NIMV: Yeni Alanlar ve Modlar

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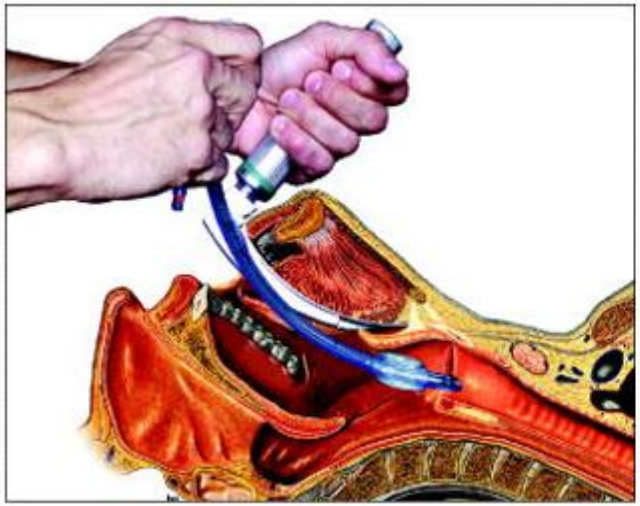
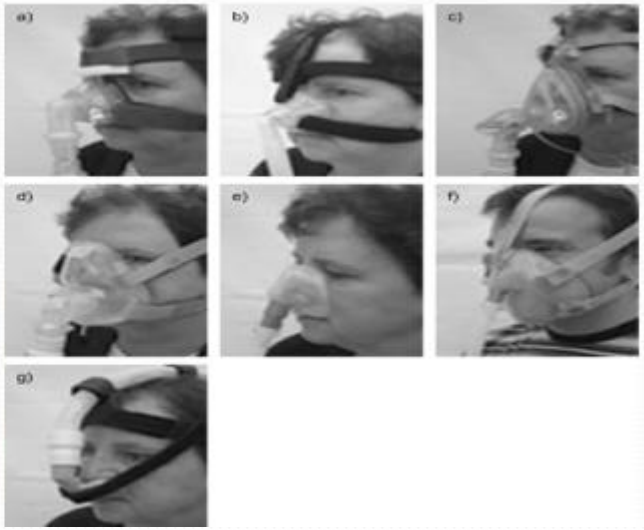
Neden NİMV?





- İMV komplikasyonları
- Daha az sedasyon
- Hasta konforu
- Maliyet

KOAH atak

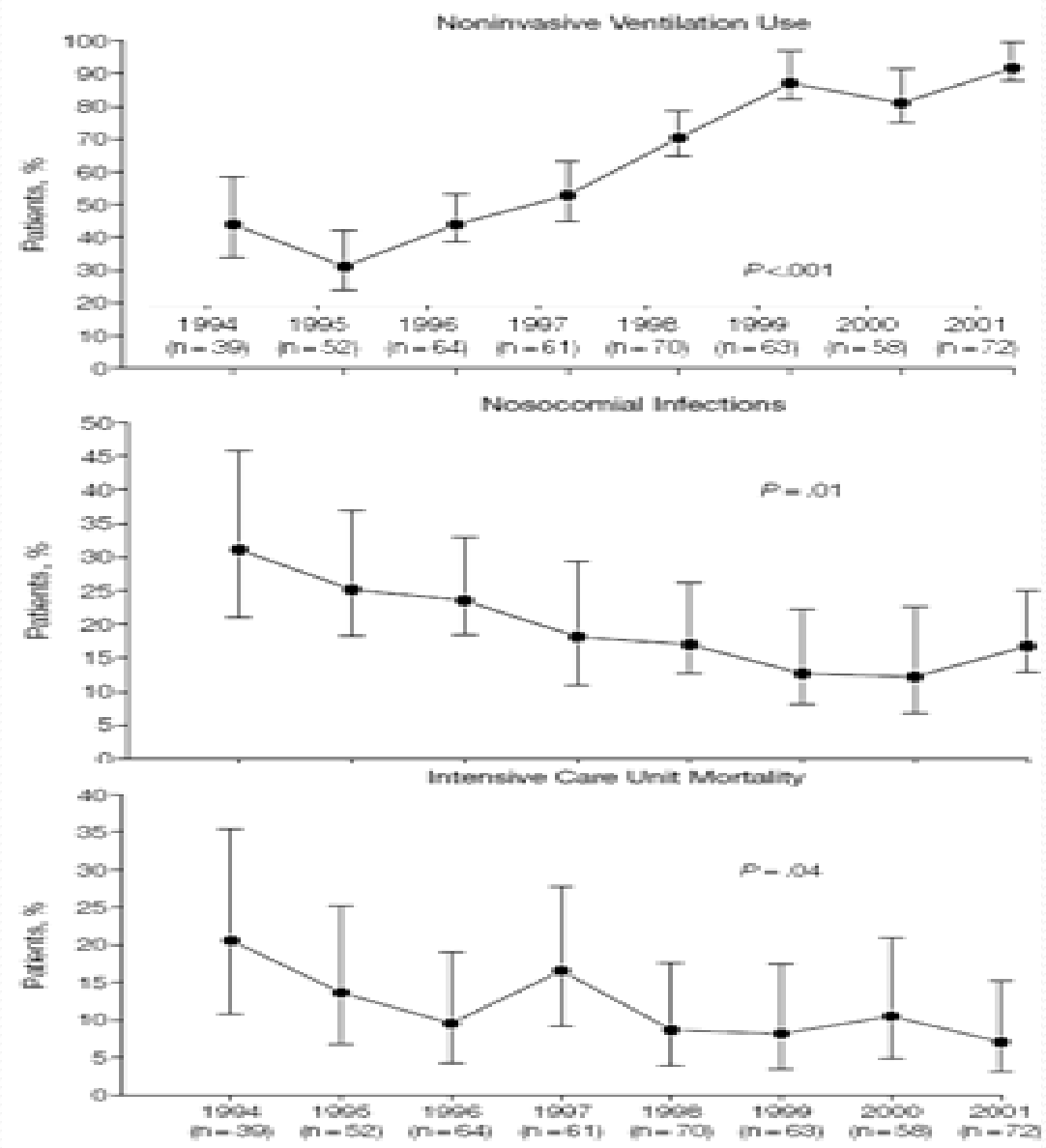
1998-2008 yılları arasında ;

> 7 milyon KOAH atak

NIMV kulllanımında %462 ↑ (tüm başvurular; **%1 ➔ %4.5**)

İMV kullanımında %42 ↓

Chandra D, et al Am J Respir Crit Care Med 2012;185:152–9


Noninvasive Ventilation Use
Patients, %
P<.001
1994 (n=39)
1995 (n=52)
1996 (n=64)
1997 (n=61)
1998 (n=70)
1999 (n=63)
2000 (n=58)
2001 (n=72)
Nosocomial Infections
Patients, %
P=.01
Intensive Care Unit Mortality
Patients, %
P=.04

Akut solunum yetmezliği

KOAH akut atağı

Kardiyojenik pulmoner ödem

Pnömoni

Postoperatif solunum yetmezliğ

Astım

Ekstübasyon yetmezliği

Nöromusküler hastalıklar

Kifoskolyoz

Üst hava yolu obstrüksiyonu

Torasik travma

Obezite-hipoventilasyon

İPF

Kistik fibrozis

Akut solunum yetmezliği-NIMV

- KOAH akut atağı
- Akut kardiyojenik pulmoner ödem
- İmmünsüpresif hastalardaki akut solunum yetmezliği
- KOAH hastalarında weaningde

Official ERS/ATS clinical practice guidelines: noninvasive ventilation for acute respiratory failure

Eur Respir J 2017; 50: 1602426

Recommendation

We suggest NIV not be used in patients with hypercapnia who are not acidotic in the setting of a COPD exacerbation. (Conditional recommendation, low certainty of evidence.)

Recommendations

We recommend bilevel NIV for patients with ARF leading to acute or acute-on-chronic respiratory acidosis (pH ⩽7.35) due to COPD exacerbation. (Strong recommendation, high certainty of evidence.)

Official ERS/ATS clinical practice guidelines: noninvasive ventilation for acute respiratory failure

Eur Respir J 2017; 50: 1602426

Recommendation

We recommend either bilevel NIV or CPAP for patients with ARF due to cardiogenic pulmonary oedema. (Strong recommendation, moderate certainty of evidence.)

