

An aerial photograph of a red and yellow helicopter in flight over a rural landscape. The helicopter is the central focus, with its main rotor blades blurred from motion. The landscape below consists of large, dark green fields, some trees, and a few buildings in the distance. The text is overlaid on the image in a light blue color.

Advanced airway management and use of capnography

Scandinavian Update 2007

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Airway Management Procedures

- **Assisting the uninstrumented airway**
- **Use of airway adjuncts**
- **Direct laryngoscopy**
- **Use of supraglottic devices (LMA/LTS)**
- **Airway topicalization**
- **Awake FO intubation**
- **Use of bougies**
- **Special laryngoscopes**
 - **McCoy, Henderson**
 - **Bullard, Wu, Upshire**
 - **GlideScope**
 - **ENT laryngoscopes**
- **Other things**



Methods /adjuncts for emergency airway management

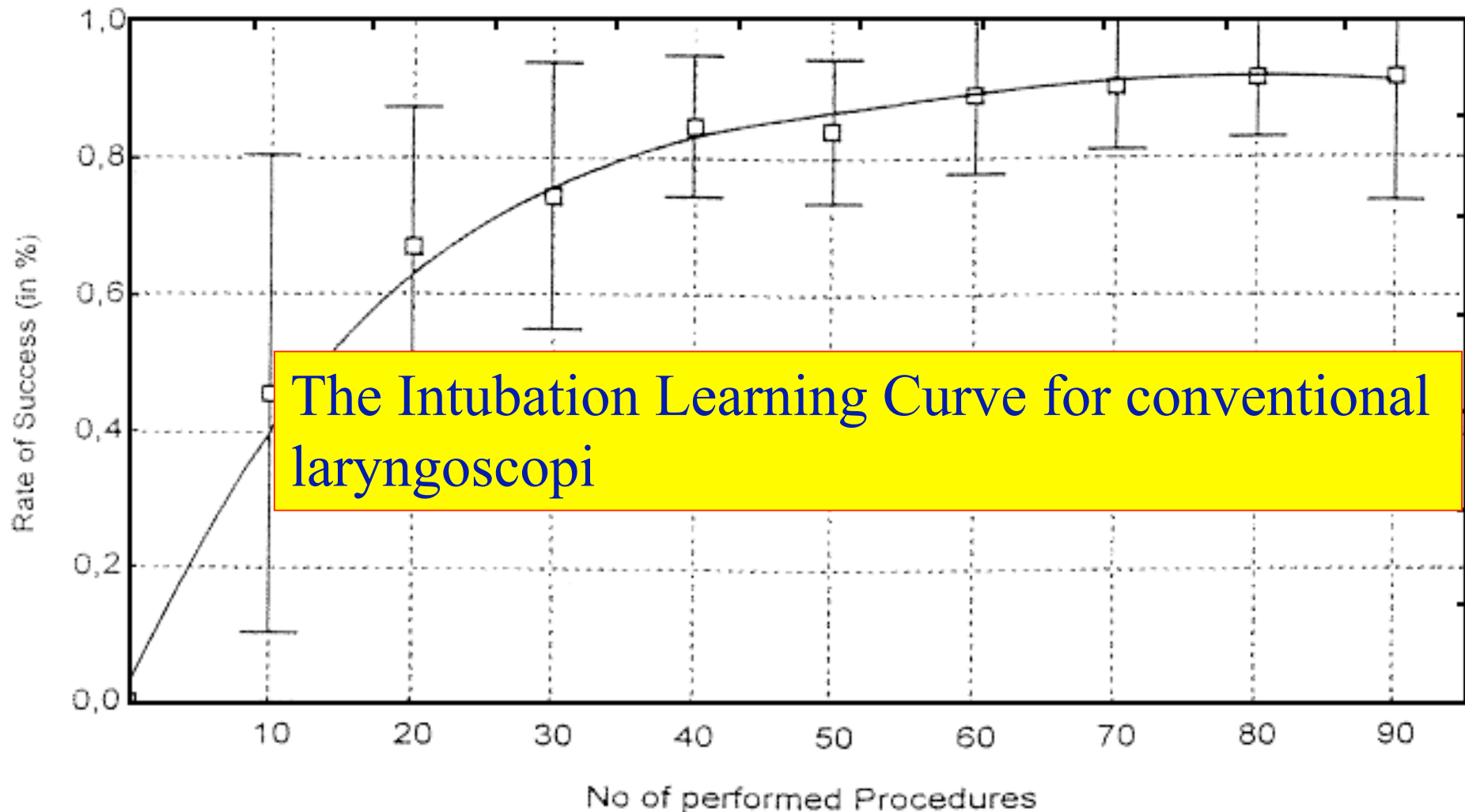
Useful

- MM/Guedel/Bag-Mask
- Laryngeal Mask (LMA)
- Proseal LMA
- ILMA/ Fasttrach
- Combitube
- Laryngeal tube
- Endotracheal Intubation

Less useful

- EOA = Esophageal obturator airway
- EGTA = Esophageal Gastric Tube Airway
- PTL = Pharyngeal Tracheal Lumen Airway
- COPA = Cuffed Oroph.Airway
- COBRA PLA = Perilaryngeal airway
- AMD = Airw. Manag. Device

Learning Curve Intubation



Intubation Learning Curve: 90% success rate after ~60 intubations.

