Regione Puglia
AZIENDA OSPEDALIERO-UNIVERSITARIA
CONSORZIALE POLICLINICO BARI
S.C. MEDICINA E CHIRURGIA DI ACCETTAZIONE E URGENZA
Dir. Dr V. Procacci

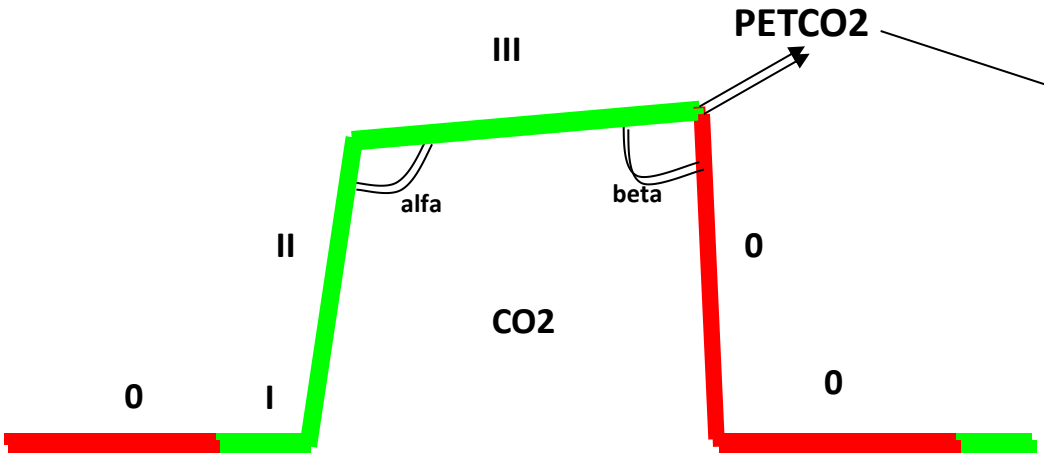
XI congresso nazionale
simeu
ROMA 24-26 MAGGIO 2018

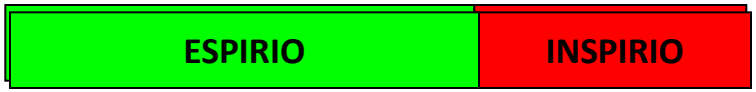
IL MONITORAGGIO CAPNOGRAFICO NEL PAZIENTE CRITICO

VITO PROCACCI

Il Monitoraggio Capnometrico/Capnografico

La misurazione della CO2 nell'aria espirata indica in maniera diretta le condizioni di eliminazione di CO2 Dai polmoni. Indirettamente essa indica anche le caratteristiche della produzione tissutale di CO2, del Trasporto di CO2 dalla periferia ai polmoni attraverso il torrente circolatorio. Quindi la capnografia È un'importante tecnica non invasiva che permette di monitorare la produzione di CO2, la perfusione E la ventilazione polmonare, nonché le principali turbe dell'equilibrio acido-base.





CAPNOGRAFIA

CAPNOMETRIA

Uso Classico nel Paziente Intubato

- Conferma Posizionamento Tubo Endotracheale

- Monitoraggio Respiratorio Nel Paziente Intubato sottoposto ad Sedazione Procedurale

Policy Statements

[redacted]

›xide Monitoring
ırd of Directors, September 1994

ırd of Directors, June 1994

e and Domestic Violence
ırd of Directors, September 1994

an College of Emergency Physicians.

Expired Carbon Dioxide Monitoring

[American College of Emergency Physicians: Expired carbon dioxide monitoring. *Ann Emerg Med* March 1995;25:441.]

The American College of Emergency Physicians believes that quality emergency care should be available to all who seek it. ACEP endorses the following principles regarding expired carbon dioxide monitoring:

- The established method for verifying proper endotracheal tube placement is by direct visualization of the endotracheal tube through the vocal cords into the trachea.
- Carbon dioxide monitoring of tracheal intubation placement is desirable, but should not be mandated at this time for all emergency patients.
- It is desirable to have carbon dioxide monitoring devices available to emergency physicians and prehospital providers to assist in confirming tracheal intubation. Absence of these monitoring devices to confirm tracheal intubation should not delay or preclude intubation in life-threatening emergencies.
- Endotracheal tube placement should be confirmed whenever carbon dioxide monitoring indicates possible esophageal intubation, and reconfirmed if there is a change in the patient's clinical status, movement or transportation of patient, or suspected extubation.
- Carbon dioxide monitoring of expired gas in intubated patients can be performed qualitatively or quantitatively on a single, intermittent, or continuous basis with different monitoring systems.
- Carbon dioxide levels may be falsely low despite correct tracheal placement of the endotracheal tube in cardiac arrests, severe shock, and other clinical conditions with low cardiac outputs and inadequate tissue perfusion.
- Other uses of carbon dioxide monitoring are under investigation. Research is continuing to define the benefits and most appropriate uses of this technology.

Th[redacted]policy was prepared by the Clinical Policies Committee/EMS Committee and replaces one with the same title.

See related correspondence, p 322.

End-Tidal CO_2 Detectors Stir Controversy

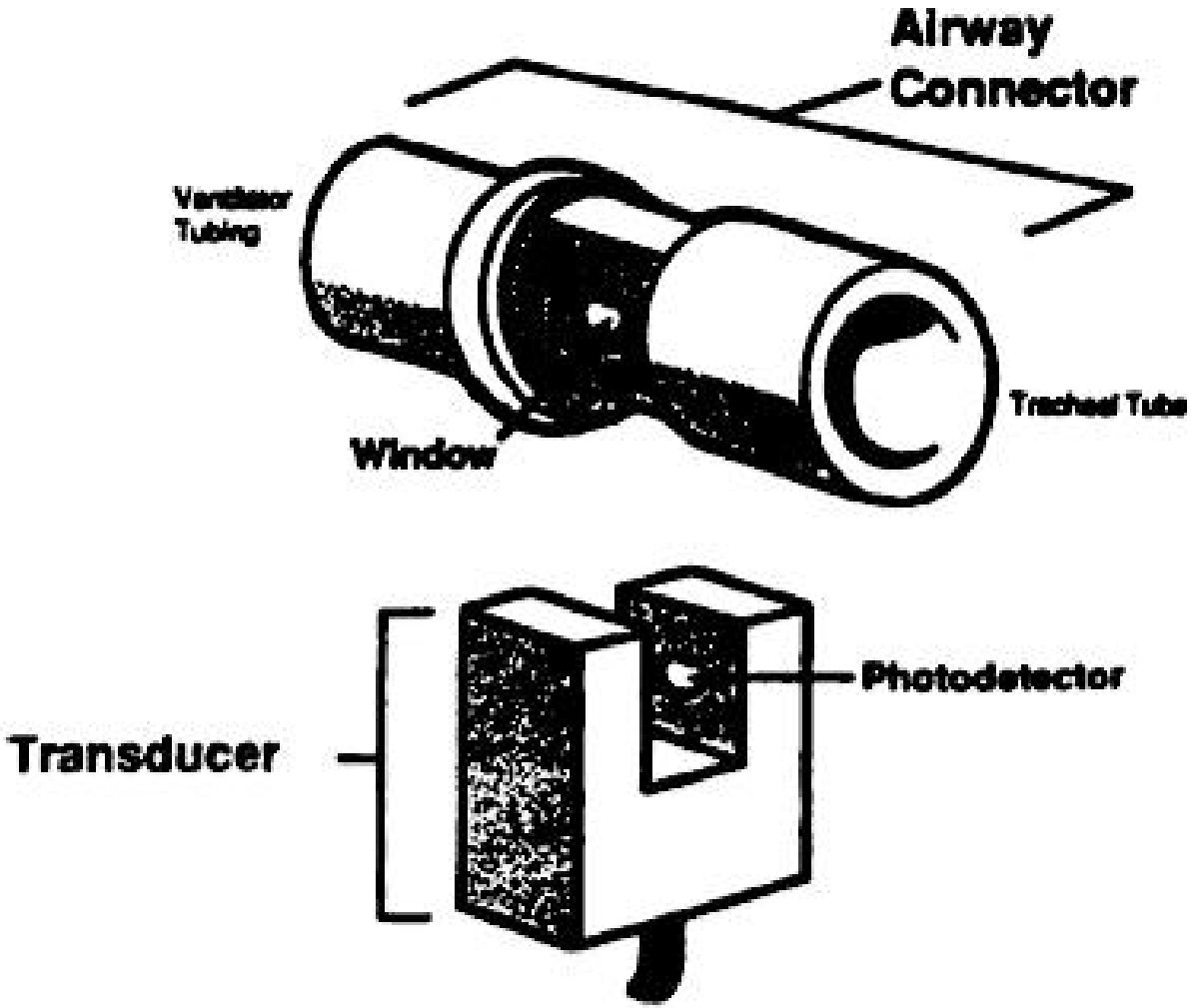
[Waeckerle JF: End-tidal CO_2 detectors stir controversy. *Ann Emerg Med* August 1994;24:320-321.]

One of the most important goals for *Annals* is to provide a forum for responsible and provocative debate. To that end, *Annals* recently published an article by William H Ginsburg, JD, titled, "When Does a Guideline Become a Standard? The American Society of Anesthesiologists Guidelines Give Us a Clue" [*Ann Emerg Med* December 1993;22:1891-1896]. This article provides us with an opportunity to discuss the development of practice standards, an issue of critical importance to emergency physicians. The article also provides a platform for thoughtful debate about the use, particularly in prehospital care, of end-tidal CO_2 detectors, a device that is being utilized but has not been completely studied.

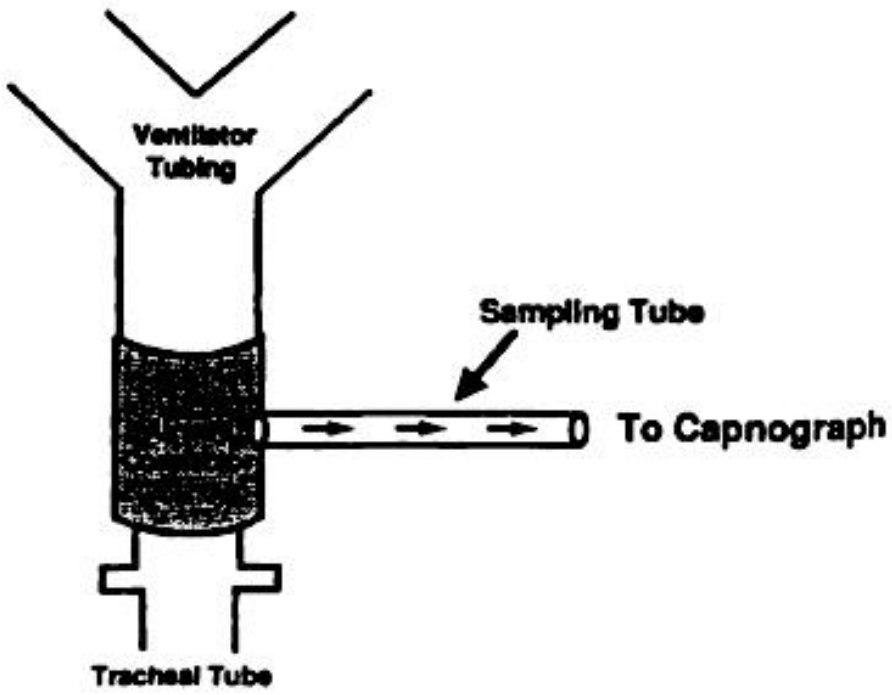
Prehospital care is one of emergency medicine's foremost responsibilities. As devices are introduced for use in prehospital care, we must ensure that they undergo vigorous scientific scrutiny to validate their use. Devices already in use must also continually be reassessed by experts in the field to ensure that they benefit patients. End-tidal CO_2 detectors have not been rigorously studied nor have they been in use long enough for those of us in the prehospital arena to be certain they are beneficial and cost-effective.