Recommendation

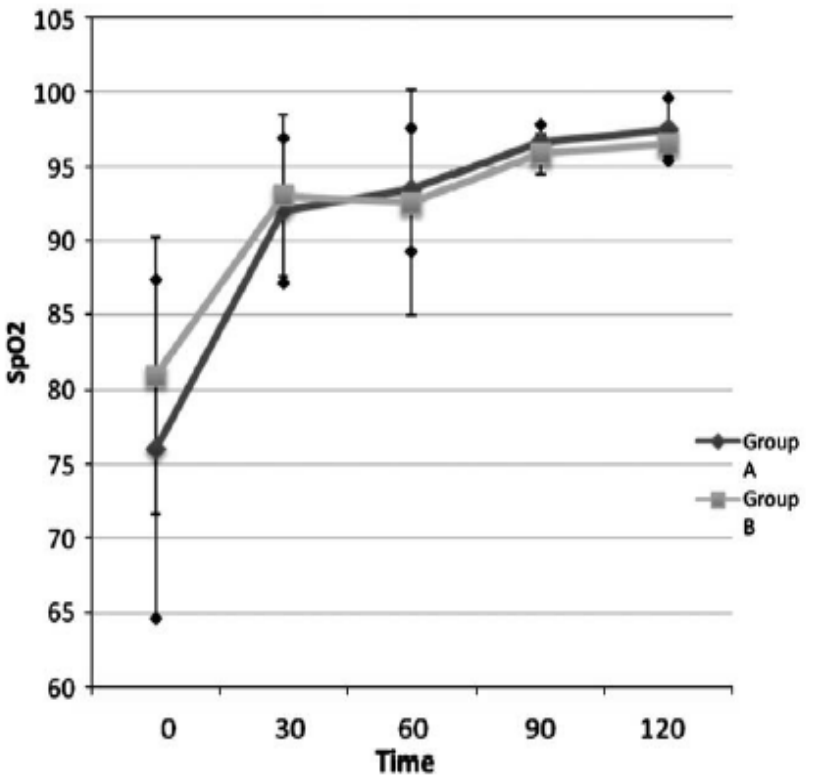
We suggest that CPAP or bilevel NIV be used for patients with ARF due to cardiogenic pulmonary oedema in the pre-hospital setting. (Conditional recommendation, low certainty of evidence.)

Diyastolik KY'de NIMV

- 36 hasta (18 sistolik fonk.normal/18 sistolik KY)
- CPAP (10 cmH2O)

Bellone A, Vettorello M, Etteri M, et al. Am J Emerg Med 2009;27:986-991.

Diyastolik KY'de NIMV



Tedaviye yanıt süresi ve entübasyon ihtiyacı bakımından iki grup arasında fark yok

İmmünsupresyon ve ASY

- ASY, YBÜ'e yatışın en sık nedeni
- İmmünsüpresyonla ilişkili infeksiyonlar
- Altta yatan malignitenin pulmoner tutulumu
- KT toksisitesi

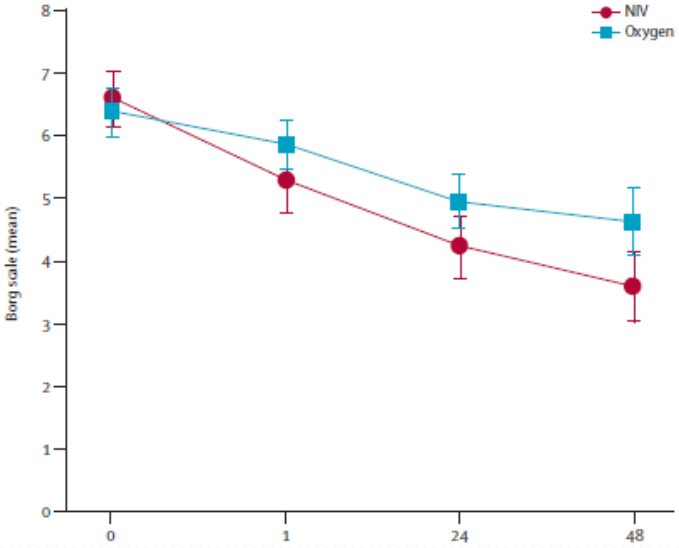
Recommendation

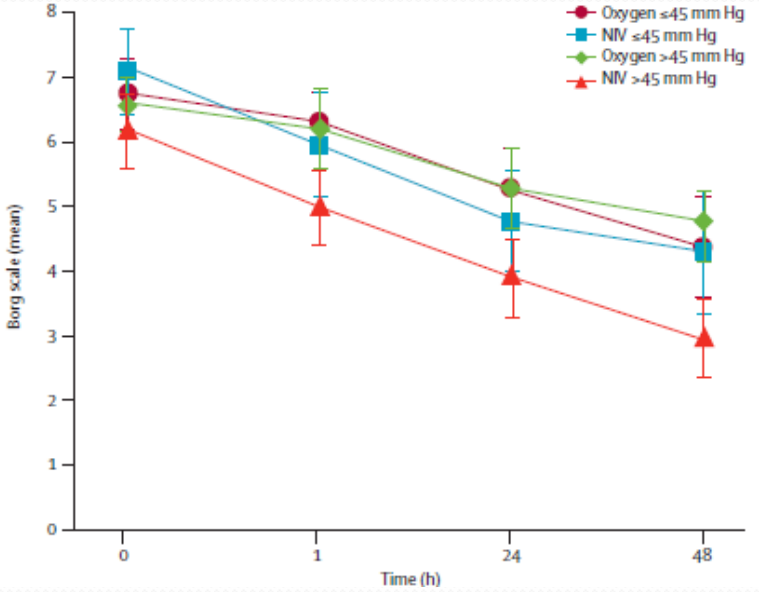
We suggest early NIV for immunocompromised patients with ARF. (Conditional recommendation, moderate certainty of evidence.)

Palyatif NIMV

- Çok merkezli randomize çalışma
- Solid tümör, ASY ve < 6 ay sağkalım beklentisi
- NIMV vs oksijen tedavisi

Nava S, Ferrer M, Esquinas A, et al. Lancet Oncol. 2013;14:219–27.





	Overall (NIV vs oxygen)	$PaCO_2$ ≤45 mm Hg (NIV vs oxygen)	$PaCO_2$>45 mm Hg (NIV vs oxygen)	Interaction
Morphine (mg)	26·9 (37·3) *vs* 59·3 (67·1)	33·4 (38·9) *vs* 58·1 (67·2)	21·3 (35·4) *vs* 60·8 (67·7)	..
Mean difference (mg)	−32·4 (−47·5 to −17·4)	−24·7 (−45·6 to −3·8)	−39·5 (−60·8 to −18·1)	−14·8 (−44·7 to 15·1)

Data are mean (SD), or mean difference (95% CI). NIV=non-invasive ventilation.

Table 4: **Morphine use**

NIMV grubunda dispnede daha hızlı düzelme
(öz. hiperkapnik hastalarda) ve daha düşük doz morfin ihtiyacı

Palyatif NIMV

- Terminal dönem hastada ASY nedeni ?
- En iyi sağkalım KOAH ve KKY (taburculuk oranı ≈%60)

Recommendation

We suggest offering NIV to dyspnoeic patients for palliation in the setting of terminal cancer or other terminal conditions. (Conditional recommendation, moderate certainty of evidence.)

Göğüs Travması

10 çalışma, meta-analiz

(7 çalışma ASY tedavisi, 3 çalışmada profilaktik NIMV)

Table 1 Randomized controlled trials

Study	Study design	Inclusion criteria	Experimental strategy	Control strategy	Sample size		Outcomes
					Experimental	Control	
Bolliger and Van Eeden	RCT	Chest trauma with multiple rib fractures	Face mask CPAP regional analgesia	CPPV	36	33	Complications, infections, ICU/ hospital stay and ICU mortality
Gunduz et al.	RCT	Chest trauma with multiple rib fractures and ARF	Face mask CPAP	CPPV	21	22	Gas exchange, infections, ICU/ hospital stay and ICU mortality
Ferrer et al.	RCT	Chest trauma with ARF	BiPAP face mask	High flow oxygen therapy	6	17	Intubation rate and ICU mortality
Hernandez et al.	RCT	Chest trauma with ARF	BiPAP face mask	High flow oxygen therapy	25	25	Intubation rate, infections, ICU/ hospital stay and mortality

RCT randomized controlled trial, *CPAP* continuous positive airway pressure, *BiPAP* bi-level positive airway pressure, *CPPV* continuous positive pressure ventilation, *ARF* acute respiratory failure, *ICU* intensive care unit

Table 2 Observational studies

Study	Study design	Inclusion criteria	Experimental strategy	Sample size	Outcomes
Hurst et al.	Prospective observational	Trauma patients with ARF	Face mask CPAP	33	Gas exchange, respiratory rate and intubation rate
Xirouchaki et al.	Prospective observational	Blunt thoracic trauma patients with ARF	Face mask BiPAP combined with regional analgesia	22	Gas exchange, respiratory rate and intubation rate
Gregoretti et al.	Prospective observational	Trauma patients with ARF weaned from mechanical ventilation	Face mask NIPSV	22	Gas exchange, respiratory rate, intubation rate
Linton and Potgieter	Retrospective observational	Blunt thoracic trauma patients	Face mask CPAP with regional analgesia	26	Complications and ICU stay
Beltrame et al.	Retrospective observational	Trauma patients with ARF	Face mask NIPSV	46	Gas exchange, respiratory rate and intubation rate
Vidhani	Retrospective non randomized	Trauma patients	Face or nasal CPAP/ BiPAP	40	ICU mortality

Göğüs Travması

- **NIMV ;**

*Oksijenizasyonda anlamlı düzelme

*Entübasyon ihtiyacı, komplikasyon oranı, hastane yatış süresi ve mortalitede azalma

Chiumello D, et al. Intensive Care Med. 2013;39:1171–80.

Recommendation

We suggest NIV for chest trauma patients with ARF. (Conditional recommendation, moderate certainty of evidence.)

