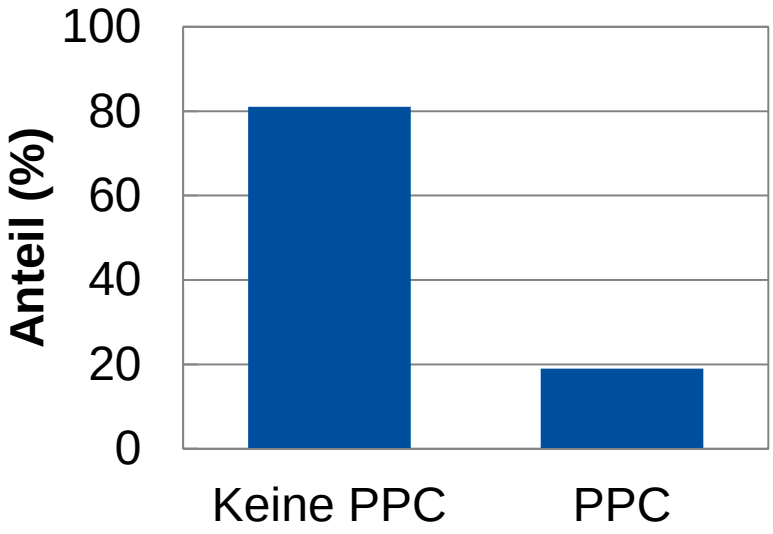
Der optimale PEEP während Allgemeinanästhesie

State of the Art

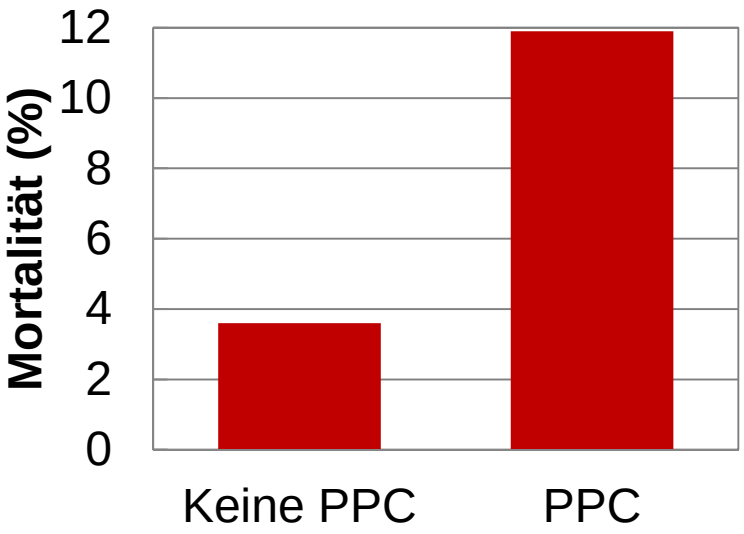
Eine Allgemeinanästhesie führt durch Atelektasenbildung sehr rasch zur Einschränkung der Lungenfunktion.

State of the Art

Postoperative pulmonale Komplikationen (PPC) sind häufig und mit erhöhter Mortalität verbunden



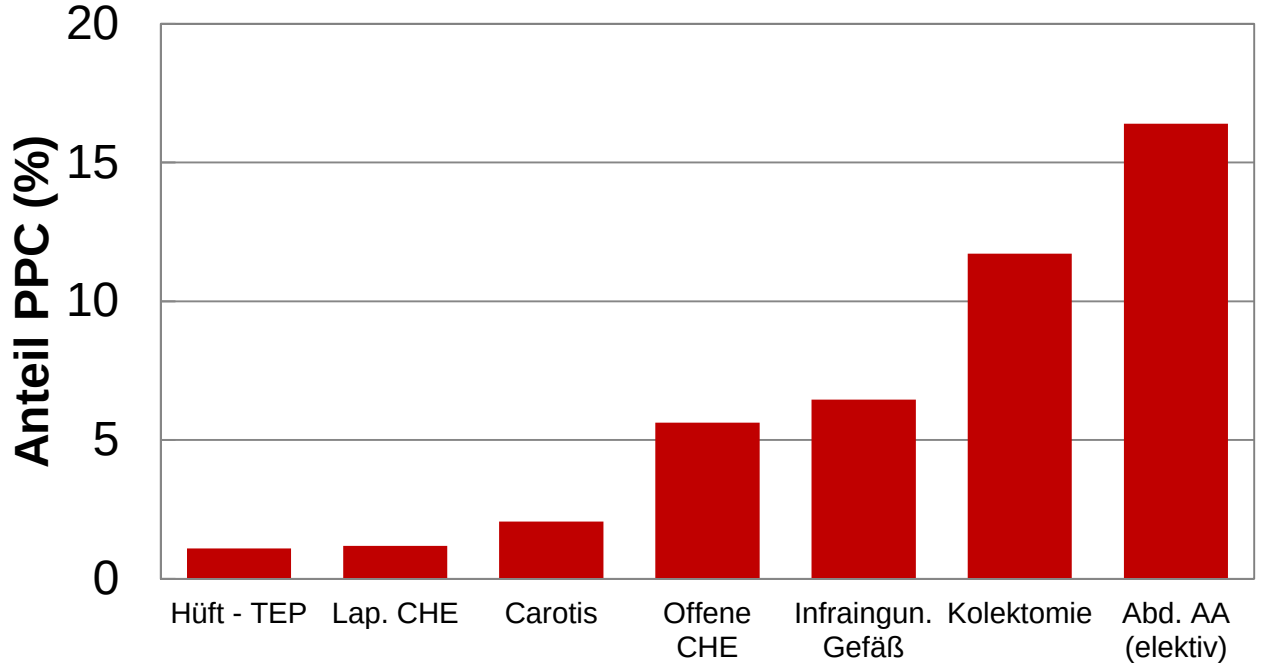
n = 45.969, Darmresektion



n = 45.969, Darmresektion

State of the Art

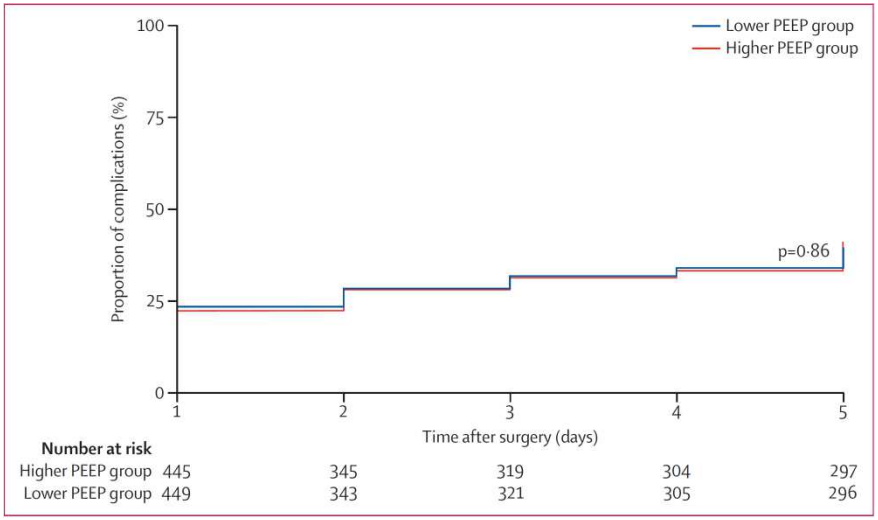
Die Inzidenz von PPC ist abhängig von der Art der Operation.

