AKUTNE.CZ®

Jan Hruda
ARK FN u sv. Anny v Brně
LF Masarykovy univerzity

FAKULTNÍ NEMOCNICE U SV. ANNY V BRNĚ

MUNI | SIMU MED

MUNI MED

PERI-INTUBATION CARDIOVASCULAR COLLAPSE

- v posledních dekádách klesá počet selhání prvního intubačního pokusu

- neklesá ale incidence peri-intubační hemodynamické nestability

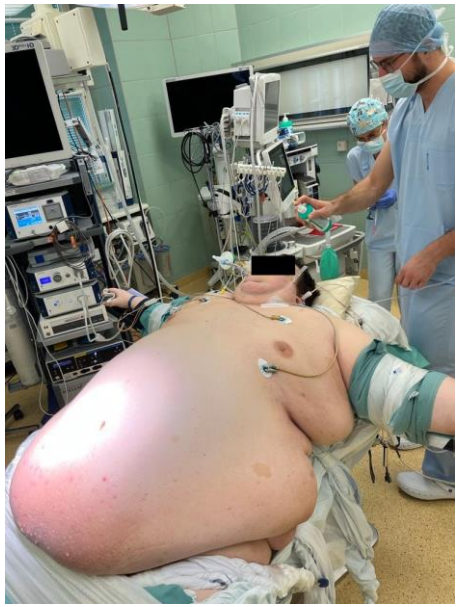


4th National Audit Project (NAP4), UK 2011

- závažná příhoda při intubaci na ED 35x častější a na ICU 55x častější než v anestezii
- 61% závažných příhod na ICU končí poškozením mozku

ANATOMICALLY DIFFICULT AIRWAY

- dáno anatomickými poměry
- známé prediktory
- selhání II. pokusu zkušeným



PHYSIOLOGICALLY DIFFICULT AIRWAY

- zajištění DC je komplikováno celkovým stavem pacienta
- nejsou jasné definice
- nejasné časové okno od OTI (2-30 min)



ANATOMICALLY DIFFICULT AIRWAYS

Anticipating difficulty in establishing an airway in emergency patients is the first step in avoiding major complications. It helps us to think about the alternative methods. LEMON is a mnemonic to remember.



L — LOOK EXTERNALLY

Look for external markers of difficult intubation; these may include the following body habitus, head and neck anatomy (short neck), mouth (small opening, loose teeth or prominent teeth), jaw abnormalities (significant malocclusion), and beards.

E — EVALUATE 3-3-2

Can the patient fit 3 fingers between the incisors?

Is the mandible length 3 fingers from the mentum to the hyoid bone?

The distance from the hyoid to the thyroid. 2 fingers are what we are looking for.

M — MALLAMPATI

Class I and class II predict adequate oral access, class III predicts moderate difficulty, and class IV predicts a high degree of difficulty.



O — OBSTRUCTION OR OBESITY

Conditions such as epiglottitis, head and neck cancer, Ludwig's angina, neck hematoma, foreign body or thermal injury can compromise laryngoscopy, the passage of the endotracheal tube (ETT), BMV, or all three.

N — NECK MOBILITY

Neck extension is the most important maneuver, and simple extension may be as effective as the "sniffing" position in achieving an optimal laryngeal view. Neck mobility can be significantly reduced in patients with trauma (cervical collar) or the elderly and those with arthritis.

