advanced airway management
for the emergency physician

june 9, 2010

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objectives

Discuss the common cognitive mistakes made in airway management

Discuss the elements of first pass success in laryngoscopy

Discuss key decisions in airway management

Discuss problems that arise during airway management (and strategies to solve them)

Discuss controversies in emergency airway management
guiding principles

you cannot accurately predict the difficult airway
you cannot accurately predict the difficult airway
guiding principles

you cannot accurately predict the difficult airway

need to intubate

RSI + hope for the best

difficult airway?

nah

RSI + hope for the best

yes

“difficult airway box” to bedside

RSI + hope for the best

get someone else to do it

oh god
guiding principles

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operator catecholamine management

patient HR

operator HR

laryngoscopy attempt #1
laryngoscopy attempt #2
laryngoscopy attempt #3
BVM
LMA
Cricothyrotomy

Aspiration
ACLS
"A calm, methodical approach is the key to difficult airway management. Conquering the chaos is half the battle."

Ron M. Walls, M.D.
Professor, Harvard Medical School
airway course algorithms

universal emergency airway algorithm
airway course algorithms

main emergency airway algorithm

from Walls et. al via emcrit.org
airway course algorithms

crash airway algorithm

from Walls et. al via emcrit.org
airway course algorithms

failed airway algorithm
difficult airway algorithm
airway course algorithms

1. **Crash airway**
   - **Maintain Oxygenation**
     - Intubation attempt successful?
       - Yes: Post-intubation management
       - No: Unable to bag ventilate?
         - Yes: Failed airway
         - No: Succinylcholine 2 mg/kg IV
           - Attempt Intubation
             - Successful?
               - Yes: Post-intubation management
               - No: Failure to maintain Oxygenation?
                 - Yes: Failed airway
                 - No: > 3 attempts by experienced operator?
                   - Yes: Failed airway
                   - No: Continue attempt

2. **Difficult airway?**
   - Yes: **Difficult Airway Algorithm**
     - Unconscious Unreactive Near Death?
       - Yes: Crash Airway Algorithm
         - Fails: RSI
       - No: Difficult Airway Algorithm
         - Fails: RSI
   - No: **Failed Airway Algorithm**

3. **Failed airway criteria**
   - Failure to maintain Oxygenation?
     - Yes: Cricothyotomy
     - No: If contraindicated
       - Choose one of: Fiberoptic method Video laryngoscope EGD Lighted Stylet Cricothyotomy
         - Cuffed ETT placed?
           - Yes: Post-intubation management
           - No: Arrange for definitive airway management

4. **Difficult airway predicted**
   - Call for assistance
   - Failure to maintain Oxygenation?
     - Yes: Cricothyotomy
     - No: If contraindicated
       - BMV or EGD predicted to be successful?
         - Yes: Intubation predicted to be successful?
           - Yes: RSI
           - No: Post-intubation management or RSI
         - No: Awake DL, FO or VL successful?
           - Yes: ILMA FO or VL Cricothyotomy BNTI Lighted stylet
           - No: Go to main algorithm
strayer airway algorithm

vs. Walls algorithms

focus on planning but not on specific techniques

focus on early, effective ventilation after unsuccessful airway attempt

permission to initiate cricothyrotomy on patients who are not dead

RSI vs. Awake

Prepare for failure of intubation and failure of BVM

Post-intubation management

Successful

Airway attempt

Unsuccessful

BVM (perfect technique) or LMA

Unsuccessful

Supraglottic device

Prepare for cricothyrotomy

Unsuccessful

Next patient

Successful

Successful

Change something

Next patient
the decision to intubate

intubate, and intubate early

especially in dynamic airways

bullets  neck trauma
bites    anaphylaxis / angioedema
burns   thermal and caustic airway injuries

Airway  mouth and neck infections, tumors, foreign bodies, bleeds
        exam: stridor, phonation, swallowing, secretions, dyspnea

Breathing failure of oxygenation or ventilation
        often amenable to medical and non-invasive therapies – think NIV

Circulation supporting tissue oxygen delivery by unloading the muscles of respiration
        sepsis