After 10 intubations 70% needed assistance. After 80 intubations: 18% of residents needed still assistance. *Konrad, Anesth Analg, Volume 86(3). March 1998, 635-639*

Success rates for prehospital intubation attempts

Table 1. Success rates for prehospital intubation attempts

Study	Patients, n	Types of patient	Grade of intubator	Permitted drugs	Success rate, %
Bradley et al. [12]	57	Apneic	EMT	Nil	49
Sayre et al. [11]	103	Apneic	EMT	Nil	51
Karch et al. [13]	94	Trauma	Paramedic	Nil	53
Eckstein et al. [10•]	148	Trauma	Paramedic	Nil	63
Murray et al. [14•]	138	Head injury	Paramedic	Nil	59
Rocca et al. [15•]	331	Vital signs absent	Paramedic	Nil	96
	101	Medical emergencies	Paramedic	Nil	74.3
	21	Trauma	Paramedic	Nil	71.4
Wang et al. [17•]	592	Mixed	Paramedic	Midazolam	90.5
Wayne and Friedland [16]	1657	Mixed	Paramedic	Succinylcholine and sedation	95.5
Pace and Full [24•]	150	Mixed—no cardiac arrests	Paramedic	Succinylcholine and sedation	92
Sloane et al. [25]	47	Trauma	Paramedic/physician aeromedical crew	Succinylcholine and sedation	97.9
Adnet et al. [30]	691	Mixed	Physicians	Succinylcholine and sedation	99.1

EMT, emergency medical technicians.

Endotracheal intubation

- **Missing randomized studies which shows increased survival or reduced neurologic injury by intubation**
- **Experience level/practice/medication not taken into account**



Bag-Mask ventilation

- **BM- ventilation failed in 2/3 of incidents**
Nordergraaf GJ, Eur J Anaesthesiol 2004
- **Airleakage up to 40%**
Wenzel et al, Resuscitation 2001;49,123-34

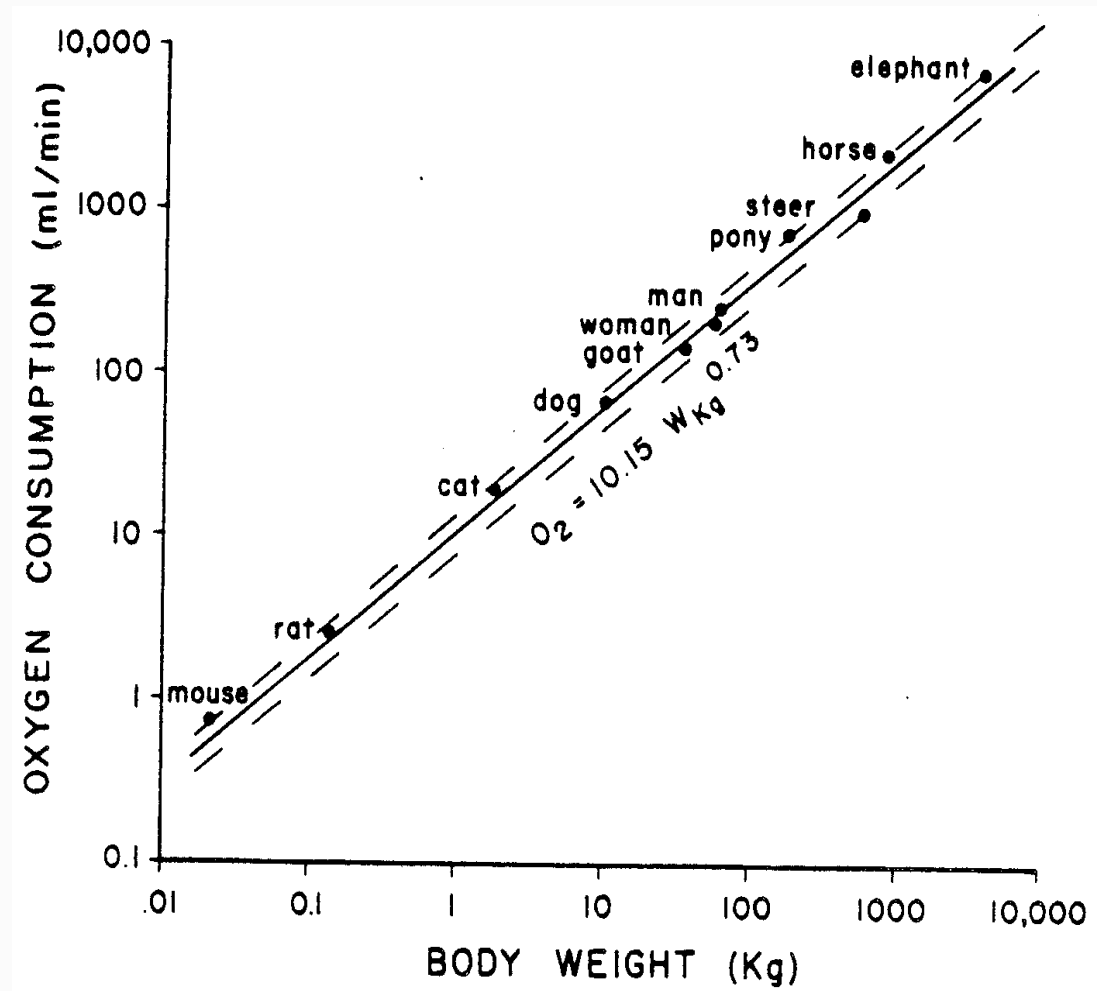


Airway management

- **Effective airway management is maybe the most important (and the most dangerous) intervention in both trauma and other patients**
- **Major purpose:**
 - **Secure sufficient oxygenation and ventilation**
 - **Protect the airways for contamination**
- **Hypoxia kills !! Not the lack of fancy interventions!**

Oxygen consumption

- Oxygen consumption in mammals are exponential-function of body weight
- 200 ml O₂/min will protect against cerebral hypoxia in adults



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- **16 ambulances, 1 helicopter in Bergen**
- **> 250 EMS personell, approx 80 are certified to intubate**
- **VERY few have >6 intubations pr yr.**
- **Training in the OR is difficult, time consuming and costly**
- **“ I haven't had a failed intubation since 1999”**



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2 major problems occur:

Which airway method/procedure is best for our EMS ?

