

Prehospital luftvägshantering & anestesi/analgesi



Agenda

- Prehospital Advanced Airway Management
 - Bakgrund
 - När, Var, Vem & Hur
 - Praktiska tips
- Prehospital anestesi/analgesi

Top 5 prehosp. research priorities

1. Pre-hospital critical care: staffing, training and effect
2. Advanced airway management in pre-hospital care
3. Define time window for time critical interventions –what are the time windows for PCC interventions whether pre-or inhospital?
4. Pre-hospital ultrasound
5. Dispatch/activation criteria for pre-hospital critical care services

Fevang E, Lockey D, Thompson J, Lossius HM: The top five research priorities in physician-provided pre-hospital critical care: a consensus report from a European research collaboration. Scand J Trauma Resusc Emerg Med 2011, 19:57.

- Sverige
 - > ambulanssjuusköterska tidigare ca 1 intubation/år (hjärtstillestånd, nu LMA)
 - > VGR helikopter ca 70 intubationer/år
- UK, London HEMS
 - > 1 intubation(RSI)/dag
 - > Afghanistan MERT 1 intubation/dag
- AIRPORT (CCT)
 - > 100 intub/år och helikopter

Fri luftväg 1:a hand basala åtgärder (käklyft/svaljtub/kantarell etc)
2:a hand LMA/intubation

Hjärtstopp

Leg. ssk → supraglottisk luftväg
(l-gel®)

Hjärtstopp

Narkos-ssk → LMA eller intubation

Medvetslös → Akut anestesi = hög risk och får endast utföras av narkossk på vitalindikation (=när fri luftväg och ventilation inte kan etableras på annat sätt).
RSI, Ketalar vid hypovolemi (trauma) och kardiovaskulär instabilitet (annars propofol)

VARFÖR ?

- Hypoxia common on scene in trauma (Stochetti, 1997)
- Airway compromise is a cause of preventable prehospital death (Esposito, 1995)
- Hypoxia and hypercarbia associated with increased morbidity and mortality in TBI (Sherren PB et al. *Curr Opin Anesthesiol* 2012)
- Aspiration is bad
- ETI is gold standard in hospital
- Patient and pathology have no respect for geography

GUIDELINES FOR EMERGENCY TRACHEAL INTUBATION IMMEDIATELY FOLLOWING TRAUMATIC INJURY

An EAST Practice Management Guidelines Workgroup. Michael Dunham, MD

- **Emergency intubation required:**
Airway obstruction, Hypoventilation, Severe hypoxemia, GCS <8, Severe hemorrhagic shock, Smoke inhalation
- Recommendations: Standard RSI
- Securing airway as early as possible is an appropriate aim in pre-hospital care

AAGBI Safety guideline - Prehospital anaesthesia

Skäl för PHETI – Guidelines

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

”Seven published studies indicate that approximately 70% of patients in need of emergency tracheal intubation do not receive it until trauma center arrival. This suggests that a large percentage of critically injured patients have a delay in optimal care”

David Lockey, London HEMS, UK. Scandinavian update

Ni är narkosläkare, det är ni som tar emot patienten på akutrummet och intuberar där?

”Tidig respektive sen intervention”

Vad är problemet?

Varför inte intubera alla prehospitalt som behöver det?

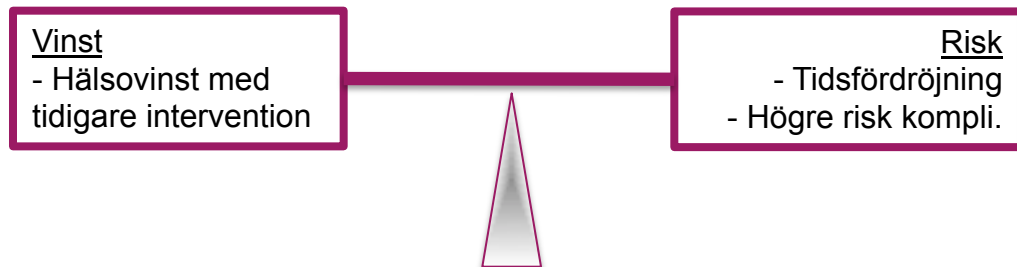
Prehospital Airway



PHAAM problem

Hospitalt eller prehospital?

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



VAR ?

Hospital eller prehospital?