iEM INTERNATIONAL EMERGENCY MEDICINE EDUCATION PROJECT

ASSESSING AIRWAY DIFFICULTY

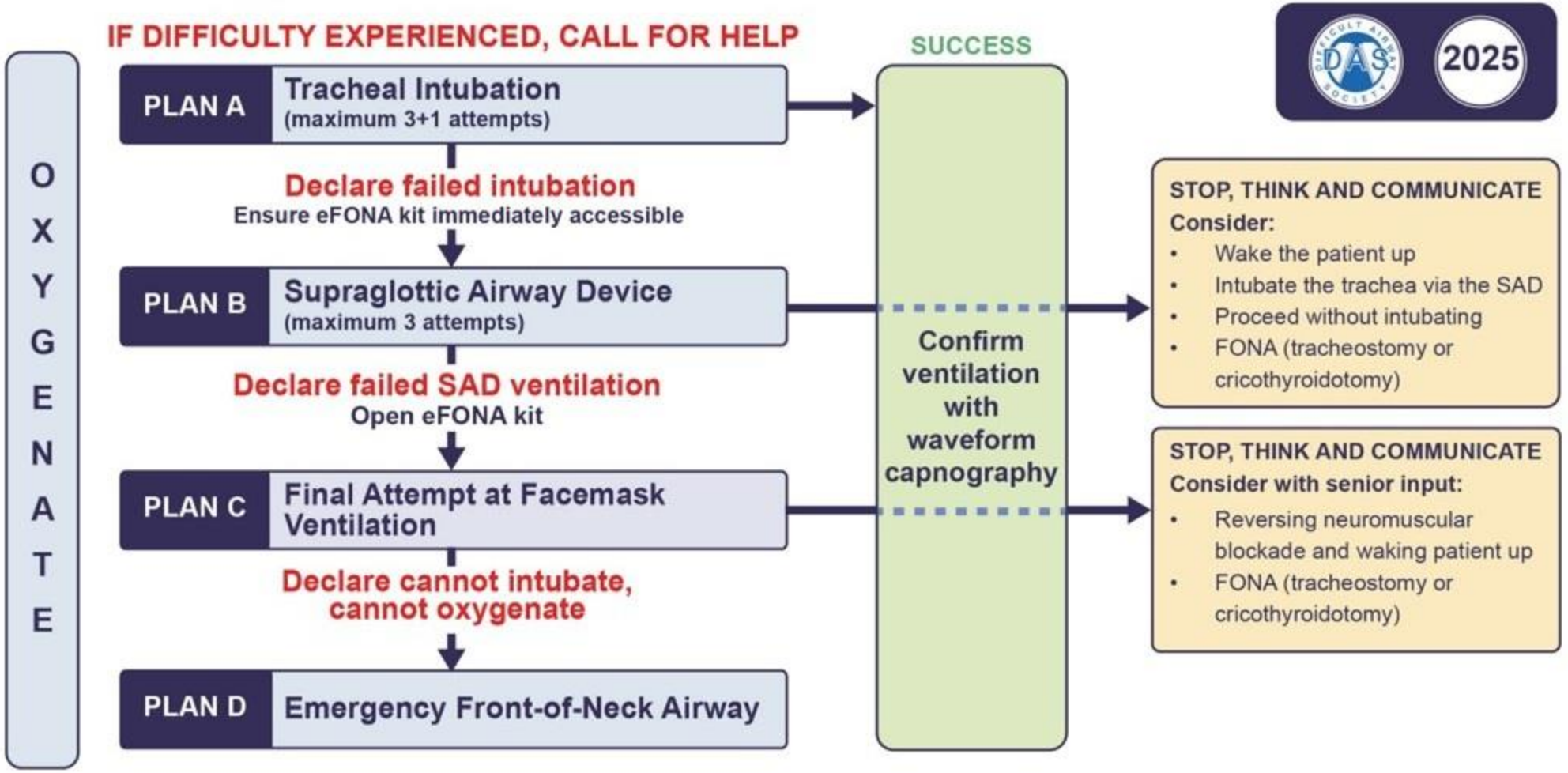
ICU

MACOCHA score

Malampatti 3 or 4	5
Obstructive sleep **A**pnoea	2
Cervical-spine movement limited	1
Mouth **O**pening <3cm	1
Coma	1
Hypoxaemia (< 80%)	1
Non-**A**naesthetist intubator	1