Pandemik H1N1 infeksiyonunda NIMV

First author [ref.]	Year	Country	Study design	Interface	Received NIV	NIV failu	Transmission among HCW#	Mortality	Observations
Kaufman [21]	2009	Australia	Multicentre, prospective cohort (n=3)	Face mask	0	100%	No		
Perez-Padilla [22]	2009	Mexico	Retrospective, multicentre cohort (n=98)	Face mask	n=18 (IMV: n=12)		Yes	n=7	22 HCW were treated with oseltamivir None were hospitalised None of the secondary infections among HCW were severe
Rello [23]	2009	Spain	Multicentre cohort (n=32)	Face mask	n=8 (33%)	75%	No	n=8	24 (75.0%) required IMV
Dubre [28]	2009	France	Case 1: pregnant	Face mask	1	0%	No	0	Pregnancy population
Kumar [24]	2009	Canada	Prospective, observational, multicentre cohort (n=168)	Face mask	n=55 (33%)	85%	No		136 (81.0%) patients received IMV
Domínguez-Cherit [31]	2009	Mexico	Prospective, observational, multicentre cohort (n=58)	Face mask	0	0	No	0	
Miller [29]	2009	USA	Monocentre, observational cohort (n=47)	Face mask	n=13 (3%)	85%	No	17%	Severe ARDS with MOF in the absence of bacterial infection was a common clinical presentation
Li [26]	2010	China	Retrospective, monocentre cohort (n=75)	Face mask	n=33 (44%)	n=10 (30	No	10%	
Koegelenberg [30]	2010	South Africa	Monocentre, observational cohort (n=19)	Face mask	n=6 (66%)	66.6%	No	n=13 (68.4%)	
Winck [36]	2010	Portugal	Case report (n=1)	Face mask	n=1	0	No		
Esquinas [37]	2010	International NIV Network Survey	Prospective, international, observational cohort	Face mask			No		
Hajjar [38]	2010	Brazil	Monocentre cancer patients, observational study cohort (n=8)	Face mask	n=8 (50%)	n=5 (62.5	No	100%	Cancer patients highlight the severity of the H1N1 pandemic in this vulnerable population and the urgent need to establish specific protocols of care and management strategies designed to face this healthcare challenge
Louriz [40]	2010	Morocco	Observational, prospective, multicentre cohort (n=186)	Face mask	n=10	n=10 (100		30%	
Adıgüzel [32]	2010	Turkey	Observational, monocentre cohort (n=19)	Face mask	Nasal cannula: n=4 (21.1%)		No		First study to include nasal cannula
Nin [39]	2011	Spain	Multicentre, observational, prospective cohort (n=96)	Face mask	n=43 (45%)	77%	No	50% global	High mortality, primarily due to refractory hypoxia
Rios [25]	2011	Argentina		Face mask	n=49 (28%)	94%	No		
Liu [43]	2011	China	Retrospective, observational, monocentre cohort (n=62)	Face mask	n=23	n=3	No	n=4 (6.5%)	Hypoxaemia, MOF, and a requirement for IMV
Timenetsky [46]	2011	Brazil	Prospective, observational, monocentre cohort (n=14)	Face mask	85.7%	58.4%	No	2.1%	
Grasselli [45]	2011	Italy	Prospective, observational, monocentre cohort (n=19)	Face mask	n=13	n=11	No		Frequent IMV
Belenguer-Muncharaz [47]	2011	Spain	Retrospective, observational, monocentre cohort	Face mask and helmet	n=10	0	No	0	First study to use a helmet and a face mask
Masclans [48]	2012	Spain	Prospective, observational, multicentre registry cohort	Face mask	n=177	n=105 (59.3	No	0	Best outcome in low APACHE II and SOFA, no vasopressor, lower chest radiograph quadrants and shorter ICU stay
Zhang [33]	2012	China	Retrospective, observational,	Face mask	n=83	n=45 (24.3	No	n=24 (28.91%)	Pregnancy population

Pandemik viral hastalıklarda NIMV

- NIMV başarısızlığı ➔ ≈ %30
- H1N1 infeksiyonuna bağlı solunum yetmezliğinde ➔ %13-77
- Uygun önlemler alındığında sağlık bakımı personeline geçiş yok

Question 9: Should NIV be used in ARF due to pandemic viral illness?

Recommendation

Given the uncertainty of evidence we are unable to offer a recommendation for this question.

NIMV

- Postekstübasyon NIMV?

  *Weaning

  *Ekstübasyon sonrası profilaktik

  *Postekstübasyon solunum yetmezliğinde terapötik

- Postoperatif SY profilaksisi ve tedavisi

- OHS

- Astım

Ekstübasyon sonrası profilaktik NIMV

- Ekstübasyon başarısızlığı ➔ ilk 48-72 saat içinde reentübasyon

- **Risk faktörleri;**

*Kalp yetmezliği
*Nörolojik disfonksiyon, deliryum
*Yaş > 65
*Ekstübasyon günü APACHE II skoru > 12
*Birden fazla başarısız weaning
*Birden fazla komorbidite
*Ekstübasyon sonrası $PaCO_2$ >45 mmHg
*Zayıf öksürük
*Bol sekresyon

Official ERS/ATS clinical practice guidelines: noninvasive ventilation for acute respiratory failure

Eur Respir J 2017; 50: 1602426

Recommendations

We suggest NIV be used to facilitate weaning from mechanical ventilation in patients with hypercapnic respiratory failure. (Conditional recommendation, moderate certainty of evidence.)

We do not make any recommendation for hypoxaemic patients.

Recommendations

We suggest that NIV be used to prevent post-extubation respiratory failure in high-risk patients post-extubation. (Conditional recommendation, low certainty of evidence.)

We suggest that NIV should not be used to prevent post-extubation respiratory failure in non-high-risk patients. (Conditional recommendation, very low certainty of evidence.)

Recommendation

We suggest that NIV should not be used in the treatment of patients with established post-extubation respiratory failure. (Conditional recommendation, low certainty of evidence.)

Official ERS/ATS clinical practice guidelines: noninvasive ventilation for acute respiratory failure

Eur Respir J 2017; 50: 1602426

Recommendation

We suggest NIV for patients with post-operative ARF. (Conditional recommendation, moderate certainty of evidence.)

Recommendation

Given the uncertainty of evidence we are unable to offer a recommendation on the use of NIV for ARF due to asthma.

Entübasyon öncesi Preoksijenizasyon

- 53 hipoksemik hasta
- Entübasyon öncesi 3 dakika

  Nonrebreathing rezervuarlı maske vs **NIMV**
- Preoksijenizasyon öncesi 2 grupta SaO_2 benzer

Baillard C, et al. Am J Respir Crit Care Med 2006;15:171-7

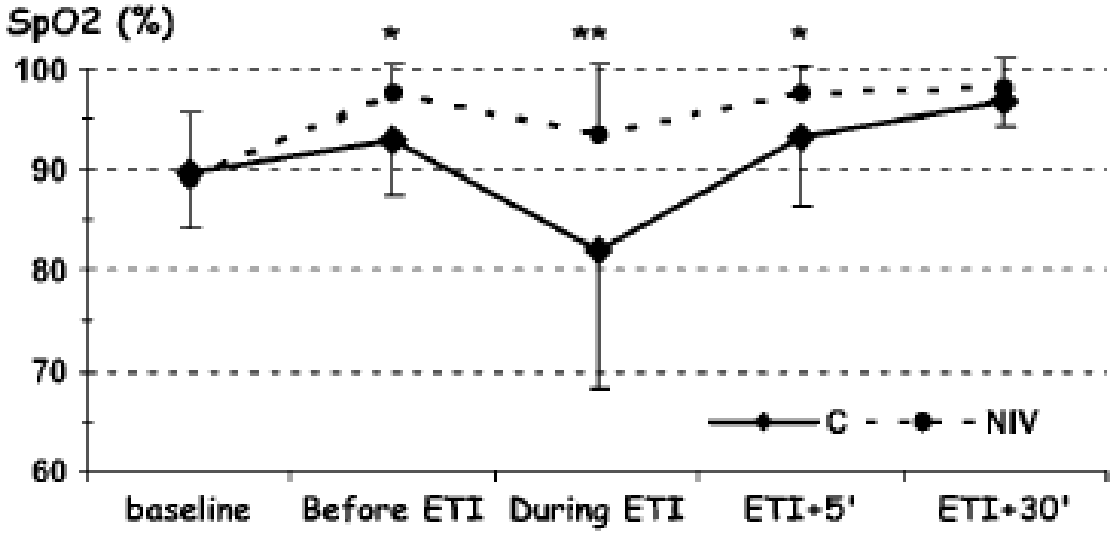


Figure Variation in mean Sp_{O_2} during preoxygenation and intubation (endotracheal intubation [ETI]). Sp_{O_2} is shown for the five steps of the study: (*1*) Before preoxygenation (i.e., baseline), when the patients are breathing with a mean of 13 L/min of O_2 supply; (*2*) after 3 min of preoxygenation with either NIV or the usual method (C) according to the randomization (i.e., before ETI); (*3*) the minimal value during ETI; (*4*) 5 min after ETI; and (*5*) 30 min after ETI. *Solid line*: control (C) group; *dotted line*: NIV group. *$p < 0.05$, **$p<0.01$, comparison between the two groups at the same point.

