

Predikce obtížné intubace.
Možnosti řešení (ne)očekávané DAM -
videolaryngoskop a jiné hračky.

Lukáš Dadák



FAKULTNÍ
NEMOCNICE
U SV. ANNY
V BRNĚ



Difficult airway (DA):

... klinická situace, ve které běžně trénovaný anesteziolog ...

- obtížná ventilace obličejovou maskou
- obtížné zavedení supraglotické pomůcky
- obtížná laryngoskopie
- obtížná intubace
- obtížná koniotomie

Patient ...



Umíme předpovědět DA?

68 + 71 rezidentů (1.-3.rok praxe)

2 roky: předanestetické vyšetření
plánovaných neporodních anestezií

3320 experiment

4743 stand.


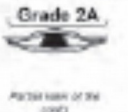

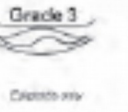

The image shows a detailed 'PREOPERATIVE AIRWAY ASSESSMENT' form. It includes sections for patient demographics, assessment of various airway factors (like neck mobility, mouth opening, Mallampati grade), and a checklist for conditions that might affect the airway. There are also diagrams of the mouth and throat area, and a ruler at the bottom for measurements.

The image shows a 'Pre-Anesthesia Evaluation' form from Meridian. It contains a comprehensive checklist for pre-anesthetic evaluation, covering medical history, physical examination, and specific airway-related checks. The form is organized into several columns and rows, with checkboxes for each item.

Umíme předpovědět DA?

- data o průběhu zajištění dýchacích cest

Appendix C - POSTOPERATIVE EVALUATION

Surgery Considered Always related:	Yes	No	If yes, why?	Anesthesia related:	Yes	No
MASK VENTILATION	Yes	No				
SpO ₂ Breathing room air:	_____ %			SpO ₂ Breathing 100% oxygen:	_____ %	
Attempted?	Yes	No		Severe (cannot intubate via larynx)	Easier (cannot intubate via supraglottic device)	
Difficult?	Yes	No				
If yes, why?	_____					
Successful?	Yes	No				
SUPRAGLOTTIC AIRWAY DEVICE						
Attempted?	Yes	No		Number of attempts?	_____	
Type:	LMA / ProSeal / ProSeal / LT / LT-Studio / Cobas / Combitube / Soft Seal / Ambu / Airway / SA / Other: _____					
Difficult?	Yes	No				
If yes, why?	_____					
Successful?	Yes	No				
DIRECT LARYNGOSCOPY						
Attempted?	Yes	No		Number of attempts?	_____	
Type of blades:	_____					
Circle best grade viewed with laryngeal manipulation:						
Grade 1	Grade 2A	Grade 2B	Grade 3	Grade 4		
						
Difficult?	Yes	No				
If yes, why?	_____					
INTUBATION						
Attempted?	Yes	No		Number of attempts?	_____	
Difficult?	Yes	No				
If yes, why?	_____					
Successful direct laryngoscopy?	Yes	No				
Alternative methods: (Circle all that apply; include number of attempts for each; include if used for teaching purposes)						
Neaxi Fiberoptic _____	Oral Fiberoptic _____	Awake _____				
Beagle _____	Prox/Wintree _____	Lightwand _____				
Beagle/Shim _____	Butler/Usher/Wu/Stapel _____	McCoy _____				
Oral Scope _____	Video Laryngoscopy _____	Retractor _____				
Other: _____						
Successful?	Yes	No				
SURGICAL AIRWAY						
Attempted?	Yes	No		Emergency / Elective	_____	
Difficult?	Yes	No		Number of attempts?	_____	
If yes, why?	_____					
Successful?	Yes	No				
EXTUBATION						
Location:	OR	PACU	Other: _____			

Standardní vyšetření:

- anamnéza
- MP
- chrup
- mobilita krku
- ostatní

156273

PRE-OP DX _____
 PROPOSED OP _____

DATE _____ TIME _____ MEDICATIONS
 ELECTIVE EMERGENCY

MENTAL STATUS: ALERT OTHER _____
 ASA STATUS: 1 2 3 4 5 E _____

INSTRUCTED NPQ 6 HRS.
 LAST SOLID INTAKE _____ LAST LIQUID INTAKE _____
 WT.: _____ HT.: _____ AGE: _____ SEX: _____
 TEMP: _____ BP: _____ P: _____ RESP: _____

MEDICAL HX/SYSTEM REVIEW

RESP: COUGH/COLD SOB PUD
 ASTHMA/BRONCHITIS COPD HIATAL HERNIA
 VENT. DEPENDENT OSA REFLUX
 VENT. SETTINGS _____ METABOLIC: OBESITY
 _____ DM
 STEROIDS
 SICKLE CELL
 THYROID

CV: CHF ANGINA 3 - 2 - 1 - 0
 EXERCISE TOLERANCE _____
 HTN
 MI
 MURMUR/ARRHYTHMIA

LIVER: JAUNDICE
 HEPATITIS
 BLEEDING (= / -)

NEUROLOGIC: TIA SPINAL CORD SEIZURE
 CVA ICP _____ NEUROPATHY
 GCS _____ MYOPATHY

PREGNANT: YES DENIES
 LMP _____

OB HX: GRAVITY _____ PARA _____ GEST AGE _____ BIRTH HX: _____
 FETAL RISK:
 NORMAL DISTRESSED COMPROMISED

PHYSICAL EXAM

AIRWAY: CLASS I II III IV
 DENTAL STATUS DENTURES CAPS TEETH
 NECK MOBILITY ADEQUATE INADEQUATE
 PROJECTED DIFFICULTIES _____

