equipment and personnel must be immediately available in labor and delivery sites to manage the difficult airway
- Adequate preoxygenation, LUD, head-elevated positioning, and use of supplementary high-flow oxygen apneic oxygenation (NO DESAT) via nasal cannula enhances oxygenation.

PREVENTING MATERNAL MORTALITY: PRACTICAL COST-STEPs FOR THE ANESTHESIA PRACTITIONER

AIRWAY DIFFICULTY IN OBSTETRIC ANESTHESIA

SUMMARY

Alternative airway devices videolaryngoscopes and optical stylets should be immediately available following a failed tracheal intubation attempt in the unanticipated DA (cannot intubate, can ventilate) scenario.

First generation supraglottic airways such as the laryngeal mask airway ILMA and second generation supraglottic airways such as the Supreme LMA, ProSeal LMA and I-Gel should be considered as ventilatory devices in the unanticipated DA

Invasive airway access with a scalpel surgical cricothyroidotomy must be considered in the CICO situation of critical airway with hypoxemia.

More cost effective to invest in a dedicated difficult airway cart and acquire advanced airway management skills than to face litigation and a $18,400,000 settlement
Thank You