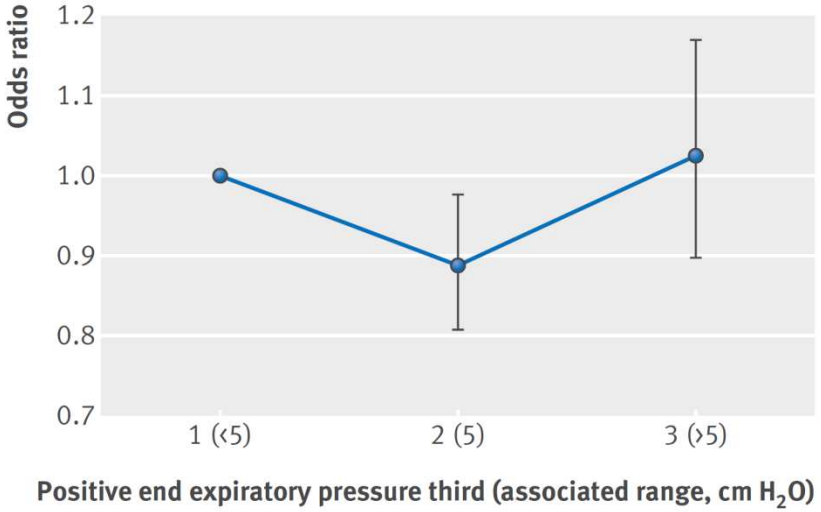


n = 105.951; Pneumonie und „failure to wean“

State of the Art

Ob ein durch intraoperativen PEEP PPC verhindert werden können, ist unklar.

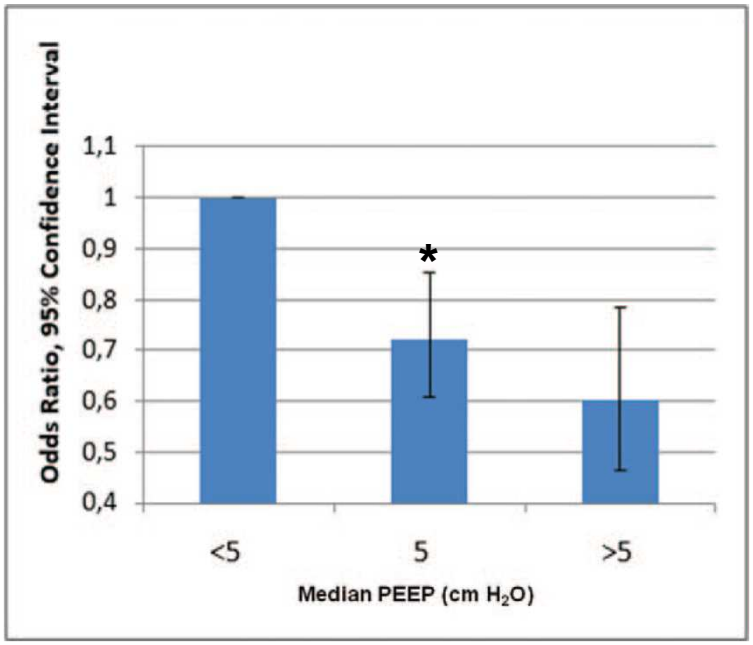


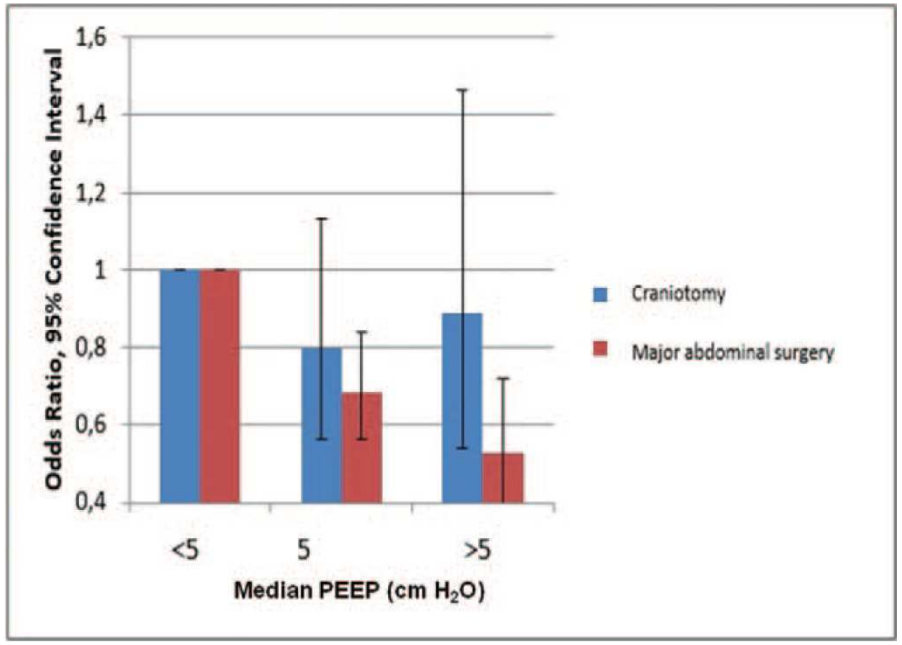


PEEP und Art der Operation

de Jong MA et al. Ann Surg. 2016;264:362-9

- Abdominelle Operation (n = 5915) vs. Kraniotomie (n = 5063), retrospektiv
- PEEP und Inzidenz PPC





Fazit für Klinik und Praxis

Wahrscheinlich ist bei intraabdominellen Operationen die Anwendung höherer PEEP–Werte (> 5 mbar) mit einer Verringerung der PPC verbunden.

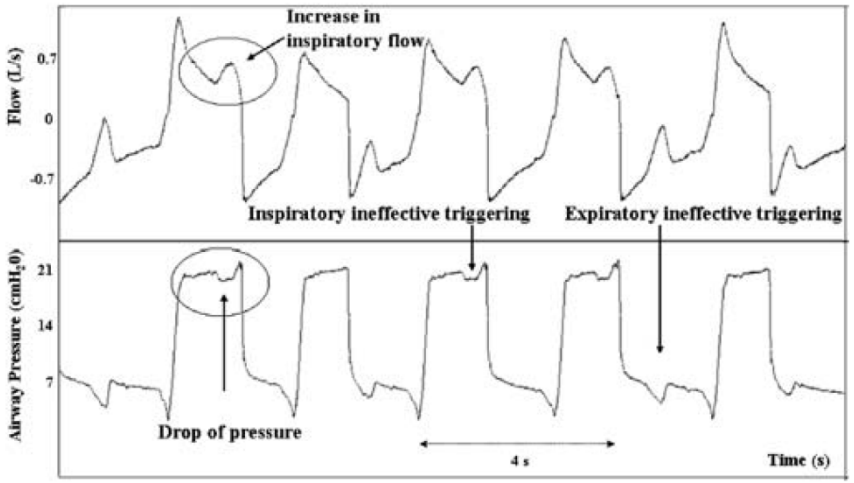
Bei Zwerchfell - fernen Eingriffen scheint die Höhe des PEEP keinen relevanten Einfluss auf PPC zu haben.

Ist NAVA im klinischen Alltag nützlich?

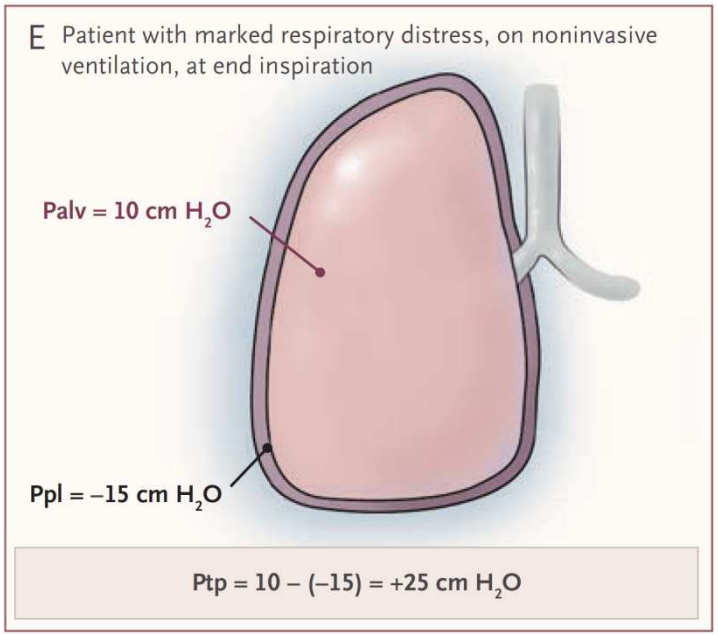
State of the Art

Unterstützte Spontanatmung ist gut.

PSV ist nicht optimal.