Factors in favour of on-scene RSI	Factors against on-scene RSI
• Impaired airway maintenance and/or protection • Hypoxaemia or hypoventilation, or hyperventilation in patients requiring neuroprotection • Fluctuating or deteriorating level of consciousness • Thermal injury to airway • Penetrating neck injury • Long road or air transfer with risk of deterioration • Polytrauma with requirement for multiple interventions and/or operative procedures • Combativeness • High cervical lesion with diaphragmatic breathing	• Morphology or pathology that may hinder successful intubation (e.g. laryngeal fracture, morbid obesity) • <u>Time critical surgical lesion</u> (e.g. penetrating trauma with shock) • Short distance from most appropriate hospital • Paediatric patients- particularly <5 yo • Hostile environment • Unconducive team dynamics



Uppskjutande av PHETI



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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



Pennsylvania Trauma Registry:

- 4,098 trauma patients
 - 43.9% received prehospital ETI.
 - 56.1% received in-hospital ETI.
- Adjusted rates of death higher for prehospital ETI (OR=3.99 [95% CI=3.21-4.93])
- Chances of poor neurologic outcome were worse for prehospital ETI (OR=1.61 (95% CI=1.15-2.26]).

Wang HE, Peitzman AB, Vassidy LD, Adelson PD, Yealey DM. Out-of-hospital endotracheal intubation and outcome after traumatic brain injury. Ann Emerg Med. 2004;44:439-450.

Sämre outcome:

The San Diego paramedic RSI Study, Davis

- 209 pts, prospective, GCS 3-8, unable to intubate > midaz/sux.
627 unintubated historical ctrls
- Mortality RSI 33% vs Controls 24% ($p < 0,05$)
- “Good outcome” RSI 45% vs Controls 57%
- Reasons?
 - Transient hypoxemia
 - Hyperventilation
 - Longer scene times

Dålig rapportering:

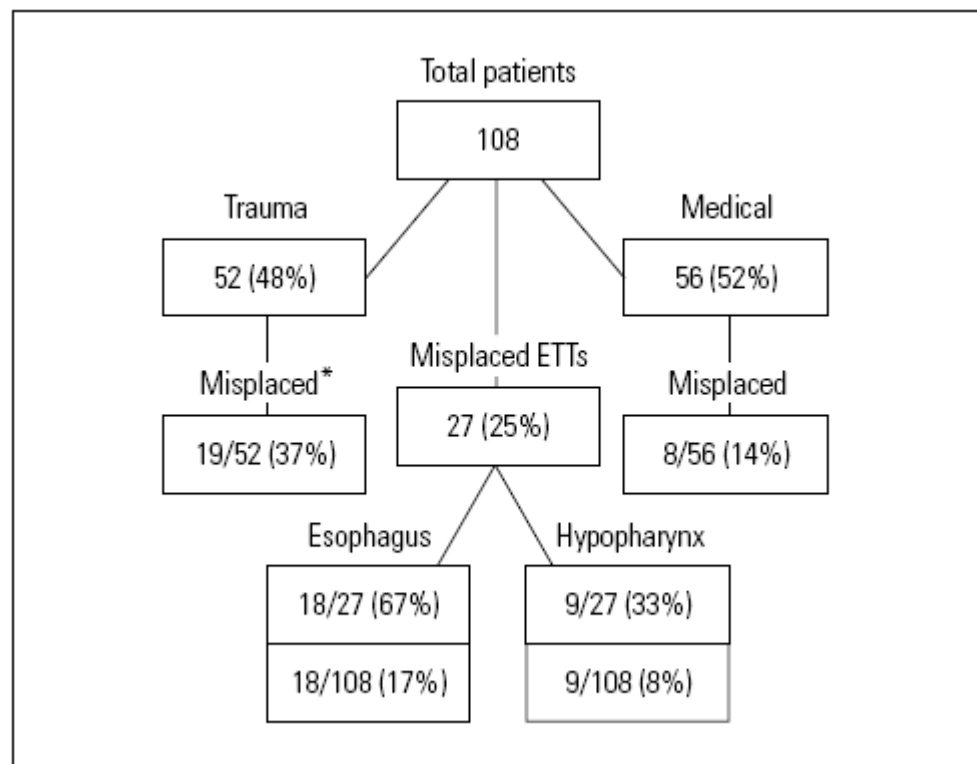
Incidence of transient hypoxia and pulse rate reactivity during paramedic RSI Dunford et al, 2003

- 57% demonstrated significant desaturation
- 19% developed bradycardia
- 84% had good SaO₂ w basic a/w manoeuvres