Entübasyon Öncesi Preoksijenizasyon

- Acil serviste, 30 hasta (çoğunluğu pnömoni, akut kalp yetmezliği, travmatik beyin hasarı)
- Entübasyon öncesi NIMV
- Gözlemsel çalışma

Kim T.H., et al. American Journal of Emergency Medicine. 2016;34:1627–30

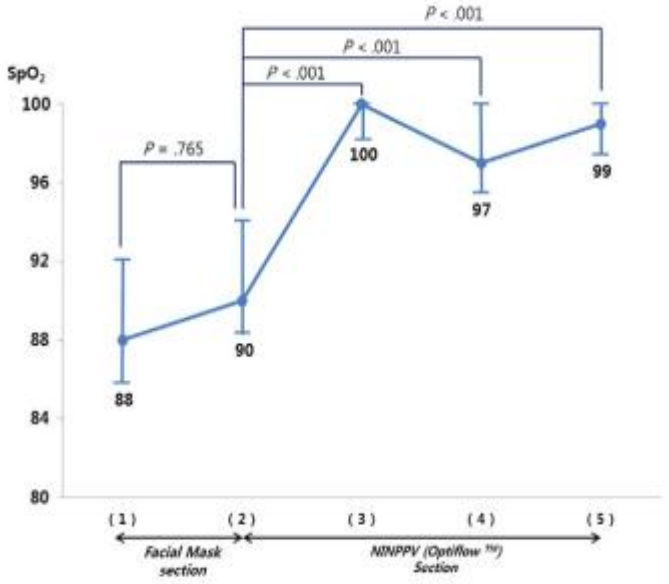


Fig. 1. Spo_2 values at the following points: (1) at ED admission, (2) just before applying the NINPPV, (3) just before intubation, (4) just after intubation, and (5) when applying the mechanical ventilator.

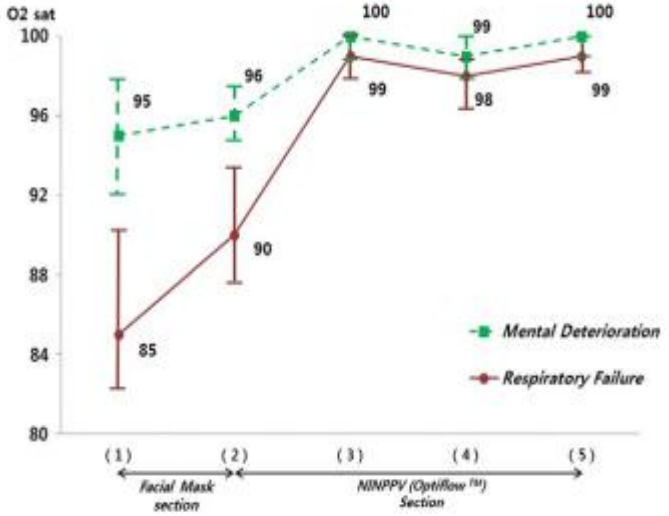
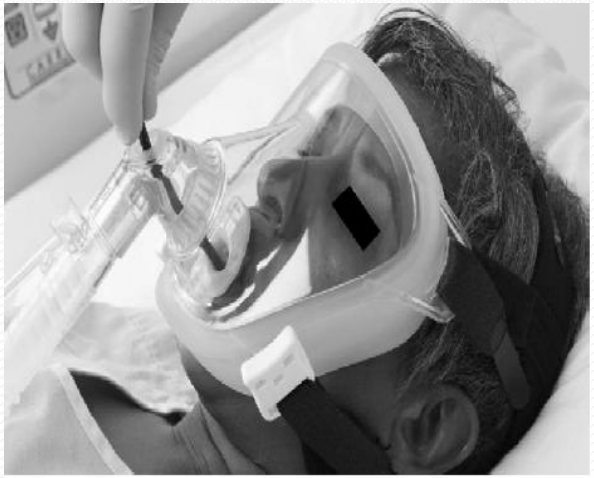


Fig. 2. The Spo_2 values of respiratory failure and mental deterioration groups at the following points: (1) at ED admission, (2) just before applying the NINPPV, (3) just before intubation, (4) just after intubation, and (5) when applying the mechanical ventilator.

NIMV eşliğinde bronkoskopi



- Trakeal lümende daralma
- Havayolu rezistansında artış
- Tidal volümde azalma
- Mukozaya irritan etki ile trakea/bronş spazmı
- Topikal anestezik, salin veya BAL ile V/Q oranında bozulma
- Sık aspirasyon ile volüm ve alveoler O2 miktarında azalma
- KOAH'lı hastalarda hava hapsi ➔ FRC'de ve oto-PEEP'de artış

Gaz değişimde bozulma

NIMV eşliğinde bronkoskopi

- 40 akut hipoksemik solunum yetmezlikli hasta
- Bütün hastalarda işlem tamamlanabilmiş
- SaO2 sadece 2 hastada %90'ın altına düşmüş (işlem boyunca en düşük değer: %84)
- PaO2/FiO2;
  İşlem öncesi: 176 ± 54
  İşlem sonrası:240 ± 130 (P < 0.001)
  İşlemden 2 saat sonra: 210 ± 79

BAL hastaların %68'inde tanısal

Baumann HJ, et al. Crit Care 2011;15:R179. doi: 10.1186/cc10328.

NIMV eşliğinde bronkoskopi

- Akut hipoksemik solunum yetmezlikli 30 hasta
  Bazal PaO_2/FiO_2: 170 (71-270)
- CPAP vs oksijen gruplarına randomize
- FOB sırasında CPAP grubunda SaO_2 anlamlı olarak daha yüksek
- Oksijen grubunda 6 hastada solunum desteği gerektiren SY (CPAP grubunda hiçbir hastada)

Maitre B, et al. Am J Respir Crit Care Med 2000;162:1063-7.

NIMV eşliğinde bronkoskopi

Table 1 Patient characteristics at admission ($n = 28$)

Age (yrs)	63.3 ± 15.9
Gender (male), *n* (%)	15 (53.6)
Comorbid illnesses, *n* (%)	27 (96.4)
Coronary artery disease	9 (32.1)
Hematological malignancy	7 (25.0)
Interstitial lung disease	6 (21.4)
Connective tissue diseases	6 (21.4)
Chronic lung disease	5 (17.9)
Solid organ malignancy	4 (14.3)
Diabetes mellitus	3 (10.7)
Chronic renal failure	3 (10.7)
Others	3 (10.7)
Immunosuppression, *n* (%)	20 (71.4)
APACHE II score[a]	15.5 (9–27)
PaO_2/FiO_2	145 ± 50.1
The diagnosis of hospitalisation, *n* (%)	
Pneumonia	20 (71.4)
Alveoler hemorrhage	3 (10.7)
Respiratory failure (other etiology)	5 (17.9)
ARDS, *n* (%)	
Mild	5 (17.9)
Moderate	18 (64.2)
Severe	5 (17.9)
Chest X-ray findings, *n* (%)	
Bilateral alveolar infiltrates	17 (60.7)
Bilateral interstitial infiltrates	7 (25.0)
Bilateral interstitial and alveolar infiltrates	4 (14.3)

Table 3 Hemodynamic and arterial blood gas parameters before and after FOB

Parameters	Before FOB	After FOB	*p* value
Arterial blood gas			
pH	7.45 ± 0.12	7.36 ± 0.14	0.07
$PaCO_2$ (mmHg)	41.3 ± 15.6	41.7 ± 16.1	0.56
PaO_2/FiO_2	132.2 ± 49.8	172.9 ± 63.2	**0.001**
Mean arterial pressure (mmHg)	96.7 ± 18.8	94.3 ± 19.6	0.43
Heart rate/min	104.0 ± 20.1	102.1 ± 18.6	0.48

Korkmaz P, et al. BMC Pulm Med 2016 31;16:89.

- A single but well conducted randomised trial suggests CPAP plus oxygen is superior to oxygen alone during bronchoscopy of patients with hypoxia, preventing reduction in saturations and the need for ventilator support post procedure. (Evidence level 1+)
- A total of three case series suggest non-invasive ventilation may be helpful in preventing mechanical ventilation in patients with hypoxia undergoing bronchoscopy, but further studies are needed in this area. (Evidence level 3)

Recommendations

- CPAP plus oxygen support may be considered in patients with hypoxia undergoing bronchoscopy to prevent desaturation and post-procedure requirement for mechanical ventilation. (Grade B)
- When patients require non-invasive ventilation prior to bronchoscopy, the procedure should be conducted in an environment where intubation and ventilatory support are readily accessible. (Grade D)

NIMV'a bronkoskopiden 15-20 dakika önce başlanmalı

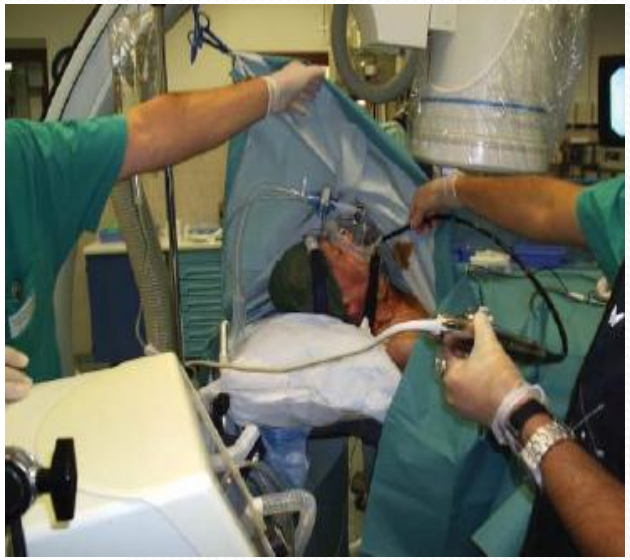
NIMV-Diğer Endoskopik İşlemler

Non-invasive ventilation-aided transoesophageal echocardiography in high-risk patients: a pilot study