How can we secure adequate oxygenation and ventilation ?



2 different attitudes....



What is the challenge here?

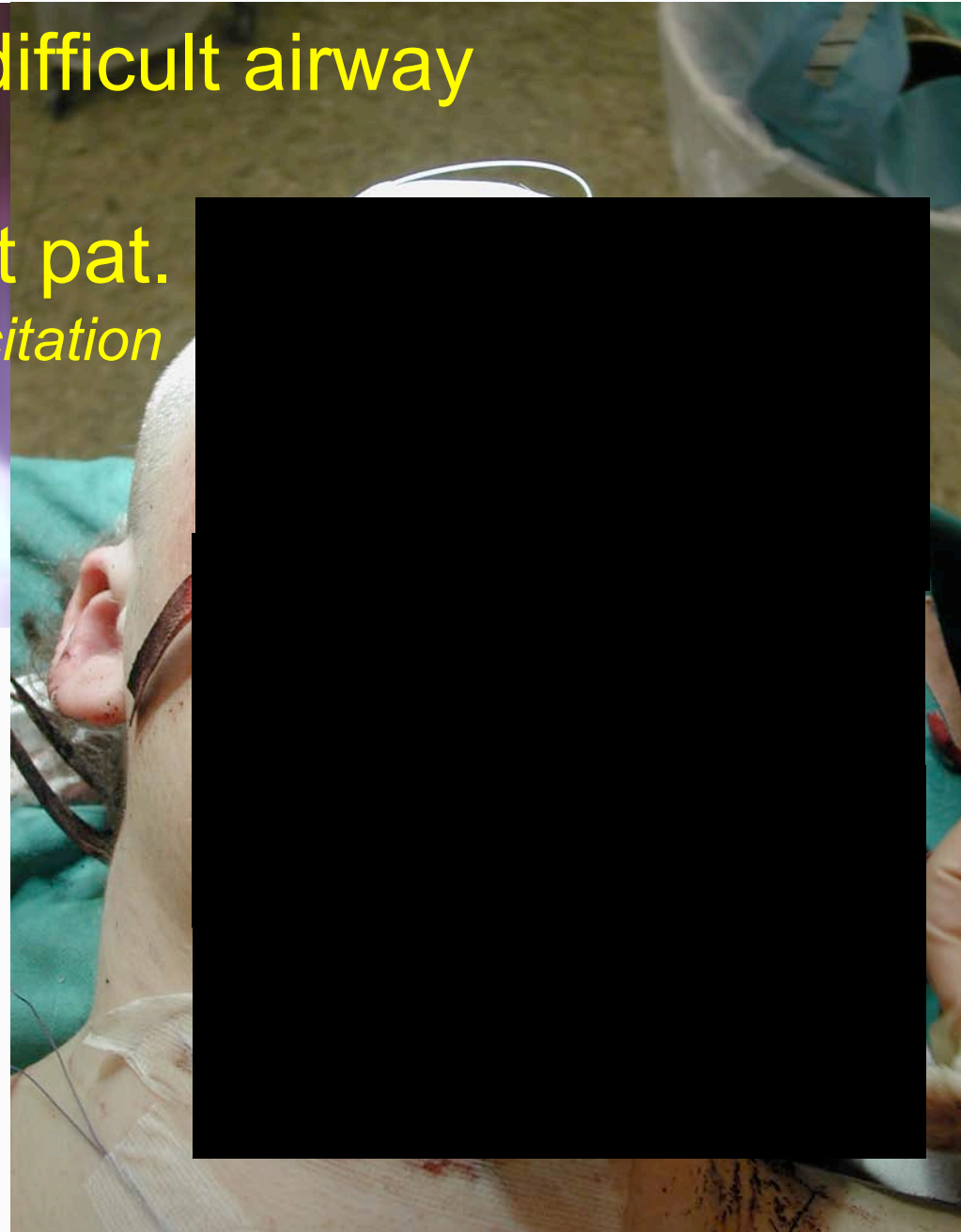
Airway management

Timmermann 2006, *Resuscitation*; **70**, 179-185

Evaluation of emergency doctors

16500 pat, 1100 intubated, difficult airway in 15%

Higher incidence of difficult airway
19% in trauma pat.
17% in cardiac arrest pat.
Timmermann 2006; Resuscitation