In 84% of the patients who desaturated
paramedics described RSI as easy

Oupptäckt esofagusintubation

- Wang 2001: 0,4%
- Pelucio 1997: 6%
- Katz 2001: 16,7%
- Jemmet 2003: 12%



Katz SH, Falk JL. Misplaced endotracheal tubes by paramedics in an urban emergency medical services system. *Ann Emerg Med.* 2001;37:32-7

- Vem gör det?
 - > EMT
 - > Paramedics/sjuksköterska
 - > Läkare UNS
 - > Anestesiolog
- Hur görs det?
 - > Intubation utan läkemedel
 - > Sedering
 - > RSI

Skäl emot PHETI - Failed PHETI



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0,9% French physicians (Adnet)

London HEMS 1,3% (trauma)

German physicians 1,5% (Thierbach)

Aus aeromed paramedics 3%(Bernard)

US ground paramedics 7,6% (East)

Nurse aeromed team 20% (Blustein)

*Paramedic, Florida 31% (Cobas)

*Paramedic, Florida 31% (Cobas)
David Lockey, London HEMS, UK. Scandinavian update (excl*)



VEM ?

“Out of Hospital Airway Management in the United States”

NEMESIS data from 16 states in 2008

4.3 million EMS calls

10,356 ETI: success 77%

(Hubble, 2010 showed 86.3% in meta-analysis of 30 studies)

1,794 alternate airways: success 87%

[Combitube, EOA, LMA, King LT]

Wang HE, Mann NC, Mears G, et al. Out-of-hospital airway management in the United States. *Resuscitation* 2011 Apr;82(4):378-85

Hubble MW, Brown L, Wilfong DA, et al. A meta-analysis of prehospital airway control techniques part I: oropharyngeal and nasotracheal intubation success rates. *Prehosp Emerg Care* 14(2010):377-401

- Prehospital ETI often requires multiple attempts,
1,941 cases of prehospital ETI:
 >30% of patients required more than 1 attempt
- Cumulative success rate overall per attempt (for first 3 attempts):
 69.9%, 84.9% & 89.9%
- Cumulative success rate for non-arrest:
 57.6%, 69.2% & 72.7%

Wang HE, Yealey DM. How many attempts are required to accomplish out-of-hospital endotracheal intubation. *Acad Emerg Med*, 2006;13:372-7

Vem ska göra det?

Physician/paramedic team

- 99.4% London HEMS (348/350)
- 98.8% London HEMS (397/402)
- 99.5% GSA-HEMS (185/186)
- 99.1% SAMU France (685/691)
- 100% Germany (342/342)

Mackay CA et al. *Emerg Med J* 2001

Harris T et al. *Resuscitation* 2010

Bloomer R et al. *Emerg Med J* 2012

Adnet F et al. *Ann Emerg Med* 1998

Helm M et al. *Br J Anaesth* 2006

Paramedic

- 97% MICA Victoria (152/157)
- 96% Auckland rescue helicopter(~280)
- 86.7% San Diego (281/209)

Bernard SA et al. *Ann Surg* 2010

Tony Smith

Davis DP et al. *J Trauma* 2003

Do paramedics want to do it?

- 99 London HEMS paramedics were asked if they felt RSI should be part of experienced UK paramedic's practice (courtesy of Prof D Lockey)
 - 65% said yes pre-term at London HEMS
 - Only 32% said yes on completion of their term working for HEMS
- Isolated to London HEMS?

Vilken läkare?

- Erfarenhet
- Specialitet
- Anestesierfarenhet
- Prehospital träning
- Tillgång och kostnad

- UK retrospektiv observationsstudie av 7256 läkare-PHETI pga trauma
- PHETI success rate of 99.3%
- Non-anaesthetists carried out 4394 attempted intubations and failed to intubate in 41 cases (0.9%), whereas anaesthetists attempted to intubate 2587 patients and failed in 11 (0.4%) ($P < 0.02$).
- All rescue airways were successful. Non-anaesthetists were twice as likely to have to perform a rescue airway intervention than anaesthetists.

Lockey D, Crewdson K, Weaver A, Davies G. Observational study of the success rates of intubation and failed intubation airway rescue techniques in 7256 attempted intubations of trauma patients by pre-hospital physicians. British Journal of Anaesthesia 2014;113(2): 220–517

Behövs ane-klinik träning (växeltjänstgöring)?



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Expected number of procedures performed by the individual HEMS physician in full time HEMS engagement per year and expected time between each procedure exposure.