MACOCHA score > 2 → Contact senior anaesthetist
Prepare for difficulty

ANATOMICALLY DIFFICULT AIRWAYS



PHYSIOLOGICALLY DIFFICULT AIRWAYS

- ✓ mechanismy
  - ✓ epidemiologie
    - ✓ predikce
      - ✓ optimalizace



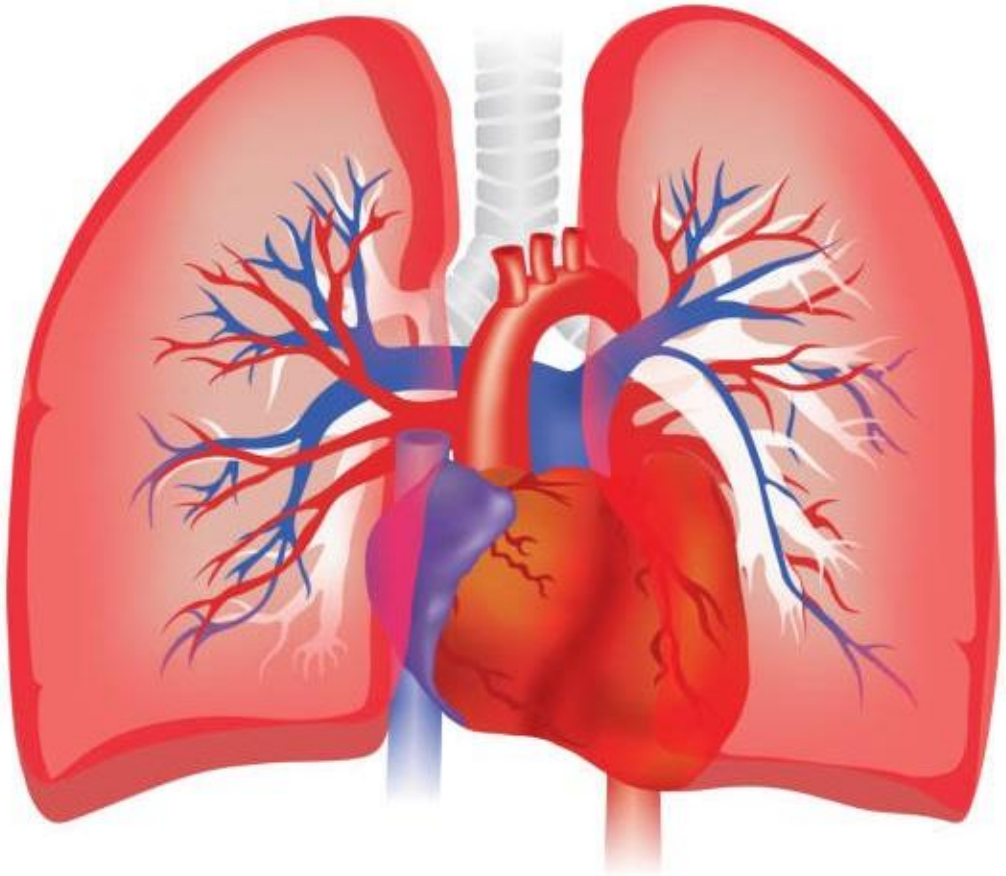
PHYSIOLOGICALLY DIFFICULT AIRWAYS

Stav pacienta

- SVR↑ nebo hůře ↓
- hypovolemie
- acidóza
- hypoxie

Podání léků

- ↓ tonus sympatiku
- vazoplegie
- kardiodeprese



Apnoe

- ↓O_2
- ↑CO_2
- ↓pH

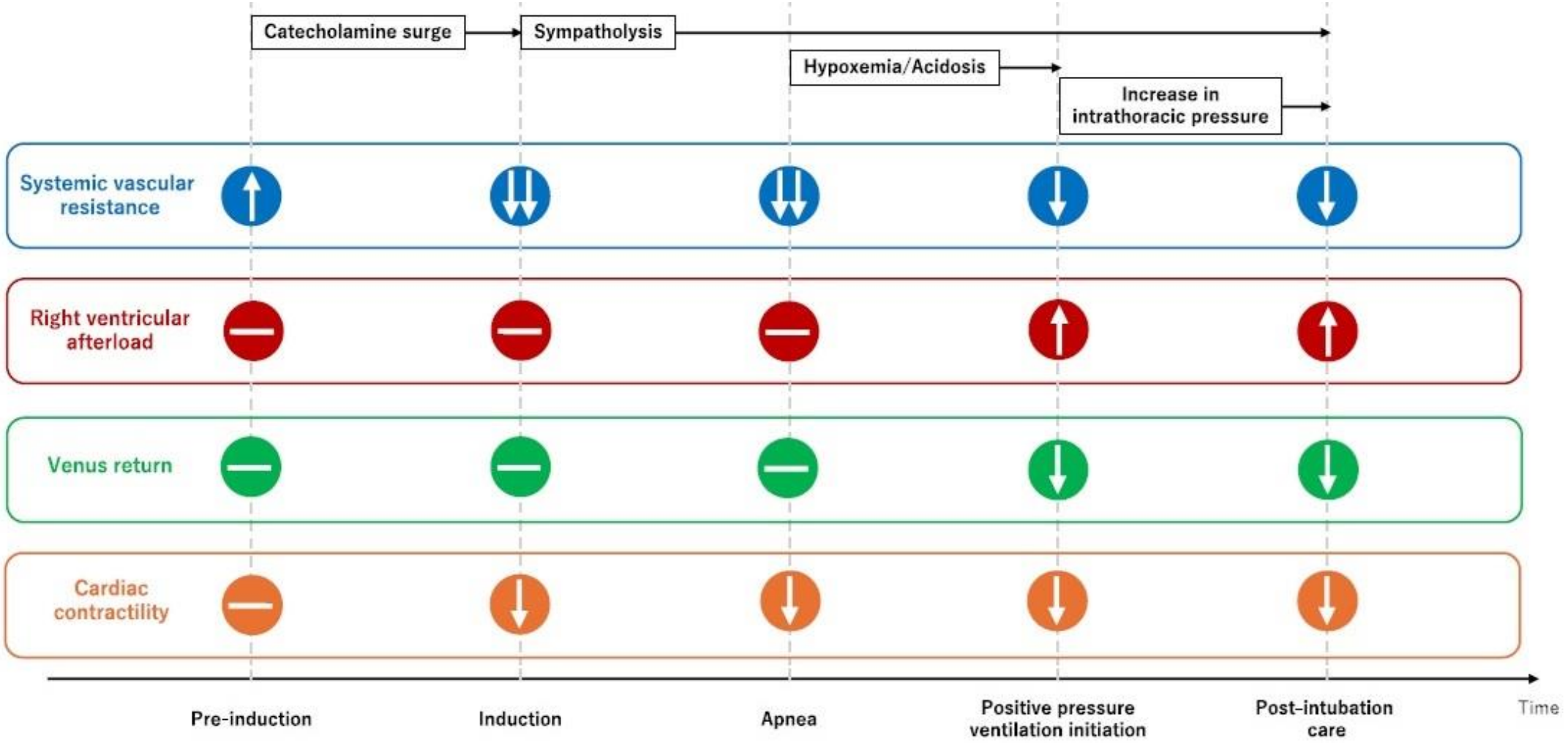
UPV

- ↓preload
- ↑afterload PK
- ↓ srdeční výdej
- VQ mismatch

PHYSIOLOGICALLY DIFFICULT AIRWAYS

Journal of Intensive Care
BMC
Kotani et al.
Journal of Intensive Care (2026) 14:42
REVIEW

The hemodynamics of tracheal intubation in critically ill patients: a narrative review



EPIDEMIOLOGIE PDA

INTUBE study

JAMA | Original Investigation | 2021;325;(12):1164-1172. Russotto V., et al.

Intubation Practices and Adverse Peri-intubation Events in Critically Ill Patients From 29 Countries

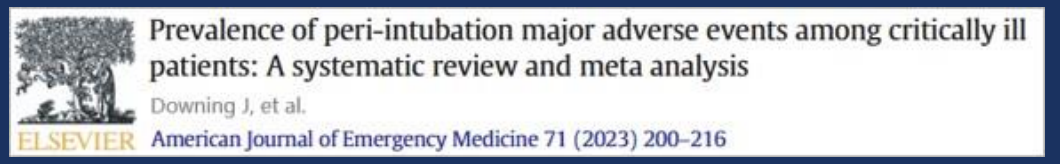
- 197 pracovišť, 29 zemí
- 2964 pacientů (3087 intubací)
- 45% intubací s „major adverse event“
- pravděpodobnost komplikace roste s počtem pokusů
- kardiovaskulární nestabilita nejčastější

Other adverse events	No./Total (%)
Esophageal intubation	167/2959 (5.6)
New onset cardiac arrhythmia	167/2960 (5.6)
Atrial fibrillation	48/167 (28.7)
Ventricular tachycardia	41/167 (24.6)
Bradycardia	38/167 (22.8)
Other[c]	40/167 (23.9)
Difficult intubation[d]	138/2957 (4.7)
Aspiration of gastric contents[e]	116/2960 (3.9)
Dental injury	28/2960 (1.0)
Pneumothorax	22/2963 (0.7)
Airway injury	21/2959 (0.7)
Tracheal laceration	5/21 (23.8)
Bronchial laceration	1/21 (4.8)
Laryngeal laceration	7/21 (33.3)
Other[f]	8/21 (38.1)
Pneumomediastinum	8/2960 (0.3)

Adverse events	No./Total (%)
Major adverse events (primary outcome)	1340/2964 (45.2)
Cardiovascular instability	1172/2753 (42.6)
New need or increase of vasopressors	1053/1172 (89.9)
Systolic pressure <90 mm Hg for >30 min	252/1026 (24.6)
Fluid bolus >15 mL/kg	151/1163 (13.5)
Systolic pressure <65 mm Hg	157/1163 (13.5)
Severe hypoxia (lowest Spo_2<80%)	272/2916 (9.3)
Cardiac arrest	93/2964 (3.1)
With return of spontaneous circulation	49/93 (52.7)
With death	44/93 (47.3)

The occurrence of a major adverse peri-intubation event was significantly associated with 28-day mortality with an adjusted OR of 1.44

EPIDEMIOLOGIE PDA



- metaanalýza 34 357 intubací mimo anestezii (21 tis. ED, 11 tis. ICU, 1600 ostatní)
- „Major Adverse Event“ ponechali definice z jednotlivých studií (44 studií)
- až 30 min po intubaci - **31% Major Adverse Event**
- bez výrazných rozdílů podle regionů

KARDIOVASKULÁRNÍ KOLAPS

- 17% ED
- 41% ICU
- výrazně častější při OTI pro hemodynamickou nestabilitu vs. OTI pro resp. selhání

SRDEČNÍ ZÁSTAVA

- 2%
- bez rozdílu ED-ICU

HYPOXIE

- 8% intubací ED
- 24% ICU

PREDIKCE PDA

- nejsou funkční predikční nástroje (DAPS a HYPS nepraktické)
- shock index? HR/SBP (ev. modified shock index HR/MAP)
  - SI > 0.7 (0.8) asociován s rizikem hypotenze, ROC AUC kolem 0.69
  - při SI > 0.9 pointubační hypotenze OR 2.13
  - OR 1.16 na každý 0.1 vzestup SI
  - asociace se SOFA a ICU mortalitou

(Trivedi, J Crit Care 2015; Smichney J Intensive Care Med 2024)

DAPS>10
ROC AUC 0,86

The difficult airway physiological score

Category	Points
Female gender	1
Age ≥45 years	2
Time of intubation/shift duty (morning/evening)	2
Presentation hypotension (<90 mmHg)	2
Presentation respiratory distress	2
Vomiting	3
Shock index ≥0.9	2
pH <7.3	4
Fever	2
Anticipated decline	2
GCS <15	2
Agitation	1