When considering this article for publication, I was reminded of a similar scenario with the pneumatic antishock garment. In the early 1970s, the pneumatic antishock garment was promoted extensively; however, the device had not undergone strict scientific evaluation before marketing. Once available, this device received acceptance and was used extensively in the field even though the precise mechanism of action, indications, and contraindications were not clearly identified for some time. In an attempt to ensure that history not repeat itself, *Annals* published the article by Ginsburg to stimulate our readers to consider not only the use of end-tidal CO_2 detectors but also the pro-

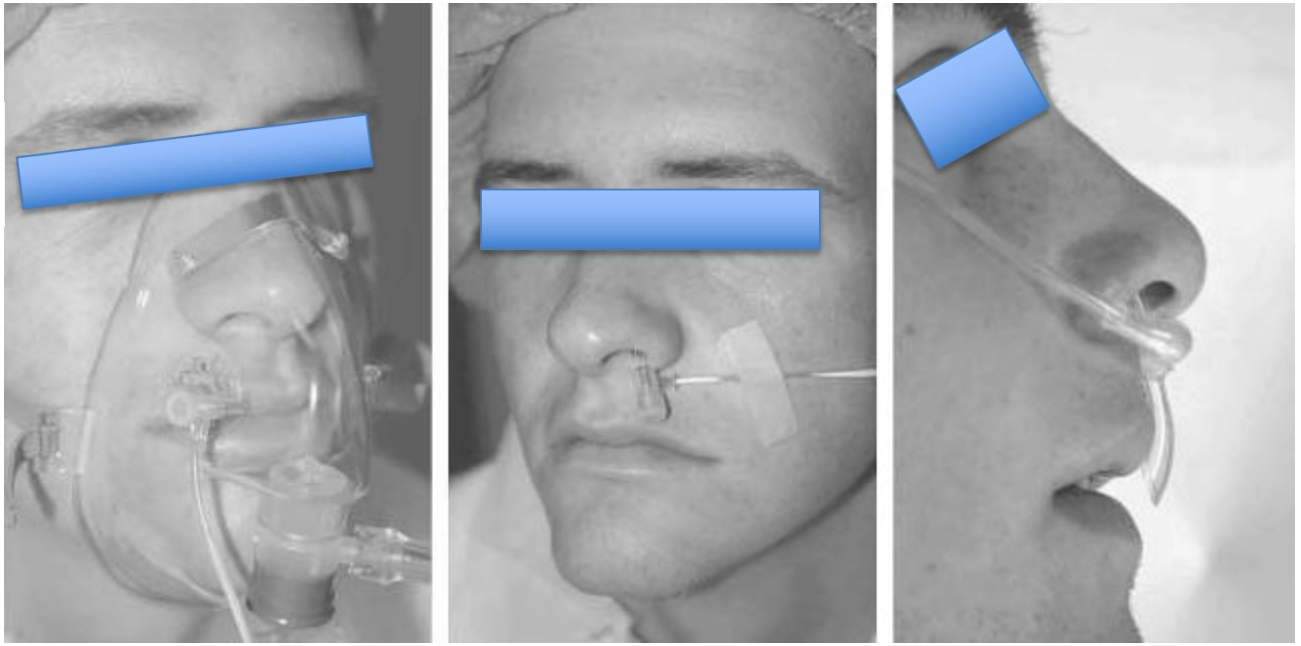
Tecnica Main Stream



Tecnica Side Stream

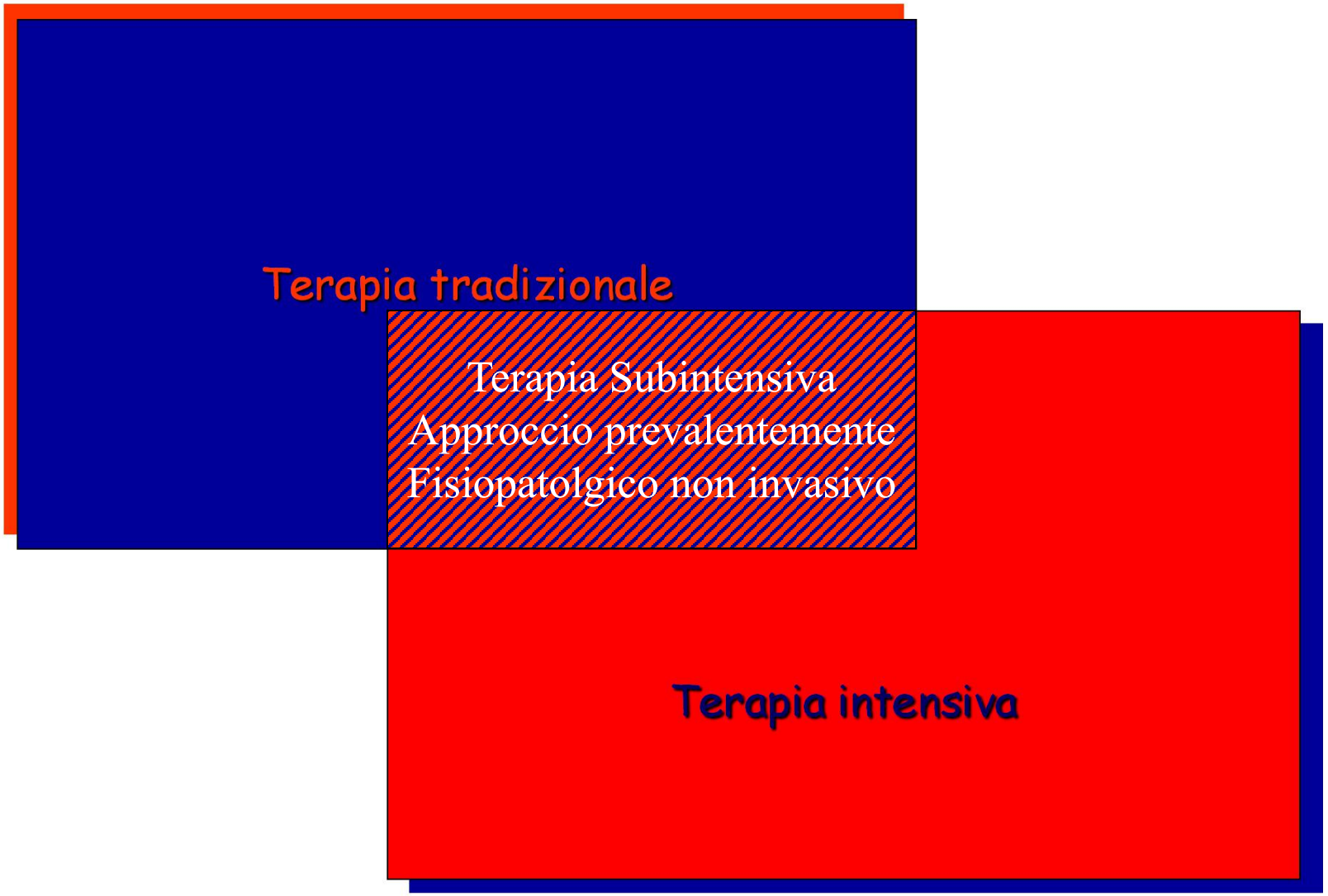


Possibilità di monitoraggio nel paziente non intubato

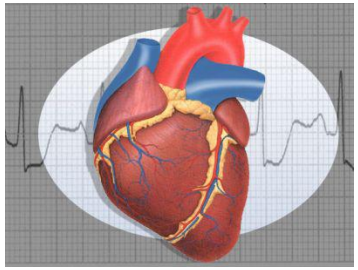



N-85
41
98
EtCO2
SpO2 %
RR
11
P
72

SPAZI DI APPLICAZIONE



LE VARIABILI FISIOPATOLOGICHE NEL PAZIENTE CRITICO



ETCO2

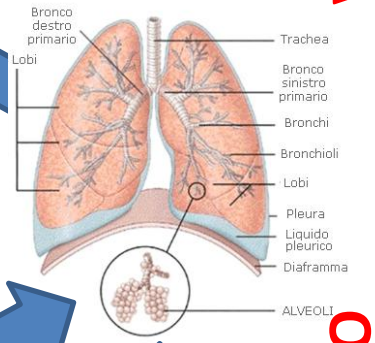
VENTILAZIONE

DO2=COxHb xSaO2

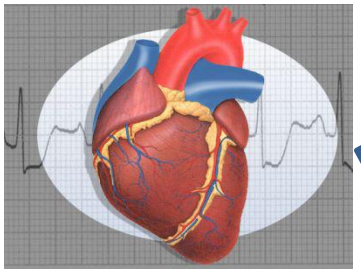
O2

METABOLISMO

PERFUSIONE



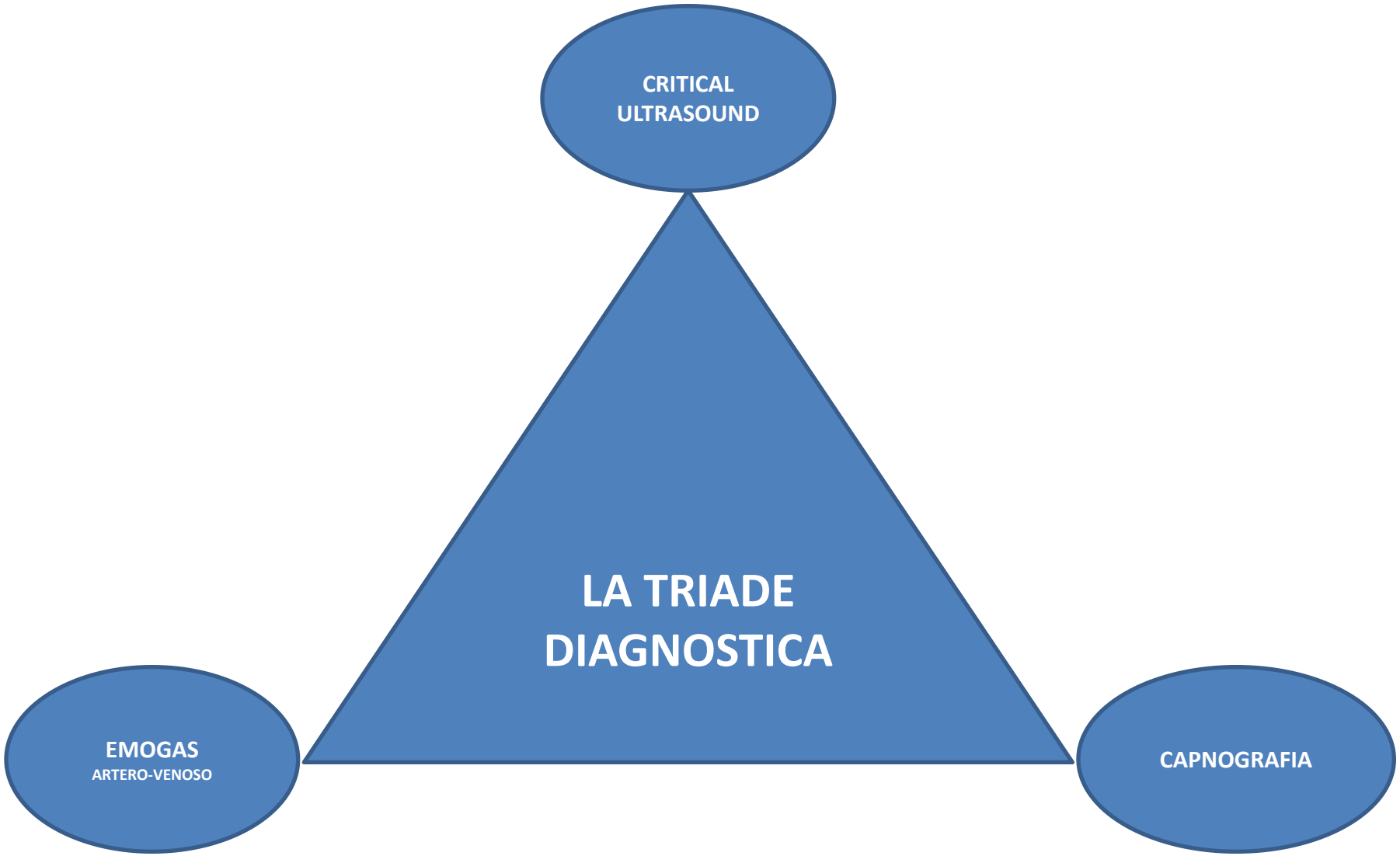
CO2

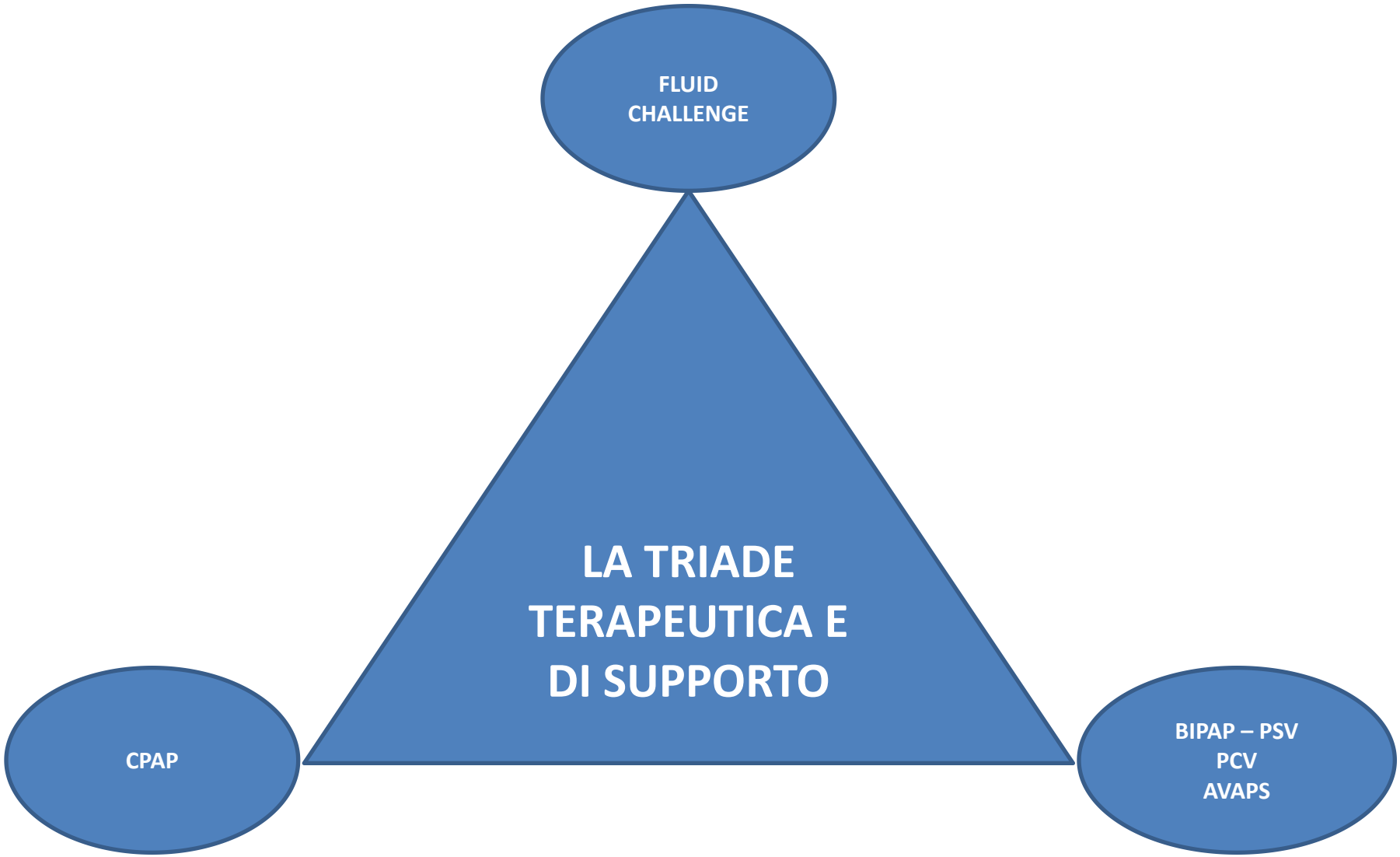


CO2

OSSIGENAZIONE

O2
ATM


CRITICAL
ULTRASOUND