Procedure	n/year	Time between exposure
Paediatric ETI	1.4	8.5 months
Adult ETI	24.8	2 weeks
Surgical airway	0.04	25 years
Chest tube insertion	1.7	7 months
Anaesthesia induction	19.6	2.5 weeks

Anaesthesiologists in Norwegian EMS can expect relatively little exposure pre-hospital to crucial life-saving interventions. Concomitant in-hospital clinical practice and other skills retraining should therefore be maintained to ensure adequate proficiency in these interventions.

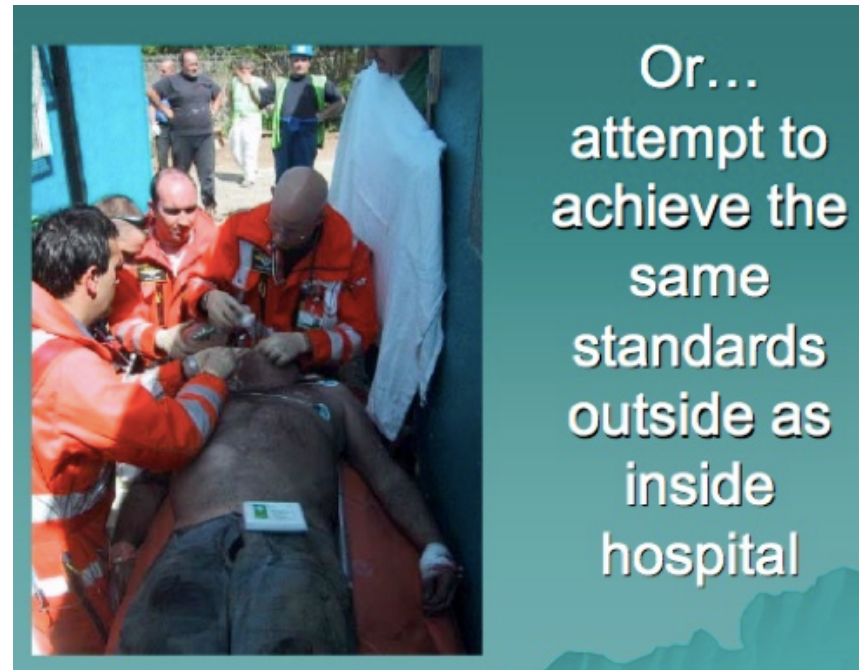
Sollid et al. Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine 2013, 21(Suppl 1):S7



Vem ska göra det?

“Those with the experience, training and competence to perform it and the necessary related skills...”

Eftersträva samma standard
prehospitalt som inhospitalt



Pre-hospital airway management: guidelines from a task force from the Scandinavian Society for Anaesthesiology and Intensive Care Medicine

P. BERLAC, P. K. HYLDMO, P. KONGSTAD, J. KUROLA, A. R. NAKSTAD and M. SANDBERG

Based on recent literature, the SSAI Task Force recommends that:

Prehospital ETI in traumatised patients or medical patients is restricted to anaesthesiologists routined in drug-assisted ETI.

HUR ?