LUNGS: _____
 HEART: _____
 BACK/EXT.: _____

SIGNIFICANT LAB

LYTES H/H CXR
 BUN/CR COAG EKG
 GLU PREGNANCY STRESS TEST

SOCIAL HISTORY
 SMOKING PPDY _____ YRS. _____
 DRUG _____ ETOH _____

ALLERGIES

ANESTH. HX/PREVIOUS SURGERIES

FAMILY HX (Anesth. Problems)

SIGNIFICANT PROBLEMS

ANESTHESIA PLAN

PREMEDICATION
 NO YES IM PO IV _____

TECHNIQUE
 GENERAL LOCAL MAC
 EPIDURAL SPINAL PN BLOCK

MONITORING
 ART CVP PA TE _____

WILL ACCEPT BLOOD: NO YES
 T&S / T&C NO YES #UNITS _____
 RISK/BENEFITS DISCUSSED AND ACCEPTED:
 PATIENT PARENT OTHER: _____

POST-OP ANALGESIA
 SPINAL EPIDURAL PNB PCA IM/PO
 COMMENTS: _____

RESIDENT SIGNATURE _____
 FACULTY SIGNATURE _____

POST-OP VISIT

Experiment

PREOPERATIVE AIRWAY ASSESSMENT

Prediction of the Difficult Airway: A Useful Clinical Assessment Model

Location:	Date:	Age (yrs):	Gender:	Height:	Weight:	BMI (kg/m ²):
Hermann			Male			
LBJ			Female	Indicate cm or inches	Indicate kg or lb	






Assessment Completed by: _____ Resident Attending

Resident Years (if applicable): PGY1 PGY2 PGY3 PGY4 PGY5

Surgical Procedure: _____

Past history of difficult intubation: _____ Airway already secured (Device: _____)

PREOPERATIVE PHASE

<p>Distances:</p> <p>Neck circumference _____ CM (Measure an oblique around neck at thyroid cartilage level)</p> <p>I-ID (Inter-incisors) _____ CM (Distance between inferior superior incisors with mouth fully open (gap between anterior arches if no teeth))</p> <p>TMD (Thyromental) _____ CM (Distance between superior anterior part of the thyroid cartilage and chin with head extended and mouth closed)</p> <p>SMD (Stemomental) _____ CM (Distance between the sternal notch and chin with head extended and mouth closed)</p>	<p>Neck Mobility: With patient sitting upright, place one index finger on the patient's chin and one index finger on the occipital bone. Ask the patient to completely extend the head on the neck. The finger on the chin is (CM= cervical mobility):</p> <div style="display: flex; align-items: center;">  <div style="margin-left: 10px;"> <input type="checkbox"/> Higher than the one on the occipital bone CM normal (Grade 1) <input type="checkbox"/> Same level CM some limitation (Grade 2) <input type="checkbox"/> Lower than the one on the occipital bone CM moderate/severe limitation (Grade 3) </div> </div>
<p>Mallampati (Circle)</p> <div style="display: flex; justify-content: space-around;">     </div>	<p>Upper Lip Bite Test: (Wilson's test or retrognathism correction). Advance mandible as far forward as possible, then view teeth.</p> <p><input type="checkbox"/> Position A (Lower teeth can be advanced beyond upper teeth)</p> <p><input type="checkbox"/> Position B (Lower teeth can be advanced even with upper teeth)</p> <p><input type="checkbox"/> Position C (Lower teeth cannot reach upper teeth)</p>

CHECK ALL CONDITIONS THAT EXIST:

- | | |
|---|---|
| <input type="checkbox"/> Cervical Spine Trauma/Pathology: _____ | <input type="checkbox"/> Neck trauma: _____ |
| <input type="checkbox"/> Edentulous: _____ | <input type="checkbox"/> Oropharyngeal cancer/radiotherapy: _____ |
| <input type="checkbox"/> Facial hair: _____ | <input type="checkbox"/> Short Neck: _____ |
| <input type="checkbox"/> Facial trauma: _____ | <input type="checkbox"/> Snoring/obstructive sleep apnea: _____ |
| <input type="checkbox"/> Full Stomach: _____ | <input type="checkbox"/> Thyroid / ant. neck mass: _____ |
| <input type="checkbox"/> Laryngeal pathology (external): _____ | <input type="checkbox"/> Previous tracheostomy: _____ |
| <input type="checkbox"/> Laryngeal pathology (internal): _____ | <input type="checkbox"/> Tracheal trauma: _____ |
| <input type="checkbox"/> Nasal deformity: _____ | <input type="checkbox"/> Tracheal deviation: _____ |

Comments & Explanations: _____

Expected difficult mask ventilation?	Yes	No
<ul style="list-style-type: none"> • Age >55 yrs • Facial hair • Nasal deformity 	<ul style="list-style-type: none"> • BMI >26 kg/m² • Facial trauma • Snoring 	<ul style="list-style-type: none"> • Edentulous • Mallampati III/IV • Wilson position C
Expected difficult supraglottic airway?	Yes	No
<ul style="list-style-type: none"> • Restricted mouth opening • Distortion/disruption of airway 		<ul style="list-style-type: none"> • Obstruction of upper airway • Stiff lungs (reduced compliance or increased resistance)
Expected difficult laryngoscopy?	Yes	No
<ul style="list-style-type: none"> • Past history DI • Mallampati III/IV • Facial or neck trauma 	<ul style="list-style-type: none"> • Neck circumference > 40 cm • Neck range of motion \geq Grade 2 • Wilson's test (prognathism) C 	<ul style="list-style-type: none"> • I-ID < 3 cm • TMD < 6 cm • SMD < 12 cm • Oropharyngeal cancer / radiotherapy • Laryngeal pathology (internal / external)
Expected difficult intubation?	Yes	No
Expected difficult surgical airway?	Yes	No
<ul style="list-style-type: none"> • Oropharyngeal cancer / radiotherapy • Laryngeal pathology (internal / external) • Previous tracheostomy • SMD < 12 cm 		<ul style="list-style-type: none"> • Tracheal deviation • Neck circumference > 40 cm • Thyroid/anterior neck mass • Neck range of motion > Grade 2

Definitions:

Difficult mask ventilation: A condition in which it is impossible for the unassisted anesthesia care provider to prevent or to reverse signs of inadequate ventilation during positive pressure mask ventilation.