HYPS>12
risk 68%
ROC AUC 0,71

HYpotension Prediciton Score

Predictor	HYPS Points
APACHE II score	
≤ 10	0
11 to 15	1
16 to 20	2
21 to 25	3
≥ 26	4
Age, years	
≤ 40	0
41 to 50	0.5
51 to 60	1
61 to 70	1.5
71 to 80	2
≥ 81	3
Sepsis diagnosis	
Yes	1
No	0
Intubation setting	
Respiratory Failure	1
MAP < 65 mm Hg	3.5
Cardiac arrest	2
Others	0
Diuretics in prior 24 hours	
Yes	3
No	0
Catecholamine 60 minutes prior to intubation	
Yes	5
No	0
Phenylephrine 60 minutes prior to intubation	
Yes	1
No	0
Systolic blood pressure (mm Hg)	
≤ 89	10.5
90 to 99	7
100 to 109	5
110 to 119	3
120 to 129	1
≥ 130	0
Etomidate used for intubation	
Yes	0
No	−1.5

PREDIKCE PDA

UpToDate®

Faktory spojené se zástavou při intubaci

- hypotenze TK_{sys} <90 mmHg
- hypoxemie
- neužití preoxygenace
- BMI >25 kg/m^2
- věk >75 let

Nelineální nárůst OR
z 1.3 při 1 faktoru po 9.9 při všech pěti

DAPS>10
ROC AUC 0,86

The difficult airway physiological score

Category	Points
Female gender	1
Age ≥45 years	2
Time of intubation/shift duty (morning/evening)	2
Presentation hypotension (<90 mmHg)	2
Presentation respiratory distress	2
Vomiting	3
Shock index ≥0.9	2
pH <7.3	4
Fever	2
Anticipated decline	2
GCS <15	2
Agitation	1

HYPS>12
risk 68%
ROC AUC 0,71

HYpotension Prediciton Score

Predictor	HYPS Points
APACHE II score	
≤ 10	0
11 to 15	1
16 to 20	2
21 to 25	3
≥ 26	4
Age, years	
≤ 40	0
41 to 50	0.5
51 to 60	1
61 to 70	1.5
71 to 80	2
≥ 81	3
Sepsis diagnosis	
Yes	1
No	0
Intubation setting	
Respiratory Failure	1
MAP < 65 mm Hg	3.5
Cardiac arrest	2
Others	0
Diuretics in prior 24 hours	
Yes	3
No	0
Catecholamine 60 minutes prior to intubation	
Yes	5
No	0
Phenylephrine 60 minutes prior to intubation	
Yes	1
No	0
Systolic blood pressure (mm Hg)	
≤ 89	10.5
90 to 99	7
100 to 109	5
110 to 119	3
120 to 129	1
≥ 130	0
Etomidate used for intubation	
Yes	0
No	−1.5

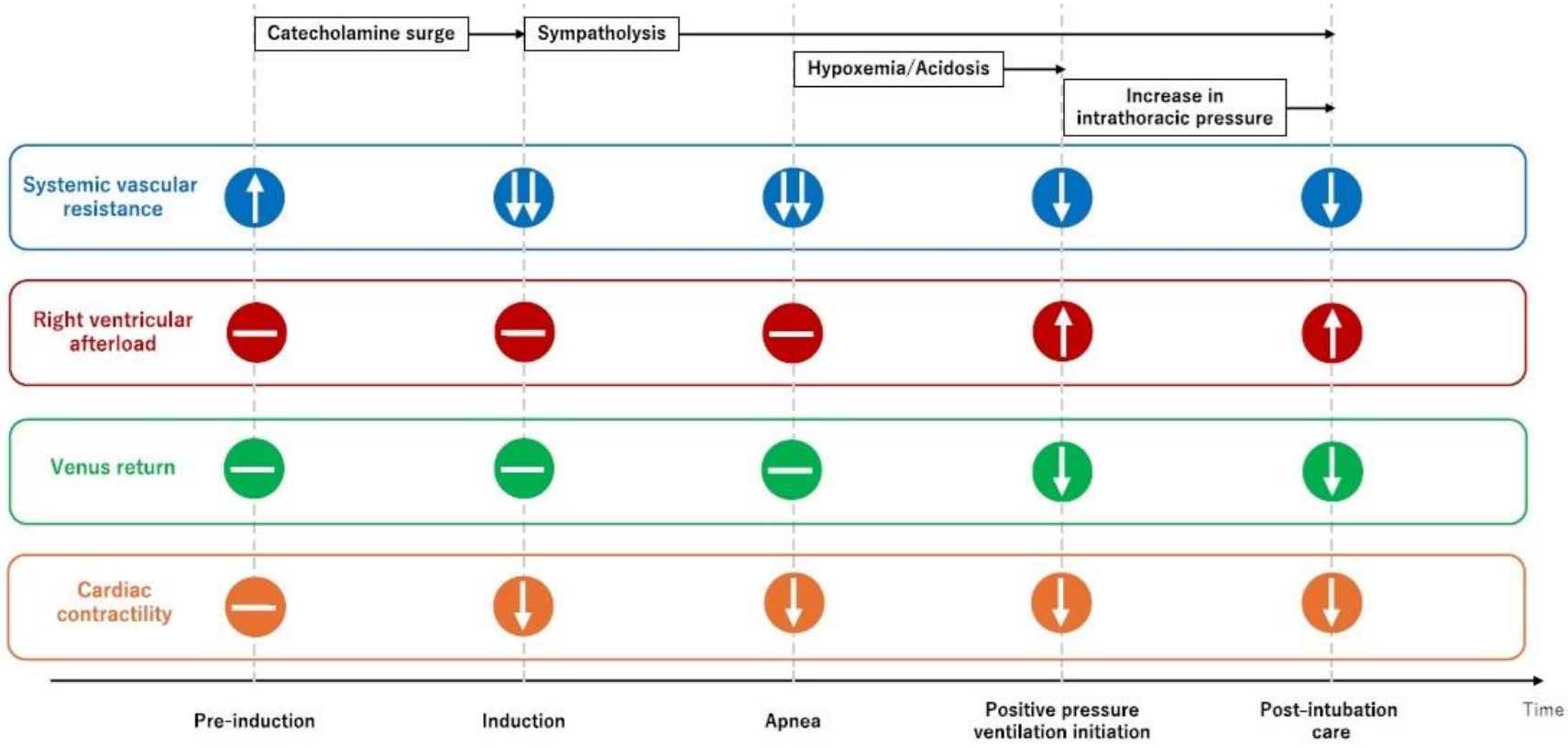
OPTIMALIZACE PŘI EMERGENTNÍ INTUBACI

- **preoxygenace**
- **volumsubstituce**
- **vazopresory**
- **volba farmak**

- pro většinu postupů ale nejsou dostatečně silné důkazy

OPTIMALIZACE PŘI EMERGENTNÍ INTUBACI

- preoxygenace
- volumsubstituce
- vazopresory
- volba farmak



PREOXYGENACE K PDA

- ventimaska, HFNO, bag-mask…
- často méně efektivní než v anestezii (pokles FRC, shunt, respirační selhání)
- přibývá dat na **neinvazivní ventilaci**
  - účinnější než maska, u hypoxie účinnější i než HFNO
  - zdá se, že nezvyšuje riziko aspirací
- navrhován postup „medication-assisted preoxygenation“