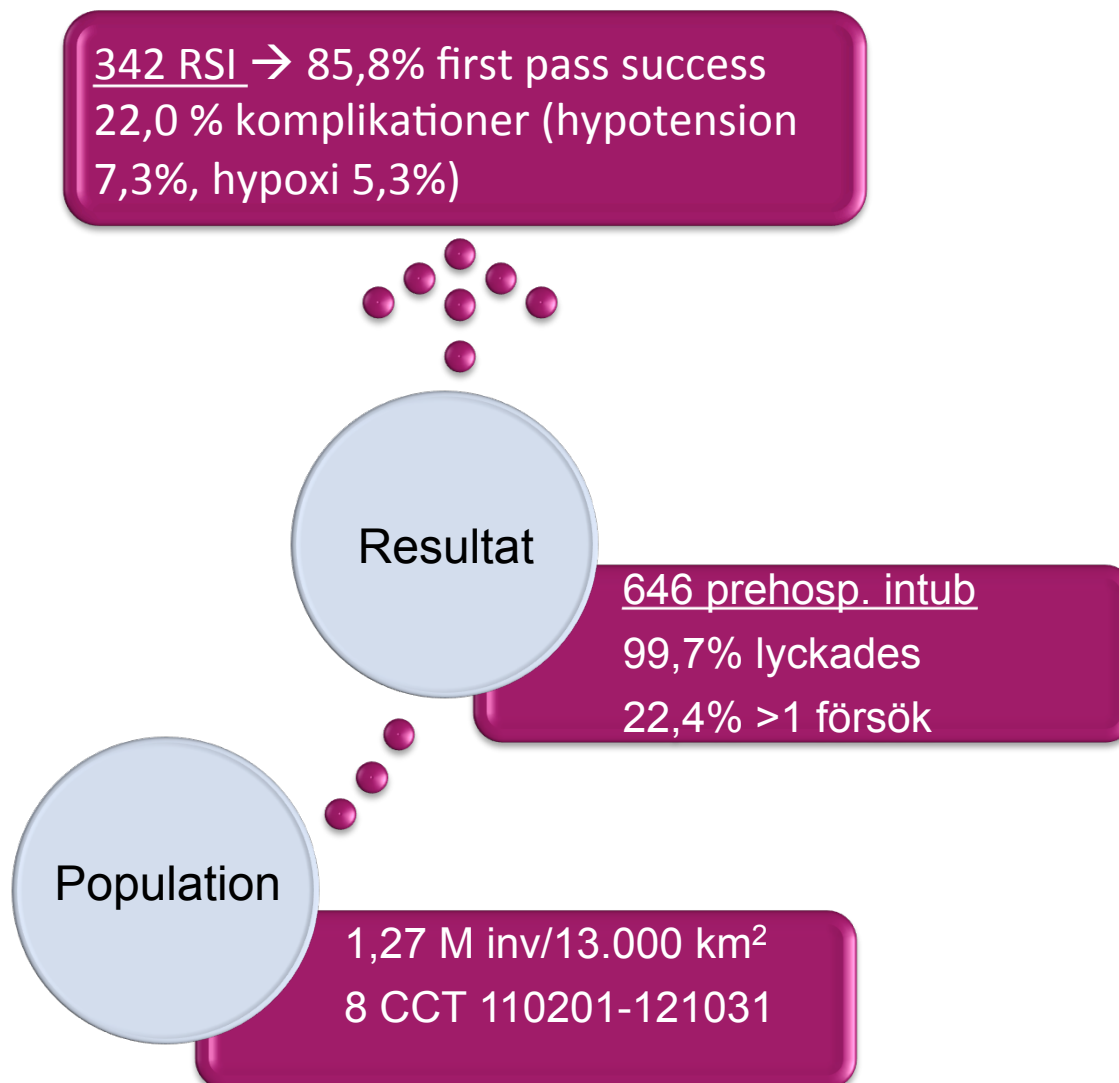
Incidence of desaturation during prehospital rapid sequence intubation in a physician-based helicopter emergency service.

Nakstad AR, Heimdal HJ, Strand T, Sandberg M.

Prehospital, RSI-related hypoxemia rates in this study are lower than reported rates in similar studies and are comparable with in-hospital rates.

Prehospital RSI may accordingly be considered a safe procedure when performed by experienced physicians with appropriate field training.

Går det att göra PHETI säkert?



Rognås L et al. Pre-hospital advanced airway management by experienced anaesthesiologists: a prospective descriptive study. SJTREM 2013

- Egenkontroll
- Identifiera misstag / “bad practice”
- Förbättring

Gott exempel – London HEMS

- 4000+ prehospitala anestesier
- Seniora läkare
- Enskild träning
- Omedelbart tillgängligt råd/stöd
- Formell utvärdering
- Regelbunden “kollegial granskning” av uppdrag

Sjukhusstandard på monitoreringen och “Kit dump”

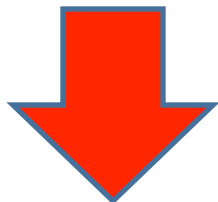


- MILS - remove C-collar
- Maximise 1st pass intubation success
 - Control your environment
 - 360 degree access
 - Optimise position
 - Use bougie for all cases
 - Standardised equipment and techniques
- Formalised failed intubation and oxygenation drills



