SOCIETÀ ITALIANA DI GERONTOLOGIA E GERIATRIA
68° CONGRESSO NAZIONALE SIGG
Ritorno al futuro
FIRENZE, 13-16 DICEMBRE 2023
PALAZZO DEI CONGRESSI

Analisi ecografica dell'escursione diaframmatica durante l'utilizzo di diverse interfacce nella terapia con CPAP

Sonia Zotti

Anna Annunziata, Giuseppe Fiorentino, Simone Scarlata, Claudio Pedone, Raffaele Antonelli Incalzi

OSPEDALI DEI COLLI
MONALDI - COTUGNO - C.T.O.
"AZIENDA OSPEDALIERA SPECIALISTICA DEI COLLI"
Monaldi - Cotugno - C.T.O.

UNIVERSITÀ CAMPUS BIO-MEDICO DI ROMA
FONDAZIONE
POLICLINICO UNIVERSITARIO
CAMPUS BIO-MEDICO

OBSTRUCTIVE SLEEP APNEA SYNDROME (OSAS)

Clinical features of obstructive sleep apnea

Examination findings
▪ Narrow or "crowded" oropharynx (eg, Mallampati 3 or 4; macroglossia, tonsillar enlargement, narrow palate)
▪ Obesity
▪ Large neck circumference (eg, >17 inches [males]; >16 inches [females])
▪ Craniofacial abnormalities (eg, retrognathia)
Symptoms
▪ Daytime sleepiness
▪ Nonrestorative sleep or fatigue
▪ Loud snoring
▪ Witnessed apneas by bed partner
▪ Awakening with choking or gasping
▪ Nocturnal restlessness
▪ Insomnia (initiation, maintenance, frequent awakenings)
▪ Lack of concentration
▪ Cognitive deficits (eg, short-term memory loss)
▪ Changes in mood
▪ Morning headaches
▪ Vivid, strange, or threatening dreams
▪ Nocturia

- ❑ **Recurrent upper airway narrowing or collapse during sleep, located in multiple sites, including the oropharynx and nasopharynx.**
- ❑ **Obesity and greater neck circumference are important risk factors**

FONDAZIONE
POLICLINICO UNIVERSITARIO
CAMPUS BIO-MEDICO

RATIONALE OF THE STUDY

AMERICAN THORACIC SOCIETY DOCUMENTS

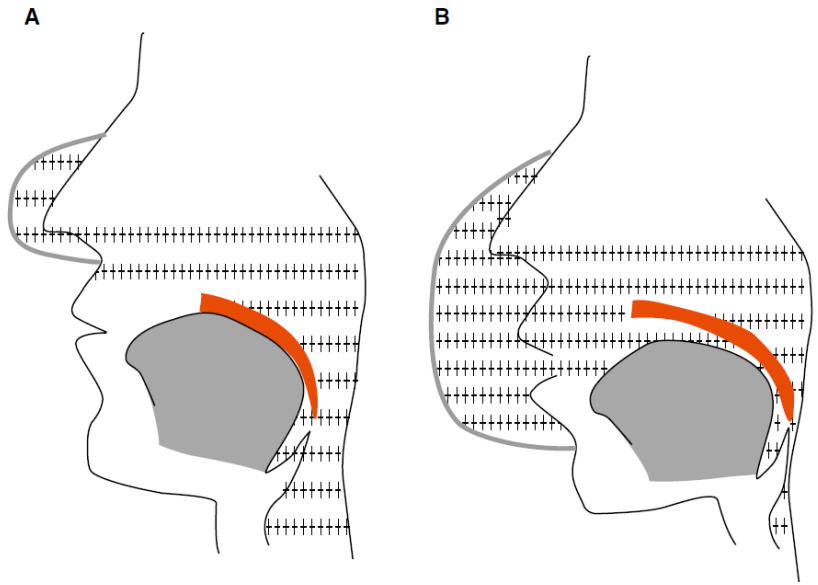


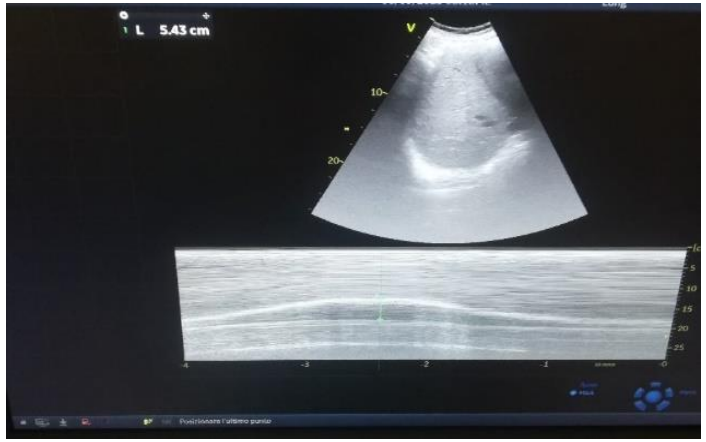
Figure 1. Potential effect of oronasal continuous positive airway pressure (CPAP) on upper-airway patency. (*A*) Nasal CPAP splints the upper airway and pushes the soft palate against the tongue. (*B*) Oronasal CPAP may neutralize the splinting effect of nasal CPAP because of the transmission of positive pressure to the mouth.