LA TRIADE
DIAGNOSTICA
EMOGAS
ARTERO-VENOSO
CAPNOGRAFIA


FLUID
CHALLENGE
LA TRIADE
TERAPEUTICA E
DI SUPPORTO
CPAP
BIPAP – PSV
PCV
AVAPS

METABOLISMO
Sindrome Ipercinetica

OSSIGENAZIONE
Eco Polmonare
Funzione Ventricolare sx
Ventricolo Dx

CRITICAL ULTRASOUND

PERFUSIONE
Funzione Ventricolo sx
PVC da Vena Cava Inferiore

MACRO

VENTILAZIONE
Cinetica Diaframmatica
Eco Pleura
Ventricolo Dx

METABOLISMO
Acidosi Metabolica

OSSIGENAZIONE
PaO2/FiO2

EGA

PERFUSIONE
LATTATO
SaO2-ScvO2
Delta v-a CO2

VENTILAZIONE
PCO2
Acidosi Respiratoria

METABOLISMO
Acidosi Metabolica
PETCO2 RIDOTTA
Pa-ETCO2 normale

OSSIGENAZIONE
PaO2/FiO2

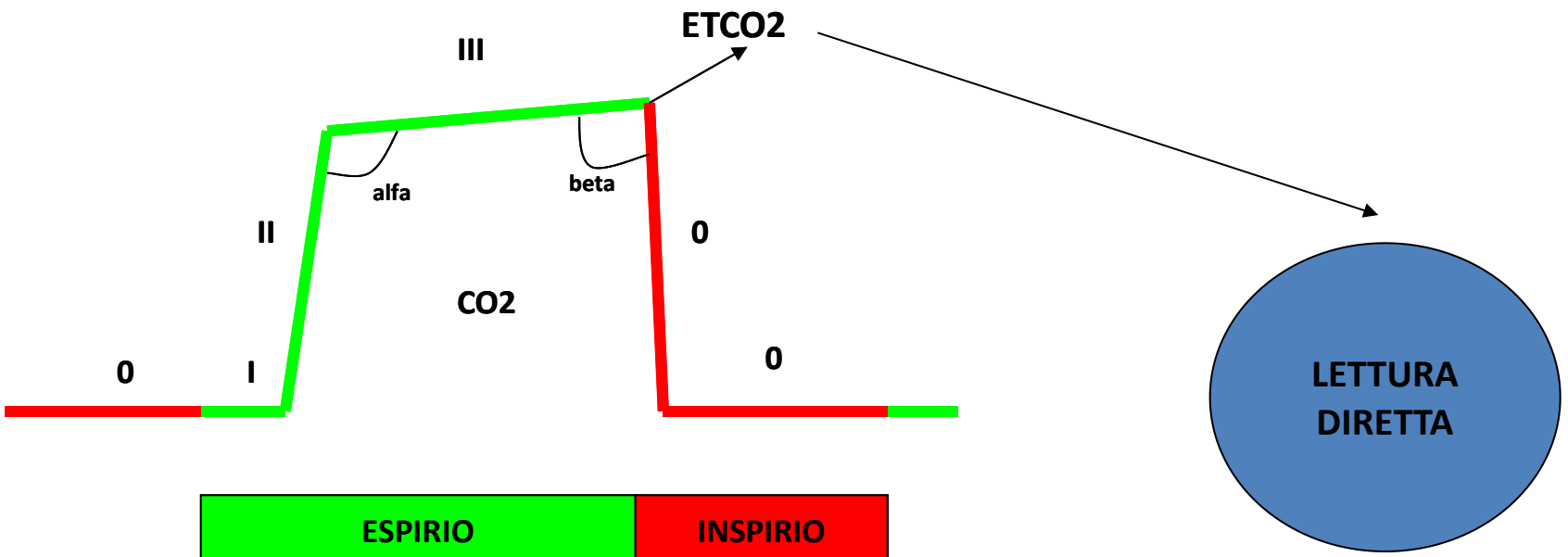
PETCO2

PERFUSIONE
SaO2-ScvO2
PETCO2 RIDOTTA
Pa-ETCO2 Aumentata

VENTILAZIONE
PCO2
Acidosi Respiratoria
PETCO2 AUMENTATA
Pa-ETCO2 Aumentata (PEEPI)

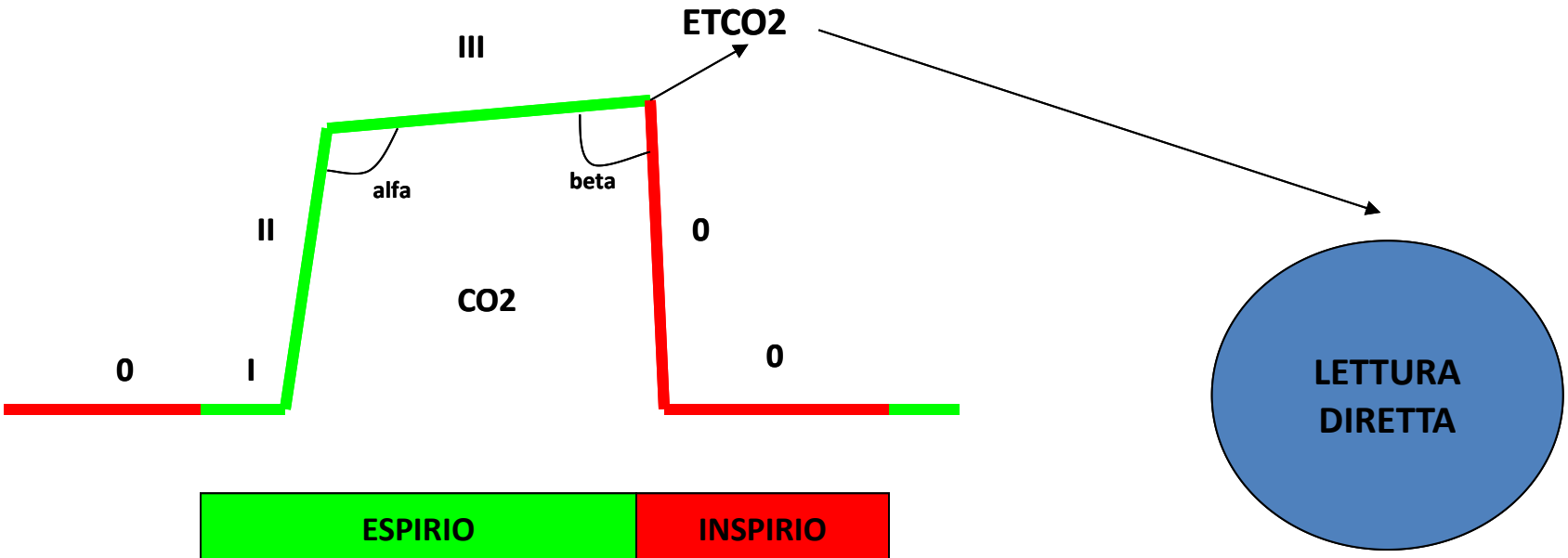
Le Fasi del Capnogramma

- Fase 0 = inspirio
- Fase I = Spazio Morto Anatomico
- Fase II = Mix Spazio Morto Anatomico - Aria Alveolare (spazio morto alveolare)
- Fase III = Plateau alveolare



I Parametri Da Considerare

- Ritmo e Frequenza dei Capnogrammi
- Altezza del Capnogramma
- Pendenza della fase II (ampiezza dell'angolo alfa)
- PETCO2 (Pressione Parziale di CO2 alla fine dell'espirio)
- PaCO2 – PETCO2 (a-PETCO2)
- Pendenza della fase 0 (angolo beta)