Monitorera ETCO₂

Colorimetric



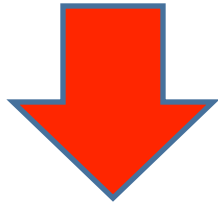
Capnometry



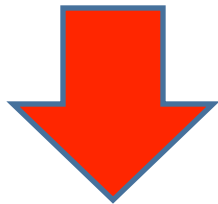
Capnography



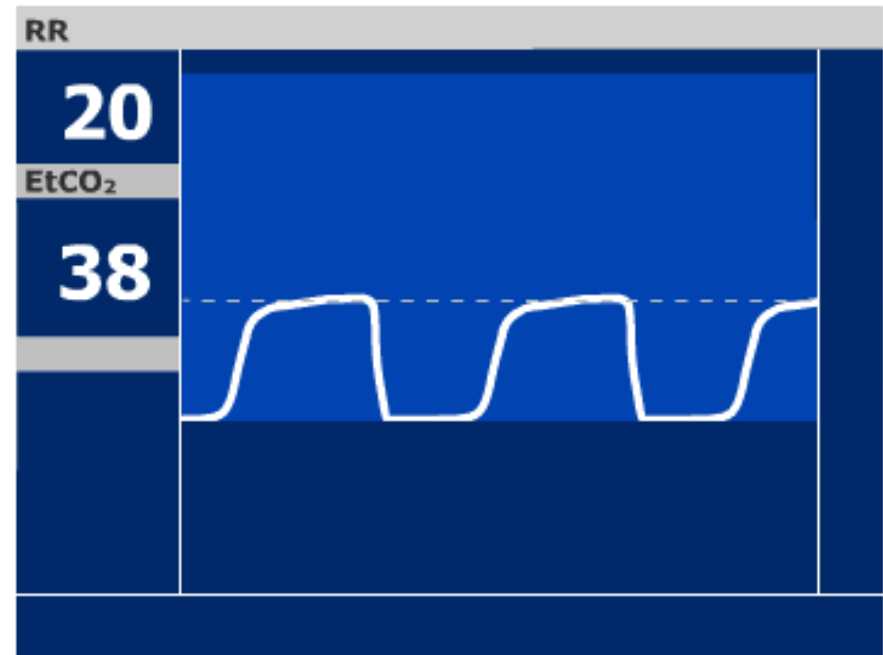
Colorimetric



Capnometry



Capnography



Percentage of EMS-physicians who reports having experienced difficult or impossible prehospital endotracheal intubation (PHETI) in different patient categories

		Number (%)
Difficult PHETI in	Patient in cardiac arrest	19/53 (35,8)
	Trauma patient	18/53 (33,9)
	Patient with respiratory failure	5/53 (9,4)
	Child	3/53 (5,7)
	Other types of patients	2/53 (3,8)
Impossible PHETI in	Patient in cardiac arrest	10/53 (18,9)
	Trauma patient	5/53 (9,4)
	Patient with respiratory failure	1/53 (1,9)
	Child	1/53 (1,9)
	Other types of patients	1/53 (1,9)*

*Patient with epiglottitis.

Rognås and Hansen Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine 2011, 19:10

- Basal luftvägsutrustning
- Olika L-blad, ledare
- LMA/Fast Trach
- Videolaryngoscop
- Koniotomiset

Ha en färdig algoritm



Videolaryngoscope

GlideScope Ranger



Stortz C-Mac



**McGrath
(Vitaid)**



**Pentax Airway Scope
(Ambu)**



**Kingvision
(Kingsystems)**



**Airtraq
(Prodrol)**



- | | |
|---------------------------|----------------------------------|
| 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. PHETI vid hjärtstillestånd

Acad Emerg Med. 2010 Sep;17(9):918-25. doi: 10.1111/j.1553-2712.2010.00827.x.

The association between prehospital endotracheal intubation attempts and survival to hospital discharge among out-of-hospital cardiac arrest patients.

Studnek JR, Thestrup L, Vandeventer S, Ward SR, Staley K, Garvey L, Blackwell T.

Center for Prehospital Medicine, Charlotte, NC, USA. jonst@medic911.com

Advanced airway management does not improve outcome of out-of-hospital cardiac arrest.

-> Oroande studier om intubation och hjärtstillestånd, ffa för patienter med VF. Paramedicstudier.