Difficult supraglottic airway: Result of poor device placement or inability to adequately ventilate with device successfully placed.

Difficult laryngoscopy: It is not possible to visualize any portion of the vocal cords after 2 attempts at conventional laryngoscopy.

Difficult tracheal intubation: Tracheal intubation requires >2 attempts, in the presence or absence of tracheal pathology.

Failed intubation: Failure to place the endotracheal tube.

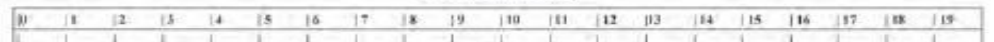
Difficult surgical airway: May be caused by an anatomical abnormality, and although rare, can be a life-threatening problem.

Anesthetic Plan: (Check all that apply and explain below)

<p>General</p> <p><input type="checkbox"/> General Anesthesia</p> <p><input type="checkbox"/> Regional Anesthesia</p> <p><input type="checkbox"/> MAC</p> <p>Airway Management</p> <p><input type="checkbox"/> Asleep</p> <p><input type="checkbox"/> Awake</p> <p><input type="checkbox"/> Endotracheal intubation</p> <p style="margin-left: 20px;"><input type="checkbox"/> Oral</p> <p style="margin-left: 20px;"><input type="checkbox"/> Nasal</p> <p style="margin-left: 20px;"><input type="checkbox"/> Endotracheal tube</p> <p style="margin-left: 40px;">Type: _____</p> <p style="margin-left: 40px;">Size: _____</p> <p><input type="checkbox"/> Direct Laryngoscopy</p> <p style="margin-left: 20px;"><input type="checkbox"/> Blade type, size: _____</p> <p>Extubation</p> <p><input type="checkbox"/> OR</p> <p><input type="checkbox"/> PACU</p> <p><input type="checkbox"/> Not extubated</p>	<p>Preoxygenation</p> <p><input type="checkbox"/> Mask Ventilation</p> <p style="margin-left: 20px;"><input type="checkbox"/> Room Air</p> <p style="margin-left: 20px;"><input type="checkbox"/> Oxygen</p> <p style="margin-left: 20px;"># minutes: _____</p> <p><input type="checkbox"/> Supraglottic airway (Device: _____)</p> <p><input type="checkbox"/> Fiberoptic (Device: _____)</p> <p><input type="checkbox"/> Other (Device: _____)</p> <p><input type="checkbox"/> Surgical airway</p> <p style="margin-left: 20px;"><input type="checkbox"/> Cricoidotomy</p> <p style="margin-left: 40px;"><input type="checkbox"/> Surgical</p> <p style="margin-left: 40px;"><input type="checkbox"/> Percutaneous</p> <p style="margin-left: 20px;"><input type="checkbox"/> Tracheostomy</p> <p style="margin-left: 40px;"><input type="checkbox"/> Surgical</p> <p style="margin-left: 40px;"><input type="checkbox"/> Percutaneous</p> <p><input type="checkbox"/> Airway exchange catheter (Device: _____)</p>
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Comments: _____

Ruler (centimeters)



Vzdálenosti

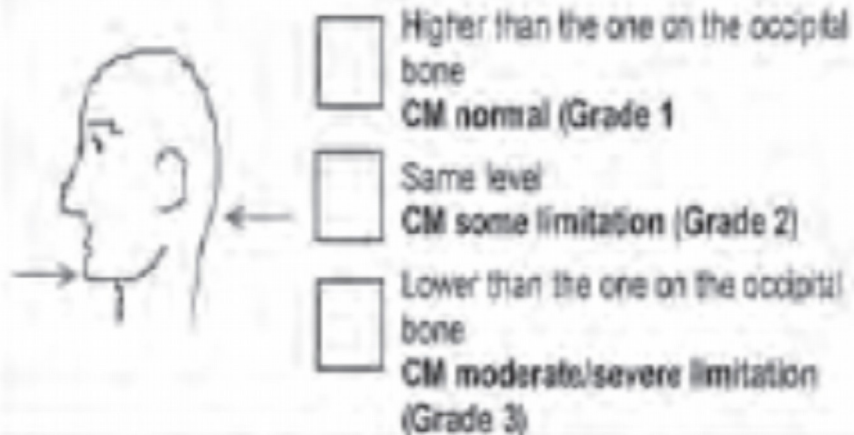
Distances:	
Neck circumference	_____ CM Maximum distance around neck at thyroid cartilage level
I-ID (Inter-incisors)	_____ CM Distance between inferior incisors with mouth fully open (gap between alveolar arches if no teeth)
TMD (Thyromental)	_____ CM Distance between superior anterior part of the thyroid cartilage and chin with head extended and mouth closed
SMD (Stemomental)	_____ CM Distance between the sternal notch and chin with head extended and mouth closed