RITMO E FREQUENZA

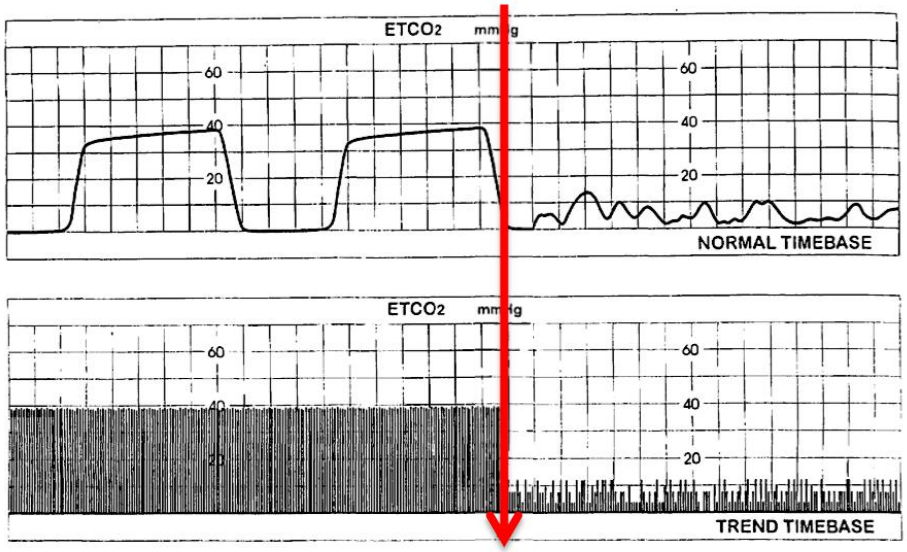
IL metodo capnografico è il metotodo più affidabile per l'analisi del ritmo
E della frequenza respiratoria perché basata sull'analisi della CO2 espirata
E quindi sugli atti ventilatori efficaci

GENERAL MEDICINE/ORIGINAL RESEARCH

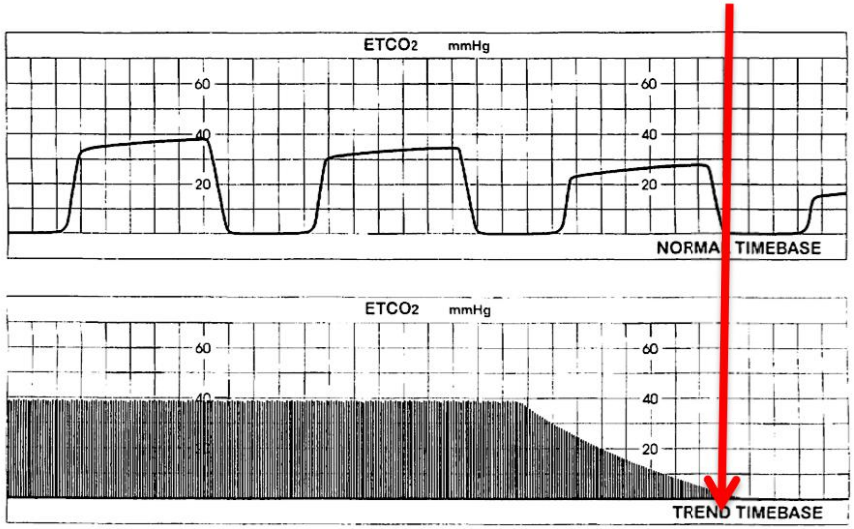
The Vexatious Vital: Neither Clinical Measurements by Nurses Nor an Electronic Monitor Provides Accurate Measurements of Respiratory Rate in Triage

Paris B. Lovett, MD
Jason M. Buchwald, MD
Kai Stürmann, MD
Polly Bijur, PhD

From the Columbia University Medical Center, New York, NY (Lovett); Memorial West Hospital, Pembroke Pines, FL (Buchwald); Beth Israel Medical Center, New York, NY (Stürmann); and the Albert Einstein College of Medicine, New York, NY (Bijur).



ARRESTO CARDIACO E/O RESPIRATORIO IMPROVVISO

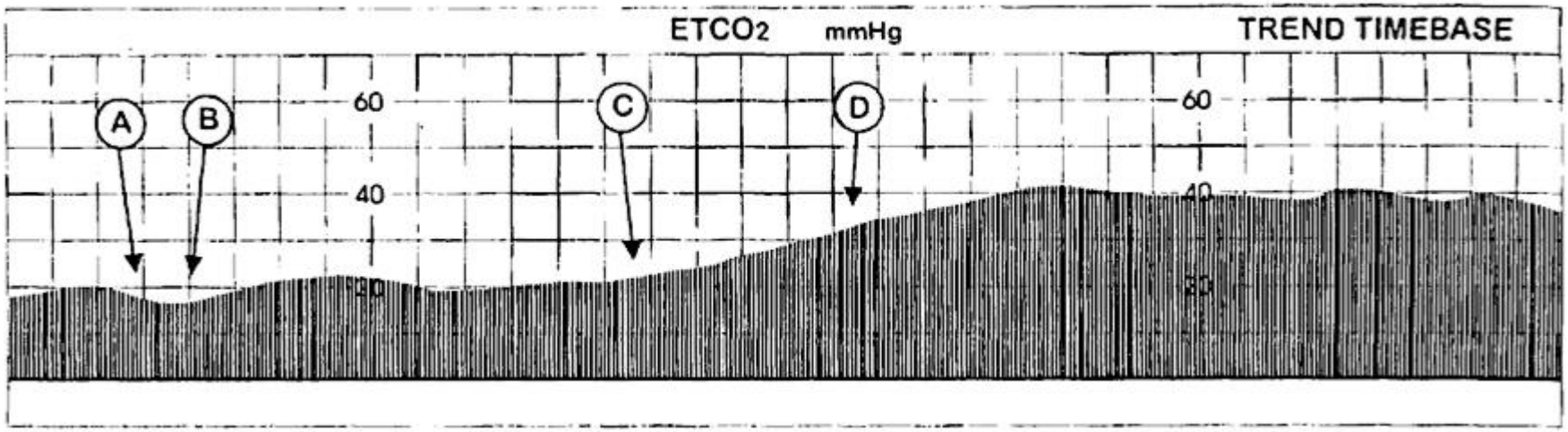


ARRESTO CARDIACO E/O RESPIRATORIO PRECEDUTO DA UNA FASE DI PREARRESTO

END-TIDAL CARBON DIOXIDE AND OUTCOME OF OUT-OF-HOSPITAL CARDIAC ARREST

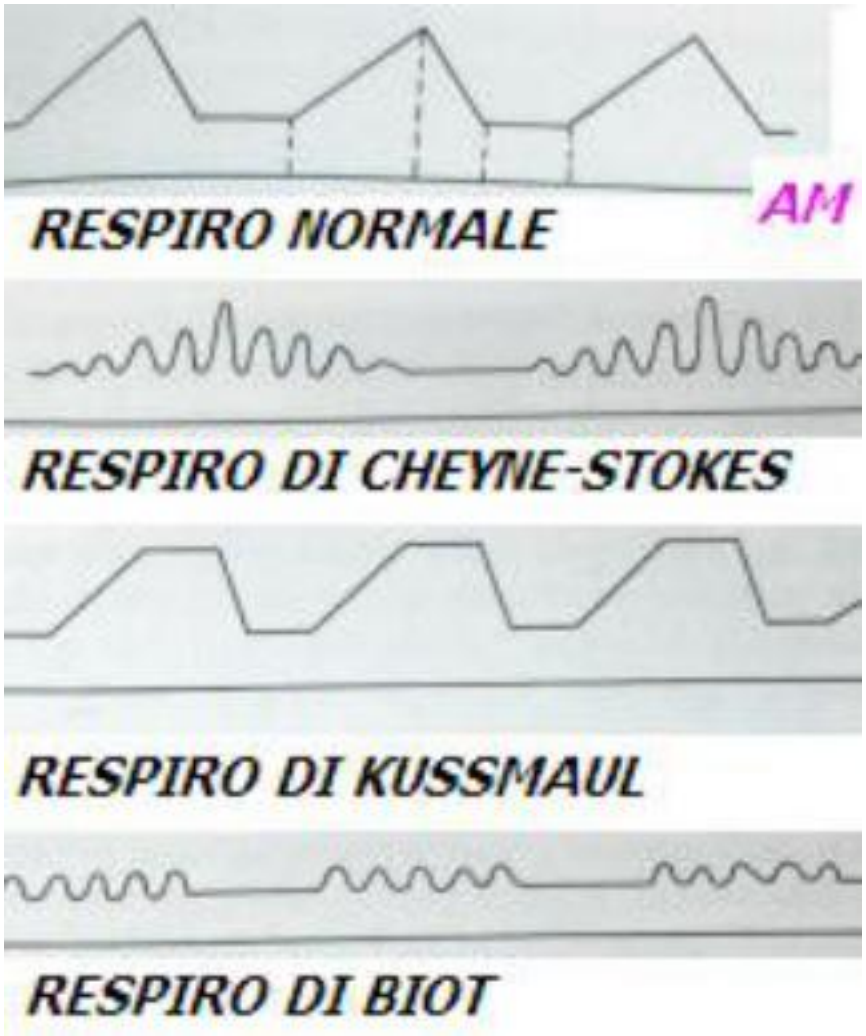
ROBERT L. LEVINE, M.D., MARVIN A. WAYNE, M.D., AND CHARLES C. MILLER, PH.D.

Nejm 1997



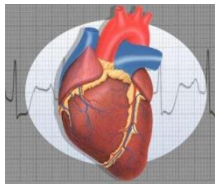
pseudoPEA

Alterazioni del Ritmo e del Sincronismo Ventilatorio nello Scompenso Cardiaco Acuto

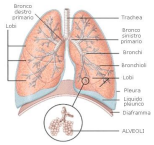


T. Brack et Al. - Zurich Open Repository and Archive 2012

ALTERAZIONI DELLA MECCANICA POLMONARE IN CORSO DI SCOMPENSO CARDIACO ACUTO



SCOMPENSO ACUTO



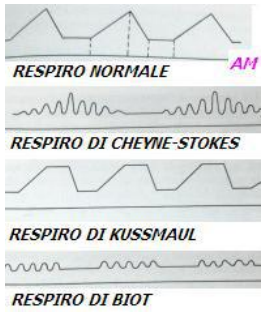
Ipertensione Capillare Polmonare

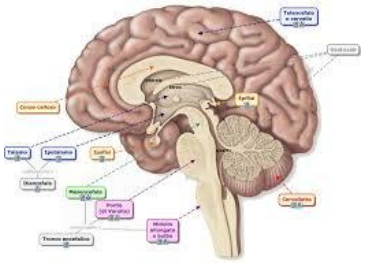
Deficit
Di scambio

IPOSSIA

Stretching
Barocettori
polmonari

Alterazione
Della sensibilità
Chemoricettoriale
Per la CO_2





ALTERAZIONE DEL
DRIVE
RESPIRATORIO

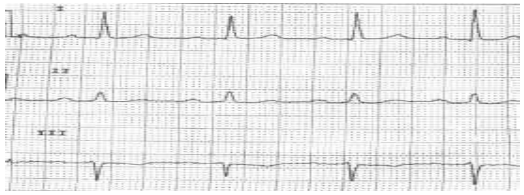
IPERCAPNIA

IPERTONO SIMPATICO

JACC Vol. 54, No. 19, 2009 Triposkiadis et al. November 3, 2009:1747–62
Sympathetic Nervous System in Heart Failure

POSSIBILITA’ DI SUPPORTO IMMEDIATO!