- **It is known that oronasal masks are not as effective at opening the upper airway compared to nasal ones.** [1]
- **The effects of CPAP masks on the upper airway may differ between individuals and may depend on other variables as BMI or neck circumference.**

1. Genta, Pedro R., et al. The importance of mask selection on continuous positive airway pressure outcomes for obstructive sleep apnea. An official American Thoracic Society workshop report. Annals of the American Thoracic Society 17.10 (2020): 1177-1185.

FONDAZIONE
POLICLINICO UNIVERSITARIO
CAMPUS BIO-MEDICO

AIM OF THE STUDY



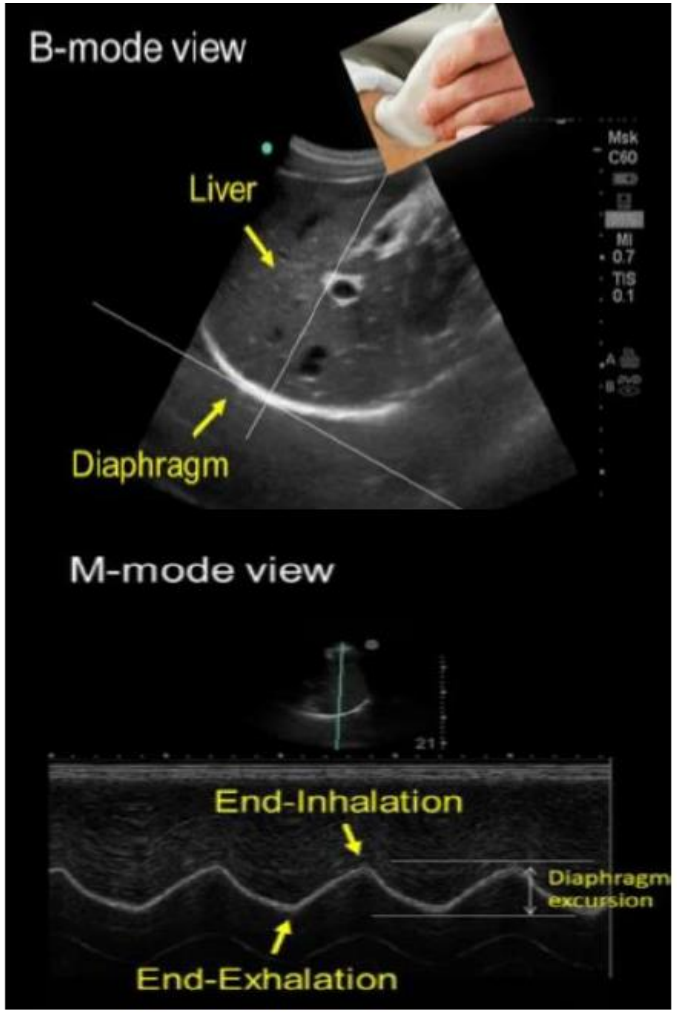
- **The objective of this study was to investigate differences in US-assessed diaphragmatic excursion (DE) using oronasal vs. nasal CPAP masks**