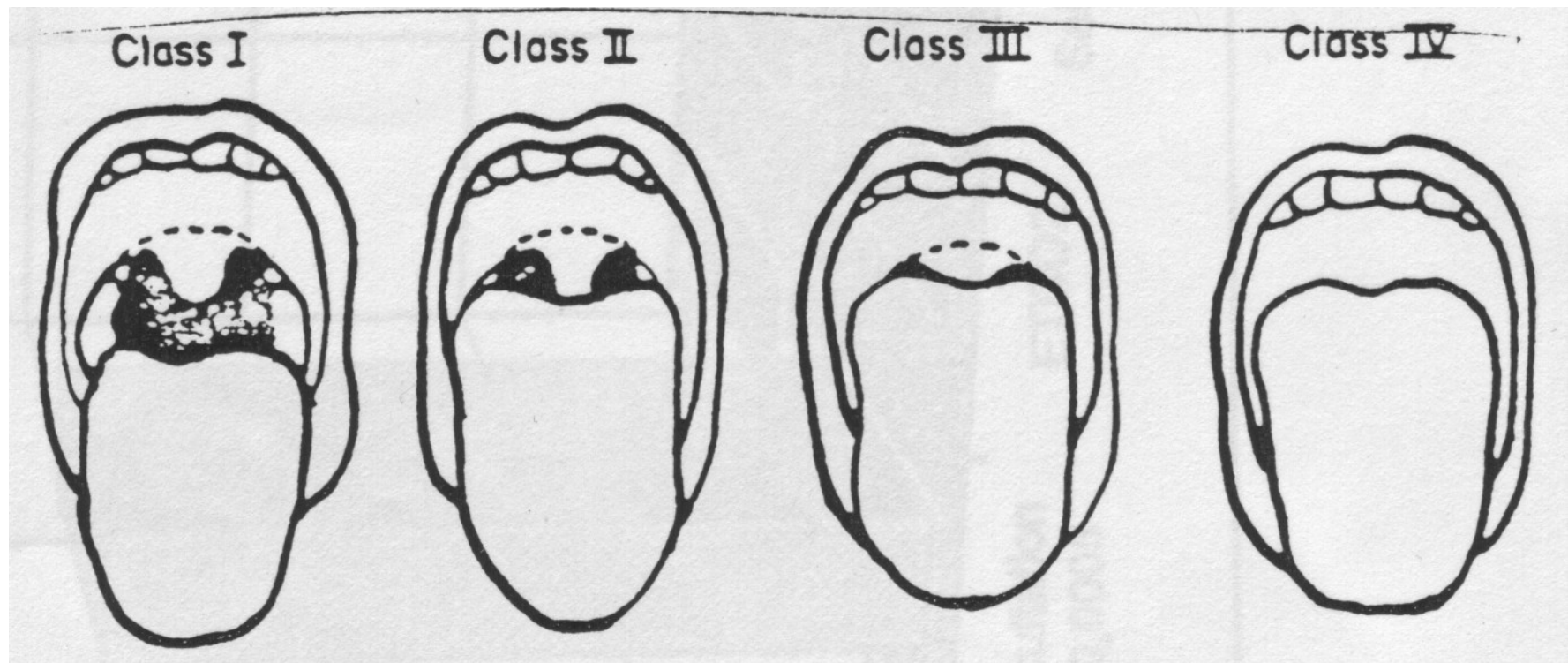
Hybnost C páteře

Neck Mobility:

With patient sitting upright, place one index finger on the patient's chin and one index finger on the occipital bone. Ask the patient to completely extend the head on the neck. The finger on the chin is (CM= cervical mobility):



Mallanpati



Gotické patro

- častější obtížná intubace
- častější abnormality d.cest



TULiB test

Upper Lip Bite Test: (Wilson's test or retrognathism correction)
Advance mandible as far forward as possible, then view teeth

- Position A** (Lower teeth can be advanced beyond upper teeth)
- Position B** (Lower teeth can be advanced even with upper teeth)
- Position C** (Lower teeth cannot reach upper teeth)





CHECK ALL CONDITIONS THAT EXIST:

- Cervical Spine Trauma/Pathology: _____
- Edentulous: _____
- Facial hair: _____
- Facial trauma: _____
- Full Stomach: _____
- Laryngeal pathology (external): _____
- Laryngeal pathology (internal): _____
- Nasal deformity: _____

- Neck trauma: _____
- Oropharyngeal cancer/radiotherapy: _____
- Short Neck: _____
- Snoring/obstructive sleep apnea: _____
- Thyroid / ant. neck mass: _____
- Previous tracheostomy: _____
- Tracheal trauma: _____
- Tracheal deviation: _____

Comments & Explanations: _____

Očekáváte ... ?



Expected difficult mask ventilation?

- Age >55 yrs
- Facial hair
- Nasal deformity

- BMI >26 kg/m²
- Facial trauma
- Snoring

No

- Edentulous
- Mallampati III/IV
- Wilson position C

Expected difficult supraglottic airway?

- Restricted mouth opening
- Distortion/disruption of airway

Yes

No

- Obstruction of upper airway
- Stiff lungs (reduced compliance or increased resistance)



Očekáváte ... ?

Expected difficult laryngoscopy?

- Past history DI
- Mallampati III/IV
- Facial or neck trauma

Yes

- Neck circumference > 40 cm
- Neck range of motion \geq Grade 2
- Wilson's test (prognathism) C

No

- I-ID < 3 cm
- TMD < 6 cm
- SMD < 12 cm

- Oropharyngeal cancer / radiotherapy
- Laryngeal pathology (internal / external)

Expected difficult intubation?

Yes

No

Očekáváte ...?

Expected difficult surgical airway?