  = mírná sedace, pokud pac. preoxygenaci netoleruje

PREOXYGENACE K PDA

The NEW ENGLAND JOURNAL of MEDICINE
Published June 13, 2024
N Engl J Med 2024;390:2165-2177

Noninvasive Ventilation for Preoxygenation during Emergency Intubation Gibbs KW, et al.

Outcomes of Tracheal Intubation.

Outcome	Noninvasive Ventilation (N=645)	Oxygen Mask (N=656)	Difference (95% CI)*
Primary outcome			
Hypoxemia during intubation — no./total no. (%)†‡	57/624 (9.1)	118/637 (18.5)	−9.4 (−13.2 to −5.6)§
Secondary outcome			
Median lowest oxygen saturation (IQR) — %‡	99 (95 to 100)	97 (89 to 100)	2 (1 to 3)
Exploratory procedural outcomes			
Lowest oxygen saturation <80% — no./total no. (%)‡	39/624 (6.2)	84/637 (13.2)	−6.9 (−10.2 to −3.7)
Lowest oxygen saturation <70% — no./total no. (%)‡	15/624 (2.4)	36/637 (5.7)	−3.2 (−5.4 to −1.1)
Cardiovascular collapse — no./total no. (%)¶	113/645 (17.5)	127/656 (19.4)	−1.8 (−6.1 to 2.4)
Systolic blood pressure <65 mm Hg — no./total no. (%)	18/621 (2.9)	28/633 (4.4)	−1.5 (−3.6 to 0.6)
New or increased use of vasopressors — no./total no. (%)	111/645 (17.2)	117/656 (17.8)	−0.6 (−4.8 to 3.5)
Cardiac arrest — no./total no. (%)‖	1/645 (0.2)	7/656 (1.1)	−0.9 (−1.8 to −0.1)
Successful intubation on the first attempt — no./total no. (%)	534/645 (82.8)	535/656 (81.6)	1.2 (−2.9 to 5.4)
Median time from induction to intubation (IQR) — seconds	115 (89 to 150)	113 (85 to 152)	2 (−5 to 9)
Exploratory safety outcomes			
Operator-reported aspiration — no./total no. (%)**	6/645 (0.9)	9/656 (1.4)	−0.4 (−1.6 to 0.7)
New infiltrate on chest imaging — no./total no. (%)††	144/509 (28.3)	148/497 (29.8)	−1.5 (−7.1 to 4.1)
New pneumothorax — no./total no. (%)‡‡	7/509 (1.4)	7/497 (1.4)	0.0 (−1.5 to 1.4)
Median oxygen saturation at 24 hr (IQR)§§	97 (95 to 100)	97 (95 to 100)	0 (−1 to 1)
Median F_{IO_2} at 24 hr (IQR)¶¶	0.40 (0.30 to 0.40)	0.40 (0.30 to 0.40)	0.01 (−0.05 to 0.05)
Exploratory clinical outcomes‖‖			
Median ventilator-free days (IQR)	21 (0 to 26)	17 (0 to 25)	4 (−1 to 9)
Median ICU-free days (IQR)	16 (0 to 23)	14 (0 to 23)	2 (−1 to 8)
In-hospital death — no./total no. (%)	209/645 (32.4)	217/656 (33.1)	−0.7 (−5.8 to 4.4)

- USA; 15 center, 24 ED a ICU
- 1301 pac.; 624 NIV a 637 maska
- NIV: FiO2 100%, alespoň 10/5 cm H_2O
- oxygenoterapie: maska 15 L/min
- alespoň 3 min před intubací

CONCLUSION

Among critically ill adults undergoing tracheal intubation, preoxygenation with noninvasive ventilation resulted in a lower incidence of hypoxemia during intubation than preoxygenation with an oxygen mask.

PREOXYGENACE K PDA

Society of Critical Care Medicine
The Intensive Care Professionals
Crit Care Med. 2023 Oct;51(10):1411-1430.
Guidelines for Rapid Sequence Intubation in the Critically Ill Adult Patient

We suggest preoxygenation with HFNO when laryngoscopy is expected to be challenging.
Quality of Evidence: Low

Conditional **Preoxygenation** **Preoxygenation**

We suggest preoxygenation with NIPPV in patients with severe hypoxemia ($PaO_2/FIO_2 < 150$).
Quality of Evidence: Low

Conditional **Preoxygenation** **Preoxygenation**

We suggest using medication-assisted preoxygenation to improve preoxygenation in patients undergoing RSI who are not able to tolerate a face mask, NIPPV, or HFNO because of agitation, delirium, or combative behavior.
Quality of Evidence: Very low

Conditional **Med-Assisted Preoxygenation** **Preoxygenation**

VOLUMSUBSTITUCE K PDA

- fixní bolus před intubací? – studie PREPARE I a II, efekt neprokázán
- optimalizace volumu ano
- diuretika v posl. 24 hodinách známým rizikovým faktorem

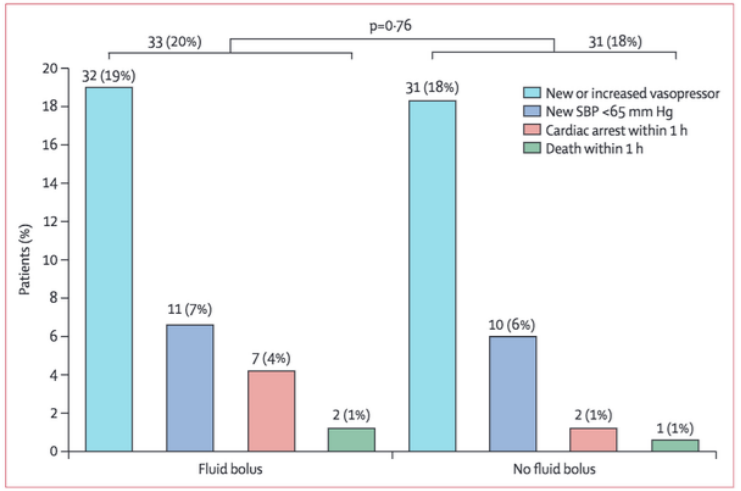
THE LANCET
Respiratory Medicine

David R Janz, MD
Volume 7, Issue 12,
P1039-1047, December 2019

Effect of a fluid bolus on cardiovascular collapse among critically ill adults undergoing tracheal intubation (PrePARE): a randomised controlled trial