Disability CNS catastrophes and CNS depression, ongoing seizures, weakness
        exam: avoid gag – assess ability to swallow and handle secretions (pooling, drooling, gurgling)
        for neuromuscular weakness: FVC < 12 ml/kg and NIF < 20 cm H20
        vomiting in the obtunded patient is a particular concern

Expected course anticipated decline, transfer to radiology or another institution

Feral need for prompt, aggressive sedation to protect patient/others
        especially with potential or undiagnosed medical instability
RSI vs. awake

vs. call for help
vs. immediate cricothyrotomy / ED double setup

RSI

peri-arrest
dynamic airway already deteriorating

known easy airway
normal anatomy

upper GI bleed
bowel obstruction
vomiting in ED

don't always need to give total intravenous anesthesia to anesthetize

Awake

urgency

stable GI bleed requiring endoscopy
slowly progressive neuromuscular weakness requiring transfer

fixed flexion deformity of the neck
cannot open mouth

difficult airway features

don't always need to give total intravenous anesthesia to anesthetize

vomiting risk

sympatholysis risk, apnea risk

all else being equal, paralyzed patients are considerably easier to intubate

you can always paralyze but cannot un-paralyze (yet)
Awake Technique

Favored in patients who require intubation less urgently, have more difficult airway features, and are not high risk for vomiting

- **Glycopyrolate** 0.2 mg or **Atropine** .01 mg/kg  *glyco* preferred, ideally given 15 min prior to next step
- Suction then pad dry mouth with gauze
- **Nebulized Lidocaine** without epi @ 5 lpm ideally 4 cc of 4% lidocaine but can also use 8 cc of 2% lidocaine
- **Atomized Lidocaine** sprayed to oropharynx especially if unable to give full dose of nebulized lidocaine
- **Viscous Lidocaine** lollipop 2% *viscous lido* on tongue depressor
- Preoxygenate  □ Position  □ Restrain prn  □ Switch to nasal cannula
- Lightly sedate with **Versed** 2-4 mg or **Ketamine** 20 mg aliquots q 2 min
- Intubate awake or place bougie, then paralyze, then pass tube
laryngoscopy

ear to sternal notch
laryngoscopy

ear to sternal notch
laryngoscopy

ear to sternal notch
laryngoscopy

ear to sternal notch

equipment is ready: suction under right shoulder

assistant pulls right mouth corner
laryngoscopy

assistant pulls right mouth corner
laryngoscopy

ear to sternal notch

equipment is ready: suction under right shoulder

assistant pulls right mouth corner

forget cricoid pressure

find the epiglottis: gentle advance from right, looking for epiglottis

vs.

gentle advance into esophagus, then withdraw, looking for epiglottis

optimize the head: put your right hand under the patient’s head and do sniff and head tilt
laryngoscopy

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laryngoscopy

ear to sternal notch

equipment is ready: suction under right shoulder

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forget cricoid pressure

find the epiglottis: gentle advance from right, looking for epiglottis vs. gentle advance into esophagus, then withdraw, looking for epiglottis

optimize the head: put your right hand under the patient’s head and do sniff and head tilt

seat the blade: either in the vallecula, or on the epiglottis itself, then gently lift

optimize the larynx: use your right hand to maneuver the thyroid cartilage into optimal position
laryngoscopy

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**find the epiglottis:** gentle advance from right, looking for epiglottis

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optimize the head: put your right hand under the patient’s head and do **sniff** and **head tilt**

**seat the blade:** either in the vallecula, or on the epiglottis itself, then gently lift

optimize the larynx: use your right hand to maneuver the thyroid cartilage into optimal position

that’s the best view you’re going to get on this attempt. if it’s not good enough, **ventilate**

before your next attempt **change something**

for the love of god, use a **bougie**
the bougie

essential

small tube for small hole

strategically designed deflection at the tip

self-confirming

can intubate epiglottis-only views

leave the laryngoscope in

lubricate the tube, pull back and rotate if you get stuck

black stripe is 25 cm - at lips, mid trachea in an adult male

the bougie is your friend
laryngoscopy

ear to sternal notch

suction under right shoulder

assistant pulls right mouth corner

forget cricoid pressure

find the epiglottis: gentle advance from right, looking for epiglottis vs.
gentle advance into esophagus, then withdraw, looking for epiglottis

