

Prehospital luftvägshantering



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Prehospital luftvägshantering



Agenda

Prehospital Advanced Airway Management

- Bakgrund
- När, Var, Vem & Hur
- Praktiska tips

Prehospital analgesi

VARFÖR ?

Is there a need for a secure airway?

- Hypoxia common on scene in trauma¹
- Hypoxia and hypercarbia associated with increased morbidity and mortality in TBI^{2 3}
- Aspiration is bad

1. Stochetti et al. Hypoxemia and arterial hypotension at the accident scene in head injury. J Trauma. 1996 May;40(5):764-7

2. Chi JH, Knudson MM, Manley GT et al. Prehospital hypoxia affects outcome in patients with traumatic brain injury: a prospective multicenter study. J Trauma. 2006 Nov;61(5):1134-41.

3. Sherren PB et al. Curr Opin Anesthesiol 2012



Is there a need for a secure airway?

- Hypoxia common on scene in trauma¹
- Hypoxia and hypercarbia associated with increased morbidity and mortality in TBI^{2 3}
- Aspiration is bad
- ETI is gold standard in hospital

Patient/pathology have no respect for geography

1. Stochetti et al. Hypoxemia and arterial hypotension at the accident scene in head injury. J Trauma. 1996 May;40(5):764-7

2. Chi JH, Knudson MM, Manley GT et al. Prehospital hypoxia affects outcome in patients with traumatic brain injury: a prospective multicenter study. J Trauma. 2006 Nov;61(5):1134-41.

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Skäl för PHETI



Karolinska
Institutet

Pre-hospital critical care anaesthesiologists' reasons for considering pre-hospital advanced airway management (n = 347)

Indication	Total*	%
Decreased level of consciousness	122	<u>35.2</u>
Hypoxemia	67	<u>19.3</u>
Ineffective ventilation	55	<u>15.9</u>
Existing airway obstruction	4	1.2
Impending airway obstruction	27	<u>7.8</u>
Anaesthesia to combative or agitated patient	3	0.9
Anaesthesia for pain relief or distress	5	1.4
Cardiac arrest	197	<u>56.8</u>
Other indications	10	2.9

*Physicians may have more than one reason for considering pre-hospital advanced airway management.

Rognås *et al.*

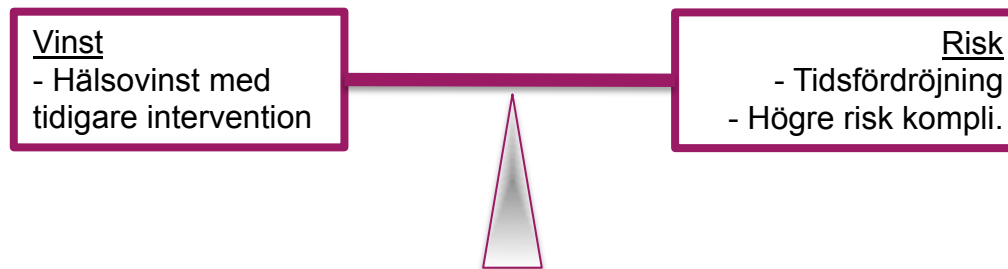
Rognås *et al. Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine* 2013 **21**:75 doi:10.1186/1757-7241-21-75



VAR ?

Hospitalt eller prehospital?

- Sjukhus
 - Kontrollerad miljö
 - Tränad assistant
 - Tillgång till kollegor
- Prehospital
 - Okontrollerad miljö
 - Variabel assistans
 - Isolerad



Prehospital Airway



PHAAM problem

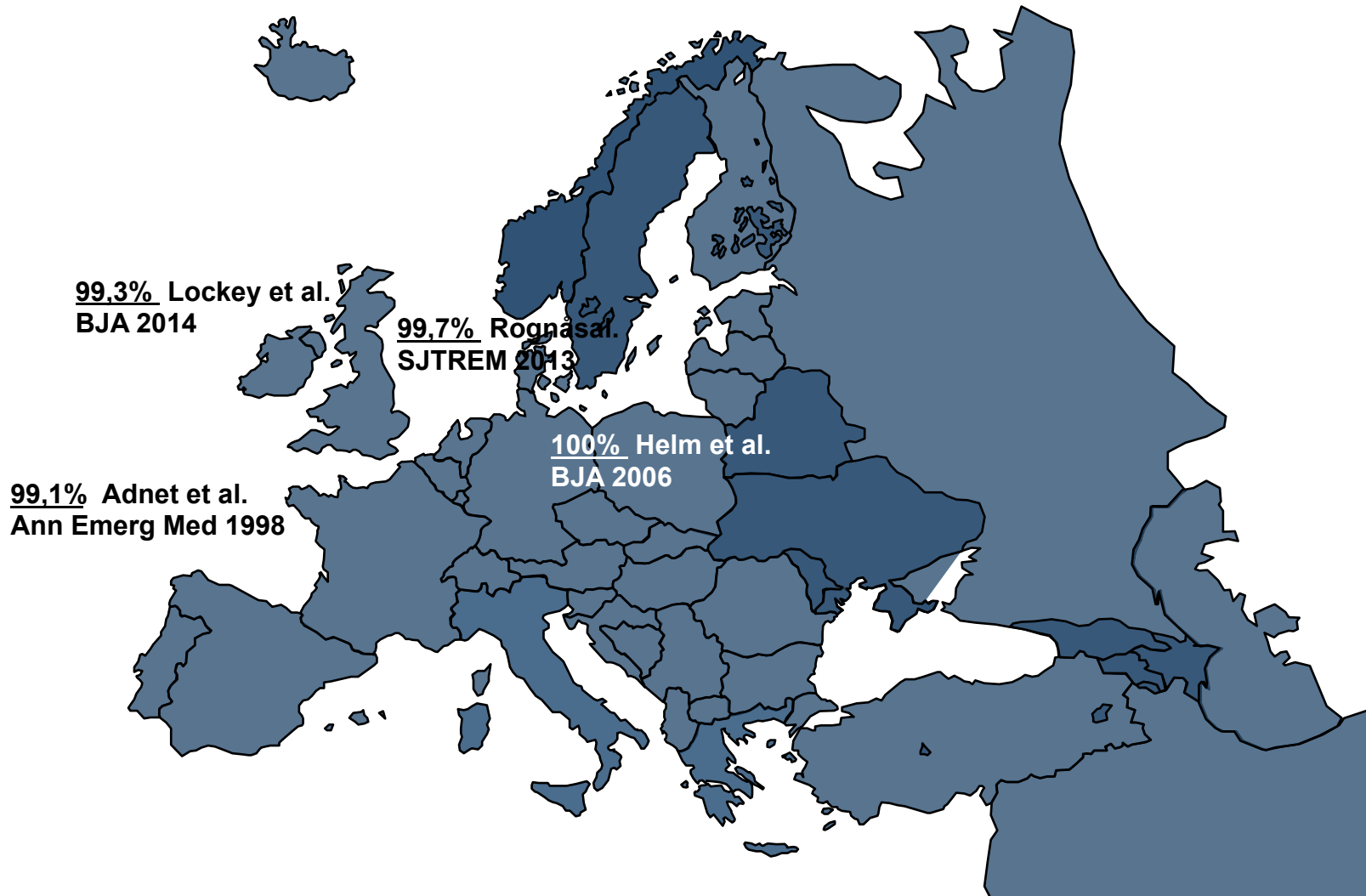
Uppskjutande av PHETI

Prehospital critical care anaesthesiologists' reasons for pre-hospital critical care anaesthesiologists postponing pre-hospital advanced airway management (PHAAM) (n = 347)

