

Pediatric Airway Management

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AFFILIATIONS/SPONSORSHIP/DECLARATION OF INTERESTS

- ✘ Flight Respiratory Therapist, Grace on Wings Air Ambulance
 - + Nation's only charity air ambulance
 - + All volunteer
 - + Based out of Indianapolis International Airport
 - + www.graceonwings.org
- ✘ No current sponsorship or research funding related conflicts of interest

THE PEDIATRIC AIRWAY

- ✘ Background
- ✘ Identifying potential problems beforehand
- ✘ ASA Difficult Airway Algorithm
- ✘ Difficult equipment and supplies
- ✘ Managing the difficult airway
- ✘ "Escape plans"

WHAT WE'RE NOT GOING TO DISCUSS....

- ✘ Normal airway anatomy
- ✘ Routine intubations
- ✘ NPO protocols for elective intubations
- ✘ Placement confirmation techniques

BACKGROUND

- ✘ Difficult and failed intubations are not every day events, but are still common even in the “controlled” environment of operating rooms¹:
 - + 1 out of 500 obstetric patients
 - + 1 out of 2320 non-obstetric patients

NO GOOD DATA READILY AVAILABLE FOR PEDIATRIC CASES....

THAT SAID....

- ✘ Low frequency, high stress event for most providers
 - ✘ “If you’re not sweating when faced with a desperately sick child, you pretty much meet the DSM criteria for being a sociopath”- My former EMS medical director
- ✘ Even fewer chances to practice skills than on adult patients
- ✘ Significant differences in airway anatomy

THE SAD TRUTH

FEW THINGS WILL
PRODUCE A DEAD CHILD
FASTER THAN A
COMPROMISED AIRWAY

MAJOR AIRWAY DIFFERENCES

- ✘ Smaller (obviously)
- ✘ Tongue is larger relative to size of airway
- ✘ Larynx is more anterior and cephalad
- ✘ Infants are more or less obligate nosebreathers
- ✘ Trachea is very short
- ✘ Cartilage is less rigid (epiglottis, larynx, tracheal rings, etc)
 - + Airway more prone to obstruction from simple flexion or hyperextension

OTHER COMPLICATING FACTORS

- ✘ Higher propensity to develop pulmonary edema (lower levels of collagen and other elastic tissues in the lungs).
- ✘ Lower respiratory reserves
- ✘ Much less tolerant of higher airway pressures especially if already hypotensive or hypovolemic.
- ✘ Kids crash abruptly and are often more difficult to “recover” than adults

IDENTIFYING POTENTIAL PROBLEMS



IF ONLY IT WERE THIS EASY ALL OF THE TIME

CONDITIONS ASSOCIATED WITH DIFFICULT AIRWAYS

(LIST MODIFIED FROM BEW, 2006)

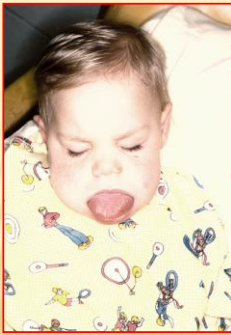
- ✗ Down's Syndrome
- ✗ Klippel-Feil syndrome
- ✗ Treacher Collins syndrome
 - ✗ Achondroplasia
 - ✗ Cleft palate
 - ✗ Burns
 - ✗ Trauma
 - ✗ Angioedema
 - ✗ Epiglottitis
- ✗ Pharyngeal abscesses
- ✗ Tonsillar hypertrophy
- ✗ Laryngeal cysts

THE "LEMON" LAW

- ✗ Also referred to as Dr. Binnion's Lemon Law¹
 - + Look externally
 - + Evaluate the 3-3-2 rule
 - + Malampatti
 - + Obstruction?
 - + Neck mobility

LOOK/LISTEN EXTERNALLY

- * Does the patient have any of the following?¹
 - + Obese or very small body habitus?
 - + Prominent Upper Incisors?
 - + Receding Jaw?
 - + Burns?
 - + Facial Trauma?
 - + False teeth?
 - + Edema of the oropharynx, face or neck?
 - + Stridor?
 - + FBAO?
 - + Alcohol or recreational pharmaceuticals on board? (yes, even in "very young" kids)
 - + Attitude problem?