Administration of an intravenous fluid bolus did not decrease the overall incidence of cardiovascular collapse during tracheal intubation of critically ill adults compared with no fluid bolus in this trial.

randomizováno 337 pac.
bolus 500 ml před indukcí
(vykapalo cca 200ml)



VOLUMSUBSTITUCE K PDA

PREPARE II

JAMA Effect of Fluid Bolus Administration on Cardiovascular Collapse Among Critically Ill Patients Undergoing Tracheal Intubation

QUESTION In critically ill adult patients undergoing tracheal intubation, does intravenous infusion of a crystalloid solution as a 500-mL fluid bolus decrease the incidence of severely low blood pressure, cardiac arrest, or death during or shortly after the procedure?

CONCLUSION Among critically ill adults undergoing tracheal intubation, administration of a fluid bolus did not significantly decrease the incidence of cardiovascular collapse.

POPULATION



617 Men
448 Women

Critically ill adult patients undergoing tracheal intubation

Median age: 62 years

LOCATIONS



11 ICUs in the US

INTERVENTION



1067 Patients randomized
1065 Patients analyzed

538
Fluid bolus
500-mL intravenous infusion of isotonic crystalloid solution of the clinician's choice

529
No fluid bolus
Initiation of a new intravenous fluid bolus was not permitted except as treatment for hypotension

PRIMARY OUTCOME

Cardiovascular collapse (new or increased vasopressor receipt or a systolic blood pressure <65 mm Hg between induction and 2 minutes after intubation, or cardiac arrest or death)

FINDINGS

Cardiovascular collapse

Fluid bolus
113 of 538 patients



No fluid bolus
96 of 527 patients



The between-group difference was not significant:
Absolute difference, 2.8%
(95% CI, −2.2% to 7.7%); *P* = .25

© AMA

Russell DW, Casey JD, Gibbs KW, et al; PREPARE II Investigators and the Pragmatic Critical Care Research Group. Effect of fluid bolus administration on cardiovascular collapse among critically ill patients undergoing tracheal intubation: a randomized clinical trial. *JAMA*. Published online June 16, 2022. doi:10.1001/jama.2022.9792

VAZOPRESORY K PDA

Pulmonary Therapy, 2025 Oct 16;11(4):569–585. Garcia SI, et al.

Peri-intubation Cardiovascular Collapse During Emergency Airway Management

- push-dose vs. continuous, nebo kombinace
- není dostatek dat, co je výhodnější
- fenylefrin + NOR vs. NOR bez rozdílu v outcome
- bolus: lepší hemodynamická stabilita při intubaci, bez rozdílu dále, stejný outcome
- adrenalin nejúčinnější, ale nejvíc chyb v dávkování

FENYLEFRIN 100 µg/ml
EFEDRIN 5 mg/ml
ADRENALIN 100 µg/ml

There is insufficient evidence to make a recommendation that there is a difference in the incidence of further hypotension or cardiac arrest between the administration of peri-intubation vasopressors or IV fluids for hypotensive critically ill patients undergoing RSI.

Peri-Intubation Vasopressors **Peri-intubation vasopressors**

ClinicalTrials.gov NCT05014581 Recruiting
Preventing Cardiovascular Collapse With Vasopressors During Tracheal Intubation (PREVENTION)

ClinicalTrials.gov NCT05318066 Active, not recruiting
Effect of a FLUid Bolus or a Low Dose VAsopressor Infusion on Cardiovascular Collapse Among Critically Ill Adults Undergoing Tracheal Intubation. (FLUVA)

FARMAKA K EMERGENTNÍ INTUBACI

- podání propofolu rizikové
- **„ketofol“** = kombinace ketaminu s propofolem
  - menší studie: hemodynamická stabilita srovnatelná s etomidátem (např. KEEP PACE trial, n=152; 2019)
  - málo dat na optimální dávku a poměr anestetik
- preferován ketamin a etomidát
- redukované dávky?
  - nejsou definovány hemodynamicky bezpečné dávky
  - data podporují spíše hemodynamickou optimalizaci před úvodem než redukci dávek
- NMBA: rokuronium a sukcinylcholin (cave KI)
- relaxace bez sedace nevhodná

We advise administering a sedative-hypnotic induction agent when an NMBA is used for intubation.

Best Practice Statement | Induction Agent Use | Induction agent

PROPOFOL

Prevalence of peri-intubation major adverse events among critically ill patients: A systematic review and meta analysis

Downing J, et al.

American Journal of Emergency Medicine 71 (2023) 200–216

ORIGINAL ARTICLE

Am J Respir Crit Care Med Vol 206, Iss 4, pp 449–458, Aug 15, 2022

Peri-intubation Cardiovascular Collapse in Patients Who Are Critically Ill

Insights from the INTUBE Study

Russotto V., et al.

Propofol (Corr. Coeff. 7.50, 95% CI3.20–11.7,p=0.001) during induction was associated with a higher prevalence of peri-intubation **cardiovascular collapse**.

Induction agent, No./total (%)	2774/2964 (93.6)
Propofol	1230 (41.5)
Midazolam	1079 (36.4)
Etomidate	527 (17.8)
Ketamine	421 (14.2)

Propofol for induction was independent risk factor associated with higher rates of peri-intubation **hypoxia**.

Propofol has not been commonly associated with higher risks of hypoxia in previous literature

The use of propofol for induction was identified as a modifiable intervention **significantly associated with cardiovascular instability/collapse.** (OR 1.283)

KETAMIN A PROPOFOL

ICM Intensive Care Medicine
Schmidt RC, et al.
Intensive Care Med (2026) 52:476–489
ORIGINAL

Propofol versus Ketamine in rapid sequence intubation in critically ill patients: a prospective, randomized, controlled trial

Study Design

Randomized, controlled, open-label trial, 2 mixed ICUs (Brazil)

- **175 critically ill adults** undergoing RSI
- Ketamine (2 mg/kg) vs Propofol (1.5 mg/kg)

Primary Outcome

Lowest MAP within 10 min after induction

- Ketamine: **66 mmHg**
- Propofol: **60 mmHg**
- Mean difference: + **6 mmHg** (p = 0.05)

Less early MAP drop with ketamine

Transient & not clinically meaningful

Early Hemodynamic Effects

Cardiovascular collapse:

- Ketamine: **22%**
- Propofol: **33%**
- Driven mainly by brief vasopressor escalation

MAP difference (over 1 h.)