Clinical Decision Making

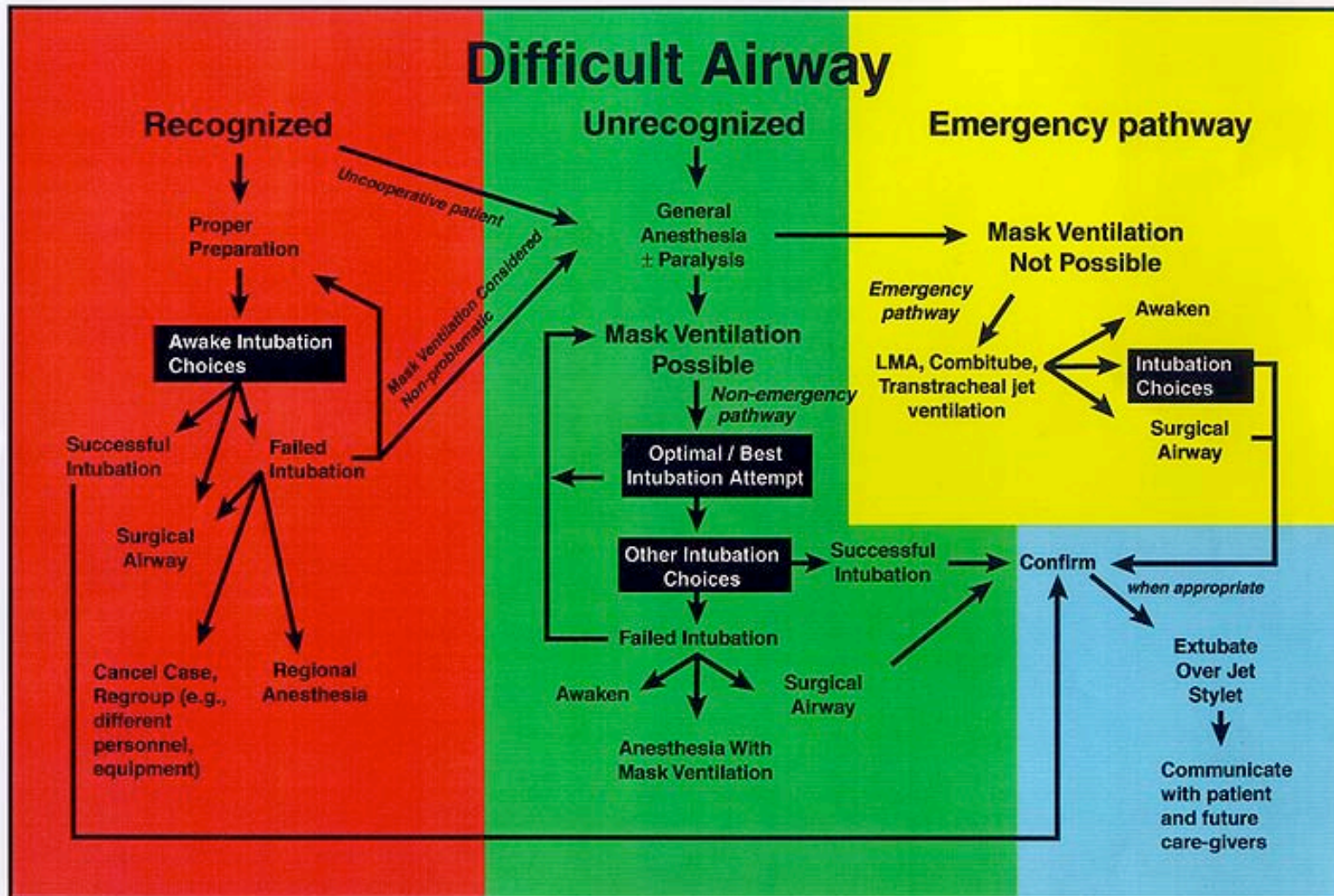


Figure 1: ASA Difficult Airway Algorithm. The three limbs are color coded: red = awake, recognized difficult airway limb; green = general anesthesia, unrecognized difficult airway limb; yellow = emergency pathway, cannot ventilate, cannot

Verify tube placement

“Standard physical examination methods, such as auscultation of lungs and epigastrium, visualization of chest movement, and fogging in the tube, are not sufficiently reliable to exclude esophageal intubation in all situations.”

Verification of Endotracheal Tube Placement - *Approved by the ACEP Board of Directors October 2001, <http://www.acep.org/1,4923,0.html> (policy statement)*