Fabio Guarracino[1*], Luca Cabrini[2], Rubia Baldassarri[1], Claudia Cariello[1], Remo Daniel Covello[2], Giovanni Landoni[2], Sonia Petronio[3], and Nicolino Ambrosino[4]

Outcomes of Percutaneous Endoscopic Gastrostomy Tube Insertion in Respiratory Impaired Amyotrophic Lateral Sclerosis Patients Under Noninvasive Ventilation

David Czell MD, Matthias Bauer MD, Janek Binek MD, Otto D Schoch MD, and Markus Weber MD



Utility of noninvasive ventilation in high-risk patients during endoscopic retrograde cholangiopancreatography

Miguel Angel Folgado, Carlos De la Serna[1], Alfonso Llorente, Sl. Rodriguez[1], Carlos Ochoa[1], Salvador Diaz-Lobato[2]

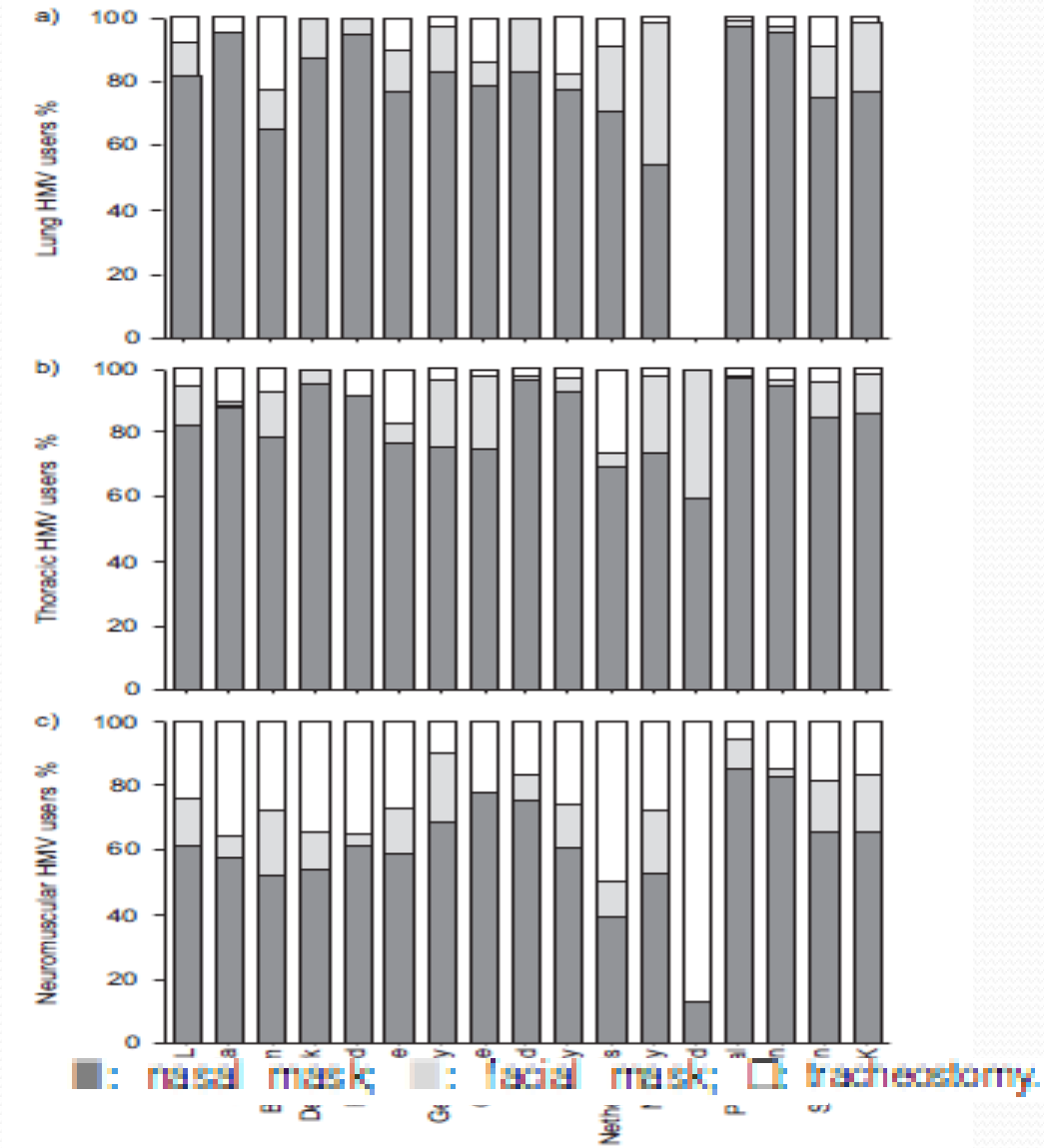
Department of Emergency, [1]Gastroenterology Service, and [2]Investigation Unit, Virgen de la Concha Hospital, Zamora, [1]Department of Pneumological, Ramón y Cajal Teaching Hospital, Madrid, Spain

Kronik Solunum Yetmezliği-EMV

- Eurovent çalışması, 16 Avrupa ülkesi
- 329 merkez
- 21,526 hasta

EMV prevalansı: 6.6/100.000

Eur Respir J 2005;25;1025-31



Eur Respir J 2005;25;1025-31

KOAH-ENIMV

- 7 randomize çalışma, 245 hastayı kapsayan meta-analiz

	Control n = 127	NIPPV n = 118
Age (yrs)	68.4 (6.5)	64.6 (7.1)
Male n (%)	75	80
$PaCO_2$ (kPa)	52.4 (6.8)	53.9 (8.3)
PaO_2 (kPa)	54.6 (8.3)	55.7 (13.1)
FEV_1 (L)	0.72 (0.23)	0.76 (0.31)
FVC (L)	2.01 (0.67)	2.02 (0.66)
IPAP (cm H_2O)	–	14.2 (3.1)
EPAP (cm H_2O)		4.0 (1.0)
Compliance (hours/day)	–	6.7 (2.2)

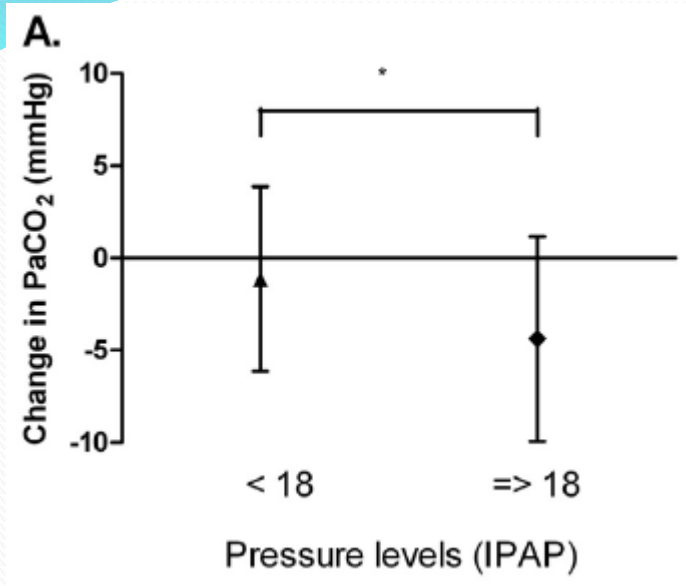
Respir Med 2014;108:329-37.