No sustained benefit

Vasopressor needs

Similar at 1h and 24h

Key Interpretation

- Ketamine provided **modestly higher early MAP**
- No sustained hemodynamic advantage
- No improvement in patient-centered outcomes

Outcomes	Ketamine	Propofol
Day-7 mortality	33%	23.8%
ICU mortality	59.3%	47.6%
Hospital mortality	60.4%	50%

Numerically higher mortality with ketamine

Trial not powered for mortality

KETAMIN A ETOMIDÁT

ETOMIDÁT

- modulátor $GABA_A$ receptorů
- hemodynamická stabilita
- útlum produkce kortisolu
  - už od jednotlivého podání
  - až 72 hod
  - reverzibilní inhibice 11β-hydroxylázy

KETAMIN

- NMDA receptory + další mechanismy
- zvyšuje hladinu katecholaminů (v šoku?)
- vazodilatační účinky
- negativně inotropní efekt
- anestezie, algeziologie, antidepresivum, …

- v US etomidát hojně používán k RSI na ED
- starší studie naznačovaly vyšší mortalitu při podání etomidátu (i jednorázově)

KETAMIN A ETOMIDÁT

The NEW ENGLAND JOURNAL of MEDICINE
Published December 9, 2025
DOI: 10.1056/NEJMoa2511420

Ketamine or Etomidate for Tracheal Intubation of Critically Ill Adults

Casey JD, et al.

- podání full – intermediate – reduced dose
  - ketamin 2 – 1,5 – 1 mg/kg
  - etomidát 0,3 – 0,25 – 0,2 mg/kg
- ostatní (tekutiny, presory, relaxancia) dle rozhodnutí klinika
  - 99,7 % relaxace, 2% propofol, bdzp, opiát
- primary outcome: mortalita D28
- secondary outcome: cardiovascular collapse

6 center: 6 ED a 8 ICU

2367 pacientů (1176 ketamin, 1189 etomidát)

- průměr 60 let
- 46,7% sepse
- vyřazena **traumata**

„CARDIOVASCULAR COLLAPSE“

- TK_{sys} < 65 mmHg
- nasazení vazopresorů
- zástava oběhu
- od zahájení podání léků do 2 min po OTI

KETAMIN A ETOMIDÁT

The NEW ENGLAND JOURNAL of MEDICINE
Published December 9, 2025
DOI: 10.1056/NEJMoa2511420

Ketamine or Etomidate for Tracheal Intubation of Critically Ill Adults

Casey JD, et al.

ketamin 1.6 mg/kg
etomidát 0.28 mg/kg

Outcomes.

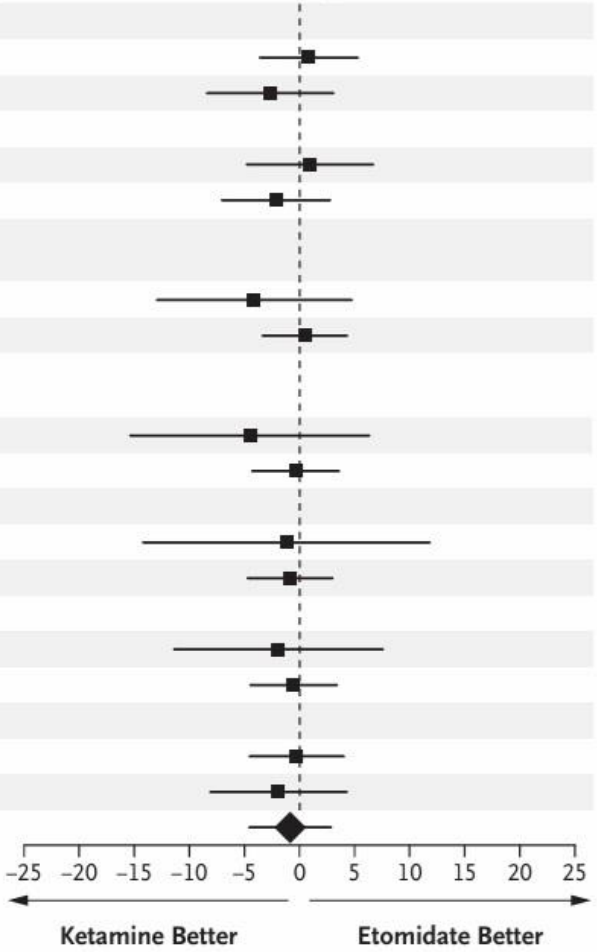
Outcome	Ketamine (N=1176)	Etomidate (N=1189)	Difference (95% CI)*
Primary outcome: in-hospital death from any cause by day 28 — no. (%)†	330 (28.1)	345 (29.1)	−0.8 (−4.5 to 2.9)‡
Secondary outcome: cardiovascular collapse during the interval between induction of anesthesia and 2 minutes after intubation — no. (%)	260 (22.1) **sepse 30.6 %**	202 (17.0) **20.9%**	5.1 (1.9 to 8.3)
Systolic blood pressure <65 mm Hg§ **< 80 mmHg**	73 (6.4) **14.4 %**	64 (5.5) **10.6 %**	0.9 (−1.0 to 2.8)
Receipt of a new or increased dose of vasopressors	251 (21.3)	189 (15.9)	5.4 (2.3 to 8.6)
Cardiac arrest	12 (1.0)	10 (0.8)	0.2 (−0.6 to 1.0)

The NEW ENGLAND JOURNAL of MEDICINE
Published December 9, 2025
DOI: 10.1056/NEJMoa2511420

Ketamine or Etomidate for Tracheal Intubation of Critically Ill Adults

Casey JD, et al.