SPECIFIC ANATOMICAL ISSUES

- ✘ Obesity
 - + Difficulty in positioning patient
 - + Rapid desaturation
 - + Difficult to manually ventilate
 - + Difficult direct visualization of cords

SPECIFIC ANATOMICAL ISSUES

- ✘ Large teeth
 - + Can make laryngoscopy difficult
 - + Can hinder passage of non-visualized airways
- ✘ Jagged/broken teeth
 - + Can lacerate the cuff of an endotracheal tube

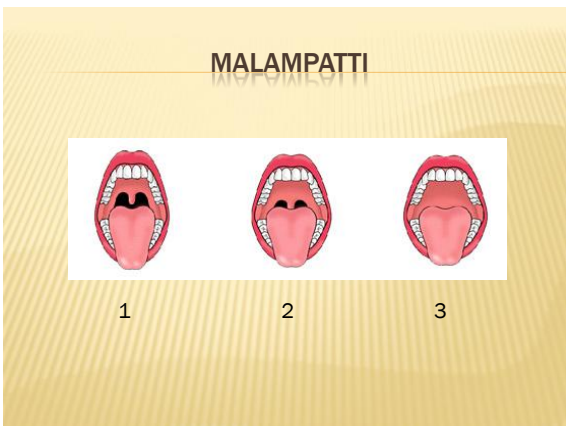
EVALUATE THE 3-3-2 RULE

- ✘ Incisor distance
 - + >3 fingerbreadths
- ✘ Hyoid to mentum (chin) distance
 - + >3 fingerbreadths
 - + Good indication of ability to move tongue into mandible
- ✘ Thyroid cartilage to floor of mouth distance
 - + >2 fingerbreadths

May have some applicability to kids...





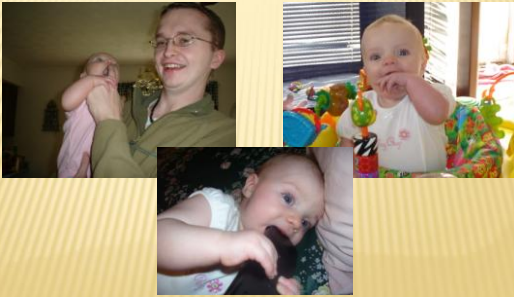


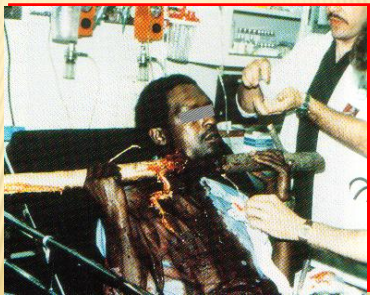
OBSTRUCTIONS?

- ✘ Tumors
- ✘ Blood/hematoma
- ✘ Vomitus
- ✘ Teeth
- ✘ Epiglottitis/Anaphylaxis/Angioedema
- ✘ Impaled Objects
- ✘ Food
- ✘ Large tongue or tonsils

OBSTRUCTIONS?

- ✘ "Non-food items"





"KISSING TONSILS"



NECK MOBILITY



NECK MOBILITY

- Conditions of concern:
- Trauma
 - Ankylosing spondylitis
 - Rheumatoid arthritis
 - Osteoarthritis
 - Surgical fixation



ANESTHESIA VERSUS EMERGENCY AIRWAYS

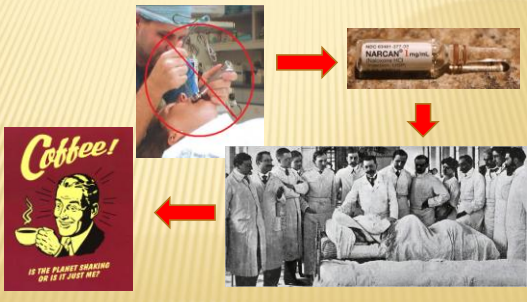
- ✘ Anesthesiology normally deals with planned airways under “controlled” circumstances and the option for reversing the anesthesia, cancelling the case and looking for a better option are available choices
- ✘ This sort of case constitutes a minority of failed airways that most providers will see

ANESTHESIA VERSUS EMERGENCY AIRWAYS

- ✘ Emergency airways are the more common circumstance in which RTs become involved (when was the last time you really planned an intubation ahead of time?)
- ✘ Less time to plan, less time to think and fewer “escape options”

So what does this difference mean?

- ✘ Failed elective airway....



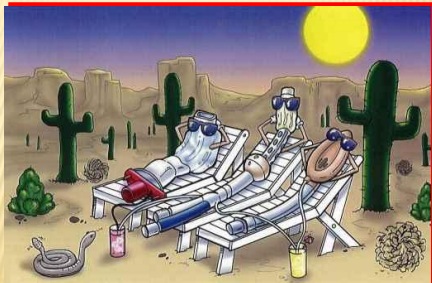
✘versus the failed emergent airway

Failed airway

- Wipe brow
- Change shorts
- Call attorney
- Call coroner/medical examiner

NO VICTIM IS MORE SYMPATHETIC IN THE EYES OF A JURY THAN A DEAD OR SERIOUSLY INJURED CHILD

EQUIPMENT FOR THE DIFFICULT AIRWAY



OPTIONS- A VERY GOOD THING TO HAVE!