Le Variabili del Monitoraggio Subintensivo

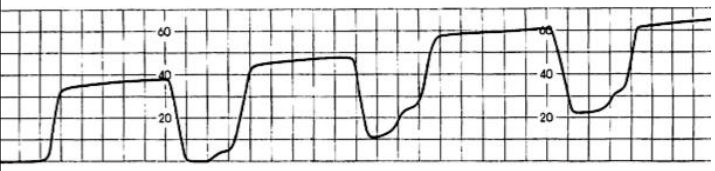


TRACCIA ECG

ATTIVITA' ELETTRICA

TRACCIA PLETISMOGRAFICA

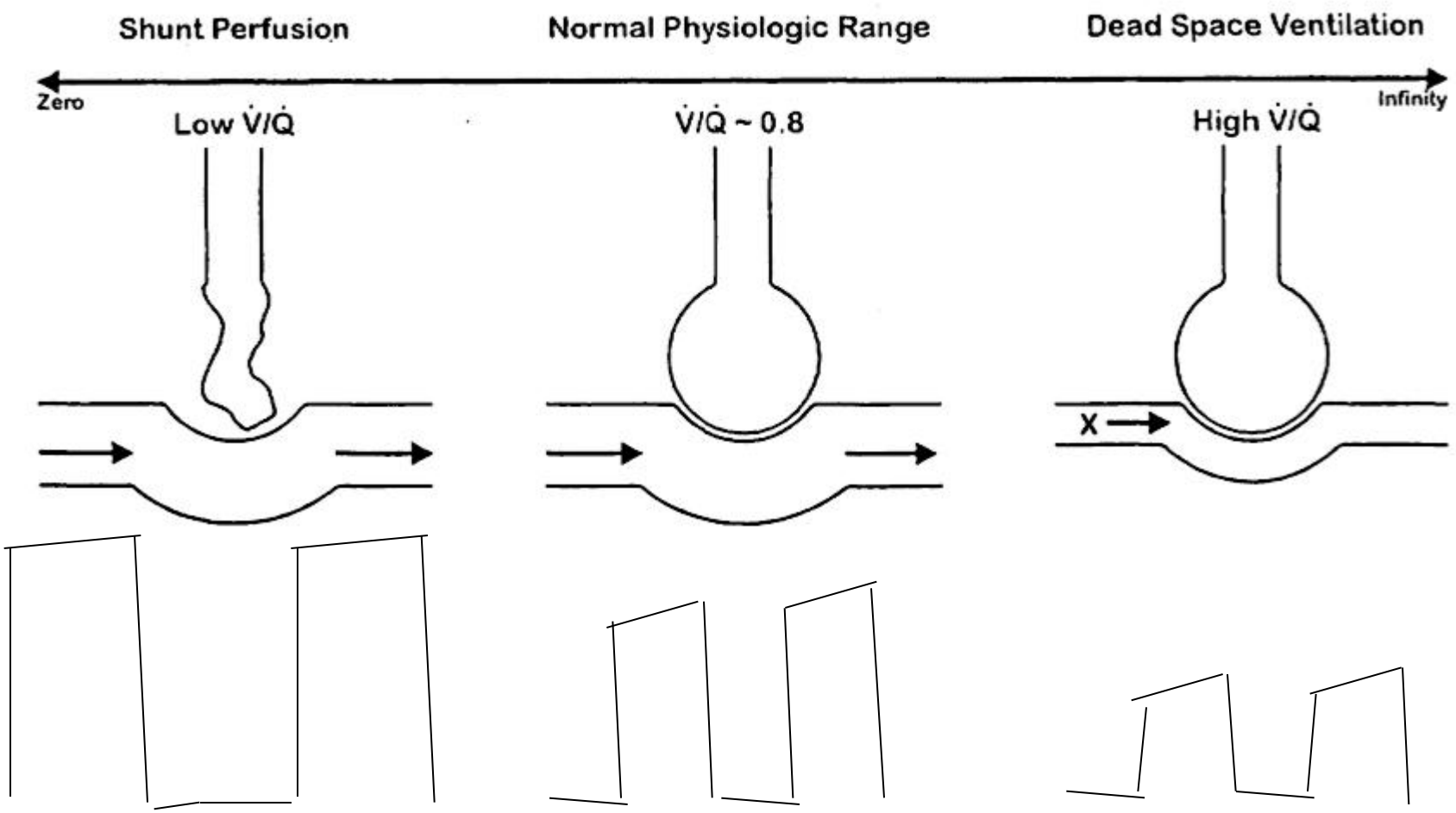
SISTOLE MECCANICA E VOLEMIA



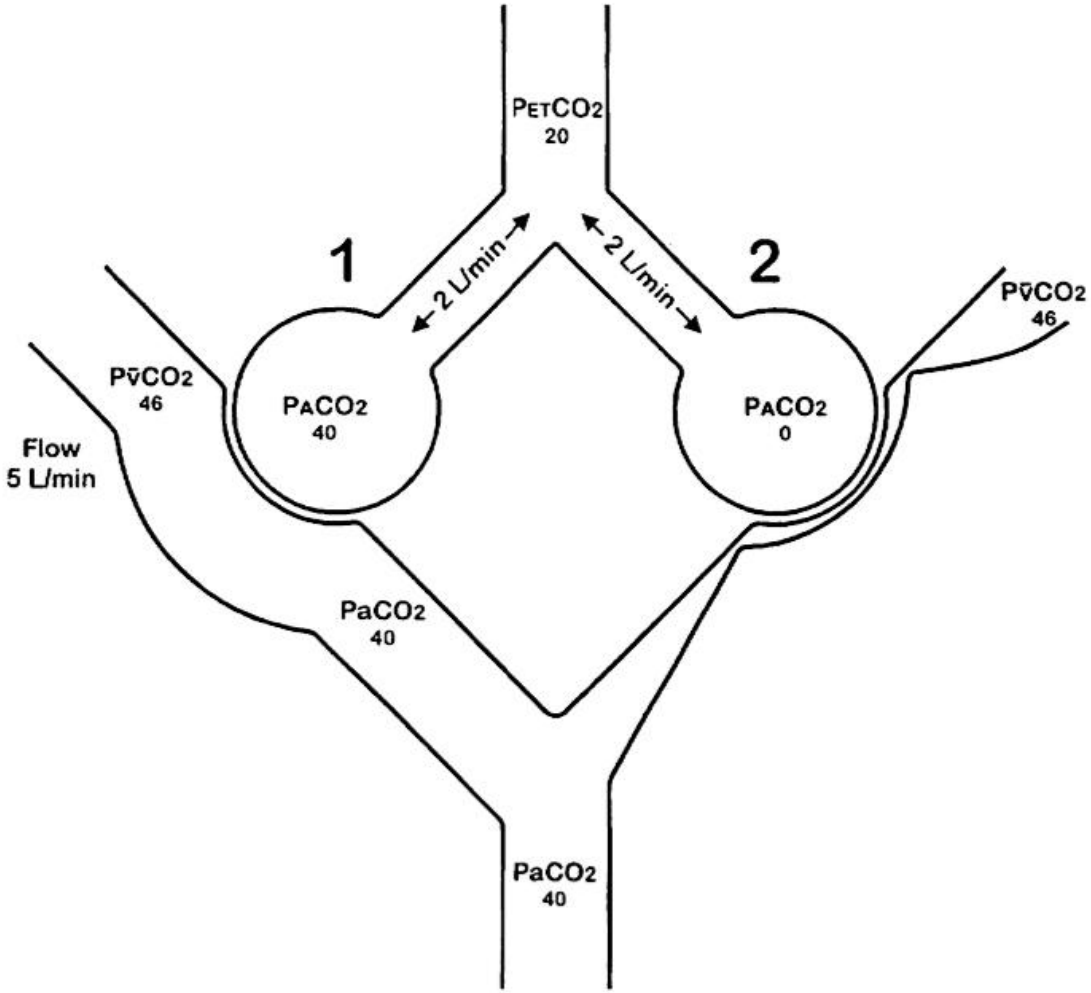
CAPNOGRAFIA

EFFICACIA PERFUSIONE E VENTILAZIONE

Altezza ⟷ **Perfusione/Ventilazione**



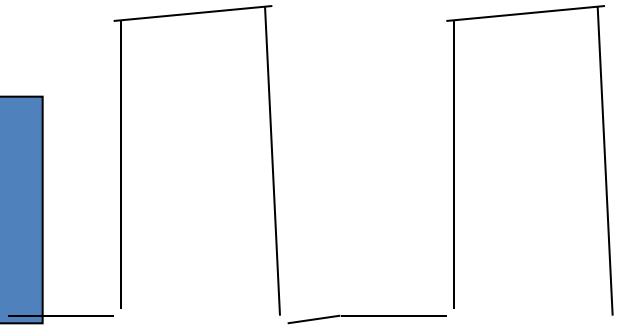
Ipoperfusione



Altezza

aumentata

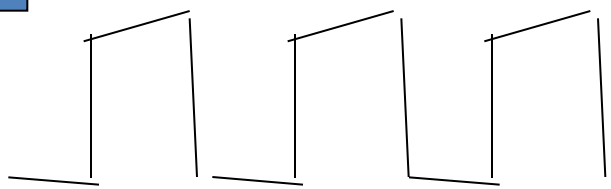
-Ipoventilazione
neuromuscolare (no PEEPi)
-Stati Ipermetabolici
senza ipoperfusione



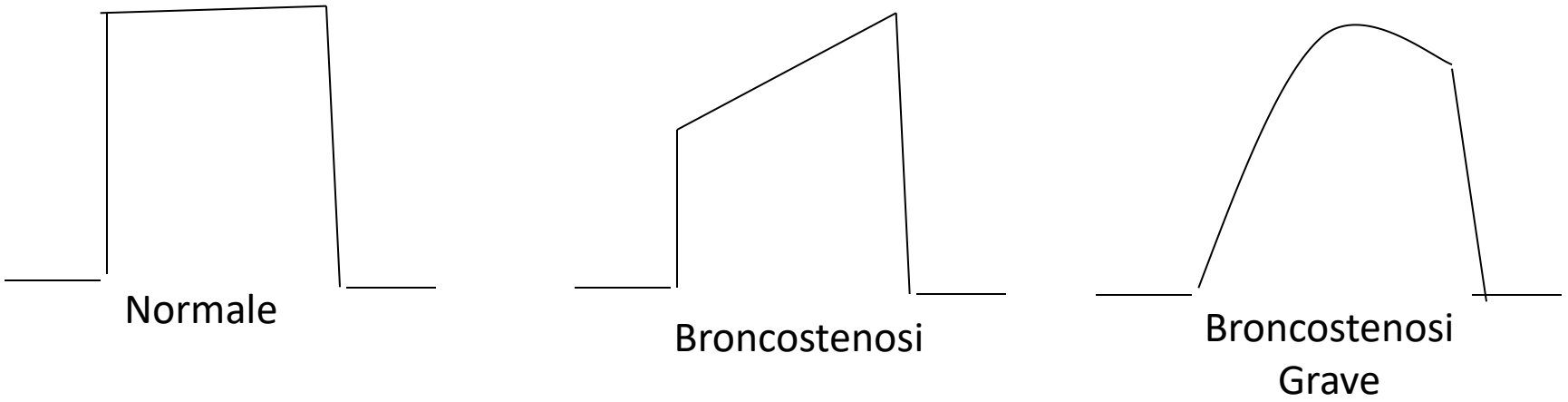
ridotta

-Iperventilazione
-Acidosi Metabolica (DKA)