Yes

No

- Oropharyngeal cancer / radiotherapy
- Laryngeal pathology (internal / external)
- Previous tracheostomy
- SMD < 12 cm

- Tracheal deviation
- Neck circumference > 40 cm
- Thyroid/anterior neck mass
- Neck range of motion > Grade 2

Výsledky:

Outcomes	Preoperative assessments				P-value	Postoperative events	
	Experimental		Control				
DA	693	20.79%	867	18.28%	0.061	1073	11.97%
DMV	293	8.79%	340	7.17%	0.0091	523	5.84%
DDL	188	5.64%	265	5.59%	0.55	393	4.39%
DI	166	4.98%	194	4.09%	0.16	315	3.51%
DSGA	46	1.38%	68	1.43%	0.13	77	0.86%

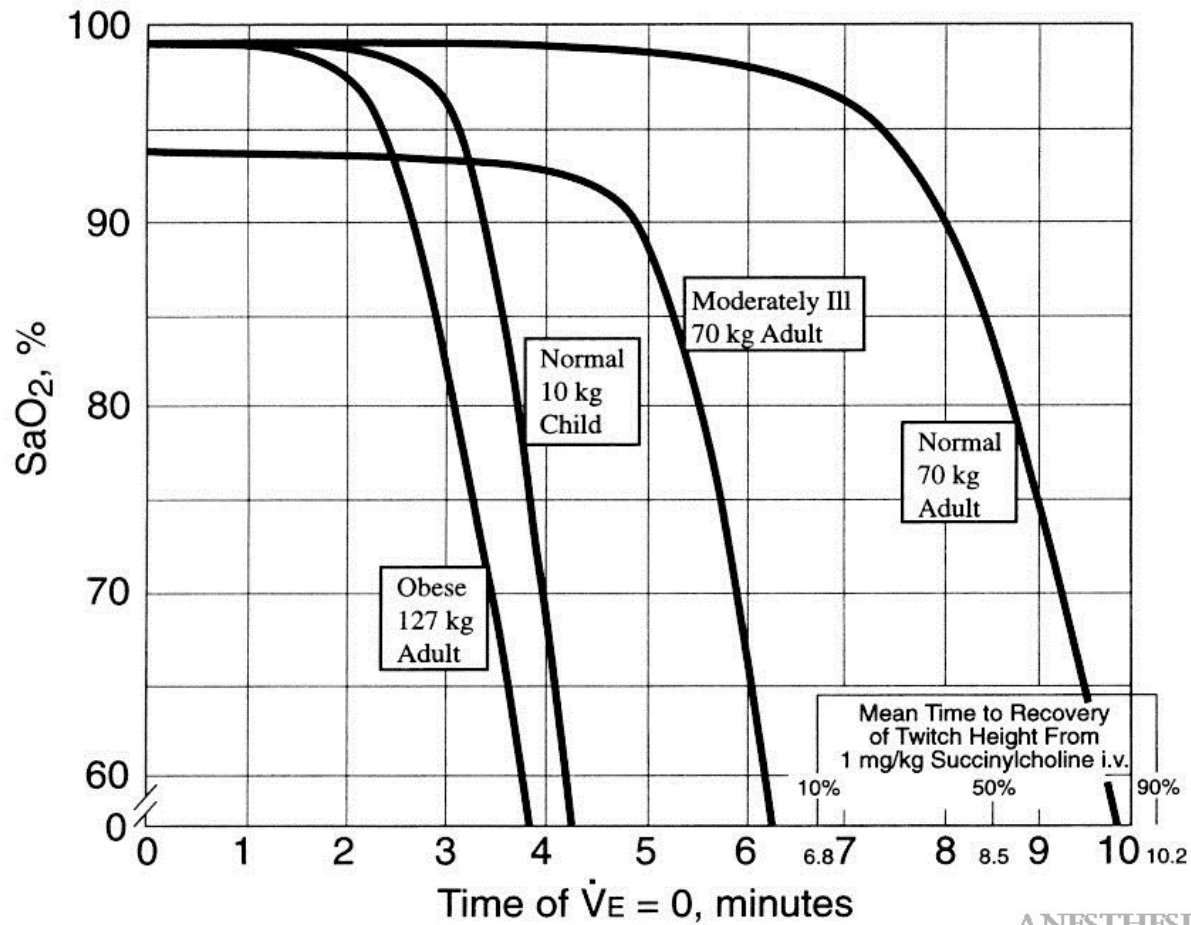
Table 2 Accuracy of difficult airway prediction in the experimental and control groups. Per χ^2 test, statistical significance between the groups is $P=0.032$

	Correct	%	Incorrect	%	Total
Control	3551	71.20	1433	28.80	4984
Experimental	2397	69.10	1074	30.90	3471
Total	5948		2507		8455

Užití podrobné dokumentace nevede k lepší predikci Difficult Airway.

Preoxygenation = denitrogenation 3min O₂

TIME TO HEMOGLOBIN DESATURATION WITH INITIAL $F_{A}O_2 = 0.87$



ANESTHESIOLOGY

Benumof, J. L. et al. Critical Hemoglobin Desaturation Will Occur before Return to an Unparalyzed State following 1 mg/kg Intravenous Succinylcholine. *Anesthesiology*. 87(4):979-982, 1997.