Different methods

- **Colorimetric**



- **Capnometry**



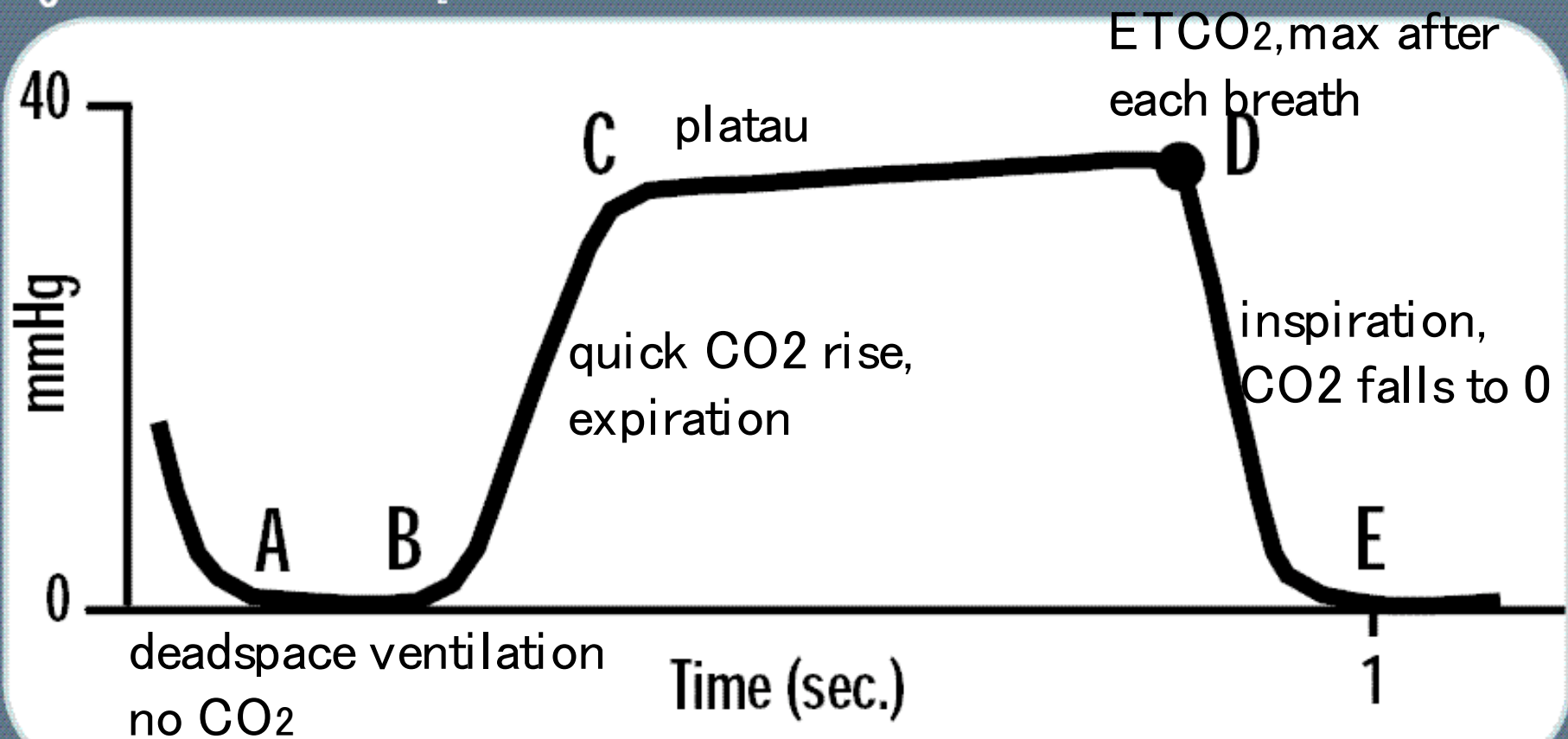
a numeric value for EtCO₂

- **Capnography**

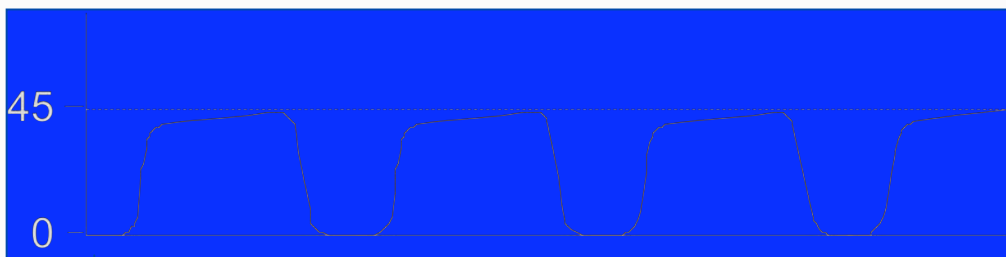


Normal waveform:

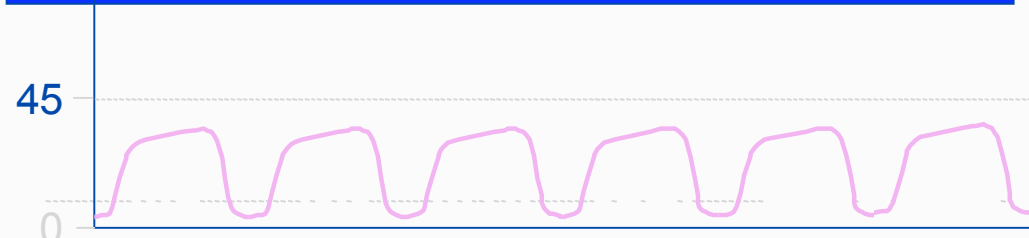
Figure 2: The Normal CO₂ Waveform



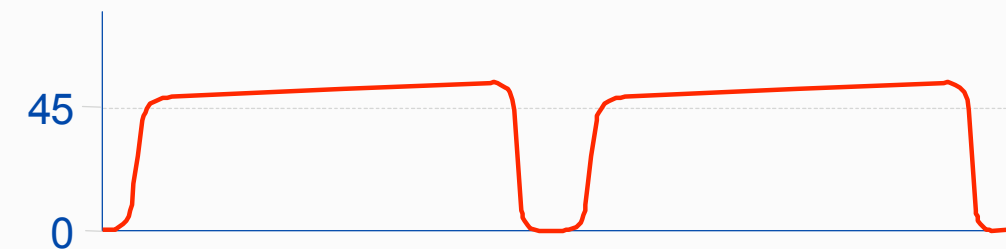
Capnography waveforms



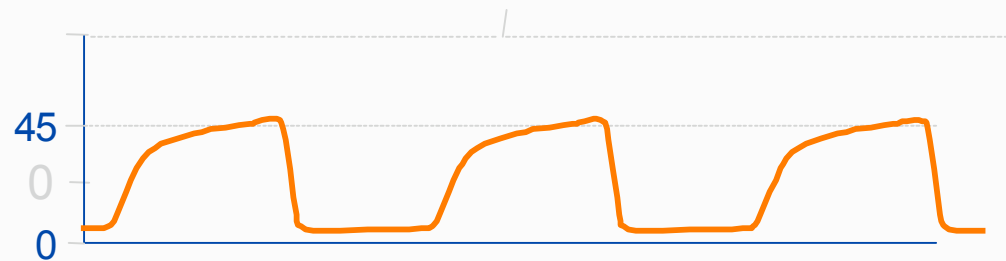
Normal



Hyperventilation

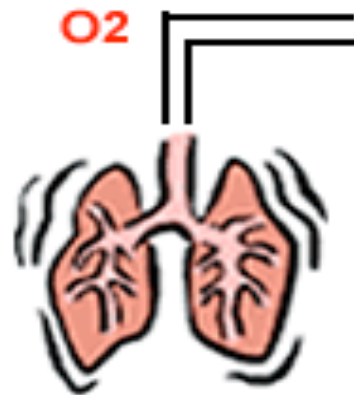


Hypoventilation



Bronchospasm

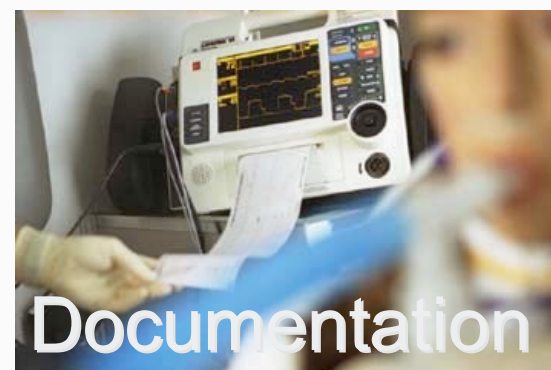
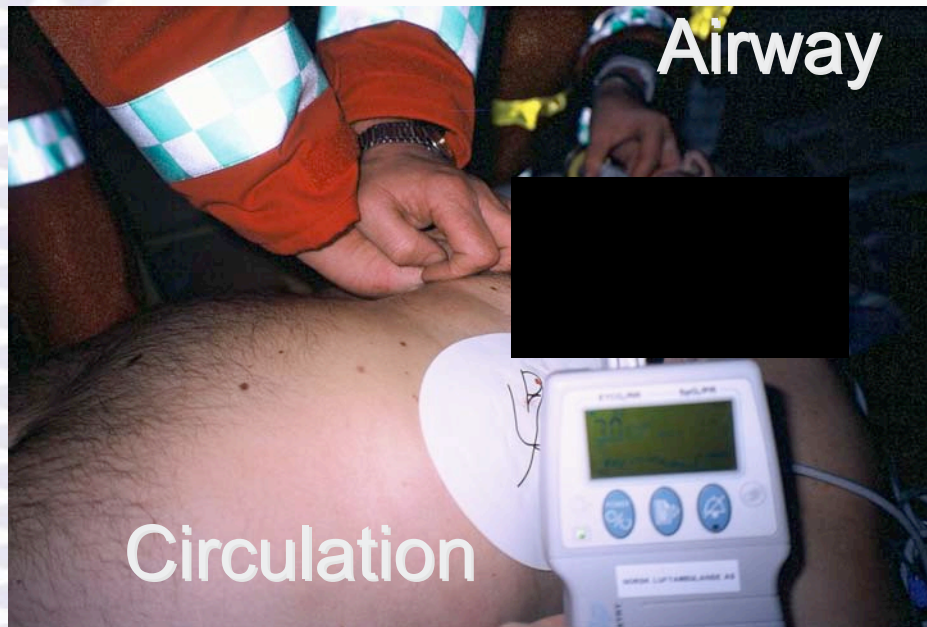
Capnography is the total picture! on circulation and ventilation



Inspiration (Phase 0)

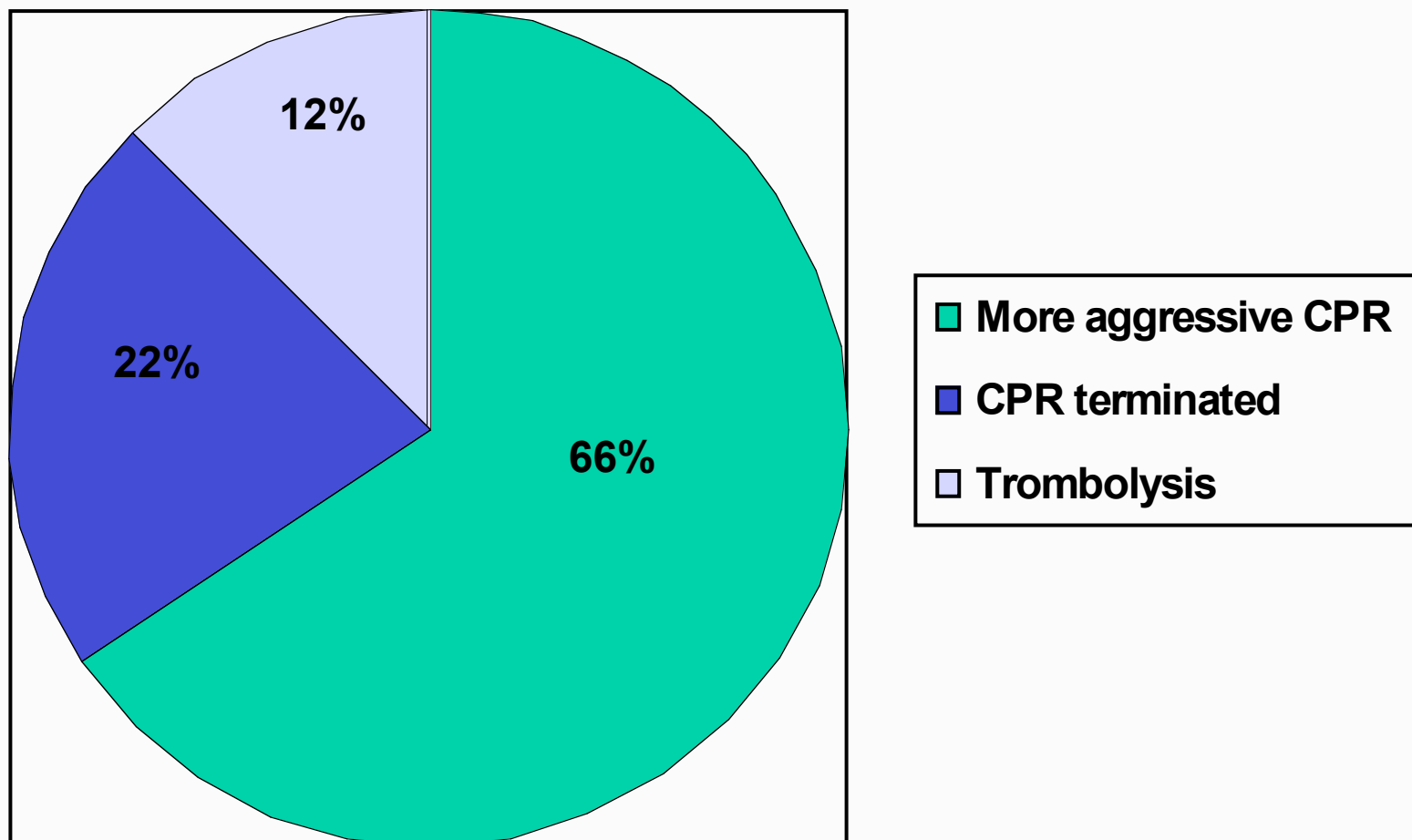
Practical use:

ABC.....and D!



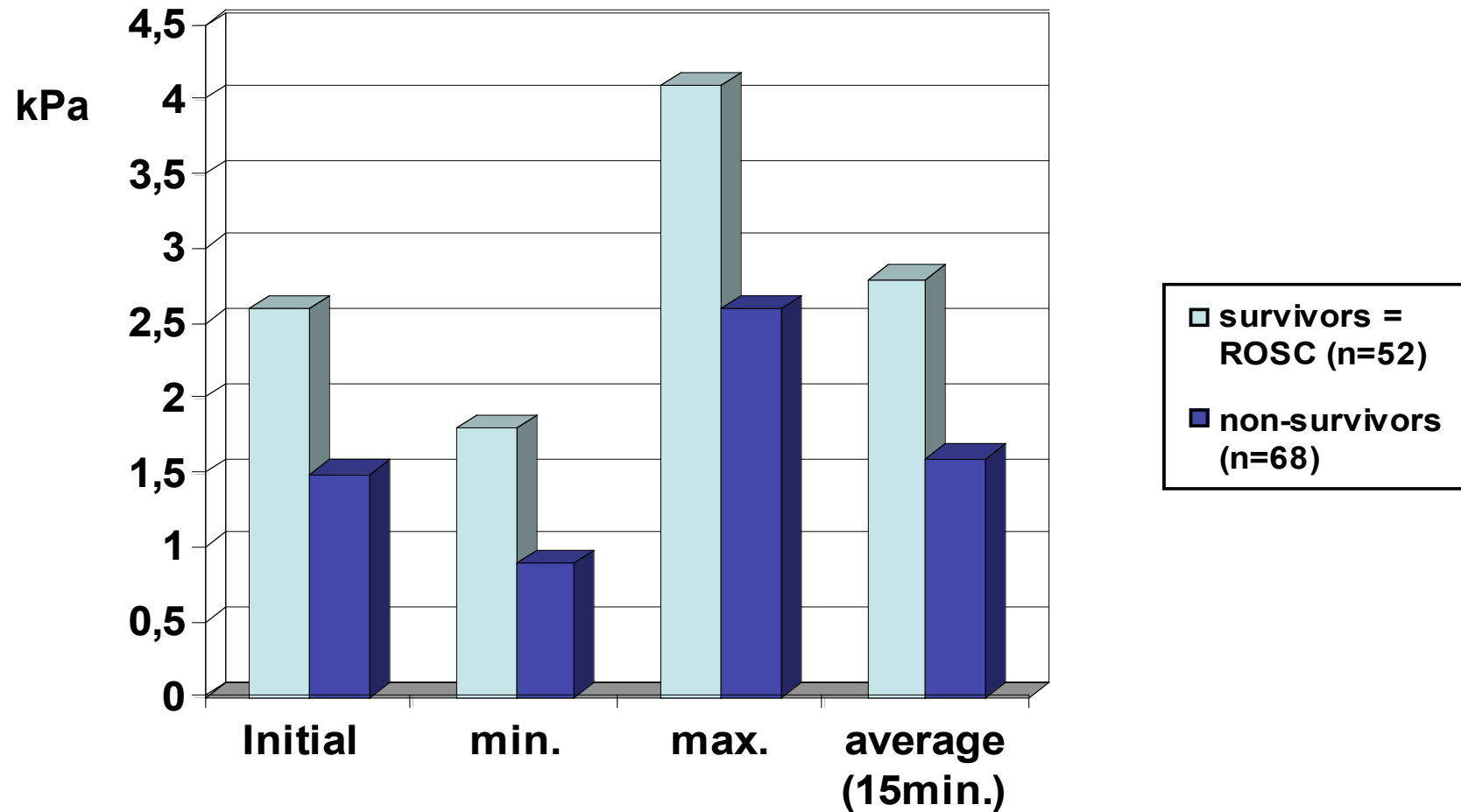
5 challenges

- **Tube position?**
- **Effect of resuscitation?**
- **Return and loss of pulse (ROSC)?**
- **Predictor for survival/death?**
- **Control of ventilation?**



For 64 pat. (53%) measuring ETCO₂ resulted in treatment /change in treatment

Fossedal , Heltnø, "END-TIDAL CARBON DIOXIDE –A TOOL FOR MONITORING THE PROGRESS OF CARDIOPULMONARY RESUSCITATION" , ERC Stavanger 2004,



ETCO₂

ETCO₂ (average) during compressions, significant higher in Survivor group (ROSC) ($p < 0.05$), all pat with ETCO₂ $> 2,3$ kPa survived, none with $< 1,7$ kPa.