Reason for postponing/withholding PHAAM*	Patients in total Number (% of the 347 patients)	ETI** in ED*** Number (% of total number in row)	Difficult ETI in ED Number (% of total number in row)
Expected difficult PHETI****	19 (5.5)	10 (52.6)	2 (20.0)
Difficult access to patient	4 (1.2)	1 (25.0)	0
Short transport time to the ED	64 (18.4)	30 (46.9)	3 (10.0)
The patient's condition	257 (75.1)	15 (5.8)	1 (6.7)
Patient co-morbidity	107 (30.8)	3 (2.8)	1 (33.3)
Insufficient PHAAM training	0	0	0
Insufficient equipment available	1 (0.3)	1 (100.0)	1 (100%)
No assistance available	4 (1.2)	2 (50.0)	0
Other	0	0	0

Rognås et al. *Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine* 2013 **21**:75 doi:10.1186/1757-7241-21-75

PHETI in Europe



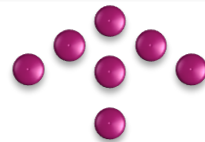
Non-CA(n=1347) prehosp intub

99,3% success

11,0 % > 1 attempt

Survival to hospital - trauma blunt 97%, penetr

94%



Results

2144 prehosp. intub

98,8 % success

14,5 % >1 attempt



Population

21 P-HEMS 2012-2013

Australia, England, Finland, Hungary,
Norway & Switzerland

EM physicians & Anaesthetists

52% >1000 intubation



VEM ?

“Pre-hospital advanced airway management should be delivered to the same standard as in-hospital care.”

“Inexperienced providers have increased complication rates when delivering pre-hospital advanced airway care.”

“Where pre-hospital airway care cannot be delivered to a consistently high standard basic airway management should be the mainstay of treatment.”

Lockey D, Krewdson K, Lossius HM. BJA 2014;113:211-19

Vem ska göra det enl guidelines?

Rehn M, Hyldmo PK, Magnusson V, Kurola J, Kongstad P, Rognås L, Juvet LK, Sandberg M. Scandinavian **SSAI** clinical practice guideline on pre-hospital airway management. Acta Anaesthesiol Scand. 2016 Aug;60(7):852-64.

Jensen AG, Callesen T, Hagemo JS, Hreinsson K, Lund V, Nordmark J; Clinical Practice Committee of the Scandinavian Society of Anaesthesiology and Intensive Care Medicine. Scandinavian clinical practice guidelines on general anaesthesia for emergency situations. Acta Anaesthesiol Scand. 2010 Sep;54(8):922-50.

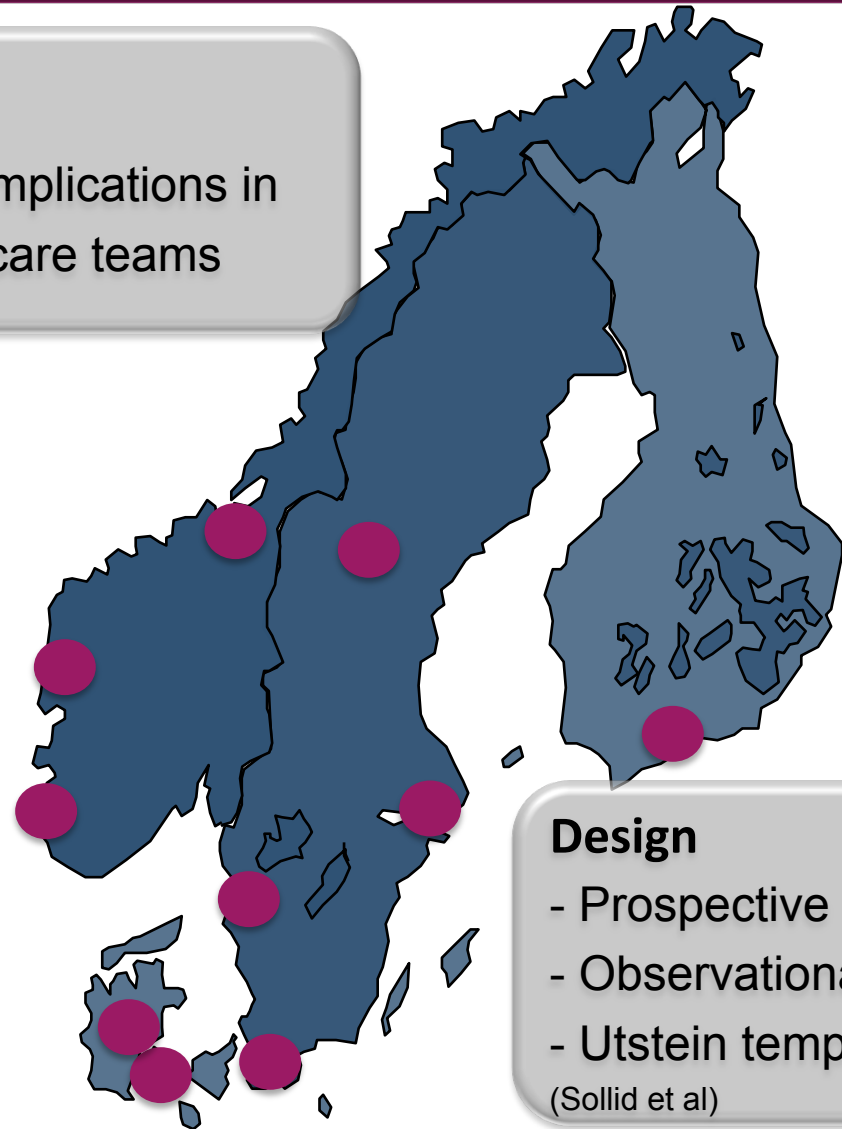
Prolonged laryngoscopy may shift the focus of care and delay other life-saving procedures. The task force recommends that pre-hospital RSI should at least meet the same standards as in-hospital emergency RSI

Hur går det med PHETI i Norden?