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optimize the larynx: use your right hand to maneuver the thyroid cartilage into optimal position

that’s the best view you’re going to get on this attempt. if it’s not good enough, ventilate

before your next attempt change something

for the love of god, use a bougie

advance the ETT or bougie from the right side and twist, do not lever
laryngoscopy

advance the ETT or bougie from the right side and twist, do not lever
laryngoscopy

advance the ETT or bougie **from the right side** and twist, do not lever
BVM

a misunderstood skill

three airways

detach the mask from the bag

two hands down

jaw thrust

open the mouth, make an underbite
BVM

jaw thrust

open the mouth, make an underbite
BVM

jaw thrust

open the mouth, make an underbite
BVM

a misunderstood skill

three airways
detach the mask from the bag
two hands down

jaw thrust

bag slowly and gently

open the mouth, make an underbite

squeeze, release, release
use the vent to bag

don’t wait for the pulse ox

remove cricoid pressure
reposition with head tilt, sniffing posture

lubricate beard, replace dentures

change mask size - usually larger

add or remove air from the mask cuff

consider oxygenation deficit

chest rise, appropriate resistance, no leak, ETCO2
LMA supreme versus facemask ventilation performed by novices: a comparative study in morbidly obese patients showing difficult ventilation predictors.


Anesthesia Department and Airway Management (Paris 13), University Diploma Group, Paris 13 School of Medicine, 93000 Bobigny, France.

Abstract

BACKGROUND: We designed a study to compare ventilation characteristics performed in morbidly obese patients by medical students via the facemask to that via the LMA Supreme. METHODS: This prospective, randomized, crossover study included 31 ASA I-III morbidly patients showing difficult mask ventilation predictors. After induction of anesthesia, ten medical students with no previous clinical experience in airway management, clinically educated to facemask ventilation maneuvers, and theoretically educated to laryngeal mask use were supervised by a senior anesthesiologist during performance of 60 s facemask and LMA Supreme ventilation in a randomly assigned order. Ventilation quality and difficulty were measured using an original score calculated as the sum of seven indicators (0=no ventilation and complications, 12=optimal and safe ventilation) and a visual analog scale (VAS; 0=no difficult-100=impossible), respectively. Values are presented as means (standard deviation) or medians [extremes]. RESULTS: Mean age and body mass index of the patients were 39 years (12 years) and 44 kg m(-2) (7 kg m(-2)), respectively. One patient was excluded because of ventilation difficulty experienced by the senior anesthesiologist. Medical students successfully established ventilation with the LMA Supreme in all the 30 patients after a delay of 21 s (9 s) compared to 34 s (14 s) with the facemask (P<0.05). Failure of ventilation occurred in four patients with the facemask. Ventilation quality score was superior and ventilation difficulty (VAS 0-100) was inferior with the LMA Supreme than with the facemask (11 [10-12] and 9 [0-45] versus 5 [1-12] and 50 [5-100]); both P<0.05, respectively. CONCLUSIONS: We showed that the LMA Supreme placed in novice hands systematically promoted easier ventilation of better quality than the facemask in morbidly obese patients showing difficult mask ventilation predictors. Our data suggest that the LMA Supreme could be considered as a standard airway management tool for both elective and rescue airway management of morbidly obese patients.
The use of drugs in emergency situations has evolved over time. Here are some key changes:

**Then**
- Lidocaine: Defasciculating agent
- Atropine
- Fentanyl

Safe choice in most situations
- Reactive airways
- IM RSI
- Hypotension / sepsis

Propofol disappears before paralytic

**Now**
- Etomidate: Adrenal suppression; lowers seizure threshold
- Ketamine: Avoid if hypertension/tachycardia undesirable
- Contraindication in high ICP is slowly dissolving
- Hypertension, seizures, hypersympathetic delirium