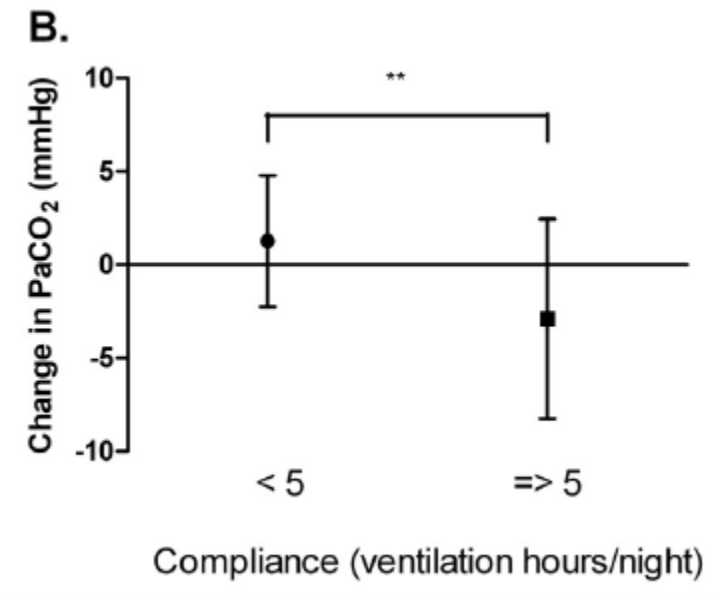
KOAH-ENIMV

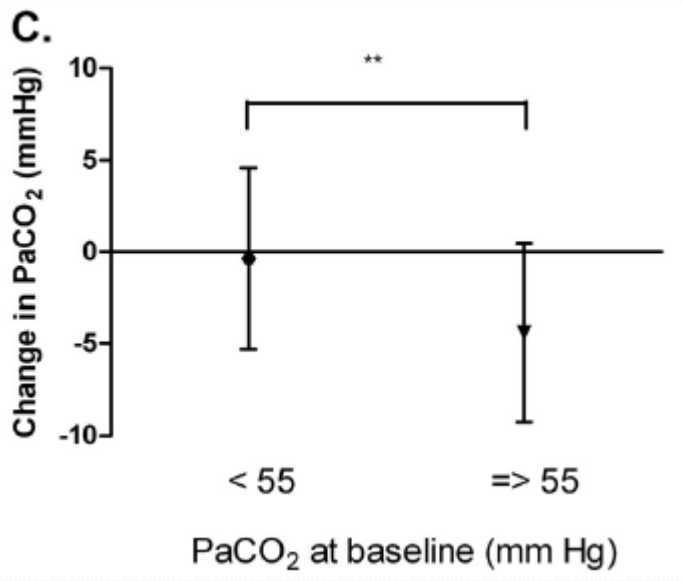
- **3. veya 12. aydan sonra;**

  *$PaCO_2$, PaO_2
  *6DYT
  *Yaşam kalitesi
  *FEV1, FVC ve MIP
  *Uyku kalitesi

  2 grup arasında fark yok







Yüksek IPAP, daha iyi uyum ve yüksek bazal $PaCO_2$

↓↓↓

$PaCO_2$'de düzelme

KOAH-ENIMV

- 73 stabil hiperkapnik KOAH hastası (ort FEV1: %30±12)
- Yüksek yoğunluklu NIMV
- Ortalama IPAP/EPAP: 28±5/5±1 cmH2O
- AKG, solunum fonksiyonları ve atak sayısında düzelme
- 2 ve 5 yıllık sağkalım: %82 ve %58

Int J Med Sci 2009;6:72-6

KOAH-ENIMV

- 17 stabil KOAH hastası

- Yüksek yoğunluklu NIMV vs düşük yoğunluklu NIMV
  (IPAP: 28.6+/-1.9 cmH2O vs 14.6+/-0.8 cmH2O)

- 6 hafta NIMV sonrası;
  Yüksek yoğunluklu NIMV grubunda
  *PaCO2, FEV1 , FVC ve yaşam kalitesinde anlamlı düzelme
  *NIMV'a uyum daha iyi (>3.6saat/gün)

Thorax 2010;65:303-8

Cochrane Database Syst Rev. 2014 Dec 13;(12):CD001941. doi: 10.1002/14651858.CD001941.pub3.

Nocturnal mechanical ventilation for chronic hypoventilation in patients with neuromuscular and chest wall disorders.

- 10 RKT, 173 hasta
- Bazı çalışmalarda semptolarda düzelme
- 4 çalışmada sağkalımda düzelme ve hastane yatış sıklığında azalma

OHS

Literature Search Results on Obesity Hypoventilation Syndrome

Outcomes								
Author Year (Ref)	**Study Type Duration**	**# of Pts**	**Mortality**	**HRQoL**	**Sleep**	**Gas Exchange**	**Vigilance**	**Other**
Piper, 2008 (16)	RCT, CPAP vs.bilevel 3 months	36 (18 CPAP; 18 bilevel)	n/a	SF-36 improved in both	Subjective improvement in Bilevel (PSQI)	Improved In both groups bilevel =CPAP	Subjective sleepiness improved in both. Performance tests improved in both	
Heinemann, 2007 (15)	Prospective 24 months	35 bilevel	n/a	n/a	n/a	Improved	n/a	VC, ERV improved Hct,Hgb decreased
Banerjee, 2007 (20)	Prospective 1 night	23 CPAP	n/a	n/a	Improved: AHI, AI, TST, SpO_2<90%	n/a	n/a	
Perez de Llano, 2007 (13)	Retrospective 50 months	54 bilevel or Volume-cycled	n/a	n/a		Improved	Subjective sleepiness improved	Dyspnea improved
Storre, 2006 (18)	RCT X-OVER bilevel vs AVAPS 6 weeks	10	n/a		Improved in both equally SRI improved equally	TCO_2 improved in AVAPS		Health care costs (physician fees and hosp. rates reduced after therapy).
Berg, 2001 (11)	Retrospective cohort CPAP or bilevel	20	n/a	n/a	n/a	n/a		Improved lung function, Hgb.
Budweiser, 2007 (14)	Prospective 41 months	126 PSV		n/a	n/a	Daytime and nighttime improved	n/a	
Hida, 2003 (17)	Prospective 3-6 months	26 CPAP	n/a	n/a	SF-36 improved	Hypercapnia improved in 51%	Subjective sleepiness improved	Headache, edema, dyspnea: improved
Kawata, 2007 (21)	Prospective 3 months	37 CPAP	n/a	n/a	Improved	PCO_2 improved	n/a	
Chouri-Pontarollo, 2007 (23)	Prospective 5-7 nights	15 bilevel	n/a	n/a	n/a	No change in CO_2	ESS, OSLER improved in low CO2 responders	
Masa, 2001 (24)	Prospective 4 months	22 OHS 14 KS 17 VCV 5 bilevel	n/a	n/a	n/a	responsiveness improved	Subjective improvement	

Pulmoner Rehabilitasyon-NIMV

- KOAH veya restriktif akciğer hastalıklarına bağlı kronik solunum yetmezliğinde

- Egzersiz sırasında NIMV

- Dispnede azalma, egzersiz kapasitesinde artış

Borel JC, et al. Respir Med 2008;102:711–9
Borghi-Silva A, et al. Respir Care 2010;55:885–94
Menadue C, et al. Respir Med 2010;104:219–27

NİMV başlanması

- Ambulans
- Acil servis
- Genel servis
- Ara YBÜ ve YBÜ

Ventilatörler

- **YBÜ ventilatörleri**

Avantaj: yüksek basınçlar ve FiO_2 sağlayabilme ve detaylı monitörizasyon , çift hortumlu devreler sayesinde yeniden soluma görülmez

- **Bilevel (Portabl) ventilatörler**

Avantaj: Ucuz, hava kaçağı kompensasyonu daha iyi

Maskeler

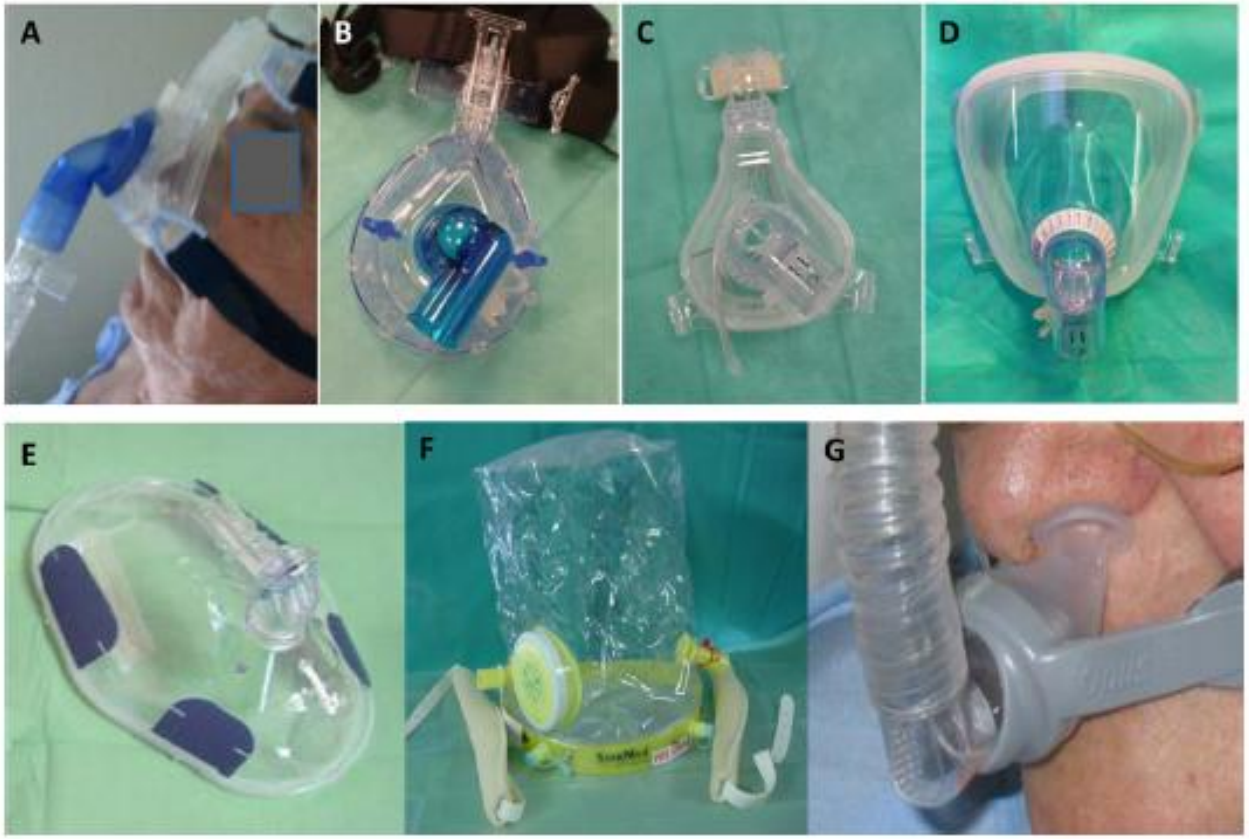


Figure 2 Interfaces for noninvasive ventilation.
Notes: (A) nasal mask; (B and C) oro-nasal masks; (D and E) full-face masks; (F) helmet; (G) nasal pillows.