Aim

PHETI success rate and complications in anaesthetist staffed critical care teams



Design

- Prospective
- Observational
- Utstein template

(Sollid et al)

Norway	Stavanger HEMS Trondheim HEMS Bergen HEMS	Physician Ane. Physician Ane. Physician Ane.
Sweden	Stockholm HEMS Stockholm RRC Stockholm RRC 1&2 Gothenburg HEMS/RRC Skåne Ambulance Östersund HEMS	Nurse Ane. Physician Ane. Nurse Ane. Physician Ane. Nurse Phys./Nurse Ane.
Denmark	Århus RRC Odense RRC	Physicians Ane. Physician Ane.
Finland	Helsinki HEMS	Physician Ane.

PHAST - Baseline characteristics

Provider data	Number (tot 2005)	%
Anaesthetist	1345	67.1
Anaesthetist registrar	115	5.7
EM Physician	30	1.5
Internal medicine	9	0.4
Nurse anaesthetist	506	25.2

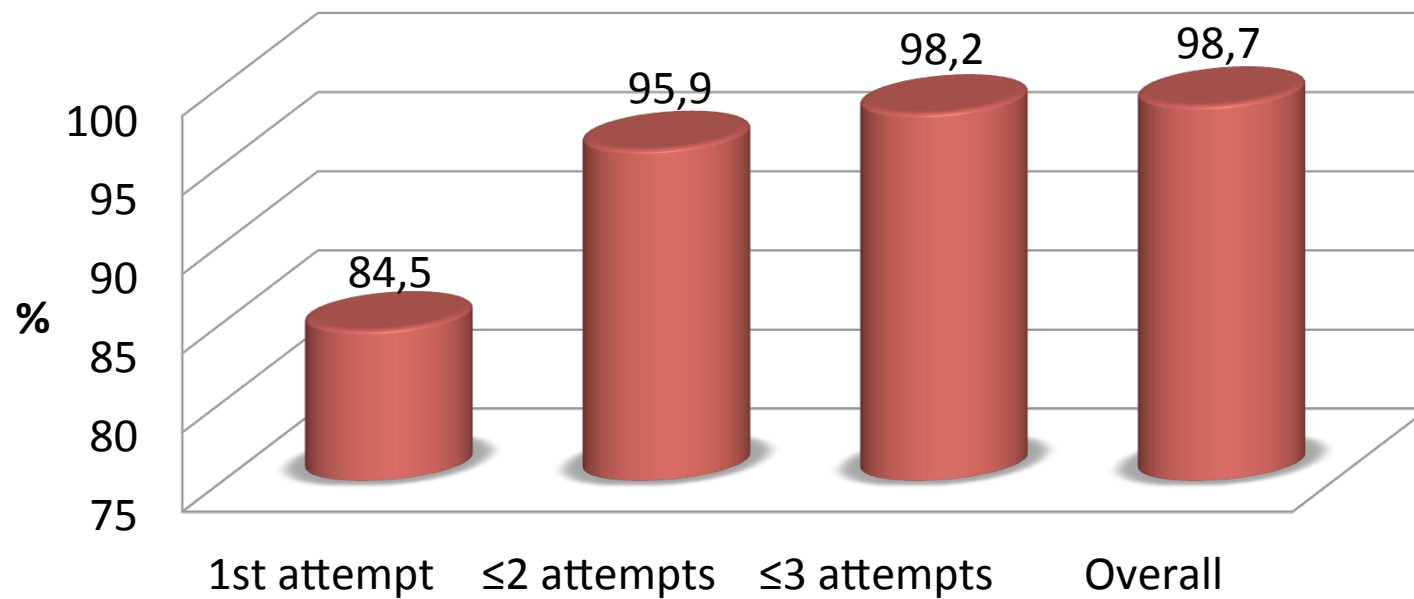
No of TI	Number (tot 2002)	%
50-200	14	0.7
200-2500	647	32.3
2500-10000	1233	61.6
>10000	108	5.4

Patient data			
Total pts		2028	
Age	median	62 y	IQR 28.9
Males		1319/1972	66.9

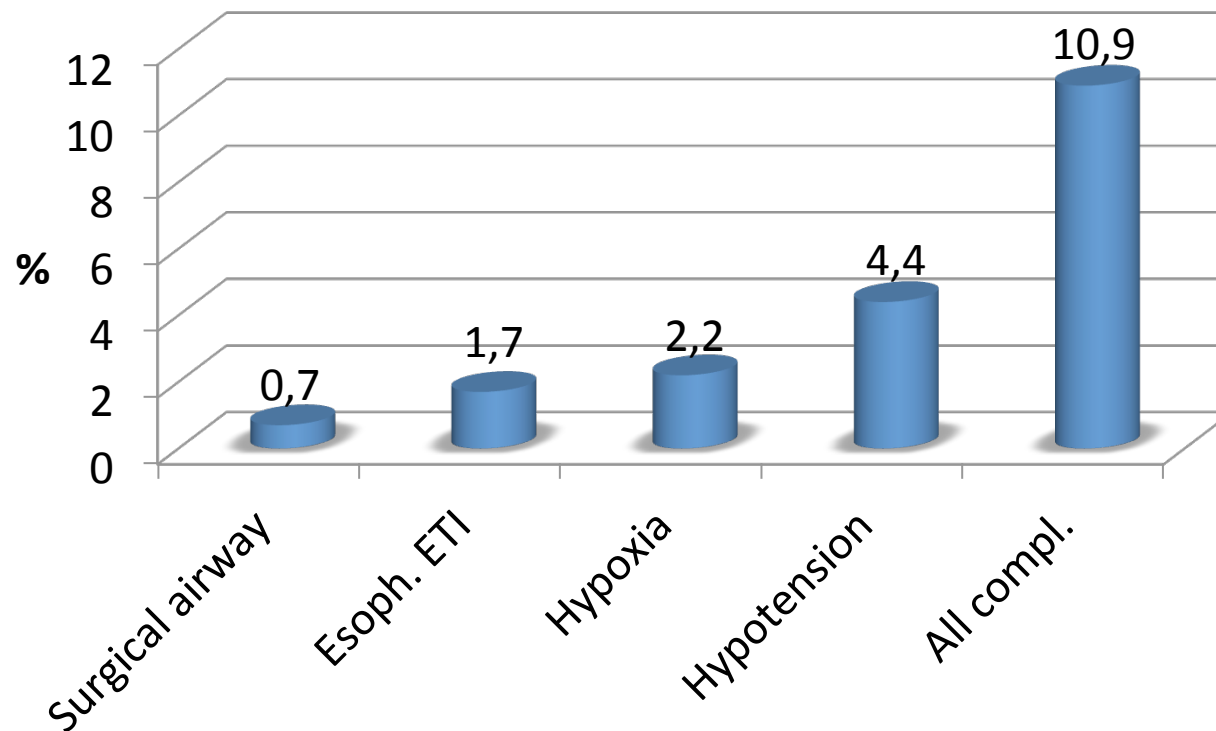
Patient categories	Number (tot 2028)	
Trauma total	387	19.1
Penetrating trauma	31	1.5
Cardiac arrest	1075	53
Medical other total	533	26.3