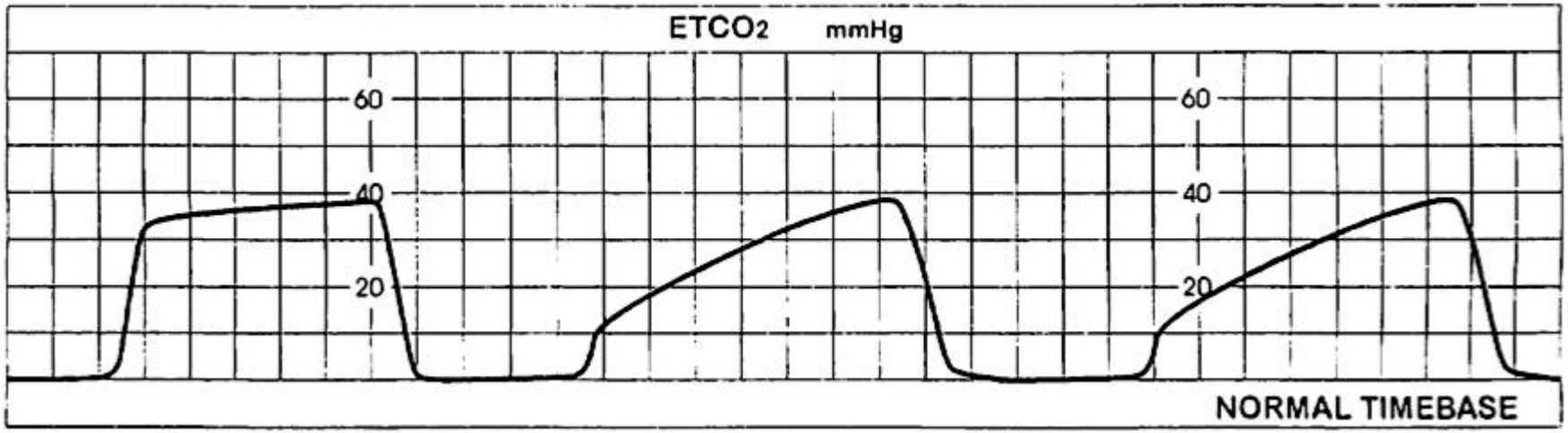
Ipoperfusione



Pendenza Fase II e III



Angolo Alfa → **Resistenze Bronchiali**



Capnography is a Triage Tool for Asthma Patients

JEMS – Journal of Emergency Medical Services - 2014

BOB PAGE, AAS, NREMT-P, CCEMT-P, NCEE

The Journal of Pediatrics
Vol 152, Issue 6, June 2008, pag. 829 - 832

Quantitative End-Tidal Carbon Dioxide in Acute Exacerbations of Asthma

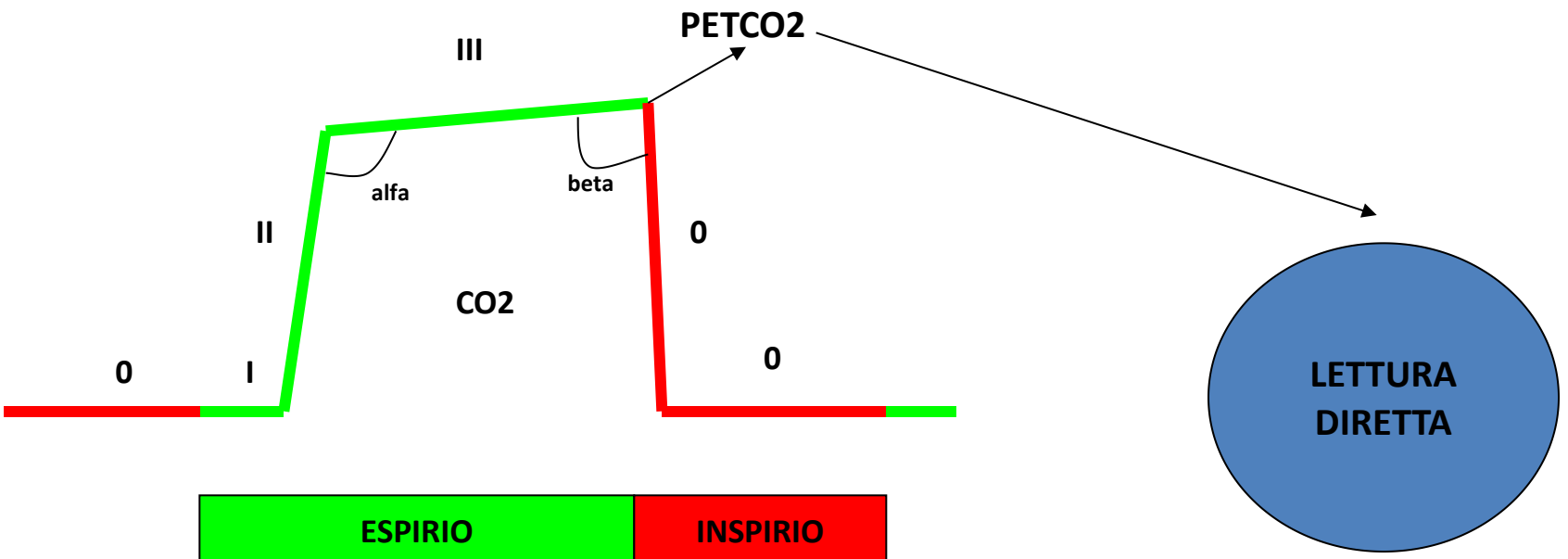
Melissa L. Langhan MD, Mark R. Zonfrillo MD, David M. Spiro MD

Study design
Patients with acute exacerbation of asthma (n = 86) and control subjects without respiratory or metabolic disturbances (n = 88) were prospectively enrolled in a pediatric emergency department. A physical examination, vital signs, and $ETCO_2$ measurements were performed on arrival and, in the patients with asthma, after each bronchodilator treatment.

$ETCO_2$ was measured successfully in 97% of enrolled children. After adjusting for respiratory rate, **$ETCO_2$ was significantly lower in patients with acute exacerbation of asthma than in control subjects ($P < .001$).** $ETCO_2$ measured after the first and after the final bronchodilator treatment were significantly associated with the number of bronchodilator treatments received and with hospital admission ($P \leq .002$).
Conclusions
$ETCO_2$ can be successfully measured in all children and is significantly lower in children with acute exacerbations of asthma compared with healthy control subjects. **Quantitative $ETCO_2$ may be an objective, noninvasive, and effort-independent way to assess the severity of asthma.**

PETCO2

- Pressione Parziale di CO2 a fine espirazione (End Tidal CO2). Esprime Numericamente l'altezza del capnogramma (vn 35-45 mmHg) e segue le stesse considerazioni fisiopatologiche.



Clinical uses of capnography

Capnometry

Various factors result in either increased or decreased/absent $PETCO_2$.

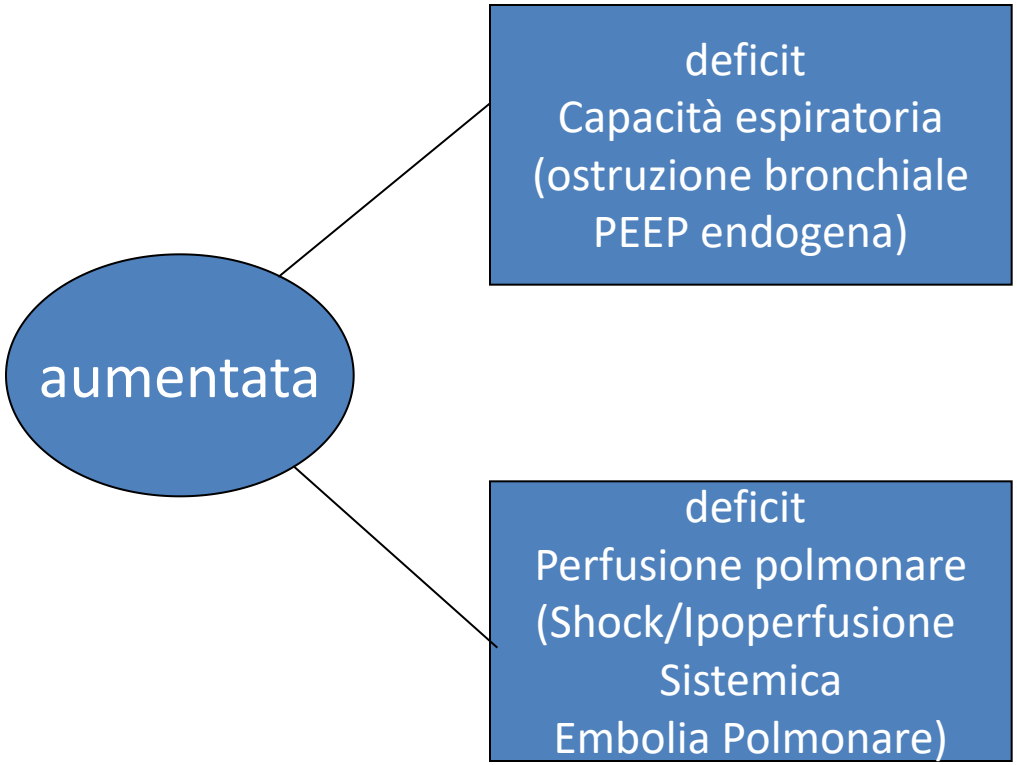
PETCO2 increased

output	Pulmonary perfusion	Alveolar Ventilation	Technical errors Machine faults
Fever Malignant hyperpyrexia Sodium bicarbonate Tourniquet release Venous CO_2 embolism	Increased cardiac output Increased blood pressure	Hypoventilation Bronchial intubation Partial airway obstruction Rebreathing	Exhausted CO_2 absorber Inadequate fresh gas flows Leaks in breathing system Faulty ventilator Faulty valves

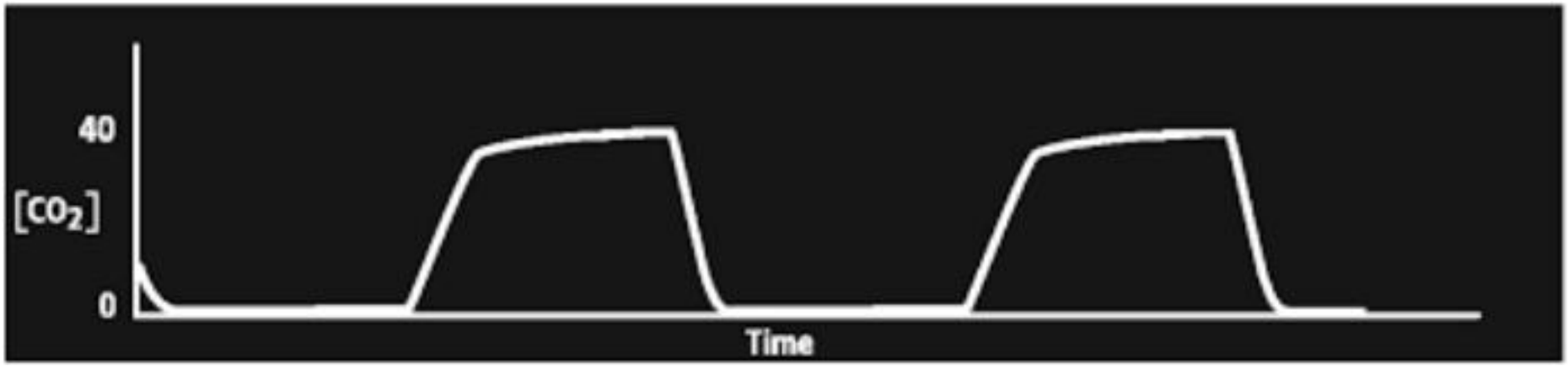
$PETCO_2$ decreased

CO_2 output	Pulmonary perfusion	Alveolar Ventilation	Technical errors Machine faults
Hypothermia Metabolic Acidosis	Reduced cardiac output Hypotension Hypovolemia Pulmonary embolism Cardiac arrest	Hyperventilation Apnea Total airway obstruction Partial airway obstruction Accidental tracheal extubation	Circuit disconnection Sampling tube leak Malfunction of ventilator