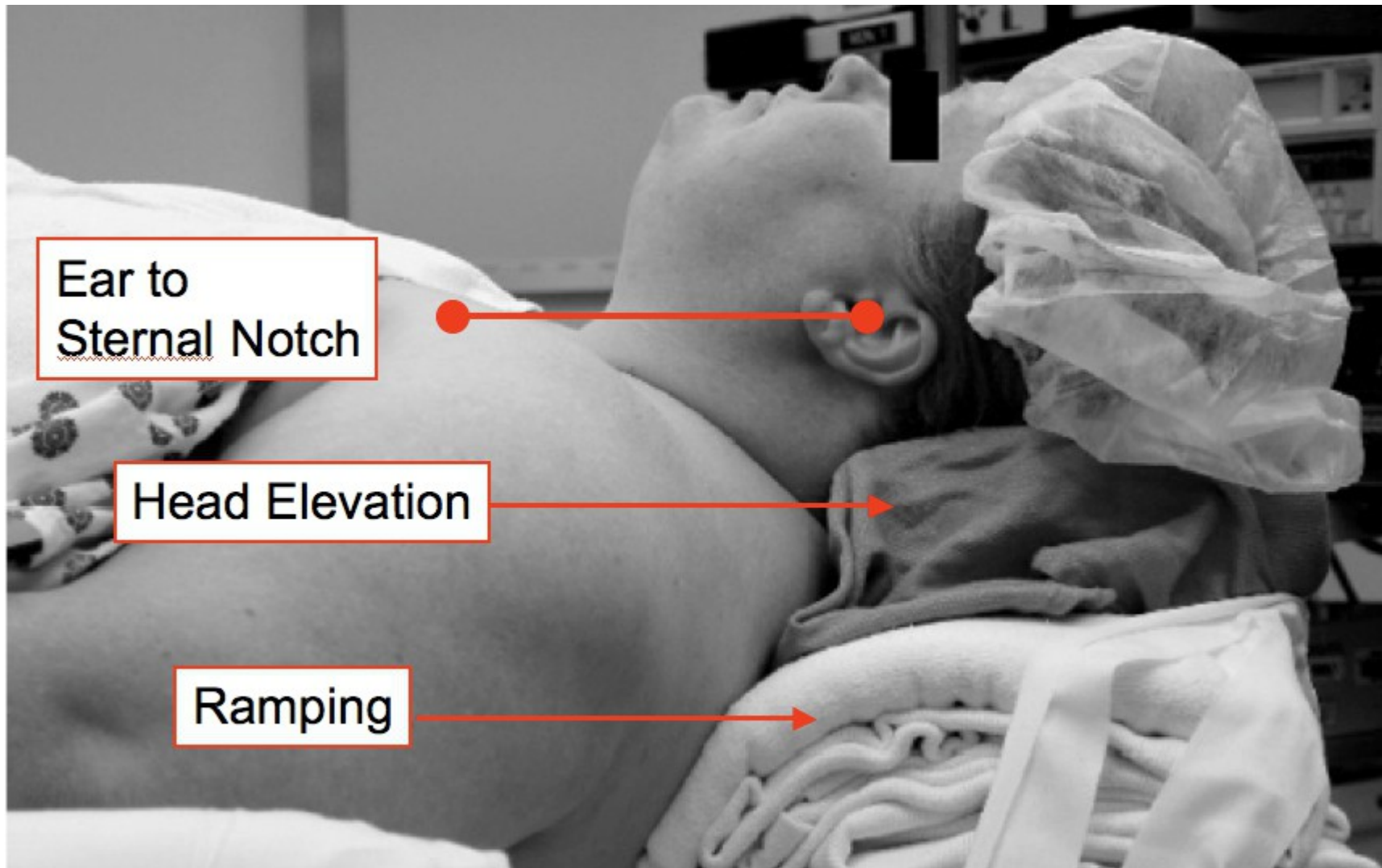
Očekávané obtíže DAM

zlatý standard

zajištění d.c. za spontánní ventilace:

- bronchoskopická intubace
- laryngoskopie (LA+sedace)
- laryngoskopie
v inhalační anestezii

Sniffing position



DAM algoritmus

Direct
laryngoscopy



Any
problems



Call
for help



DAM algoritmus

Direct laryngoscopy → Any problems → Call for help

Plan A: Initial tracheal intubation plan

Direct laryngoscopy - check:
Neck flexion and head extension
Laryngoscope technique and vector
External laryngeal manipulation -
by laryngoscopist
Vocal cords open and immobile
If poor view: Introducer (bougie) -
seek clicks or hold-up
and/or Alternative laryngoscope

failed intubation

succeed

Not more than 4 attempts, maintaining:
(1) oxygenation with face mask and
(2) anaesthesia

Tracheal intubation

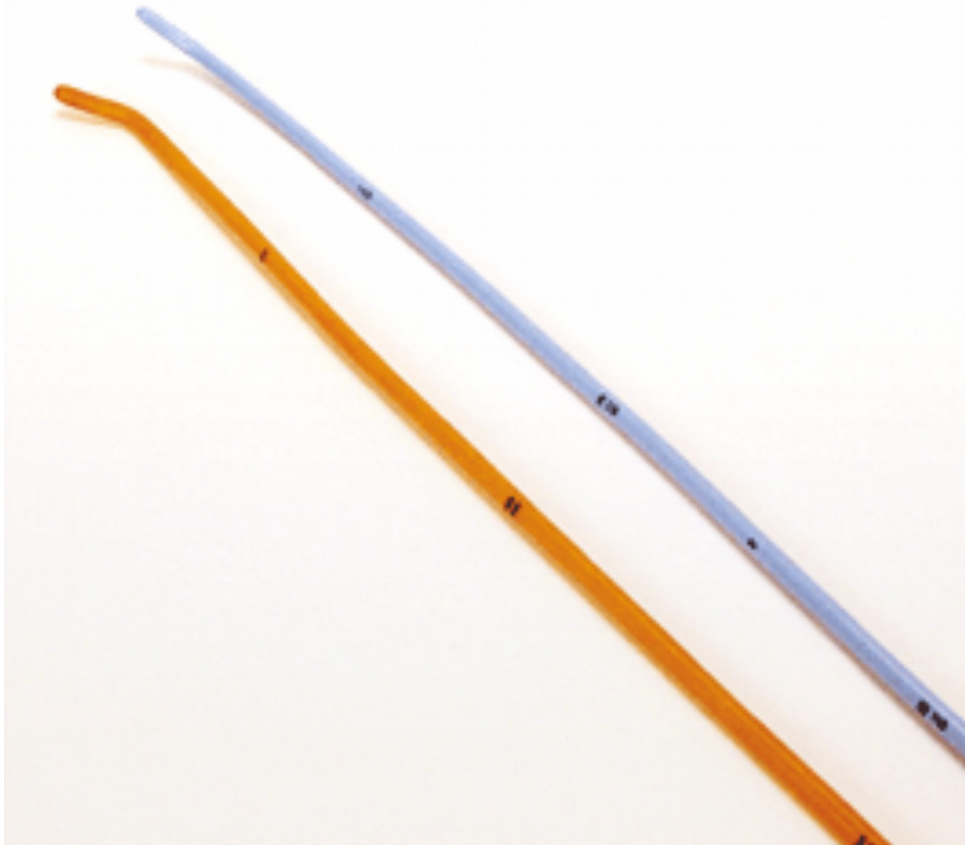
Verify tracheal intubation
(1) Visual, if possible
(2) Capnograph
(3) Oesophageal detector
"If in doubt, take it out"