- ✘ Chin lift/jaw thrust with proper BVM use and good patient positioning
- ✘ Nasal/Oropharyngeal airway
- ✘ Esophageal-Tracheal Combitube or King Airway
- ✘ Laryngeal mask airway (LMA)
- ✘ Blind Approach (“digital intubation”)
- ✘ Gum Elastic Bougie (GEB)
- ✘ Light Wand
- ✘ Fiberoptic Bronchoscope

OPTIONS- A VERY GOOD THING TO HAVE!

- ✘ Needle cricothyrotomy/trans-tracheal jet “ventilation”
- ✘ Retrograde Intubation
- ✘ Surgical cricothyrotomy/percutaneous tracheotomy
 - + The ‘surgical option’ in children

MASK TECHNIQUE

- ✘ Probably the most common reason for inability to ventilate someone with a bag valve mask is poor technique or poor patient positioning
- ✘ This is true even with “experienced” personnel and not just students and new graduates

Proper Mask Technique

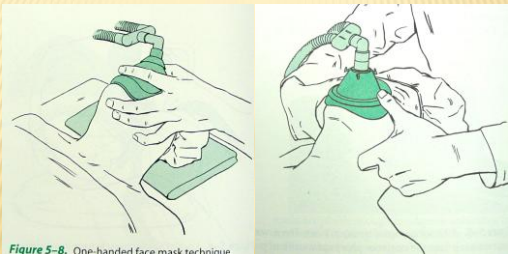
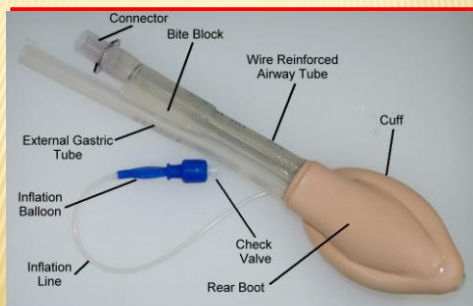


Figure 5-8. One-handed face mask technique.

Proper Mask Technique

- ✘ Practice is essential
- ✘ Sizing of the mask
- ✘ Positioning of the patient
- ✘ Pull the face into the mask, do not push the mask onto the face
- ✘ Use water-soluble lubricant to achieve a better mask seal

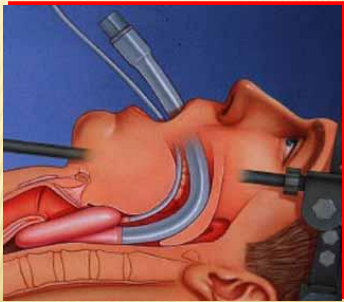
Laryngeal Mask Airways



Laryngeal Mask Airway (LMA)

- ✘ Another non-visualized airway, but the design of the cuff prevents it from being placed into the esophagus
- ✘ Only usable in a patient without any glossopharyngeal or laryngeal reflexes
- ✘ Arguably it should not be used in patients with full stomachs or poor lung compliance
- ✘ Probably the best option for securing an airway in a child that can not be intubated

Laryngeal Mask Airways



Combitube



Combitube

- ✘ "The Rodney Dangerfield of airway adjuncts"
- ✘ Basically a melding of an esophageal obturator airway and a cuffed ET tube
- ✘ Blindly inserted, normally it winds up in the esophagus in 70-90% of cases
- ✘ Can be intubated around although this is not the easiest thing to do
- ✘ A smaller size is now available which can be used in larger children and adolescents

Combitube

- ✘ Ventilate first through blue port, then white. If no breath sounds and signs of gastric insufflation, use the white port.
- ✘ “The sky is blue before the white clouds come rolling in”
- ✘ The only real contraindications are esophageal disease and a patient with gag reflexes

Manual Intubation

- ✘ The “old school” approach to intubation
- ✘ Useful in austere environments or in the face of equipment failure
- ✘ Low light conditions, awkwardly positioned patients, potential spinal injury, etc
- ✘ Requires a practitioner with long fingers and good dexterity
- ✘ High risk of getting bit (personal experience)

Gum Elastic Bougie



Gum Elastic Bougie

- ✦ The airway equivalent of a vascular guidewire
- ✦ Easy to learn to use
- ✦ Inexpensive
- ✦ Can be used blindly
- ✦ Can also be used as a tube exchanger

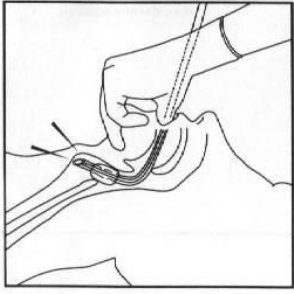
Gum Elastic Bougie

- ✦ Expertise takes a lot of practice
- ✦ Not useful in cases of distorted airway anatomy
- ✦ Some do not recommend its use in the “can’t intubate/can’t ventilate” scenario