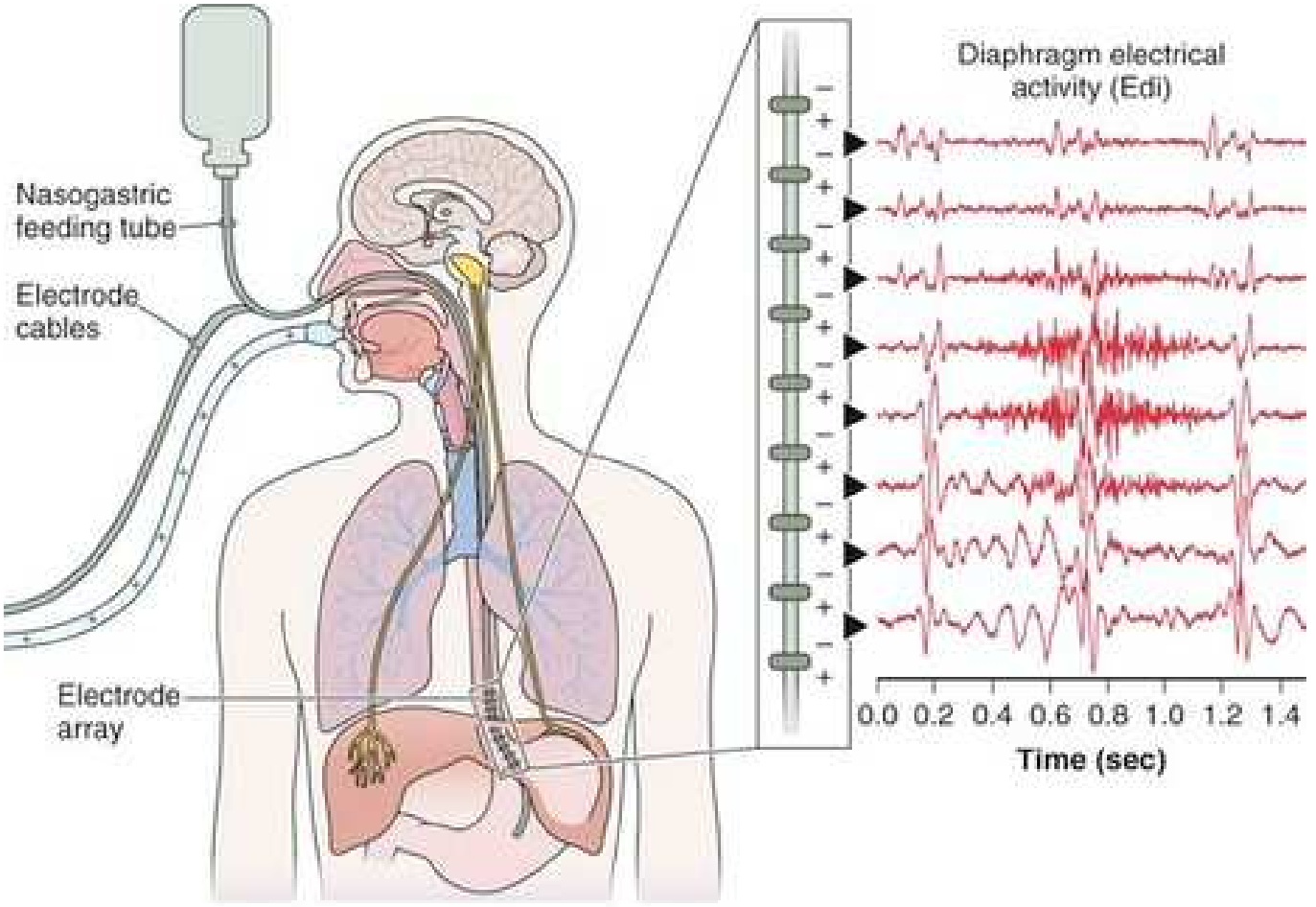


Desynchronisation
Beatmungsdauer ↑



VILI
NIV oder PSV

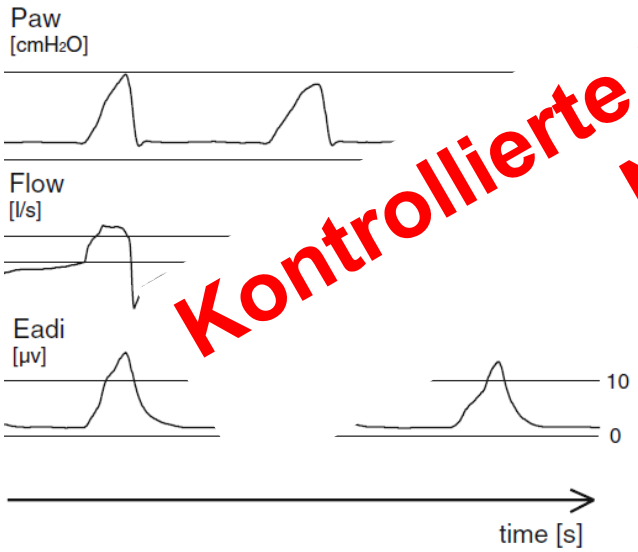
State of the Art

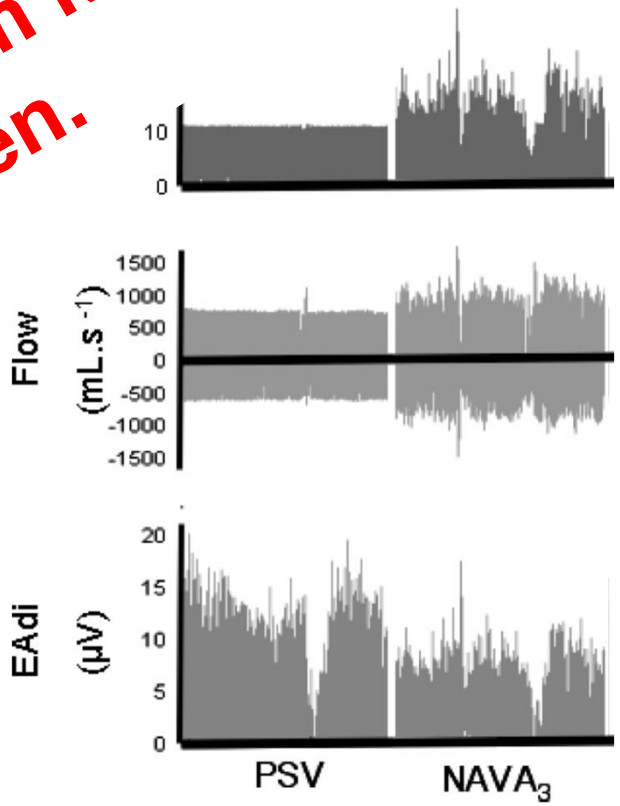


State of the Art

NAVA verbessert Synchronisat
erlaubt physiologische
Variabilität der Atmu

Kontrollierte Studien zum klinischen Nutzen fehlen.