$PaCO_2 - PETCO_2 = 2\text{-}5$ mmHg



Pendenza Fase IV e Angolo Beta



REBREATHING

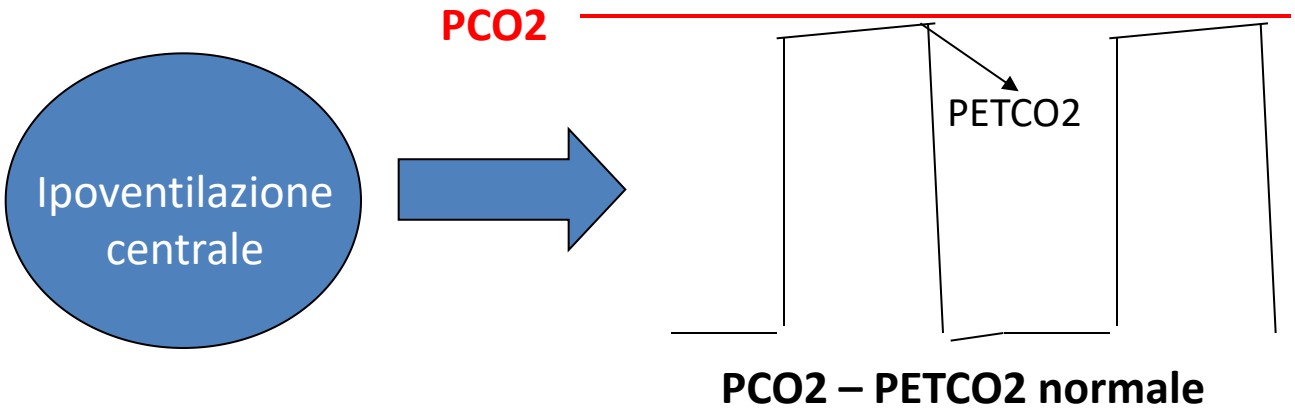
Capnographic Waveforms in the Mechanically Ventilated Patient

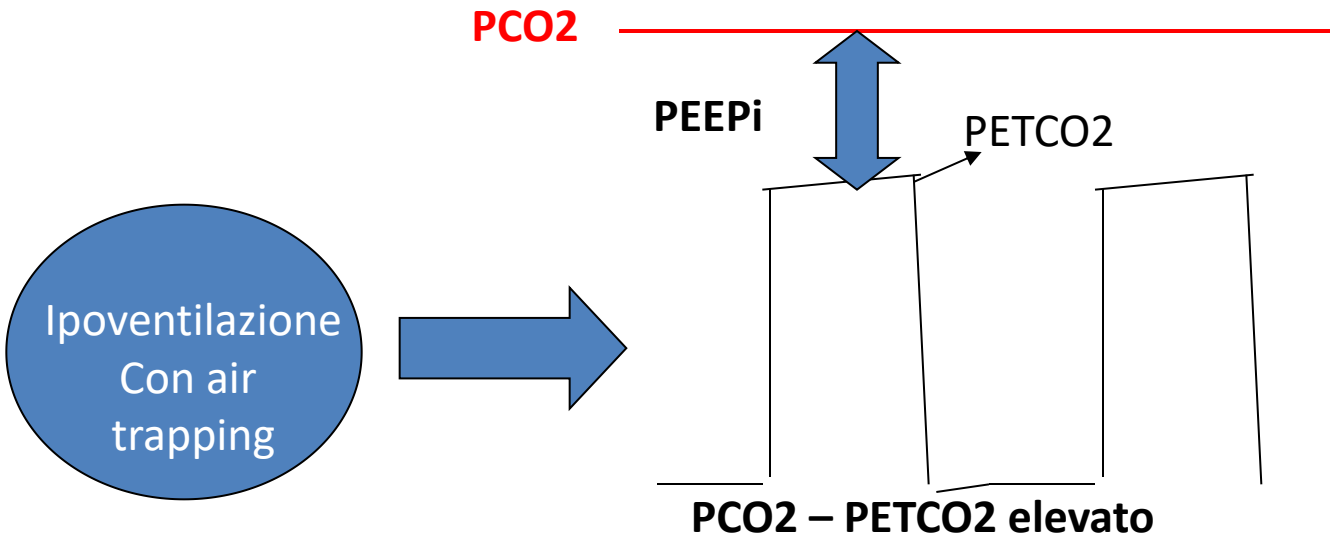
John E Thompson RRT FAARC and Michael B Jaffe PhD

Respir Care 2005;50(1):100–108. © 2005

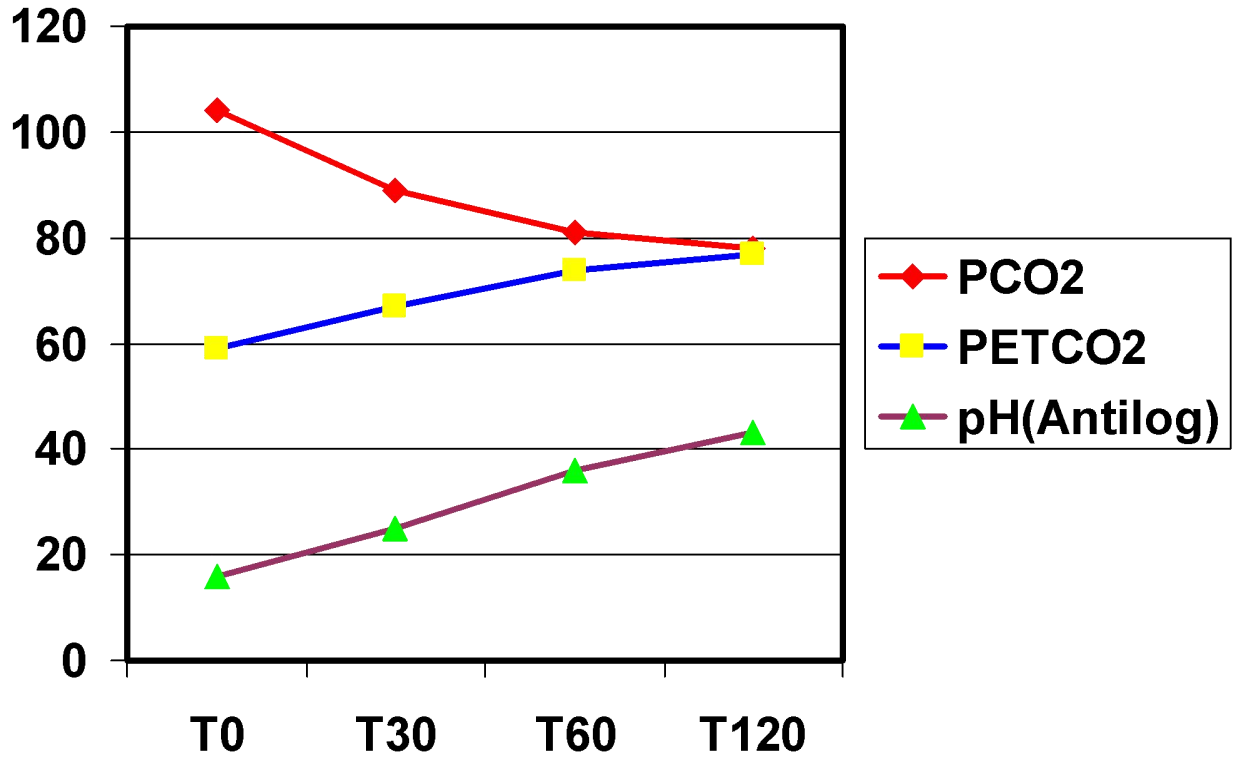
Modelli Fisiopatologici e Clinici

Ipoventilazione ed Ipercapnia


PCO2
Ipoventilazione centrale
PETCO2
PCO2 – PETCO2 normale


PCO2
PEEPi
PETCO2
Ipoventilazione Con air trapping
PCO2 – PETCO2 elevato

Effetti dell'applicazione della PSV sul Tracciato capnografico nell'IRA ipercapnica



Open Access Emergency Medicine June 2013

End-tidal arterial CO2 partial pressure gradient in patients with severe hypercapnia undergoing Non invasive ventilation

V. De Filippis MD, D. D'Antini MD, G. Cinnella MD, M. Dambrosio MD, F. Schiraldi MD, V. Procacci MD

Misurazioni

Emogasanalisi
End-tidal CO2 (capnografia side-stream)

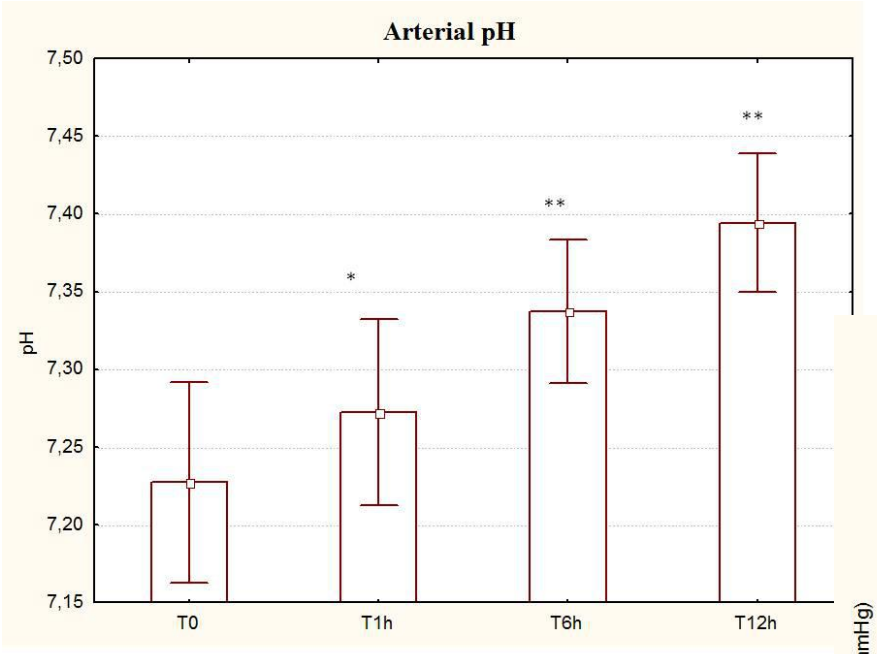
RISULTATI

BPCOr (60%)

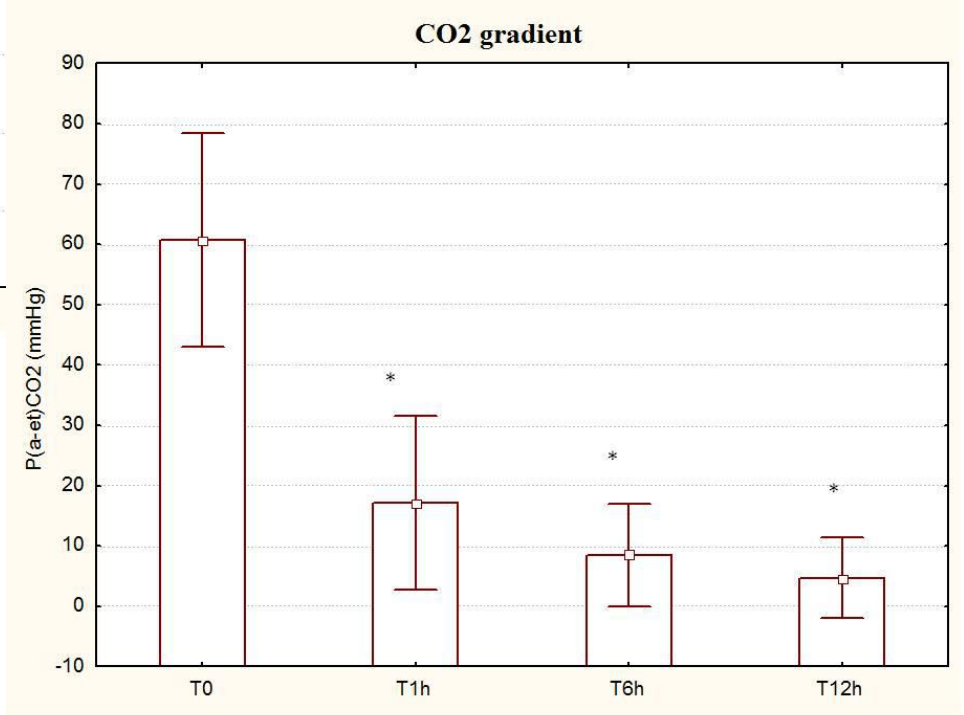
CAUSE

Polmonite (10%)