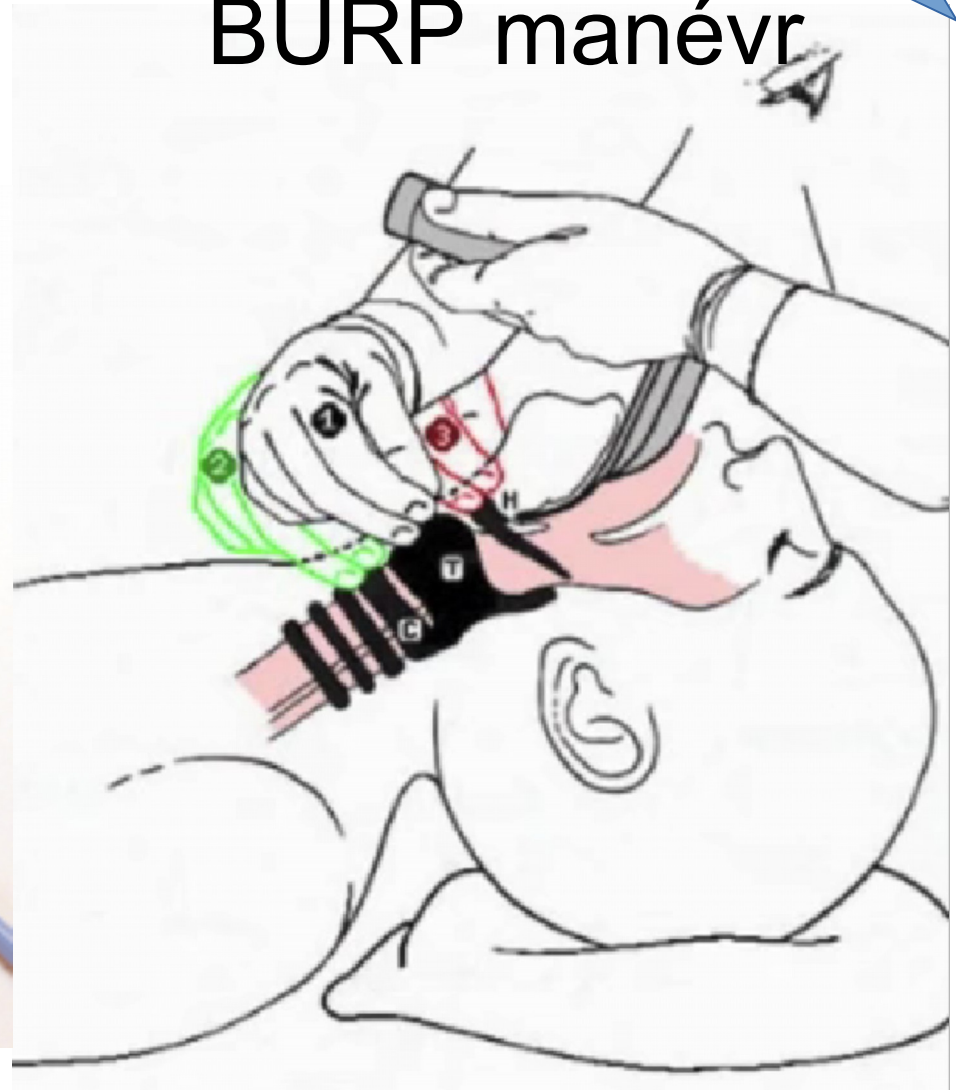
Plán A:

Co ještě můžu zlepšit?