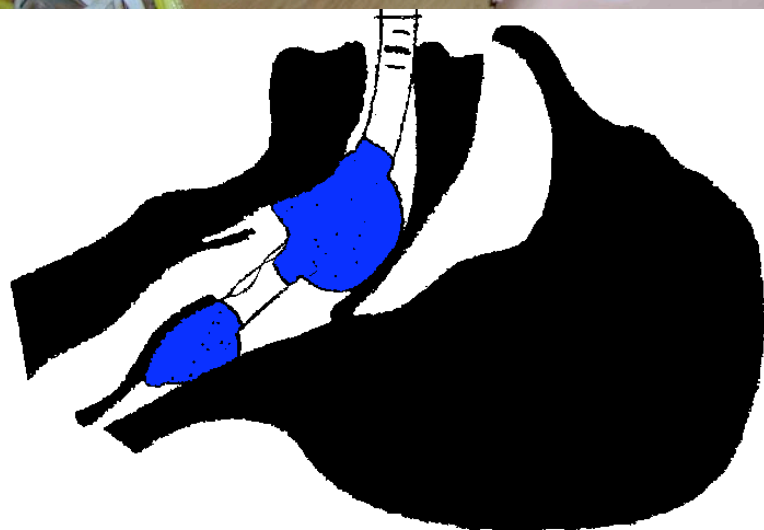
"END-TIDAL CARBON DIOXIDE –A TOOL FOR MONITORING THE PROGRESS OF CARDIOPULMONARY RESUSCITATION", Fossedal, Heltne, ERC 2004

Laryngeal tube:

- Laryngeal tube has been our 1. choice in our EMS since 2002
- Many studies has shown that laryngeal tube (LTS) is an alternative to endotracheal tube (ETT) outside the hospital
- We evaluated the use of LT/LTS as airway method in 101 prehospital cardiac arrests pat.
- Post-resuscitation registration and data was evaluated



*AIRWAY MANAGEMENT WITH THE LARYNGEAL TUBE IN 101 CARDIAC ARREST CASES
Sunde et al, Resuscitation April 2006*



New airways for resuscitation?

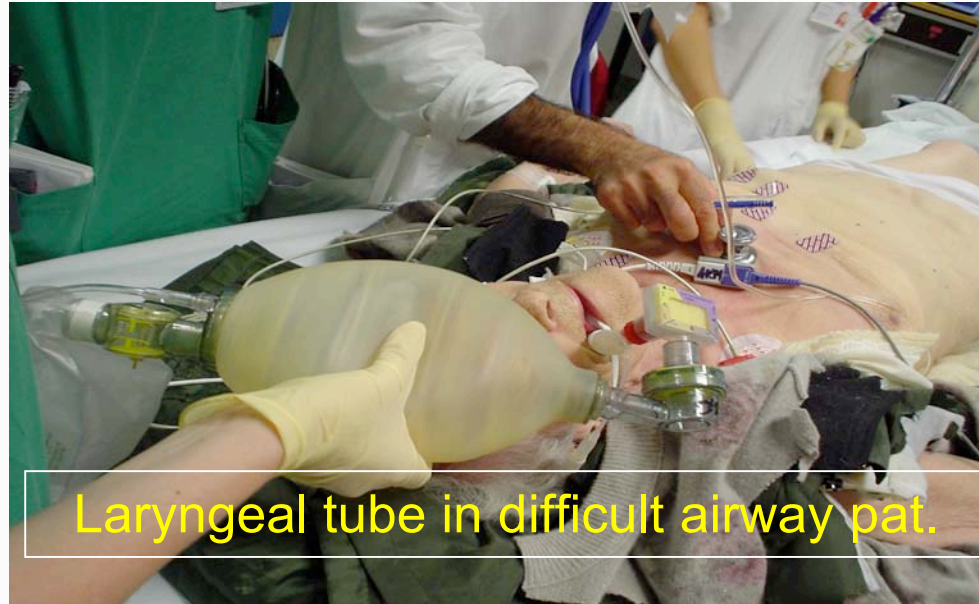
Cook, Hommers: Resuscitation 2006, (69) 371-387

- **Research/studies and development of new gadgets, evidence from clinical anesthesia**
- **Does "new" devices have a place/or advantages over traditional adjuncts during resuscitation?**
- **"those trained in intubation, practise often and know the pitfalls: ET "gold standard", but should not even be tried by untrained/inexperienced!"**
- **Alternative devices have a place during resuscitation: both for inexperienced/available for all in case ET fails**

Summary

- **Every new adjunct or technique has to be evaluated concerning patient safety!**
- **Are supraglottic airway device as effective during resuscitation in emergency medicine?**
- **Last 15 years these devices have revolutionized the airway management in anesthesiology**
- **Increasing number of studies**
- **Missing controlled randomized studies**
- **Guidelines 2005, recommended**

Airway problems: Be prepared!



- **Have a plan! Simple first**
- **Have a plan B!**
- **One supraglottic adjunct**
- **Practice your difficult airway algorithm!**
- **Always capnography !**



”It is the skill, the technique, knowledge about the pitfalls and the ability to handle the complications that makes the difference, not the person who has the skill”

W. Ummenhofer

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