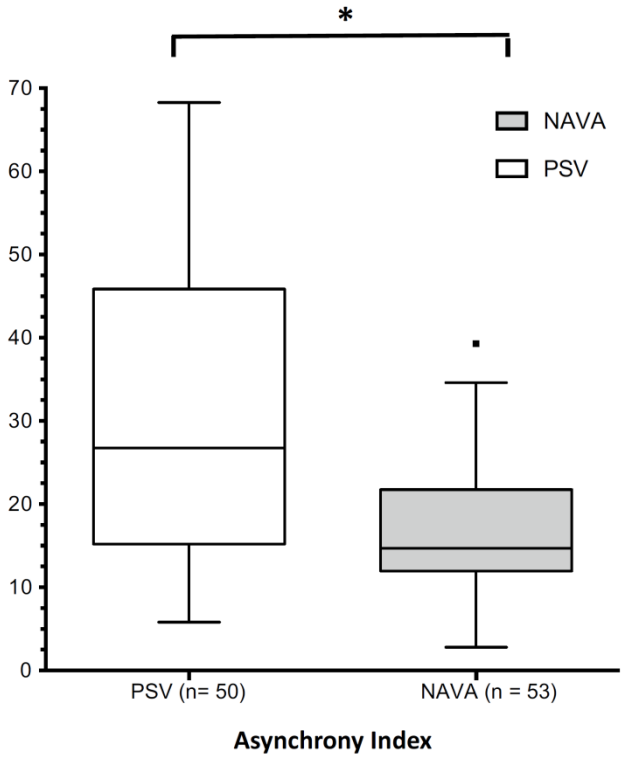


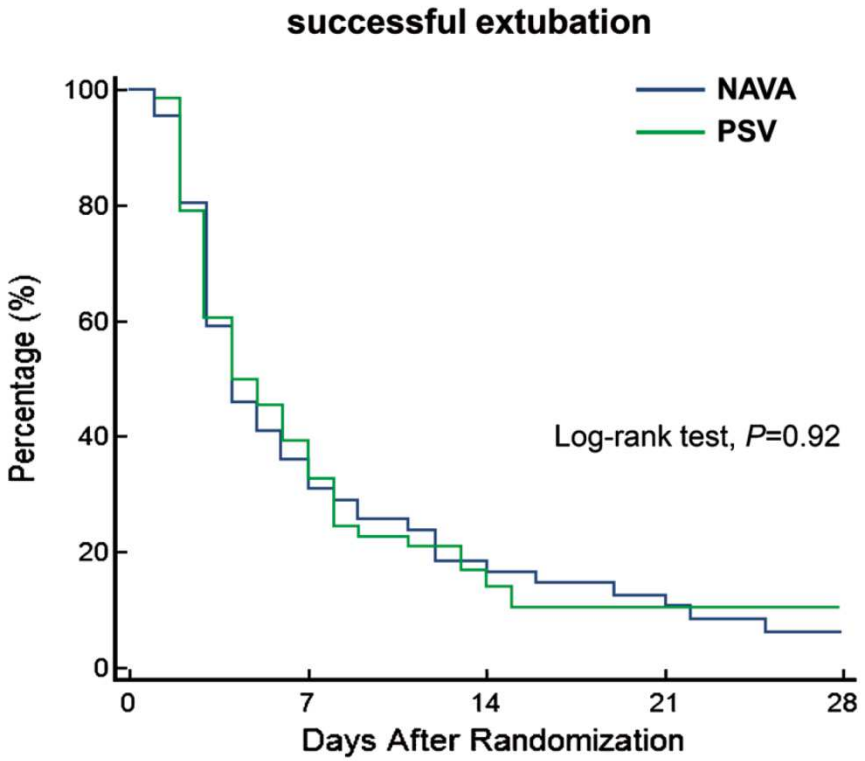
Verkürzt NAVA die Beatmungsdauer?

Demoule A et al. Intensive Care Med. 2016;42:1723-32

n = 128, mind. 24h beatmet,

n = 66 PSV, n = 62 NAVA, max. 14 Tage





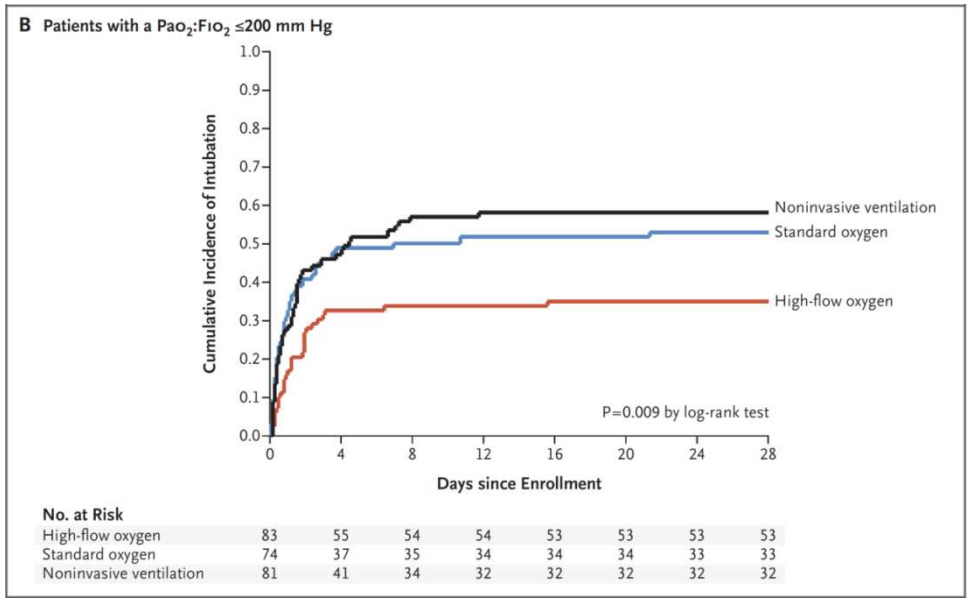
Fazit für Klinik und Praxis

Nach derzeitigem Wissensstand wird die Beatmungsdauer durch NAVA nicht verkürzt.

Die nicht – invasiven Verfahren: High – Flow O_2 und NIV

State of the Art

Durch eine nasale High – Flow O_2 – Therapie (HFNC) kann bei Patienten mit respiratorischer Insuffizienz die Intubation teilweise vermieden und die Mortalität reduziert werden.



State of the Art

Nach geplanter Extubation müssen 10 – 15% der beatmeten Intensivpatienten wegen respiratorischer Insuffizienz reintubiert werden.

Unklar ist, ob auch bei diesen Patienten eine Reintubation durch HFNC vermieden werden kann.

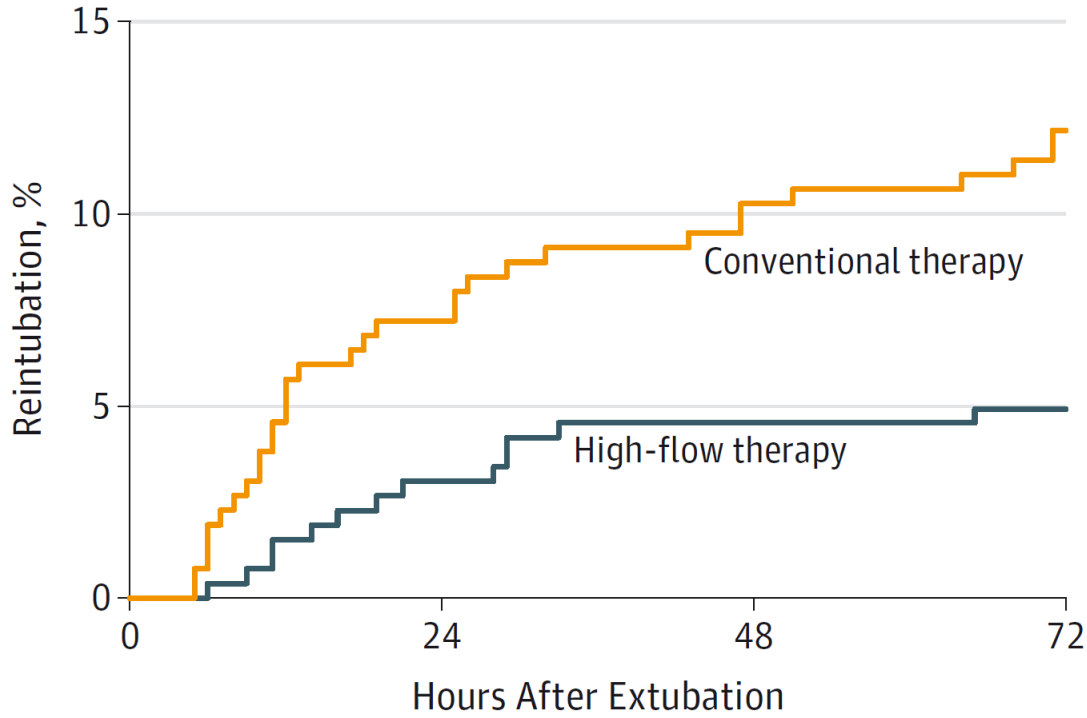
Vermeidung Reintubation durch HFNC?

Hernández G et al. JAMA. 2016;316:1565-74

- n = 527, mindestens 12 h beatmet
- Geringes Risiko für eine Reintubation
  - < 65 Jahre, BMI < 30 kg/m², einfaches Weaning
  - APACHE II < 12 Pkt. vor Extubation
  - Keine Herzinsuffizienz oder schwere COPD
- Randomisierung
  - n = 263 O_2 – Insufflation, SpO_2 > 92%
  - n = 264 HFNC, SpO_2 > 92%
- Reintubation innerhalb 72 Std.?