Michigan retrospective study 1995-2006

1,515 arrests, 86.2% intubated

Overall survival to discharge: 6.5% vs 10.0% (intubated vs not)

VF/VT survival to discharge decreased with intubation

California retrospective study 1994-2008

1,294 arrests, 79.4% intubated

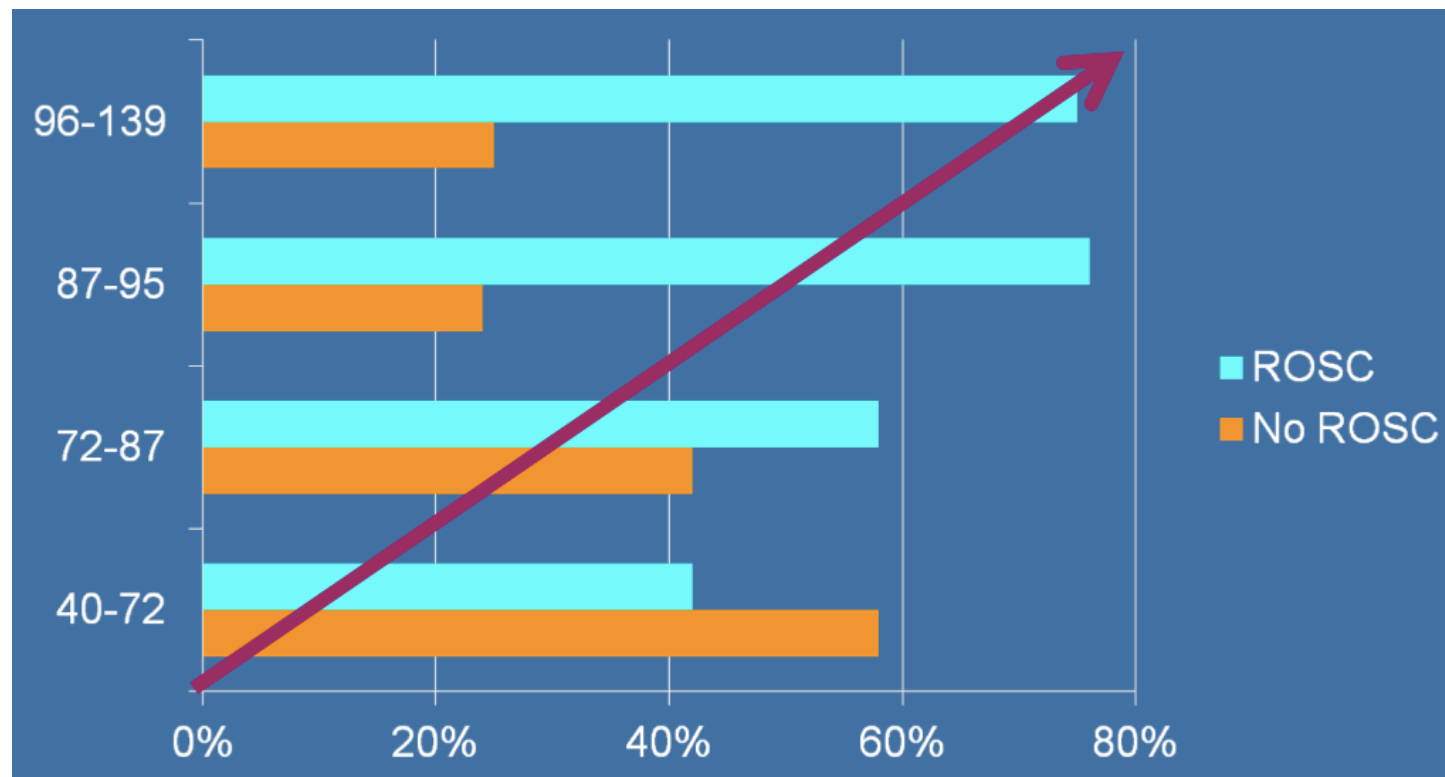
Survival to discharge: BVM 4.5x more than intubation

North Carolina retrospective study 2006-2008

1,142 arrests, **ROSC 5.4x more likely in nonintubated pts**

1) Egly J, Custodio D, Bishop N, et al. Assessing the impact of prehospital intubation on survival in out-of-hospital cardiac arrest. Prehosp Emerg Care 2011 Jan-Mar;15(1):44-9 2) Hanif MA, Kaji AH, Niemann JT, et al. Advanced airway management does not improve outcome of out-of-hospital cardiac arrest. Acad Emerg Med 2010 Sep;17(9):926-31 3) Studnek JR, Thestrup L, Vandeventer S, et al. The association between prehospital endotracheal intubation attempts and survival to hospital discharge among out-of-hospital cardiac arrest patients. Acad Emerg Med 2010 Sep;17(9):918-25

-> No intubation attempt should interrupt chest compressions for more than 10s



"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

-> No intubation attempt should interrupt chest compressions for more than 10s

- 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



2. Intubation pga luftvägsproblem

Vänta

- Tillstånd där utrustning saknas (ie fiberbronkoskop)
- Egen osäkerhet
- Korta avstånd, interventioner under transport
- Ok respiratoriska parametrar
- Ok luftväg med enklare hjälpmedel