Modlar

- BİPAP (S ve S/T)
- CPAP
- PAV
- AVAPS (Ortalama Volüm Garantili Basınç Desteği)
- AVAPS-AE
- NAVA

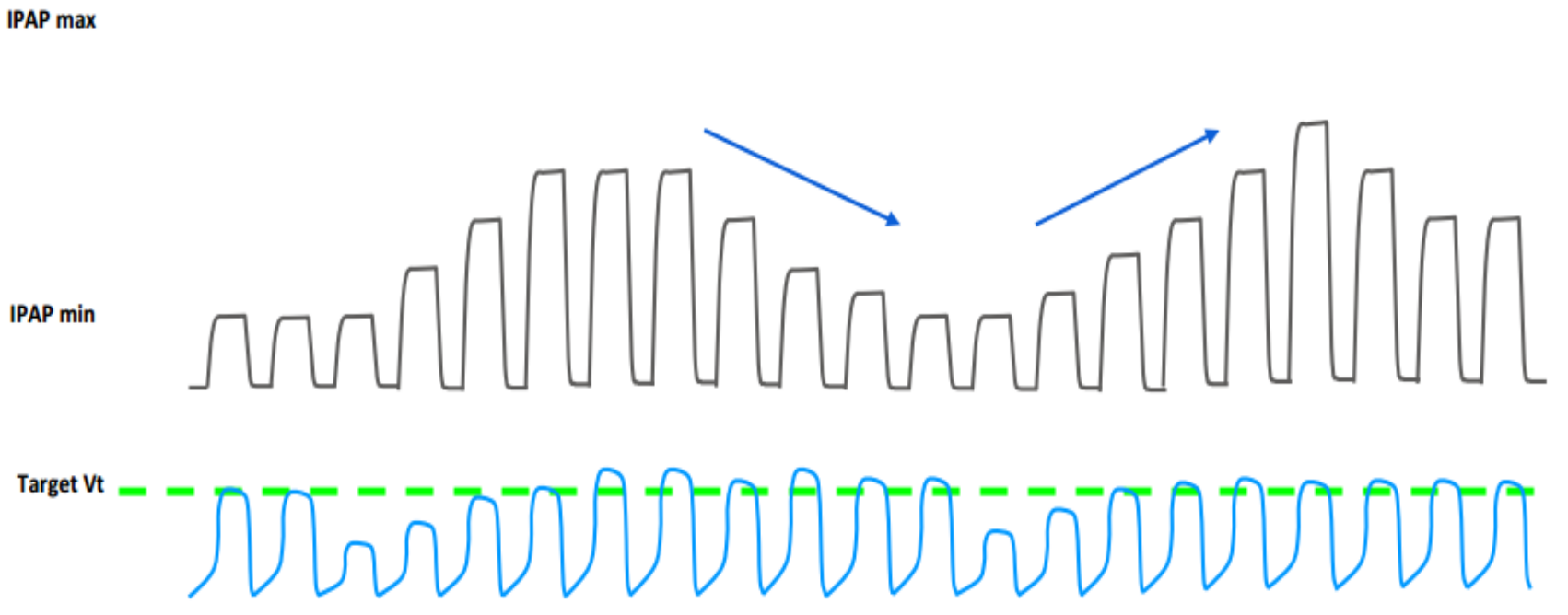
AVAPS


PHILIPS
Oto Sınırlama Alarmı
Nfs Verme
Hız
16
366
5.8
TSB
9
Top.Sızın.
90
Hs. Tetikl.
30
26
Alarmlar
Yrnl Mod: AVAPS
550
15
5
EPAP
5
24
30
25
İptal
Alarm Ayarları
Modlar

AVAPS

Average Volume Assured Pressure Support

(adjunct to Pressure modes)



AVAPS

- CPAP tedavisine yanıtsız OHS'li hastalar
- S/T vs AVAPS
- AVAPS grubunda nokturnal PtcCO2'de anlamlı azalma

Storre JH, et al. Chest 2006;130:815-21

AVAPS

- KOAH atak ve hiperkapnik ensefalopatili 22 hasta
- S/T vs AVAPS

Briones Claudett KH, et al. BMC Pulm Med. 2013;13:12. doi: 10.1186/1471-2466-13-12

Table 1 Initial patient assessment results

NIV study groups (All 22 patients)		Mean	SD	*P*
BMI	BiPAP S/T	26.22	2.87	.99
	BiPAP S/T +AVAPS	24.23	2.62	
Age (years)	BiPAP S/T	77.55	6.49	.10
	BiPAP S/T + AVAPS	79.82	13.53	
APACHE II	BiPAP S/T	18.45	2.50	.86
	BiPAP S/T + AVAPS	18.55	2.73	
Initial GSC	BiPAP S/T	8.36	1.43	1.00
	BiPAP S/T + AVAPS	8.36	1.63	
Initial pH	BiPAP S/T	7.28	0.02	.45
	BiPAP S/T + AVAPS	7.29	0.03	

*Statistically significant (*P* value <.05).
A total 22 patients. 11 patients of group BiPAP S/T and 11 patients of group BiPAP S/T +AVAPS.

Table 2 Evolution of blood gases, vital signs, and ventilatory parameters (mean ± SD)

Variables	Groups	Initial	1 hour	3 hours	12 hours	*P*
GSC	BiPAP S/T	8.3 ± 1.4	9.7 ± 2	12 ± 1.5	13 ± 1	.00001*
	BiPAP S/T + AVAPS	8.3 ± 1.6	11 ± 1	14.1 ± 0.8	15 ± 0	
pH	BiPAP S/T	7.28 ± 0.02	7.30 ± 0.05	7.31 ± 0.11	7.32 ± 0.12	.31
	BiPAP S/T + AVAPS	7.29 ± 0.03	7.34 ± 0.04	7.37 ± 0.11	7.37 ± 0.08	
pCO_2	BiPAP S/T	64.8 ± 9.1	58.3 ± 8.7	53.2 ± 9	50.1 ± 6.5	.03*
	BiPAP S/T + AVAPS	63 ± 16.3	50.7 ± 11.2	45.4 ± 7.9	43.6 ± 6.5	
PO_2	BiPAP S/T	66.6 ± 12.7	83.1 ±17.8	75.3 ± 26.7	79.7 ± 16.2	.31
	BiPAP S/T + AVAPS	71.5 ± 16.8	78 ± 19.1	87.5 ± 11.5	87.4 ± 18	
Respiratory rate	BiPAP S/T	27.9 ± 5.6	23.2 ± 3.5	21 ± 2.6	20 ± 1.61	.01*
	BiPAP S/T + AVAPS	29 ± 6.9	17.4 ± 3.2	18.5 ± 3.6	19.9 ± 5.1	
Maximum delivered IPAP received	BiPAP S/T	12.3 ± 0.9	12.6 ± 0.9	14.3 ± 0.8	14.7 ± 1	.005*
	BiPAP S/T + AVAPS	19.8 ± 2.2	18.3 ± 2.3	18 ± 2.6	17 ± 2.3	
Exhaled tidal volume	BiPAP S/T	304 ± 60.6	400.5 ± 73.9	519 ± 61.4	531.1± 63.6	.01*
	BiPAP S/T + AVAPS	298.6 ± 54.3	606.3 ± 75.4	626.3 ± 77.6	617.6 ± 77.4	

J Crit Care. 2017 Jun;39:232-237. doi: 10.1016/j.jcrc.2016.12.023. Epub 2017 Jan 30.

Evaluation of the feasibility of average volume-assured pressure support ventilation in the treatment of acute hypercapnic respiratory failure associated with chronic obstructive pulmonary disease: A pilot study.

Çiftci F[1], Çiledağ A[2], Erol S[3], Öz M[4], Acar D[5], Kaya A[6].

- 106 KOAH akut hiperkapnik solunum yetmezlikli hasta
- AVAPS başarısı: %76.4
- Başarı ile ilişkili faktörler: Bazal CRP, GKS, ilk 2 saatteki AKG yanıtı

AVAPS-AE (Automatic EPAP)

- Hedef tidal volüm ve delta P'ye ek olarak
- Otomatik EPAP
- KOAH ve OHS'li hastalarda eşlik eden OSA
- Obstrüktif apnelerin engellenmesi?

Respirology. 2014 May;19(4):596-603. doi: 10.1111/resp.12269. Epub 2014 Mar 24.