Vermeidung Reintubation durch HFNC?

Hernández G et al. JAMA. 2016;316:1354-61



No. at risk				
Conventional therapy	263	244	236	231
High-flow therapy	264	256	252	251

Nach 72 h:
4,9% vs. 12,2%
p = 0,004

Fazit für Klinik und Praxis

Eine Reintubation kann bei Patienten mit niedrigem Risiko durch eine nasale High – Flow O_2 Therapie weitaus häufiger vermieden werden als durch konventionelle O_2 – Therapie.

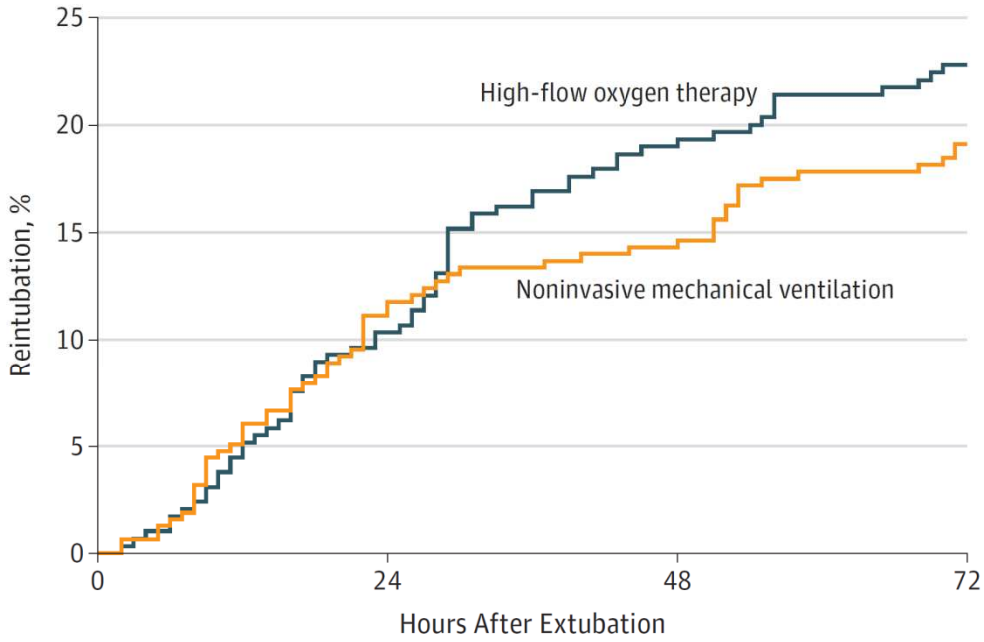
Reintubation und HFNC bei hohem Risiko

Hernández G et al. JAMA. 2016;316:1565-74

- n = 604, mindestens 12 h beatmet
- Hohes Risiko für eine Reintubation (mind. 1)
  - > 65 Jahre, BMI > 30 kg/m²
  - >1 Co-Morbidität, APACHE II > 12 Pkt. vor Extubation
  - schwieriges/prolongiertes Weaning
  - Herzinsuffizienz oder COPD
- Randomisierung
  - n = 314 **NIV**, SpO_2 > 92%, AF ≤ 25 min^{-1}
  - n = 290 HFNC SPO_2 > 92%
- Reintubation innerhalb 72 Std.?

Reintubation und HFNC bei hohem Risiko

Hernández G et al. JAMA. 2016;316:1565-74



No. at risk				
High-flow oxygen therapy	290	260	234	223
Noninvasive mechanical ventilation	314	279	269	253

Nach 72 h:
22,8% vs. 19,1%
n. s.

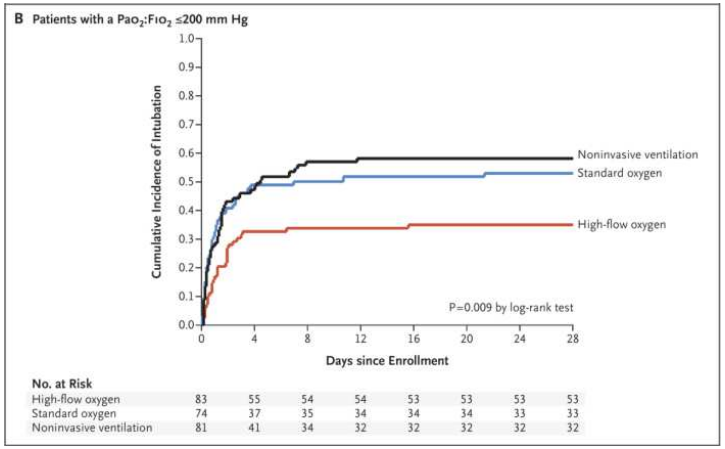
Fazit für Klinik und Praxis

Bei Patienten mit einem hohen Reintubationsrisiko ist nach der primären Extubation die HFNC gleichwertig mit der NIV.

Bei der NIV traten wesentlich häufiger Komplikationen auf als bei HFNC.

State of the Art

Durch eine HFNC kann bei Patienten mit respiratorischer Insuffizienz die Intubation teilweise vermieden und die Mortalität reduziert werden.



Unklar ist, ob bei postoperativen Patienten mit erhöhtem Risiko für PPC durch *prophylaktische* HFNC eine Intubation vermieden werden kann.

Prophylaktische postoperative HFNC

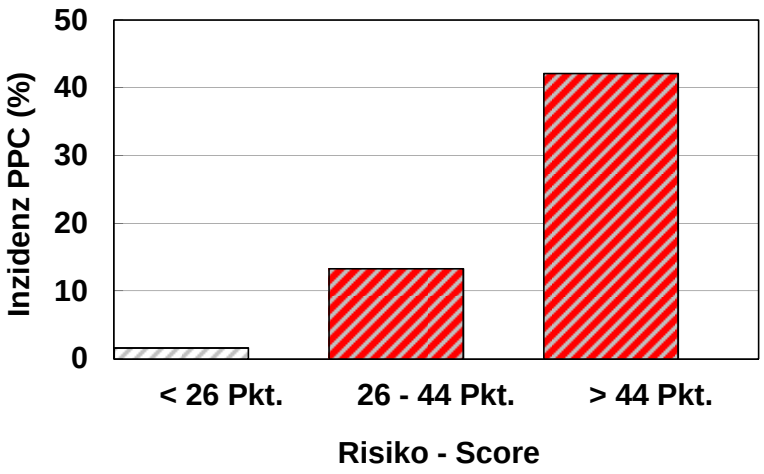
Futier E et al. Intensive Care Med. 2016;42:1888-98

- Abdominelle oder abdominothorakale Operation ≥ 2 h; n = 220
- Erhöhtes Risiko für PPC
- Randomisierung
  - O_2 – Insufflation (n = 112)
  - HFNC (n = 108)
  - Therapie bis 1. postop Tag 8.00 Uhr
- Endpunkte
  - PaO_2/FIO_2 < 300 mmHg 1 Std. postop.
  - PPC innerhalb 7 Tagen
  - Notwendigkeit O_2-Therapie im Verlauf