Fentanyl
- Lidocaine
- Atropine

Propofol: Half dose paralytic: do not use.
Vecuronium only if rocuronium not available
Roc vs. sux
problems with succinylcholine

rhabdomyolysis
eexisting hyperkalemia
multiple sclerosis
ALS
muscular dystrophies / inherited myopathies
denervating injuries > 72 hours old (e.g. stroke, spinal cord injury)
burns > 72 hours old
crush injury > 72 hours old
tetanus, botulism, and other exotoxin infections
severe infections > 72 hours old (esp. intra-abdominal infections)
immobilization (including patients found down)

predisposition to malignant hyperthermia
bradycardia
fasciculations – increased ICP, myalgias, hastened desaturation
masseter spasm
contraindications to rocuronium
roc vs. sux
onset

**success**: intubation within 30 seconds

**black**: excellent intubating conditions
**white**: good intubating conditions
**hatched**: poor intubating conditions

roc vs. sux
onset

0.6
1.0
1.2
roc vs. sux
duration

succinylcholine
5-10 minutes

rocuronium
30-90 minutes
Can't intubate, can't ventilate

Roc vs. sux duration

Critical Hemoglobin Desaturation Will Occur before Return to an Unparalyzed State following 1 mg/kg Intravenous Succinylcholine

Benumof, Jonathan L. MD; Dagg, Rachel MS; Benumof, Reuben PhD
Failure to use awake technique
Failure to use rescue device
Failure to perform surgical airway

Dangerous decision-making

Can’t intubate, can’t ventilate

Roc vs. sux
duration
tummy tuck vs. airway burn
“...the need to support the patient’s ventilations in the event of a failed airway for a minimum of 20–25 min before reversal can be attempted is a daunting prospect. Like many others, I therefore have little enthusiasm for the concept of using rocuronium for all patients undergoing RSI.”

Ron Walls

sux, round 2 (and 3)

roc rocks
post-intubation management

tube confirmation

continuous capnography > colorimetric capnography >>>> chest auscultation
false negatives

esophageal detector device

bougie test
post-intubation management

post-intubation pharmacology

old school

paralysis

sedation

analgesia

new school

analgesia

sedation

paralysis

just intubated phase

still paralyzed

diagnostic uncertainty

transport

painful procedures

vs.

stable on the vent phase

ICU

fentanyl drip to light sedation

benzodiazepines to deep sedation

add an opiate

avoid re-paralysis: ketamine bolus

if you must re-paralyze: roc or vec

titrates up opiates and titrate down sedatives when stable
special situations

patients without oxygenation reserve

do not try to fix oxygenation with quick intubation

pre-oxygenate with NIV

keep airway patent as patient is induced

immediate oxygenation with LMA

awake technique?
special situations

patients without ventilation reserve

DKA, severe sepsis, salicylate toxicity, toxic alcohol toxicity

awake technique?

BVM during induction

BVM very early if laryngoscopy unsuccessful - quick look then iLMA

hyperventilation before intubation = hyperventilation after intubation

ETCO2 vs. PaCO2

also applies to patients who are susceptible to changes in ICP
special situations

trauma

if you don’t get a good view with manual in-line stabilization mobilize the neck

exception: diagnosed or very likely cervical spine injury
special situations

hypotension

RSI and positive pressure worsen hypotension

IVF prior to induction

pressors prior to induction, be ready with pressors post-induction

reduce the dose of the induction agent

don’t forget the paralytic
special situations

high aspiration risk

- upper GI bleeding
- bowel obstruction
- pre-induction vomiting

NGT prior to intubation

intubate in semi-upright position

bag early, but slightly less early
key points

you cannot predict the difficult airway – have a plan for failed intubation and failed ventilation and be ready to carry out that plan

initiate rescue maneuvers such as ventilation and cricothyrotomy early so that the patient has enough reserve to allow for calm and effective execution

BVM with three airways in, two hands down

replace BVM with LMA ventilation

make the bougie part of your routine

ask the question: should I use an awake technique?

rocuronium

use a checklist to keep you focussed on what’s important
thanks

richard levitan  scott weingart  ron walls