VERY EXPERIENCED AIRWAY PROVIDERS

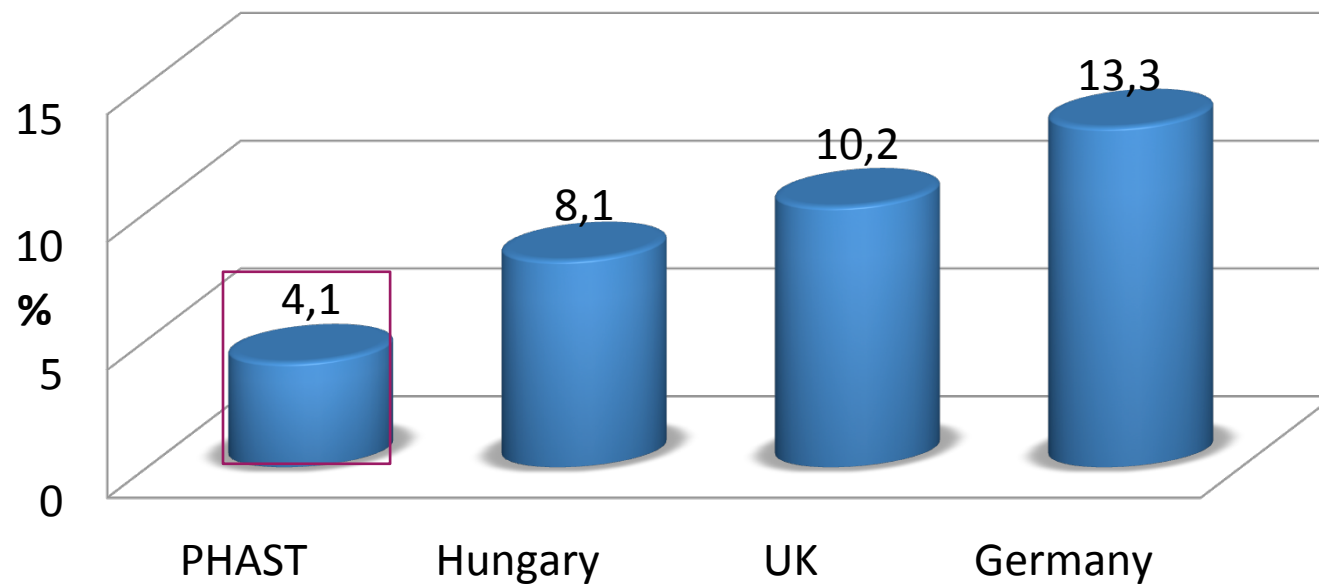
Successrate



Complications



Post RSI hypoxia



The worlds largest prospective study on prehospital intubation by anaesthesiology personell (n=2028)

Very experienced providers (67,0 % >2500 ETI)

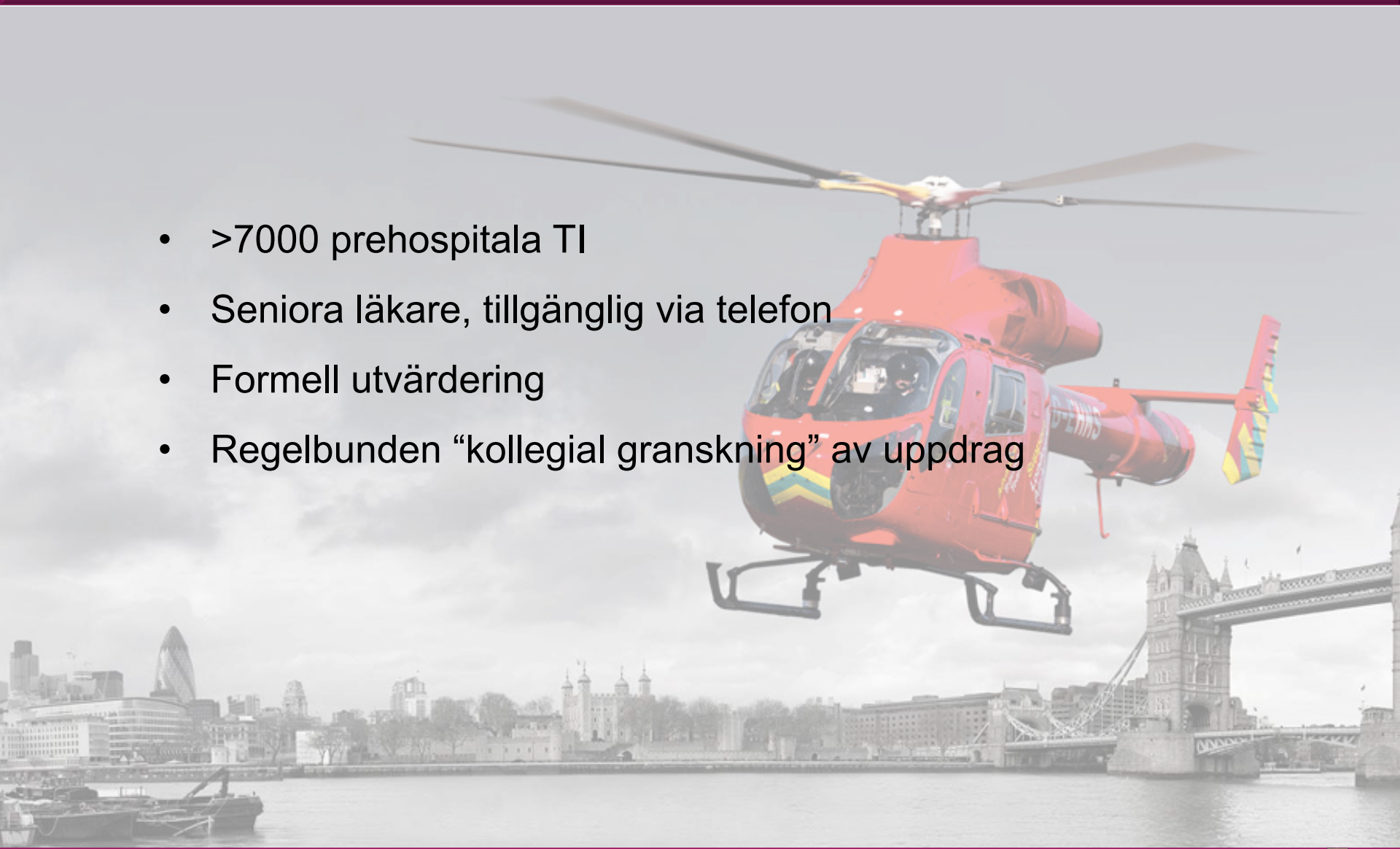
High intubation success rate (98,7%) and few (10,9 %) complications

Short intubation time (25s, IQR 15 s) och on-scene time (25 min, IQR 15 min)

HUR ?