Erhöhtes Risiko für PPC

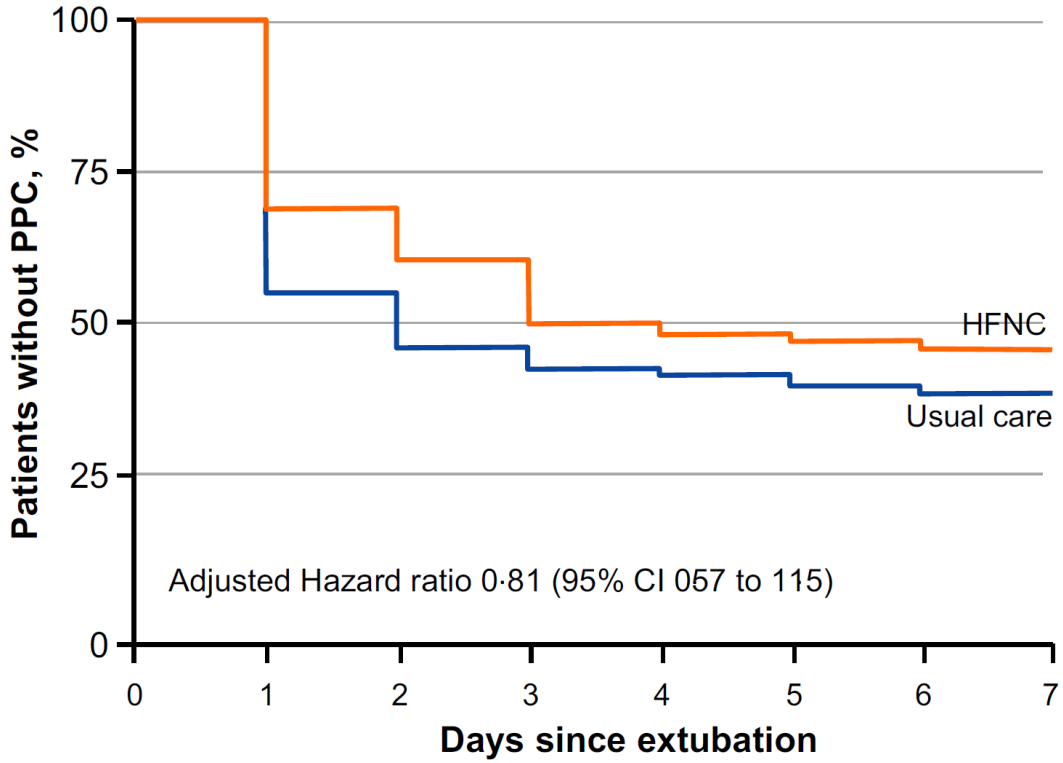
	Risk Score
Age, yr	
≤50	
51–80	3
>80	16
Preoperative SpO_2, %	
≥96	
91–95	8
≤90	24
Respiratory infection in the last month	17
Preoperative anemia (≤10 g/dl)	11
Surgical incision	
Peripheral	
Upper abdominal	15
Intrathoracic	24
Duration of surgery, h	
≤2	
>2 to 3	16
>3	23
Emergency procedure	8

> 25 Punkte
Risiko für PPC ≥ 12%



Prophylaktische postoperative HFNC

Futier E et al. Intensive Care Med. 2016;42:1888-98



Number at risk

Usual care	112	62	52	48	47	45	44	44
HFNC oxygen therapy	108	75	66	55	53	52	51	50

Andere Endpunkte ebenfalls kein Unterschied

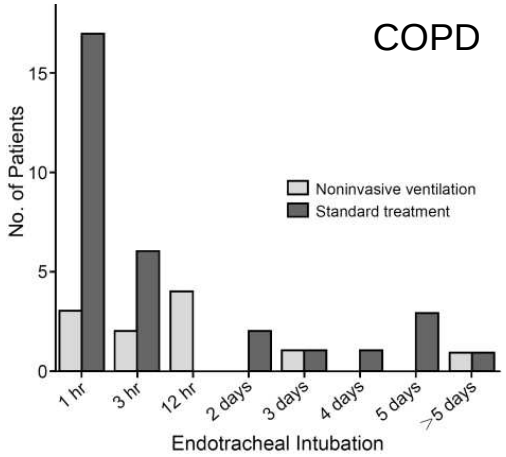
Fazit für Klinik und Praxis

Postoperative *prophylaktische* HFNC verhindert das Auftreten von PPC bei Risikopatienten nicht.

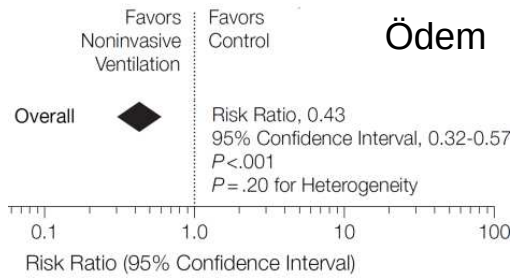
Ob dies durch eine längere Anwendung von HFNC erreicht werden kann ist unklar.

State of the Art

Durch NIV wird die Intubationsrate bei exazerbierter COPD und kardialem Lungenödem verringert.



Unklar ist, ob auch nach großen abdominalchirurgischen Operationen die Intubationsrate durch NIV reduziert werden kann.



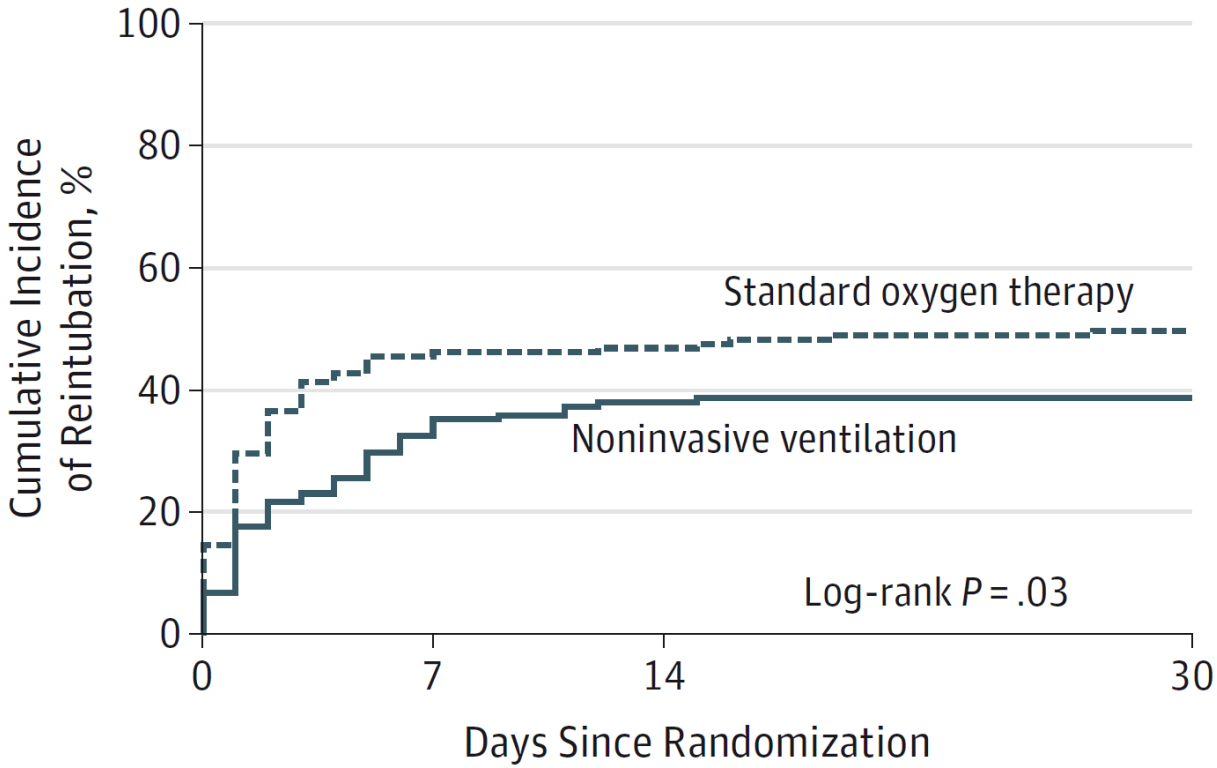
Postoperative NIV?

Jaber S et al. JAMA. 2016;315:1345-53

- n = 293 nach abdominalchir. OP
- Respiratorische Insuffizienz:
  - PaO_2 < 60 mm Hg Raumluft oder
  - PaO_2 < 80 mmHg unter 15l O2/min
- Plus 1 Symptom:
  - AF > 30/min
  - Klin. Zeichen Atemarbeit ↑
- n = 148 NIV, n = 145 O_2 – Insufflation
- Intubation innerhalb 7 Tagen

Postoperative NIV?