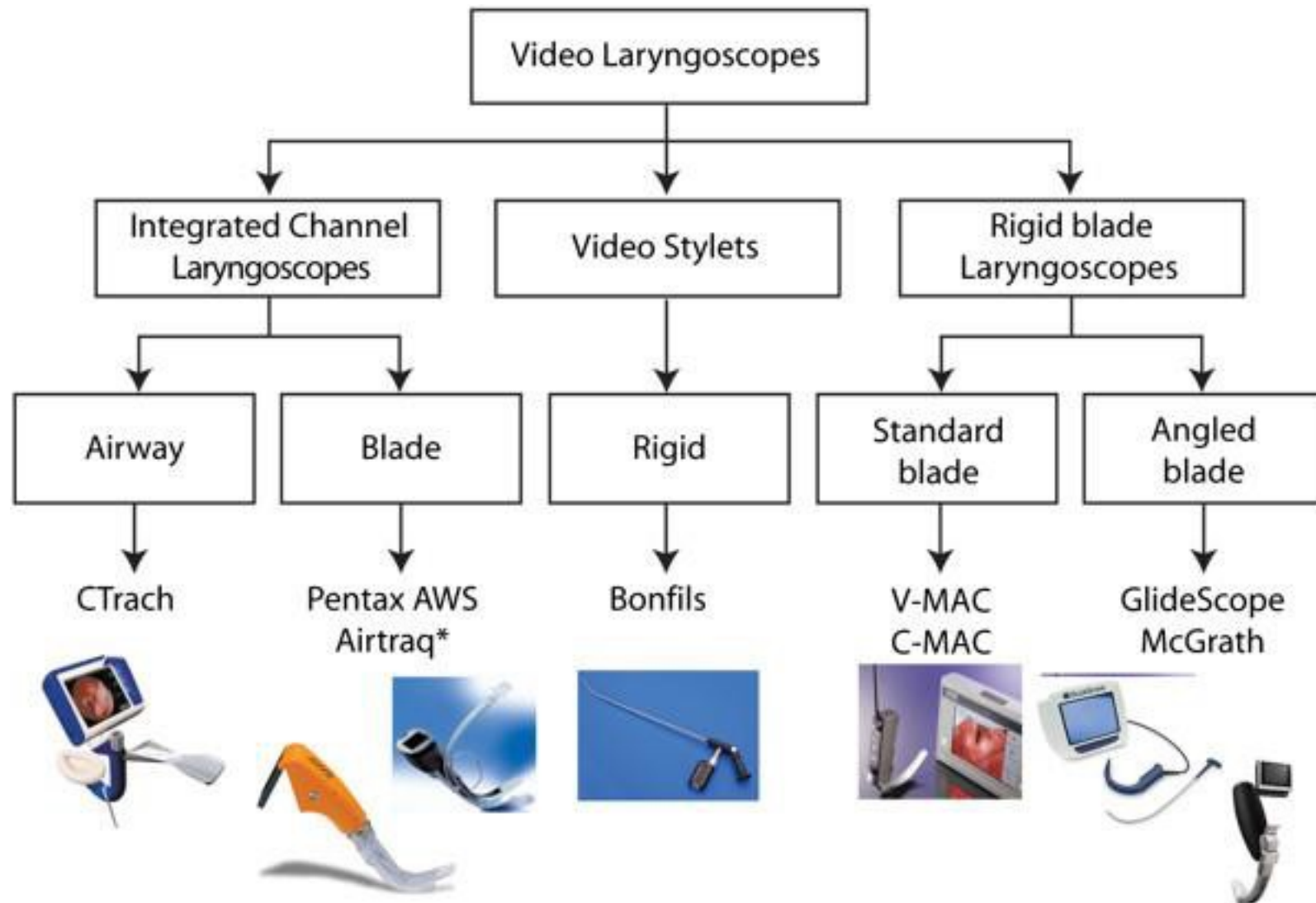
Bužie



BURP manévr



Plán A:



Plán A



B

pokud

- dobrá ventilace

- SpO2 >90%

- 2. intubace



DAM algoritmus

Direct laryngoscopy



Any problems



Call for help

Plan A: Initial tracheal intubation plan

Plan B: Secondary tracheal intubation plan

ILMA™ or LMA™
Not more than 2 insertions
Oxygenate and ventilate

succeed

Confirm: ventilation, oxygenation, anaesthesia, CVS stability and muscle relaxation - then fiberoptic tracheal intubation through IMLA™ or LMA™ - 1 attempt
If LMA™, consider long flexometallic, nasal RAE or microlaryngeal tube
Verify intubation and proceed with surgery

failed oxygenation
(e.g. $SpO_2 < 90\%$ with $FiO_2 1.0$)
via ILMA™ or LMA™



DAM algoritmus

Direct laryngoscopy → Any problems → Call for help

Plan A: Initial tracheal intubation plan

Plan B: Secondary tracheal intubation plan

Plan C: Maintenance of oxygenation, ventilation, postponement of surgery and awakening

Revert to face mask
Oxygenate and ventilate
Reverse non-depolarising relaxant
1 or 2 person mask technique
(with oral ± nasal airway)

succeed

Postpone surgery
Awaken patient

failed ventilation and oxygenation



DAM algoritmus (bez rizika regurgitace)

Direct
laryngoscopy



Any
problems



Call
for help

Plan A: Initial tracheal intubation plan

Plan B: Secondary tracheal intubation plan

Plan C: Maintenance of oxygenation, ventilation, postponement of surgery and awakening

Plan D: Rescue techniques for "can't intubate, can't ventilate" situation



DAM algoritmus (s rizikem regurgitace)

Direct
laryngoscopy



Any
problems



Call
for help

Plan A: Initial tracheal intubation plan

~~**Plan B:** Secondary intubation plan~~

Plan C: Maintenance of oxygenation, ventilation,
postponement of surgery and awakening

Plan D: Rescue techniques for
"can't intubate, can't ventilate" situation

nepodávej 2. dávku relaxace a vzbud'



Plán A: Videolaryngoskop



Samá pozitiva ?

Studie:

- lepší vizualizace glottis
- vyšší úspěch v zajištění difficult airways
- rychlejší učení nováčků
- dobrá spolupráce intubujícího týmu (všichni vidí)

Negativa !

- Falešný pocit jistoty ...
- poranění v d.ústní (manipulace bez optické kontroly)

GlideScope®

- lžíce odstupuje v úhlu 60°



porovnání lžic #4 MacIntosch vs GlideScope #4

GlideScope®

vodič s trach. rourkou „J“



GlideScope®

- zavádění – střední čarou
– uvula – kořen jazyka – epiglotis – glotis



GlideScope® 2roky

2 centra, 71570 OTI

success for Glidescope intubation was 97% (1,944 of 2,004).

- primary intubation successful in 98% of 1,755 cases
- rescued failed direct laryngoscopy in 94% of 239 cases.
- (coniotomy 2pts)

Závěr 1:

Vyšetřit všechny = odhalit některé.

Preoxygenovat všechny = získat několik minut navíc.

Několik malých abnormalit může vést k difficult airway.

Předvídej nemožnost ventilace / intubace.

Měj **plán dřív než** vznikne **problém**.

Připrav všechny **pomůcky včas**.

Vizualizace glotis **při vědomí není v anestezií** garantována.

Závěr 2:

Videolaryngoskopie

- „per se“ nezajišťuje oxygenaci ani ventilaci.
- není 1. volbou v doporučených postupech DAM
- je vhodnou alternativou přímé laryngoskopie za dobré oxygenace/ventilace pacienta
- je nutné se ji učit