Hur gör London HEMS

- >7000 prehospitala TI
- Seniora läkare, tillgänglig via telefon
- Formell utvärdering
- Regelbunden “kollegial granskning” av uppdrag



B – Bag (om korrekt stängd finns allt på plats)

B – BVM (endast Ruben ligger ej i luftvägsväskan)

B – Brief (indikation, induktionsdos, svår luftväg)

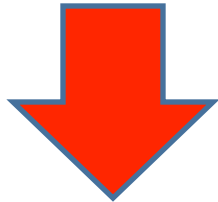
B – Brains (pupiller, GCS, fokalneurologi)

Sjukhusstandard på monitoreringen och “Kit dump”

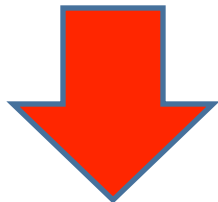


Monitorera ETCO₂

Colorimetric



Capnometry



Capnography



- MILS - remove C-collar
- Maximise 1st pass intubation success
 - Control your environment
 - 360 degree access
 - Optimise position
 - Use bougie for all cases
 - Standardised equipment and techniques
- Formalised failed intubation and oxygenation drills



DL vs VL

Method	Attempt 1	Attempt 2	Attempt 3	Attempt 4	Attempt 5
	2028	313	68	15	3
Conventional TI	1185 (58.4%)	197 (62.9%)	29 (42.6%)	1 (6.7%)	0
Video laryngoscope	843 (41.6%)	99 (31.6%)	28 (41.1%)	8 (53.3%)	1 (33.3%)
Surgical airway	0	4 (1.3%)	4 (5.9%)	0	2 (66.7%)
SGA	0	13 (4.2%)	7 (10.3%)	6 (40.0%)	0

1st attempt success rate was higher with videolaryngoscopy vs direct laryngoscopy (92.9% vs. 78.6%, $p < 0.01$).

FinnHEMS (anaesthetist-staffed HEMS) C-MAC PM + bougie (Frova intubating introducer) 22 months prospective observational trial (n = 543) and compared with controls (n = 238) treated in the previous year

The mean first-pass success rate was 98.2% (96.6–99.0%) in the study group and 85.7% (80.7–89.6%) in the control group, $p < 0.0001$.

- | | |
|---------------------------|----------------------------------|
| 1. Livlös | Hjärtstillestånd, hypotermi |
| 2. Luftvägsproblem | Övre luftvägshinder, sekundärt |
| 3. Respiratorisk svikt | Thxskada, inhalationsskada, KOL |
| 4. Skallskada GCS<9 | TBI; Status Ep, Stroke, postROSC |
| 5. Cirkulatorisk chock | Blödning, hjärtsvikt |
| 6. Analgesi/humanitärt | Stora skador |
| 7. Transportskäl | Orolig patient |
| 8. Blir ändå gjort på sjh | För undersökning, kirurgi |

1. CA & phTI - CAAM study

Out-of-hospital cardiac arrest

- N=2043
- Randomisation
- 15 centres
France, 5
Belgium

1° = 28 d survival
with good neurol
outcome (CPC≤2)

BMV

Intubation

Endpoint

1°

4,2% BMV
4,3% ETI

Failed airway
6,7% BMV
2,1% ETI

Aspiration
15,2% BMV
7,5% ETI

"The best technique is dependent on the precise circumstances of the cardiac arrest and the competence of the rescuer"

- The risk of an unrecognised misplaced trachealtube
- A prolonged period without chest compressions
- A comparatively high failure rate

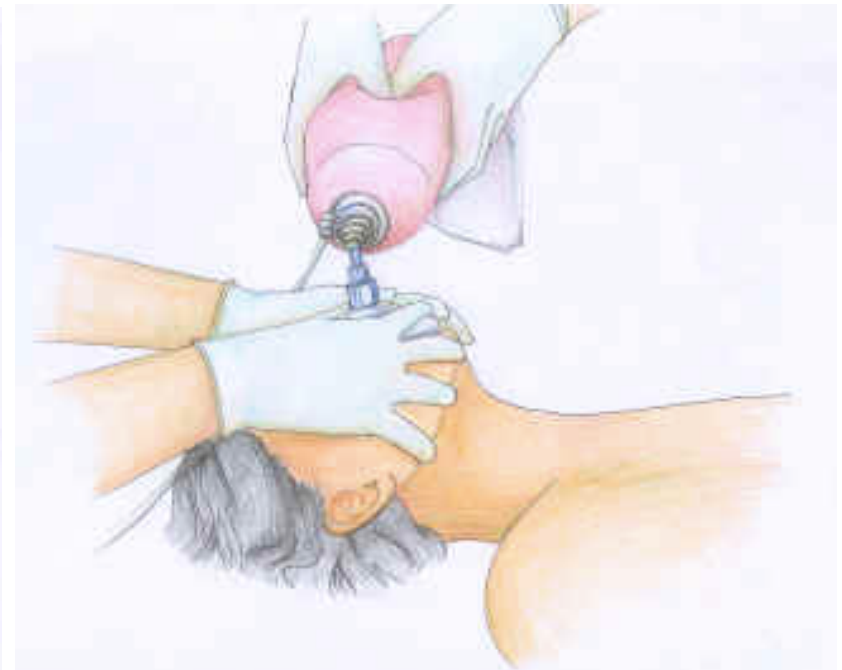
-> Personnel skilled in advanced airway management should be able to undertake laryngoscopy without stopping chest compressions

Airway Management & Ventilation

Pre ROSC - maximal FiO₂ (reservoir system, O₂ 10l/min, no data on optimal SaO₂)

- each breath about 1 s (avoid high inflation pressure)
- After TI/SGA -> RR 10/min

Post ROSC - SaO₂ 94-98%



J. Soar et al. Resuscitation 2015;95):100-147

- Intubera inte de som snabbt och tydligt vaknar
- Intubera alla andra
- Hur ska detta göras?
 - RSI
 - Noggrann hemodynamisk kontroll
 - Undvik hyperoxemi

- Dålig ergonomi
- Prioritera kompressioner!!
- Lyft larynxöppningen ur "kräksjön"
- Underskatta inte risken för felintubation
 - EtCO₂
 - Inte förväntad effekt av HLR
- Hyperventilera inte
- Hyperoxygenera inte



- Traumatiska ansiktsskador
 - RSI eller “tjuvtitta” med Ketalar
 - leta bubblor, ev trycka på thorax
 - Ofta bättre “längre ner”
 - Cave hals/larynxskador
 - Svullnar fort
 - Videolaryngoscop begränsningar vid blödningar
- Diskutera plan och reservplan innan.
 - Koniotomi, “enkelt om enkla förhållanden”