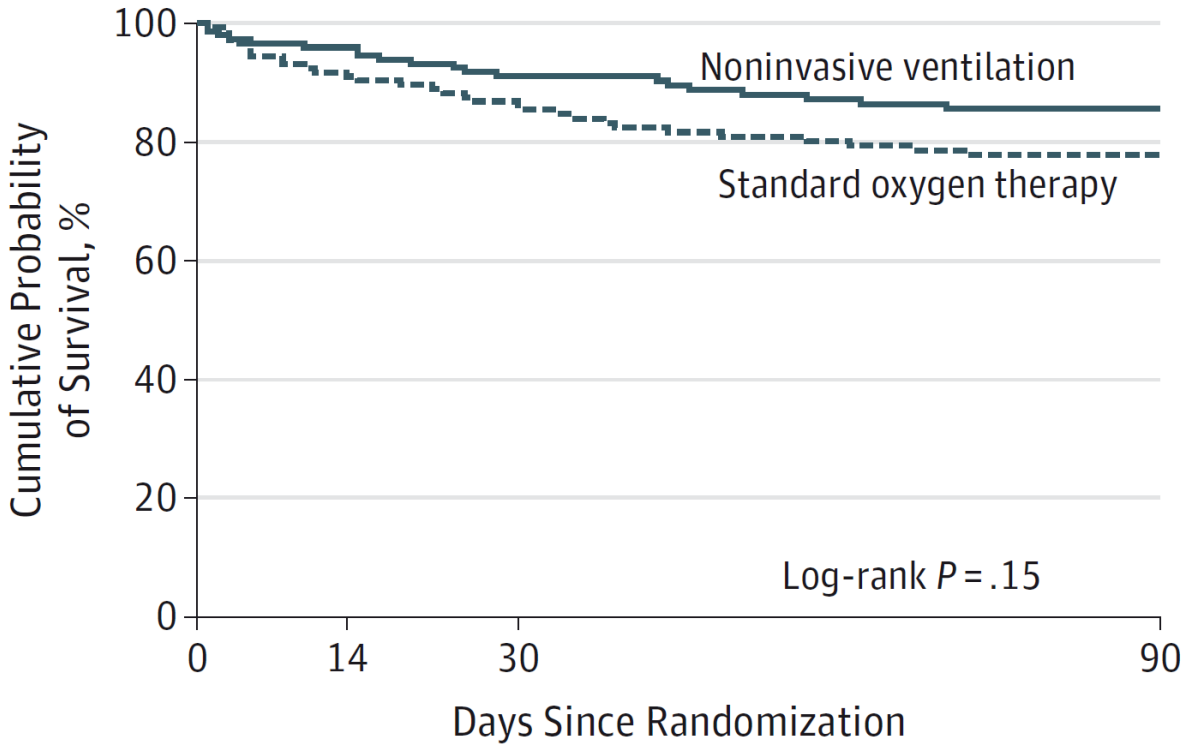
Jaber S et al. JAMA. 2016;315:1345-53



No. at risk				
Standard oxygen therapy	145	79	76	71
Noninvasive ventilation	148	99	90	87

Postoperative NIV?

Jaber S et al. JAMA. 2016;315:1345-53



No. at risk				
Standard oxygen therapy	145	132	125	102
Noninvasive ventilation	148	141	131	109

Fazit für Klinik und Praxis

Bei respiratorischer Insuffizienz nach abdominalchirurgischen Eingriffen wird eine Reintubation durch NIV häufiger vermieden als durch konventionelle O_2 – Insufflation.

In dieser Studie fehlt eine Gruppe, die mit HFNC behandelt wurde.

Rekrutierungsmanöver bei ARDS?

State of the Art

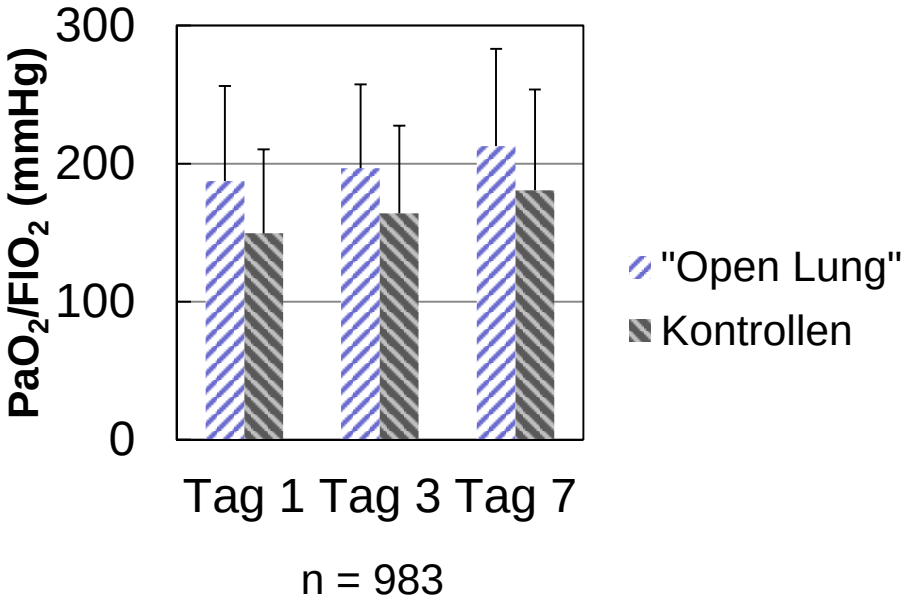
Intensive Care Med (1992) 18:319–321

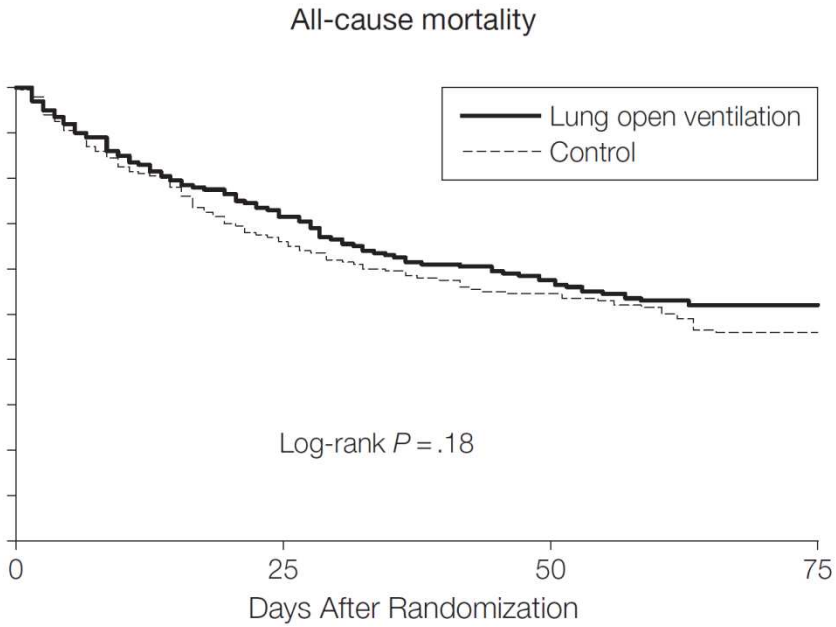
Intensive Care Medicine
© Springer-Verlag 1992

Editorial

Open up the lung and keep the lung open

B. Lachmann





State of the Art

Intensive Care Med (1992) 18:319–321

Editorial

Open up the lung and keep the lung open

B. Lachmann

Intensive Care Medicine

- Andere Studien widersprüchliche Ergebnisse:
  - Verkürzung der Beatmungsdauer
  - Weniger MOF
  - Besseres Überleben

Rekrutierungsmanöver bei ARDS

Kacmarek RM et al. Crit Care Med. 2016;44:32-42

- Frühes ARDS (≤ 48 h, n = 200)
- Reevaluation nach 12-24h, Randomisierung

- Kontrollen: V_T 6 ml/kg, P_{plat} < 30 mbar
  PEEP nach Tabelle
- PaO_2 55 – 80 mmHg
- Permissive Hyperkapnie toleriert

Rekrutierungsmanöver bei ARDS

Kacmarek RM et al. Crit Care Med. 2016;44:32-42

Interventionsgruppe (n = 101)