UNIVERSITÀ CAMPUS BIO-MEDICO DI ROMA

FONDAZIONE
POLICLINICO UNIVERSITARIO
CAMPUS BIO-MEDICO

MATERIALS AND METHODS

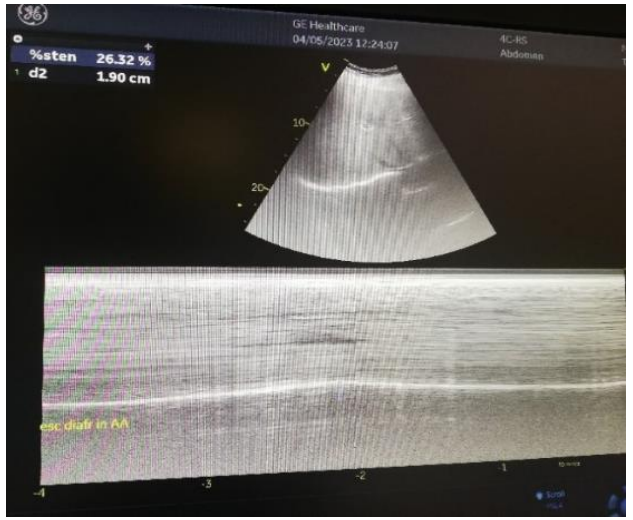
- The cranio-caudal movement of the dome of the diaphragm during quiet breathing and during forceful inspiratory efforts such as sniff maneuvers or maximal inspirations can be monitored using curvilinear ultrasound probes.
- Curvilinear probes use low frequency ultrasound waves (2–6 Hz) that penetrate deeply in the body giving a wide depth of field.
- On the right, operators position the probe longitudinally in the subcostal area between the mid-clavicular and anterior axillary lines using the liver as acoustic window.
- The probe is directed medially, cephalad and dorsally so that the ultrasound beam reaches the right dome of the diaphragm perpendicularly.
- On the left side, operators use the spleen as an acoustic window. (Less often, operators may use the right or left lateral view (midaxillary lines) or the posterior subcostal view or the subxiphoid view).
- Once a good quality B-mode image is obtained, operators adjust the M-mode interrogation line as to be perpendicular to the movement of the hemidiaphragm. With M-mode ultrasonography, the diaphragm appears as a single thick echogenic line.
- During inhalation the contracting diaphragm moves towards the ultrasound probe.

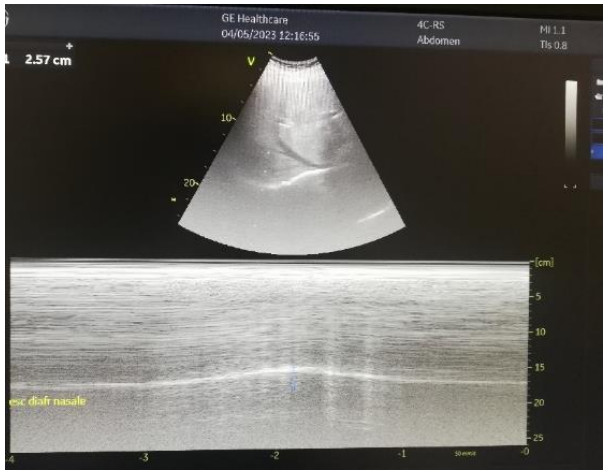


Boussuges A, Gole Y, Blanc P. Diaphragmatic motion studied by m-mode ultrasonography: methods, reproducibility, and normal values. Chest. 2009 Feb 1;135(2):391-400.

MATERIALS AND METHODS

- ✓ Neck circumference: 47 cm
- ✓ Mallampati score: IV
- ✓ PEEP during CPAP: 10 cmH20





RESULTS

Table 1: Baseline characteristics of patients (n=50)

Variables	Values as mean (SD) or sum (%)
Age (years)	63.9 (12.2)
Sex (male) (n; %)	27 (54%)
BMI (Kg/m^2)	34.5 (6.2)
Non-smokers	11 (22%)
Pack Years	58 (36.1)
CCI	2.9 (1.9)
NC	45.4 (4.6)
AC	122 (13)
Mallampati score (Grade IV)	82% (41)
AHI	43.6 (19.8)
ODI	39.5 (22.5)
FVC (liters, L)	2.83 (1.10)
FVC (%)	79.8 (22.1)
FEV1 (%)	75.9 (27.9)
FEV1/FVC (%)	73.6 (14.6)
pO2	74.6 (12.8)
pCO2	40.2 (4.44)
$HCO3^-$ (mEq/L)	27.4 (2.97)
Total Protein (g/dL)	6.89 (0.51)
Albumine (g/dL)	4.29 (0.39)

Abbreviations: BMI, Body mass index; CCI, Charlson Comorbidity Index; NC, Neck circumference; AC, Abdominal circumference; AHI, Apnea-hypopnea index; ODI, Oxygen desaturation index; T90, Cumulative time with oxygen saturation below 90% in total sleep time; FVC, Forced Vital Capacity; FEV1, Forced expiratory volume in the first second; pO2, partial pressure of oxygen; pCO2, partial pressure of carbon dioxide; HCO3-, hydrogen carbonate.

RESULTS

Table 2: Diaphragmatic excursion in spontaneous breathing and during CPAP

Variables	Values as mean (SD) or sum (%)
DE	2.12 (0.7)
DE in Oronasal Mask	2.61 (0.59)
DE in Nasal Mask	3.4 (0.82)
PEEP	10.6 (1.68)

Abbreviations: DE, Diaphragmatic excursion; PEEP, positive end-expiratory pressure.