Ketamine increasingly popular induction agent for pre-hospital and emergency department induction and analgesia. Reservations about the use of ketamine in head-injured patients because of the risks of increased intracranial pressure have largely declined ^{1, 2}

1. Morris C, Perris A, Klein J, Mahoney P. Anaesthesia in haemo- dynamically compromised emergency patients: does ketamine represent the best choice of induction agent? *Anaesthesia* 2009; 64:532–9
2. Lockey, Crewdson K, Lossius HM. Pre-hospital anaesthesia: the same but different *British Journal of Anaesthesia*. 2014;113(2): 211–19

Kolenda et al (1996) - Ketamine/midazolam vs. fentanyl/midazolam in moderate to severe head injury – slightly higher ICP and CPP in ketamine group with no difference in outcome

Albanese et al (1997) - propofol sedated ventilated patients with TBI – ketamine produced a decrease in ICP with no change in CPP

Bourgoin et al (2003) - ketamine/midazolam vs. sufentanil/midazolam for moderate to severe TBI – no difference in mean daily ICP or CPP

Bar-Joseph et al (2009) - sedated children with intracranial hypertension randomised to ketamine bolus — ketamine bolus decreased ICP and increased CPP

- The evidence that ketamine elevates ICP is weak
- There is no evidence that ketamine causes harm in TBI
- Ketamine's haemodynamic stability may be of benefit in the patient with traumatic brain injury requiring rapid sequence intubation

Hughes S. Towards evidence based emergency medicine: best BETs from the Manchester Royal Infirmary. BET 3: is ketamine a viable induction agent for the trauma patient with potential brain injury. Emerg Med J. 2011 Dec; 28(12):1076-7.

4. PHETI vid skallskada



- Neuroprotektiv anestesi
 - Skyddad luftväg, kontrollerad ventilation, cerebral metabolism ↓
- Invasiv tryckmonitorering
- Inotropi/pressor
- RSI - Ketamine/Propofol/Pento/Fentanyl
- Kapnografi

Eftersträva din egen sjukhusstandard

Glöm inte resten:

Höjd huvudända

Nackkrage, tubband

Osmoterapi, sedering/relaxering, FiO2 mm



1966-2015, 50 trials with 4151 pts (all ages)

RSI suxamethonium (1 mg/kg) vs rocuronium (min 0,6mg/kg)

”We have found that rocuronium is slightly less effective than succinylcholine for creating excellent and acceptable intubation conditions.”

Tran DTT, Newton EK, Mount VAH, Lee JS, Wells GA, Perry J. 2015.



US Emergency Department TBI intubation 2010-2014 (n=233)
Retrospective cohort, Suxamethonium (n=149) vs rocuronium (n=84)
TBI high severity and low severity group

Mortality high severity group

Rocuroinim 23% (7/30)

Suxamethonium 44% (20/46) (95% CI 14-46)

Multivariatanalysis -> OR 4.10 (95% CI 1.18-14.12)

In severely brain-injured patients undergoing RSI in the ED,
succinylcholine associated with increased mortality vs. rocuronium.

Patanwala AE, Erstad BL, Roe DJ, Sakles JC. Succinylcholine Is Associated with Increased Mortality When Used for Rapid Sequence Intubation of Severely Brain Injured Patients in the Emergency Department. *Pharmacotherapy*. 2016 Jan;36(1):57-63

5. PHETI vid cirkulatorisk chock

Aktiv hypotensiv resuscitering



- Kraftigt minskade doser anestetika
- Ökade doser muskelrelaxering
- Försiktig ventilation och noggrann övervakning
- Förvänta stora cirkulatoriska effekter! - Risk för asystoli/ventrikulära arrytmier

6,7,8. PHETI svaga indikationer

Smärtlindring, Transportskäl, “Blir ändå gjort på akuten”

Försök göra en helhetsbedömning, jämför med de förutsättningar du själv skulle haft på ett akutrum...

- Vilka alternativ finns
- Vilka är dina motiv
- “First Do no harm”