Vänta inte

- Stridor
- Höga andningsfrekvenser
- Ansiktsskador
- När kompetensen inte är högre dit du åker

- 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
- Epiglottit – undvik i det längsta
- Diskutera plan och reservplan innan.
 - Koniotomi, “enkelt om enkla förhållanden”

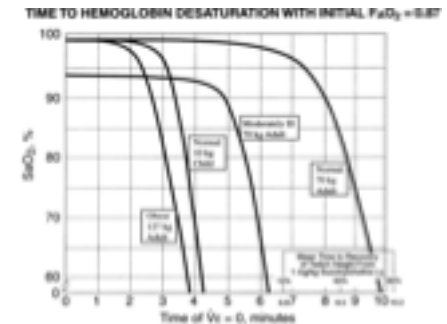


3. PHETI vid respiratoriska besvär

Ofta högre krav på respirator!

Mindre marginaler till hypoxi

- Astma
 - förvänta spasm i luftvägar
 - Ketalar om ej kontraindicerat, Adrenalin 10 ug/ml
- KOL
 - Oftast endast behov av lite sedering, sällan relaxeringsbehov, vänta ut inspirationsfas
- Hjärtsvikt
 - Ofta desperat dåliga patienter vid intubationsbehov, beredd på stora cirkulatoriska effekter. Asystoli, VF/VT



4. PHETI vid skallskada

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

Eftersträva din egen sjukhusstandard

Glöm inte resten:

Höjd huvudända

Nackkrage, tubband

Osmoterapi, sedering/relaxering, FiO2 mm

5. PHETI vid cirkulatorisk chock

Argument För:

- Påverkat medvetande > Dålig luftväg > hypoventilation och försämrad syresättning
- Illamående > risk för aspiration
- Aktiv hypotensiv resuscitering

Argument Emot:

- Förvänta stora cirkulatoriska effekter!
- Stor fara med tidsförlust

-> Försiktig ventilation och noggrann övervakning

-> Risk för asystoli/ventrikulära arytmier

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”

Disposition

1. Administrationsvägar
2. Analgesi
3. Anestesi
4. Ketalar
5. Korta rus

Disposition

1. Administrationsvägar
2. Analgesi
3. Anestesi
4. Ketalar
5. Korta rus

- IV
- IO
- IM
- IN

- Proceduranalgesi
 - Interventioner
 - Losstagnig
 - Reponering
 - Överflyttning på akuten(!)
- “Basanalgesi”/anxiolys

Läkemedel

- Morfin
- Fentanyl
- Rapifen
- Ketalar
- NSAID/Paracetamol

Blockader

- Ffa Femoralblockader

Induktion

- Liten hemodynamisk effekt (hypotensiv resuscitering)
- Snabb effekt
- “Snällt” mot CNS
- Propofol/Pentotal
- Ketalar
- Fentanyl/Rapifen
- Relaxering? Depolariserande/Icke depolariserande

Underhåll

- Underhåll på pump?

- NMDA antagonist
- Utvecklades på 60-talet ur PCP
- Dissociativ anestesi
- Hallucinogena effekter
- Kan administreras “på alla sätt”

- Analgesi, anestesi
- Attraktiva egenskaper
 - Liten effekt på luftvägar/andning
 - Sympatikoton effekt
 - Takykardi
 - Dilatation av luftvägar
- Biverkningar
 - Hallucinationer/förvirring
 - Salivering
 - (Ökat ICP)

- Ketalar 10 mg/ml, 50 mg/ml
- Analgesi ca 0,5 mg/kg iv
- Anestesi
 - Induktion ca 2 mg/kg iv (<1 min)
 - Underhåll
 - > 500 mg i 500 ml + 10-20 mg Midazolam -> (vikt i kg) drp/min
 - > Ketalar infusion 2-6 mg/kg/tim
 - > Drygt induktionsdosen på en timma

- Av stort värde vid korta procedurer
 - Reponeringar, förflyttningar inkl losstagningar
 - Ketalar/BDZ eller “Ketofol”
 - Ställer krav på vana av Ketalar
- Ställer stora krav på klinisk bedömning
 - Aspiration
 - Luftvägar
 - Hypoxi
 - Cirkulation mm

- Anestesiläkare *eller likvärdig* kompetens intuberar
- Systemsäkerhet
- Sjukhusstandard