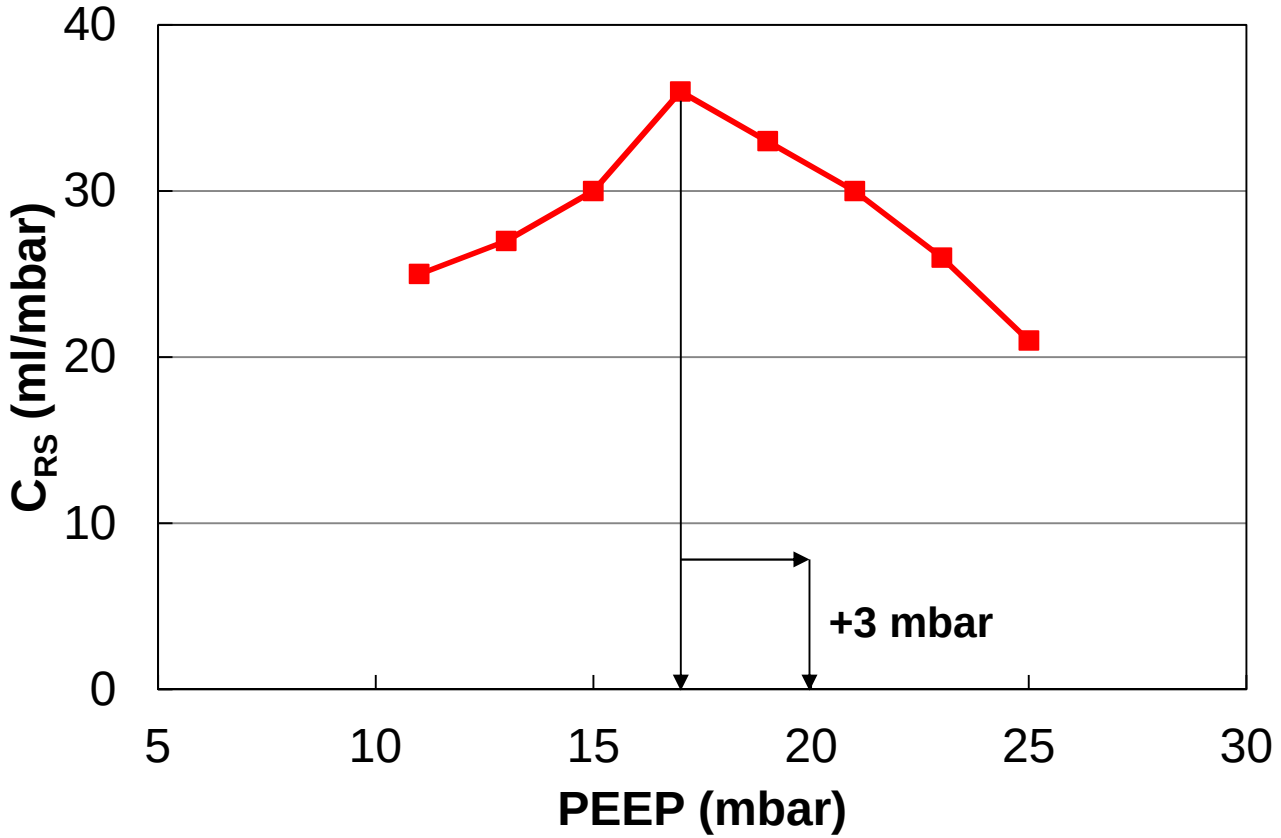
Recruitment:
PEEP ↑ auf 35 - 40 mbar bis Pplat max. 60 mbar
stufenweise, insgesamt 30 Atemzüge

Keep the lung open:
PEEP auf 25 mbar, stufenweise Reduktion 2 mbar
3 min, Berechnung C_{RS}
Definitiver PEEP 3 mbar höher als bei maximaler C_{RS}

Wiederholung nach 4 h, wenn $FIO_2 > 0,4$

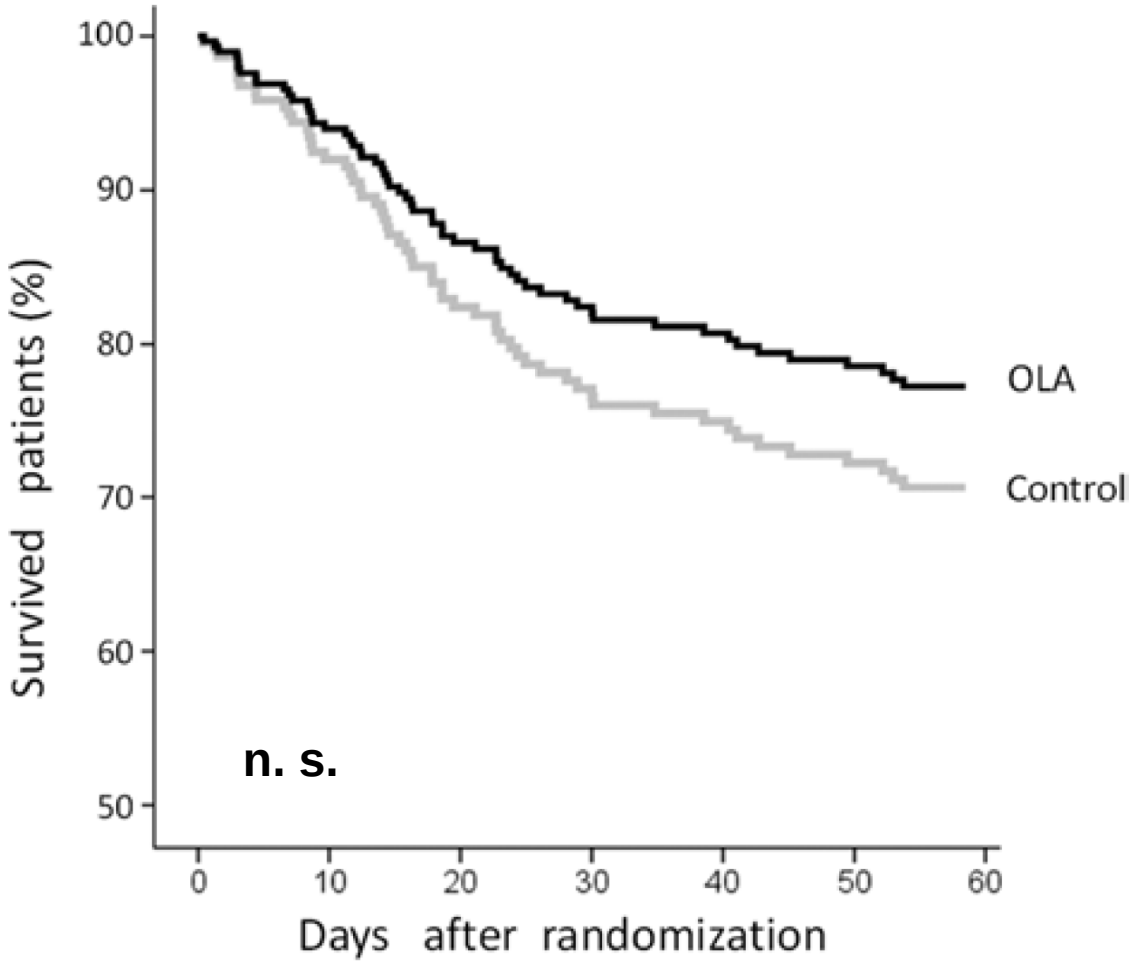
Rekrutierungsmanöver bei ARDS

Beispiel



Rekrutierungsmanöver bei ARDS

Kacmarek RM et al. Crit Care Med. 2016;44:32-42



Abbruch nach 5 Jahren
und 200 Patienten

Rekrutierungsmanöver bei ARDS

Hodgson C et al. Cochrane Database Syst Rev. 2016 Nov 17;11:CD006667

Outcomes	Relative effect (95% CI)	Number of participants (studies)
28-Day mortality	**RR 0.86** (0.74 to 1.01)	1450 (5 studies)
ICU mortality	**RR 0.83** (0.72 to 0.97)	1370 (5 studies)
In-hospital mortality	**RR 0.88** (0.77 to 1.01)	1313 (4 studies)
Rate of barotrauma	**RR 1.09** (0.78 to 1.51)	1508 (7 studies)

Fazit für Klinik und Praxis

Rekrutierungsmanöver bei ARDS verbessern nicht die Überlebensrate.

Rekrutierungsmanöver bei ARDS sind eventuell bei schwerer Hypoxämie als Rescue – Maßnahme sinnvoll.

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