- ## Ha en färdig algoritm



Videolaryngoscope

GlideScope Ranger



Storz C-Mac



**McGrath
(Medtronic)**



**Pentax Airway Scope
(Ambu)**



**Kingvision
(Kingsystems)**

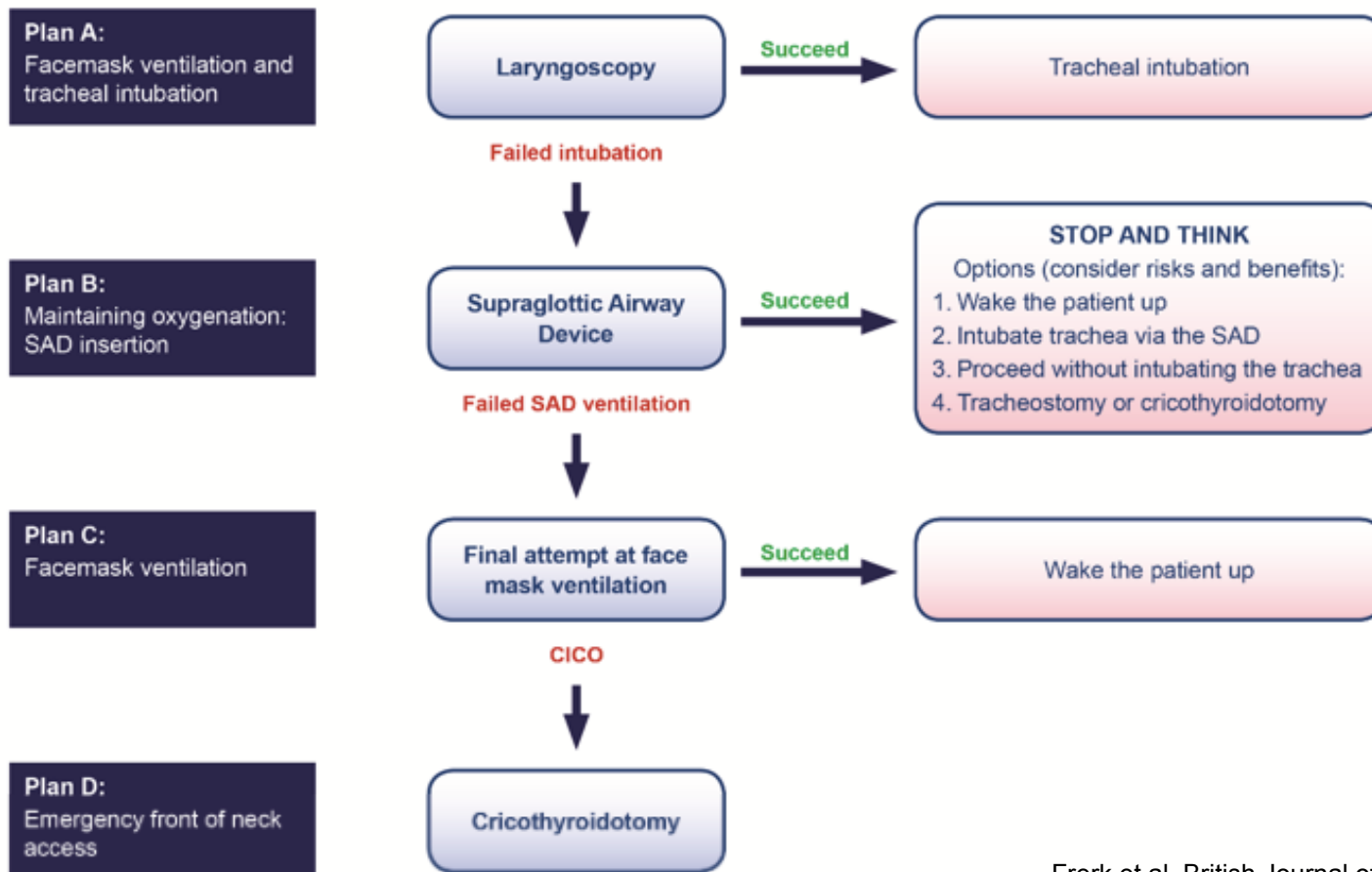


**Airtraq
(Prodrol)**





DAS Difficult intubation guidelines – overview



Frerk et al. British Journal of Anaesthesia, 2015



”Wide-bore cannula kits (Cook, Melker®) use a wire-guided (Seldinger) technique ¹.... The skills required are familiar to anaesthetists and intensivists because of CVC and percutaneous tracheostomy” ²

However,....

”.... these techniques require fine motor control, making them less suited to stressful situations”.

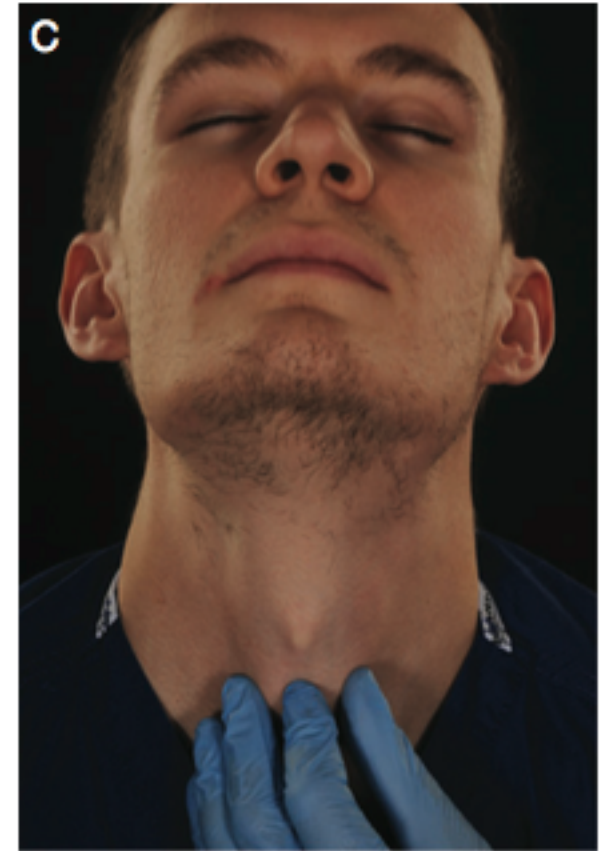
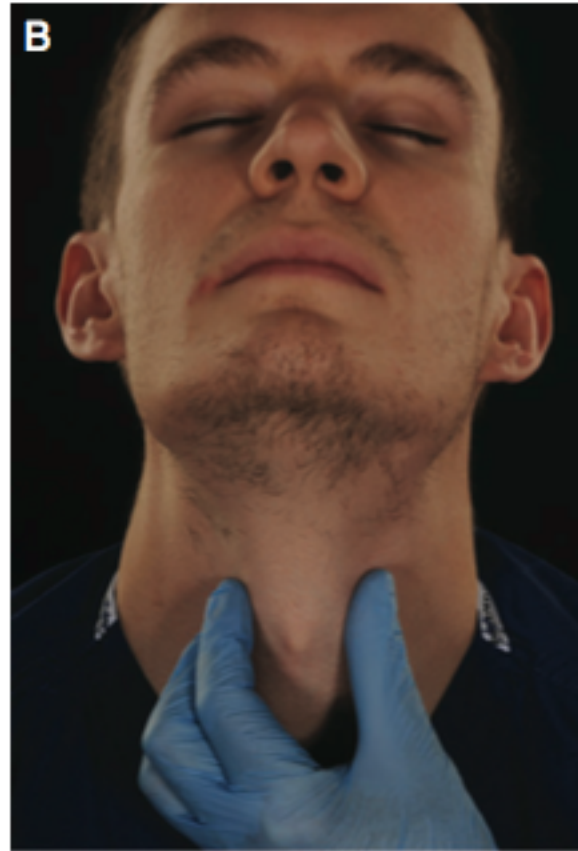
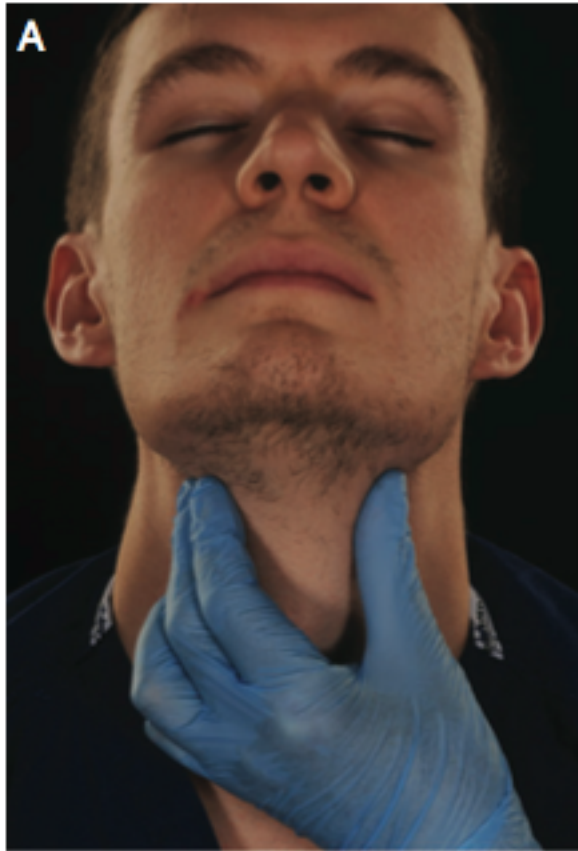
”.... Whilst reasonable alternative for anaesthetists who are experienced with this method, the evidence suggests that a surgical cricothyroidotomy is both faster and more reliable” ³