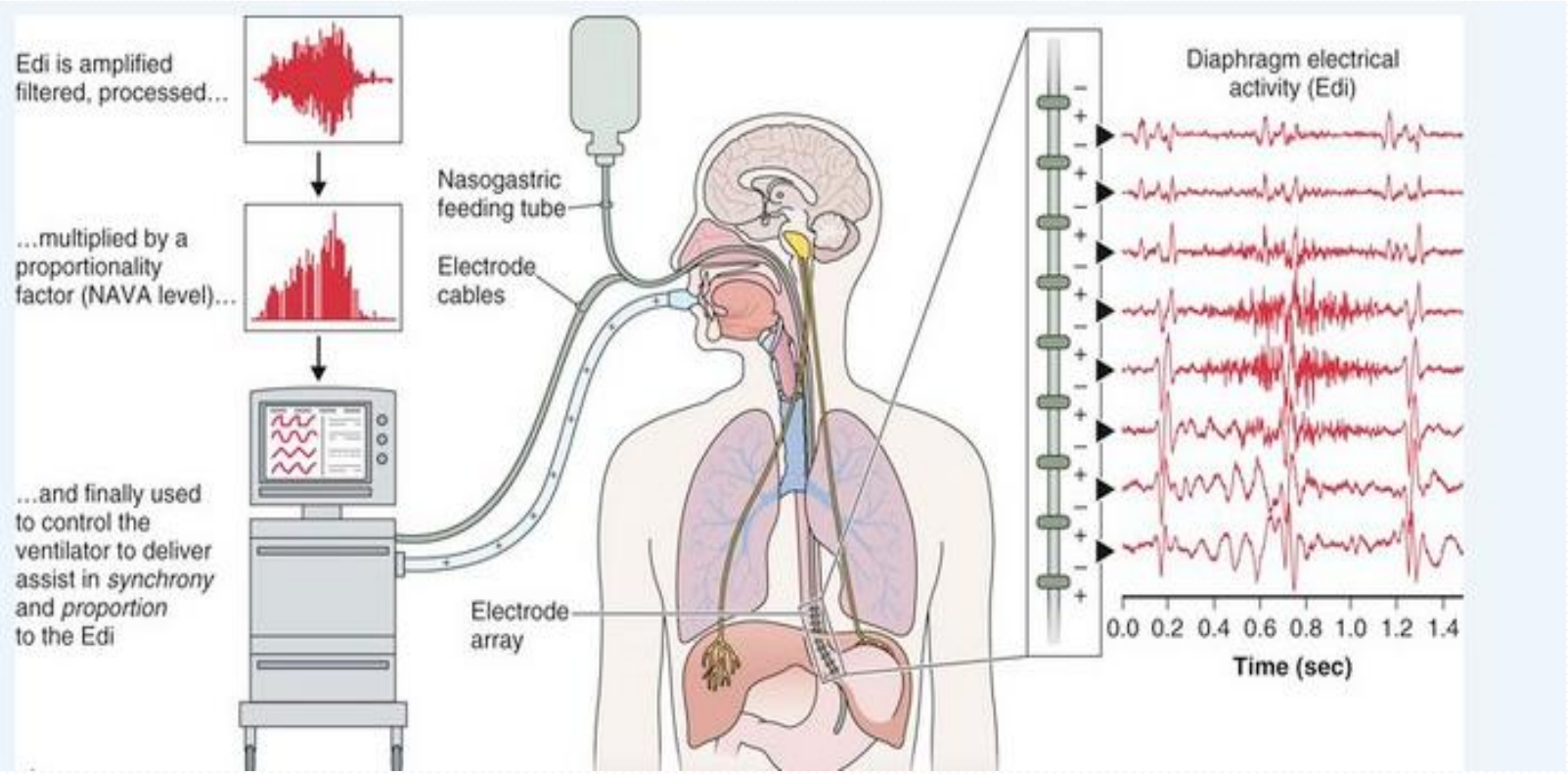
Randomized trial of 'intelligent' autotitrating ventilation versus standard pressure support non-invasive ventilation: impact on adherence and physiological outcomes.

Kelly JL[1], Jaye J, Pickersgill RE, Chatwin M, Morrell MJ, Simonds AK.

- 18 kronik obstrüktif veya restriktif akciğer hasta
- iVAPS vs PSV gruplarına randomize
- Bazal ve 1. ayda PSG ve transkutan CO_2
- İki grup arasında spirometri, solunum kas gücü, uyku kalitesi, arousal ve SaO_2 bakımından fark yok

	iVAPS	Standard PS	Median difference between treatments (95% CI)	*P*
Ventilator settings (*n* = 18)				
PS minimum and maximum boundaries (iVAPS) (cmH_2O)	5.0 (5.0–5.0)–17.5 (15.0–18.0)	n/a	n/a	n/a
PS (standard PS) (cmH_2O)	n/a	10.0 (9.0–11.4)	n/a	n/a
EPAP (cmH_2O)	7.8 (6.0–9.0)	7.3 (6.0–9.0)	0 (0 to 1)	0.77
RR (bpm)	16.5 (14.0–21.0)	12.0 (12.0–13.0)	4.7 (2.3 to 7.3)	0.001†
Target Va (l/min)	4.9 (4.1–6.1)	n/a	n/a	n/a
Ventilator output (*n* = 16)				
PS delivered median (cmH_2O)‡	8.3 (5.6–10.4)	10.0 (9.0–11.4)	−2.2 (−4.5 to 0.3)	0.001†
Median leak (l/min)—vent	6.5 (3.5–26)	3.6 (0.2–9.6)	3.5 (−2.5 to 9.6)	0.23
Median tidal volume (mL)	421 (321–521)	400 (300–575)	−10 (−54 to 23)	0.47
Median minute ventilation (l/min)	6.8 (5.3–8.3)	6.2 (5.4–9.4)	−0.2 (−1.2 to 0.5)	0.50
Median RR (bpm)	16.7 (13.2–18.4)	15.5 (13.5–17.0)	0.3 (−0.7 to 2.2)	0.41
Adherence (*n* = 17)				
Mean NIV usage time (hh:mm/day)	5:40 (4:42–6:49)	4:20 (2:27–6:17)	01:04 (00:27 to 1:44)	0.004†
% days used in study	91 (64–98)	92 (70–99)	−1 (−15 to 7)	0.53
% days used ≥4/24	74 (49–92)	60 (27–85)	8 (−2 to 17)	0.1

NAVA


Edi is amplified filtered, processed…
…multiplied by a proportionality factor (NAVA level)…
…and finally used to control the ventilator to deliver assist in *synchrony* and *proportion* to the Edi
Nasogastric feeding tube
Electrode cables
Electrode array
Diaphragm electrical activity (Edi)
0.0 0.2 0.4 0.6 0.8 1.0 1.2 1.4
Time (sec)

Chest. 2013 Jan;143(1):30-36. doi: 10.1378/chest.12-0424.

Neurally adjusted ventilatory assist vs pressure support ventilation for noninvasive ventilation during acute respiratory failure: a crossover physiologic study.

Bertrand PM[1], Futier E[2], Coisel Y[3], Matecki S[4], Jaber S[5], Constantin JM[1].

- 13 ASY'li hasta
- Sıra ile 30'ar dakika PSV sonra NAVA

Table 3—*Respiratory Parameters and Patient-Ventilator Asynchrony During PSV and NAVA*

Parameters and Asynchrony	NIV Trial		*P* Value
	PSV (n = 13)	NAVA (n = 13)	
Respiratory parameters			
Pmax, cm H_2O	12.1 (11.0-13.2)	12.6 (11.3-13.6)	.21
Pmin, cm H_2O	4.4 (4.1-6.5)	4.9 (4.4-5.8)	.18
V_{TE}			
mL	515 (410-593)	498 (421-663)	.06
mL/kg	8 (6-8)	8 (7-8)	.08
PEEP, cm H_2O	6 (5-7)	6 (5-7)	.35
EAdi max, μV	10.6 (8.1-18.8)	11.9 (10.0-15.1)	.017
T_{In}, ms	880 (770-1,140)	870 (770-1,055)	.63
Td	90 (30-130)	0 (0-30)	< .001
T_{Iexe}, ms	125 (20-312)	10 (0-28)	< .001
Asynchrony, n/min			
Ineffective efforts	0.4 (0.2-0.6)	0.0 (0.0-0.0)	.008
Autotriggering	0.2 (0.0-0.6)	0.0 (0.0-0.2)	.08
Double triggering	0.2 (0.0-0.2)	0.06 (0.0-0.4)	.10
Delayed cycling	0.8 (0.2-1.6)	0.2 (0.0-0.4)	.028
Premature cycling	0.6 (0.3-1.0)	0.6 (0.15-1.2)	.73

Intensive Care Med. 2016 Nov;42(11):1813-1815. Epub 2016 Aug 25.

Asynchrony index in pressure support ventilation (PSV) versus neurally adjusted ventilator assist (NAVA) during non-invasive ventilation (NIV) for respiratory failure: systematic review and meta-analysis.

Sehgal IS[1], Dhooria S[2], Aggarwal AN[2], Behera D[2], Agarwal R[2].

- Toplam 9 çalışma, 96 hasta
- 6'sı erişkin, 3'ü pediatrik popülasyon
- 5 RKÇ, 4 gözlemsel çalışma
- Asenkroni indeksi PSV'de anlamlı olarak daha fazla

Teşekkür ederim