Lighted Wand Stylet



Lighted Wand Stylet



Lighted Wand Stylet

- ✘ Minimal neck movement
- ✘ Useful adjunct to laryngoscopy or manual intubation
- ✘ Portable and relatively inexpensive
- ✘ Usable in bloody airway

Lighted Wand Stylet

- ✘ Blind insertion technique
- ✘ There have been documented cases of laryngeal trauma associated with aggressive insertion
- ✘ The room should be darkened (or the neck covered with a blanket) to accentuate the glow associated with proper placement
- ✘ Expertise requires practice
- ✘ Not an option in smaller children

Fiberoptic Bronchoscope



Fiberoptic Bronchoscope

- ✘ Allows direct airway visualization even when you have damage or distortion of the anatomy
- ✘ Causes little hemodynamic stress
- ✘ Can be done in all age groups
- ✘ Requires minimal neck movement
- ✘ Can be used either via the nasotracheal or orotracheal route

Fiberoptic Bronchoscope

- ✘ Expensive
- ✘ Steep learning curve
- ✘ Delicate equipment needs careful maintenance
- ✘ Visual field easily impaired by blood and secretions
- ✘ Seldom used in prehospital environment

Needle Cricothyrotomy/Transtracheal Jet Ventilation

- ✘ Most frequently used in children (< 8 years of age)
- ✘ Serves as a stop gap measure until a more definitive airway can be inserted
- ✘ Insertion procedure is relatively easy to learn and perform

Needle Cricothyrotomy/Transtracheal Jet "Ventilation"

- ✘ Risk of complications in unskilled hands is relatively high....at least potentially
- ✘ Requires high pressure oxygen and proper equipment
- ✘ Is not really "ventilation" but rather a stopgap way of oxygenation
- ✘ Lack of protection against aspiration

Retrograde Intubation



Retrograde Intubation

- ✘ Basically a modification of the needle cricothyrotomy technique
- ✘ Guidewire placed through cricothyroid space and into posterior oropharynx
- ✘ A pair of forceps is used to grasp the wire and pull it out of the mouth
- ✘ An ET tube is then slid down the wire into position and the wire is then pulled out via the mouth

Retrograde Intubation

- ✘ Advantages include that this can be done without movement of the cervical spine and with minimal movement of the mandible
- ✘ The major drawback is the lack of proficiency by most practitioners in this skill and the lack of previously assembled equipment
- ✘ The procedure is time consuming

Surgical Cricothyrotomy/Percutaneous Tracheotomy

- ✘ Probably the best “surgical airway” for emergency situations
- ✘ Normally a quick and simple procedure
- ✘ Can be complicated by patients on anticoagulants, short necks, thick necks or tracheal/laryngeal trauma
- ✘ **ALWAYS** use a vertical incision
- ✘ The final step for any “can’t intubate/can’t ventilate” protocol

Surgical Cricothyrotomy/Percutaneous Tracheotomy

- ✘ “The hardest part of doing a cricothyrotomy is picking up the knife.” – Peter Rosen

Surgical Airways in Children

- ✘ Cricothyrotomies are not normally possible until 10-12 years of age (some say “post puberty)
- ✘ Traditional thinking is that tracheotomies are not an “emergency” airway
- ✘ They can be done quickly, but requires a higher degree of surgical skill than a cricothyrotomy
- ✘ If you are truly left with no other option, a less than textbook perfect (but serviceable) tracheotomy is preferable over a dead patient

BASIC PRINCIPLES TO MANAGING DIFFICULT AIRWAYS

- ✘ #1: Oxygenation and ventilation are the goal, not intubation
 - ✘ #2: Your ego: check it at the door
- ✘ #3: Call for help; in fact, call for more help than you think you will need
 - ✘ #4: If it is stupid and it works, it isn't stupid
 - ✘ #5: Newer is not always better
 - ✘ #6: Plan ahead (avoid the “coffin corner”)
 - ✘ #7: Hold your own breath
- ✘ #8: If it's not working, let someone else try or try something else
- ✘ #9: When in doubt, skip to the end of the protocol (surgical airway)
- ✘ #10: If they are still breathing and you are not sure you can take over, don't stop them from doing so

Escape Plans

- ✘ What skills do I have?
- ✘ Who is around to help?
- ✘ What skills do those around me have?
- ✘ What equipment do I have?
 - + “Why didn’t we put together a difficult airway cart?”

“PRACTICE MAKES PERFECT”

- ✘ Practice “infrequent procedures” frequently (monthly?)
- ✘ The airway equivalent of a “megacode”
- ✘ Nothing is worse than having forgotten how to do something that could have saved the patient

JUST SO THAT WE END ON A HAPPY NOTE...

I leave you with the following:





ACKNOWLEDGMENTS

- ✦ Dr. Brian Woodcock and Dr. Joseph Lex for providing reference materials and many of the photos in this presentation