1. Melker JS, Gabrielli A. Melker Cricothyrotomy Kit: an alternative to the surgical technique. Ann Otol Rhinol Laryngol 2005; 114: 525–8

2. Frerk et al. British Journal of Anaesthesia, 2015

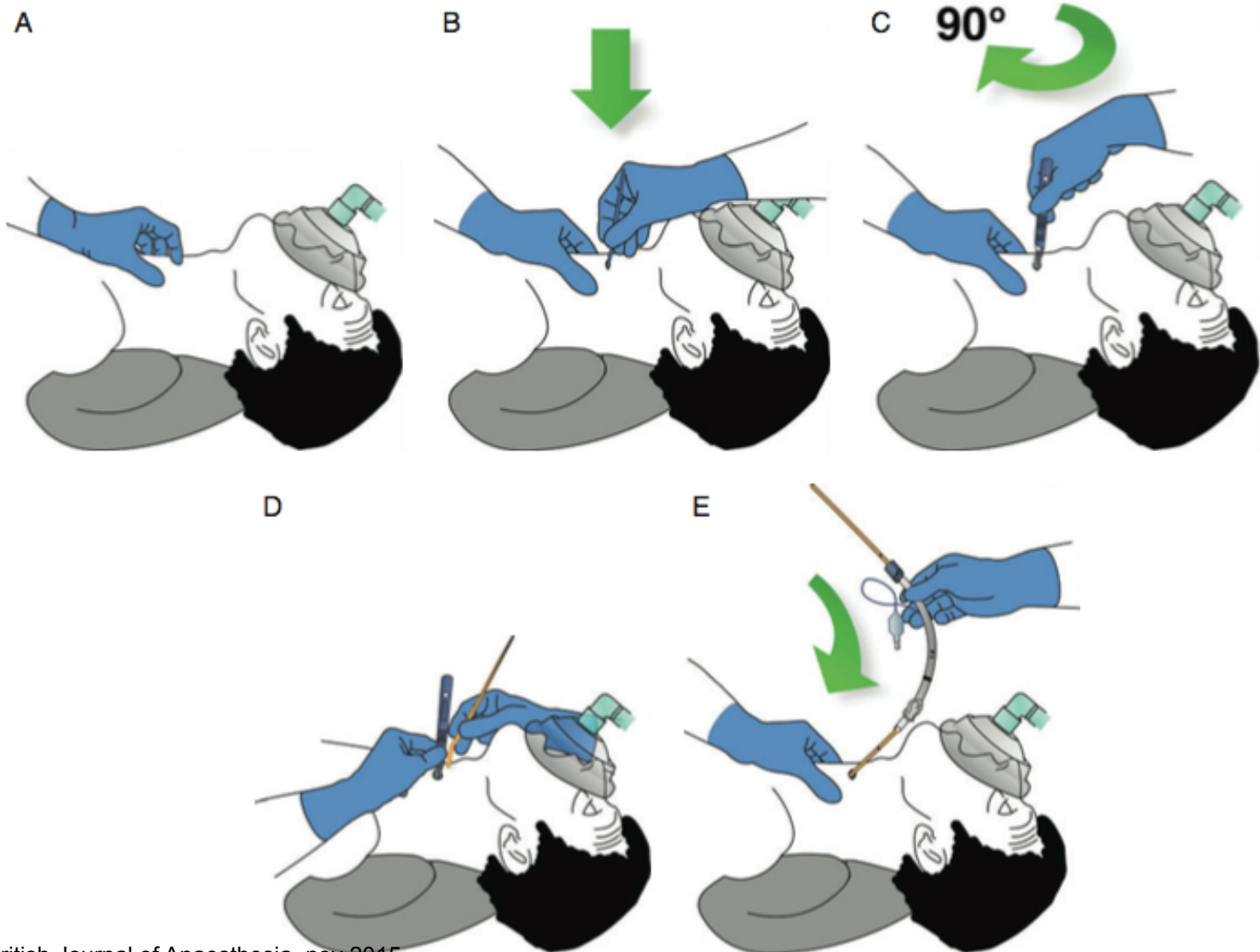
3. Heard AMB et al. The formulation and introduction of a ‘can’t intubate, can’t ventilate’ algorithm into clinical practice. Anaesthesia 2009; 64: 601–8

Laryngeal hand shake method



1. Frerk et al. British Journal of Anaesthesia, nov 2015

Scalpel cricothyroidotomy



1. Frerk et al. British Journal of Anaesthesia, nov 2015

Analgesi

- Behandla med målsättning att nå VAS 3. Börja med att mäta och dokumentera initial VAS
- Börja med inj Morfin 1 mg/ml, 1,0-2,5 ml iv, upprepas tills tillräcklig effekt uppnås. Den låga dosen till äldre eller på annat sätt sköra patienter
- Om otillräcklig effekt

- Fentanyl/rapifen (fentanyl ofta bra bas)
- Tillägg ketamin (20-40 mg) inför smärtsamma moment, ev m 1 mg midazolam
- Glöm ej PONV-profylax innan illamående uppträder

- Ketofol (Ketalar 5 mg/ml + propofol 5 mg/ml)
- Propofol 30-50 mg och efter 1 min Ketalar 40-60 mg, samt vb mer Ketalar

- Iv Esketamin 5 mg/ml, Startdos 0,025-0,05 ml/kg (0,125-0,25 mg/kg) iv Kan upprepas med 1/2 startdosen efter efter 5-15 min.
- Ge intranasalt Esketamin 25 mg/ml, 0,02 ml/kg (0,5 mg/kg), fördelat i båda näsborrarna. Effekt inom 3-10 min. Kan upprepas max 1 gång (totalt 0,04 ml/kg (1,0 mg/kg)
- Ge intranasalt Fentanyl 50µg/ml, 0,03 ml/kg (1,5 µg/kg) max 2 ml. Effekt inom 2-5 min. Kan upprepas med 1/2 dosen tidigast efter 15 min. Effektduration 20-30 min.

- Anestetisk effekt genom selektiva avbrott av associationsbanor i hjärnan
- Muskeltonus förblir normal eller något ökad
- Farynx- och larynxreflexer påverkas vanligen inte
- Stimulerande effekt på kardiovaskulära och respiratoriska system
- Bronkdilaterande

- För att mildra bieffekterna av Esketamin kan inj Midazolam 1 mg/ml, 1 ml (1 mg) iv ges.
- Vb Alfentanil 0,5 mg/ml, 0,5–1,0 (0,25–0,5 mg) iv i upprepade doser till önskad effekt.
- Paracetamol 1g

Frågor/diskussion?