Subgroup	Ketamine	Etomidate
	no. of patients with event/total no. of patients (%)	
Location of intubation		
Emergency department	128/661 (19.4)	121/653 (18.5)
Intensive care unit	202/512 (39.5)	224/533 (42.0)
Sepsis or septic shock		
Yes	209/538 (38.8)	215/563 (38.2)
No	121/635 (19.1)	130/623 (20.9)
Vasopressor use <1 hr before enrollment		
Yes	115/246 (46.7)	136/273 (49.8)
No	215/927 (23.2)	209/913 (22.9)
Adrenal insufficiency or long-term glucocorticoid use		
Yes	45/136 (33.1)	48/129 (37.2)
No	285/1037 (27.5)	297/1057 (28.1)
Acute neurologic condition		
Yes	44/125 (35.2)	45/120 (37.5)
No	286/1048 (27.3)	300/1066 (28.1)
Acute cardiac condition		
Yes	87/216 (40.3)	95/222 (42.8)
No	243/957 (25.4)	250/964 (25.9)
APACHE II score		
<20	118/649 (18.2)	123/658 (18.7)
≥20	212/524 (40.5)	222/528 (42.0)
Overall	**330/1173 (28.1)**	**345/1186 (29.1)**



CONCLUSIONS

Among critically ill adults undergoing tracheal intubation, the use of ketamine to induce anesthesia did not result in a significantly lower incidence of in-hospital death by day 28 than etomidate.

Hypotension, receipt of vasopressors, and ventricular tachycardia during intubation each appeared to be more common with ketamine than with etomidate.

Our findings do not rule out the possibility of small differences in outcomes in favor of either ketamine or etomidate.

KETAMIN A ETOMIDÁT

Critical Care Medicine

Greer A., et al.

Ketamine Versus Etomidate for Rapid Sequence Intubation: A Systematic Review and Meta-Analysis of Randomized Trials

53(2):p e374-e383, February 2025.

7 studií, 2384 pac.

ketamine when compared with etomidate:

- probably increases hemodynamic instability in the peri-intubation period
- probably decreases the need for initiation of continuous infusion vasopressors
- results in less adrenal suppression
- probably has no effect on successful intubation on the first attempt
- probably has no effect on the maximum SOFA score during the first 3 days in ICU
- may have no effect on mortality

We suggest there is no difference between etomidate and other induction agents administered for RSI with respect to mortality or the incidence of hypotension or vasopressor use in the peri-intubation period and through hospital discharge.

Quality of Evidence: Moderate

Conditional | **Induction Agent Selection** | **Induction agent**

Society of Critical Care Medicine

Crit Care Med. 2023 Oct;51(10):1411-1430.

Guidelines for Rapid Sequence Intubation in the Critically Ill Adult Patient

AWAKE INTUBACE

- velmi málo dat v kontextu emergentní intubace nebo „physiologically difficult airway“
- původně hlavně fibroskopicky (AFOI – awake fibrooptic intubation)
- během pandemie COVID nárůst awake intubací videolaryngoskopem

Difficult Airway Society

- **ATI:FB**
  - awake tracheal intubation with flexible bronchoscope
- **ATI:VL**
  - … with videolaryngoscope

- úspěšnost intubace ATI:FB a ATI:VL stejná
  - jedinou výjimkou omezené otevření úst
- ATI:VL o něco rychlejší
- u ATI:FB stejná úspěšnost nosem i ústy
- u ATI:VL není rozdíl mezi typy laryngoskopů
- zmínky o **VAFI** – video assisted fibreoptic intubation
- renesance regionálních technik v oblasti laryngu??



AWAKE INTUBACE

DAS ATI technique

Anaesthesia 2020, 75, 509–528

Recommendations

1. Awake tracheal intubation must be considered in the presence of predictors of difficult airway management.
2. A cognitive aid such as a checklist is recommended before and during performance of awake tracheal intubation.
3. Supplemental oxygen should always be administered during awake tracheal intubation.
4. Effective topicalisation must be established and tested. The maximum dose of lidocaine should not exceed 9 $mg.kg^{-1}$ lean body weight.
5. Cautious use of minimal sedation can be beneficial. This should ideally be administered by an independent practitioner. Sedation should not be used as a substitute for inadequate airway topicalisation.
6. The number of attempts should be limited to three, with one further attempt by a more experienced operator (3 + 1).
7. Anaesthesia should only be induced after a two-point check (visual confirmation and capnography) has confirmed correct tracheal tube position.
8. All departments should support anaesthetists to attain competency and maintain skills in awake tracheal intubation.

OXYGENATE

- Apply HFNO early
- Titrate HFNO from 30–70 $l.min^{-1}$
- Continue HFNO throughout procedure

TOPICALISE

- Lidocaine 10% spray to oropharynx, tonsillar pillars, base of tongue
- 20 – 30 sprays (during inspiration, over 5 min)
- If nasal route: co-phenylcaine spray
- Test topicalisation atraumatically
- If inadequate, re-apply LA up to maximum dose:
  - Further 5 sprays of lidocaine 10% to tongue base
  - 2 ml lidocaine 2% (x 3) spray above, at and below vocal cords via epidural catheter/working channel of FB or using MAD

Lidocaine
- 1 spray (0.1 ml) of 10% = 10 mg
- 1 ml of 2% = 20 mg

Co-phenylcaine
- 2.5 ml = 125 mg lidocaine + 12.5 mg phenylephrine

PERFORM

- Select appropriate tracheal tube
- Patient sitting up
- Ensure operator can readily see patient monitor, infusion pumps and video screen
- Clear secretions
- For ATI:FB
  - Operator positioned facing patient
  - Consider bronchoscope airway if oral route
  - Bevel facing posteriorly
- For ATI:VL
  - Operator positioned behind patient
  - Consider bougie
- Before induction of anaesthesia: two-point check



SEDATE

- Sedate if required
- Remifentanil TCI (Minto) Ce 1.0–3.0 $ng.ml^{-1}$
- If second anaesthetist present, consider adding midazolam 0.5–1 mg

Take home message

- koncept „physiologically difficult airway“
- kardiovaskulární komplikace intubace jsou časté (na ICU >40%)
- peri-intubační kardiovaskulární kolaps zvyšuje mortalitu
- predikce obtížná, šokový index (HR/SPB) dobrým varováním
- velmi důležitá preoxygenace – zvážit NIV? medication-assisted?
- etomidát hojně využíván, zřejmě nezvyšuje mortalitu
- ketamin není zárukou oběhové stability
- málo srovnávacích dat na propofol, dostupná prevalenční data spíše proti
- neopomínat možnost awake intubace



Děkuji za pozornost

Journal of Intensive Care — BMC — Kotani et al. Journal of Intensive Care (2026) 14:42

REVIEW

The hemodynamics of tracheal intubation in critically ill patients: a narrative review

Pulmonary Therapy, 2025 Oct 16;11(4):569–585. Garcia SI, et al.

Peri-intubation Cardiovascular Collapse During Emergency Airway Management

Society of Critical Care Medicine — The Intensive Care Professionals

Crit Care Med. 2023 Oct;51(10):1411-1430.

Guidelines for Rapid Sequence Intubation in the Critically Ill Adult Patient