CHEST

Volume 135, Issue 2, February 2009, Pages 391-400

Original Research
Ultrasonography

Diaphragmatic Motion Studied by M-Mode Ultrasonography: Methods, Reproducibility, and Normal Values

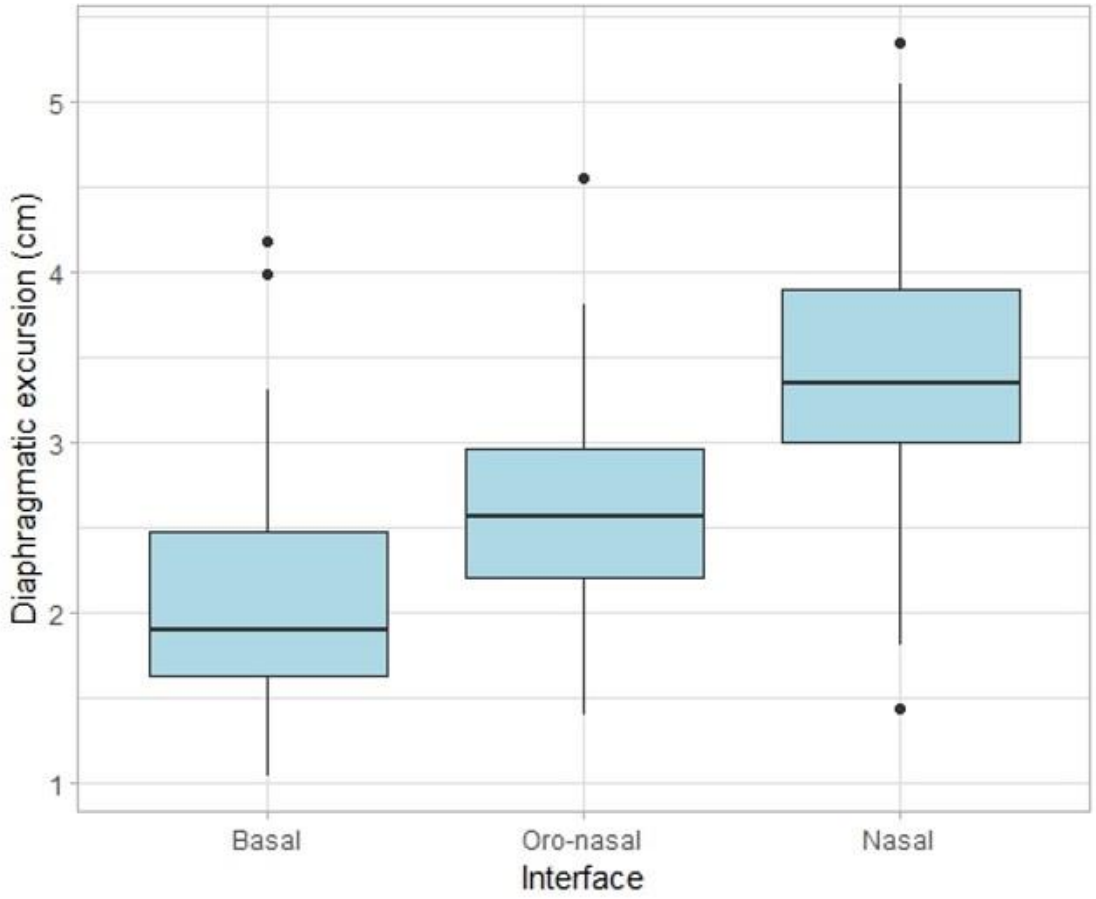
Alain Boussuges MD, PhD, Yoann Gole MSc, Philippe Blanc MD

Table 2. Right Diaphragmatic Excursions and Limit Values in Men and Women*

Variables	Men, cm	Women, cm	p Value
Quiet breathing	1.8 ± 0.3 (1.1–2.5)	1.6 ± 0.3 (1–2.2)	< 0.001
Voluntary sniffing	2.9 ± 0.6 (1.8–4.4)	2.6 ± 0.5 (1.6–3.6)	< 0.001
Deep breathing	7 ± 1.1 (4.7–9.2)	5.7 ± 1 (3.6–7.7)	< 0.001

RESULTS

Figure 1: Comparative analysis of DE during spontaneous breathing and CPAP with oronasal and nasal mask



LIMITATIONS OF THE STUDY

- Limited sample size
- Not performed during real sleeping
- Not verified any long-term effect of CPAP therapy on DE according to the different mask

CONCLUSIONS

- Our study evaluated the acute impact on **US-assessed DE** after changing CPAP route from **oronasal** to **nasal**.
- There are no currently validated methods for predicting which interface type would be most beneficial for each patient.
- Nasal interface should be the **more suitable option** for patients with OSA and higher neck circumference.
- Diaphragmatic motion throughout US may be considered as a **practical** and **low-cost tool** to help in the choice of the fittest mask in patients undergoing CPAP.