EPA (30%)



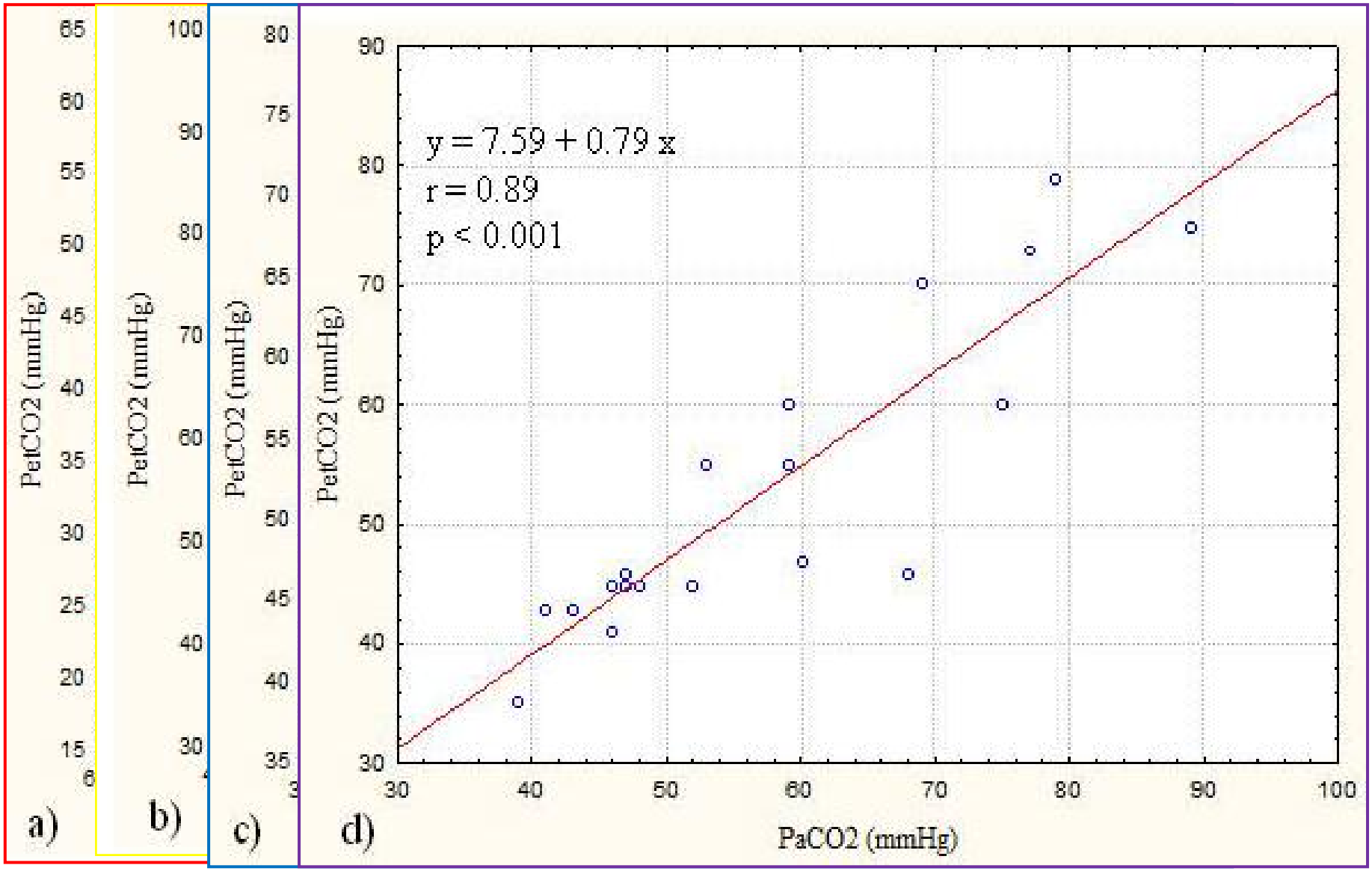
* $p < 0.05$
**$p < 0.001$



*$p < 0.001$

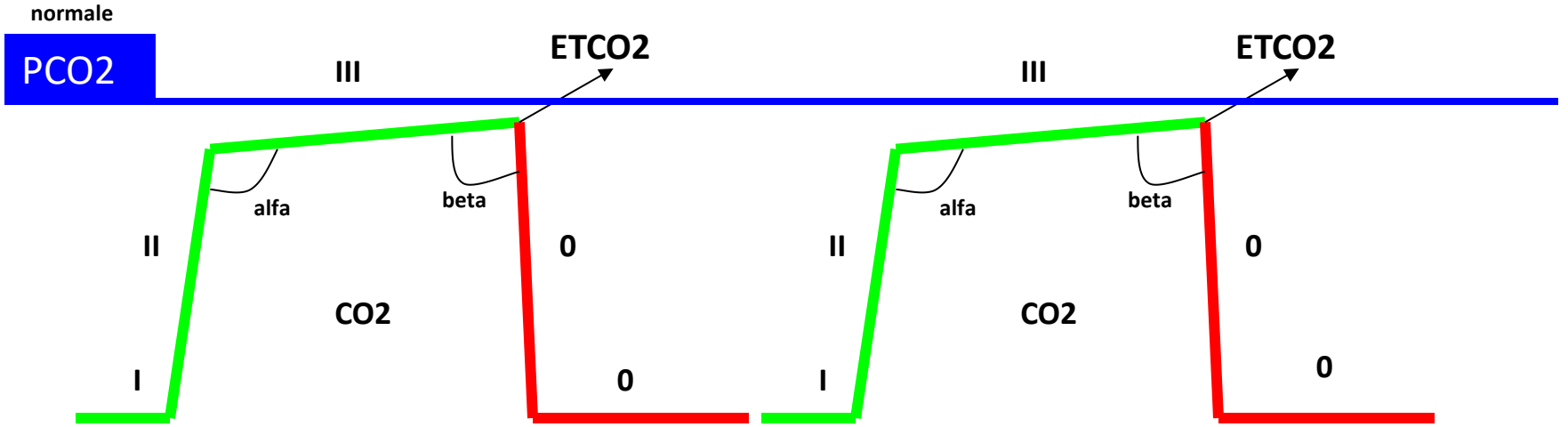
RISULTATI

CORRELAZIONE TRA CO2 ARTERIOSA STIMATA (EtCO2) E MISURATA ($PaCO_2$)



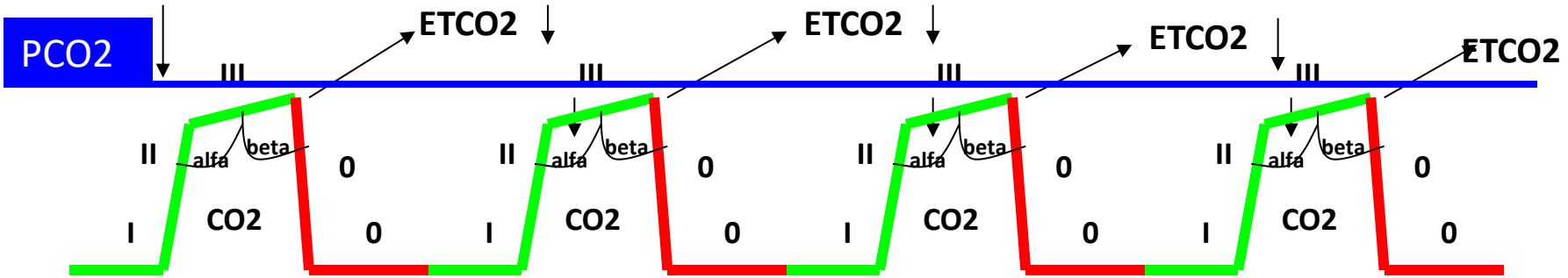
Iperventilazione

- **Ipossiemia**
- **Acidosi Metabolica**
- **Iperventilazione Centrale**
- **Iperventilazione Funzionale**



PCO2 – PETCO2 normale

CAPNOGRAMMA NORMALE



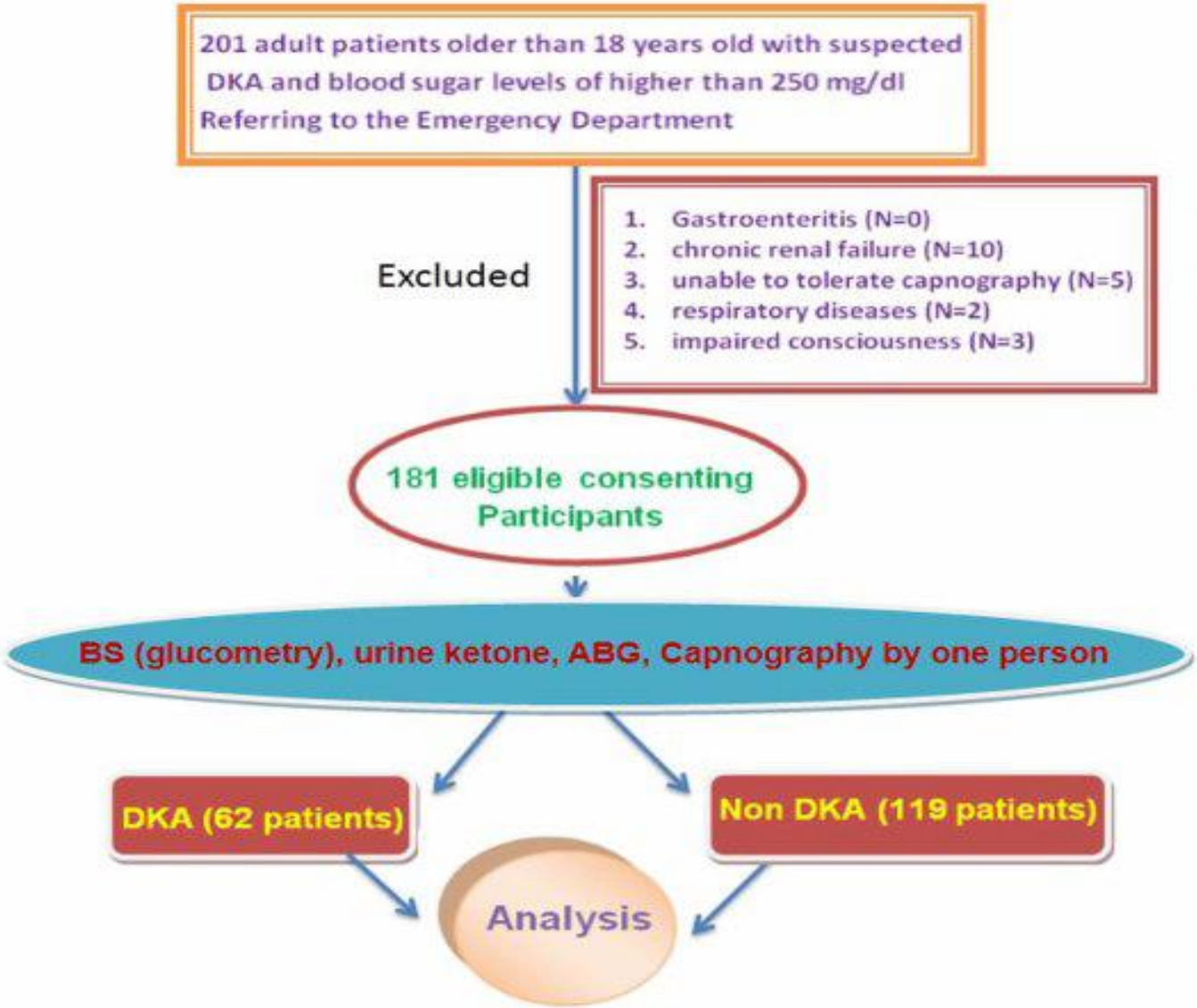
PCO2 – PETCO2 normale

CAPNOGRAMMA NELLA CHETOACIDOSI

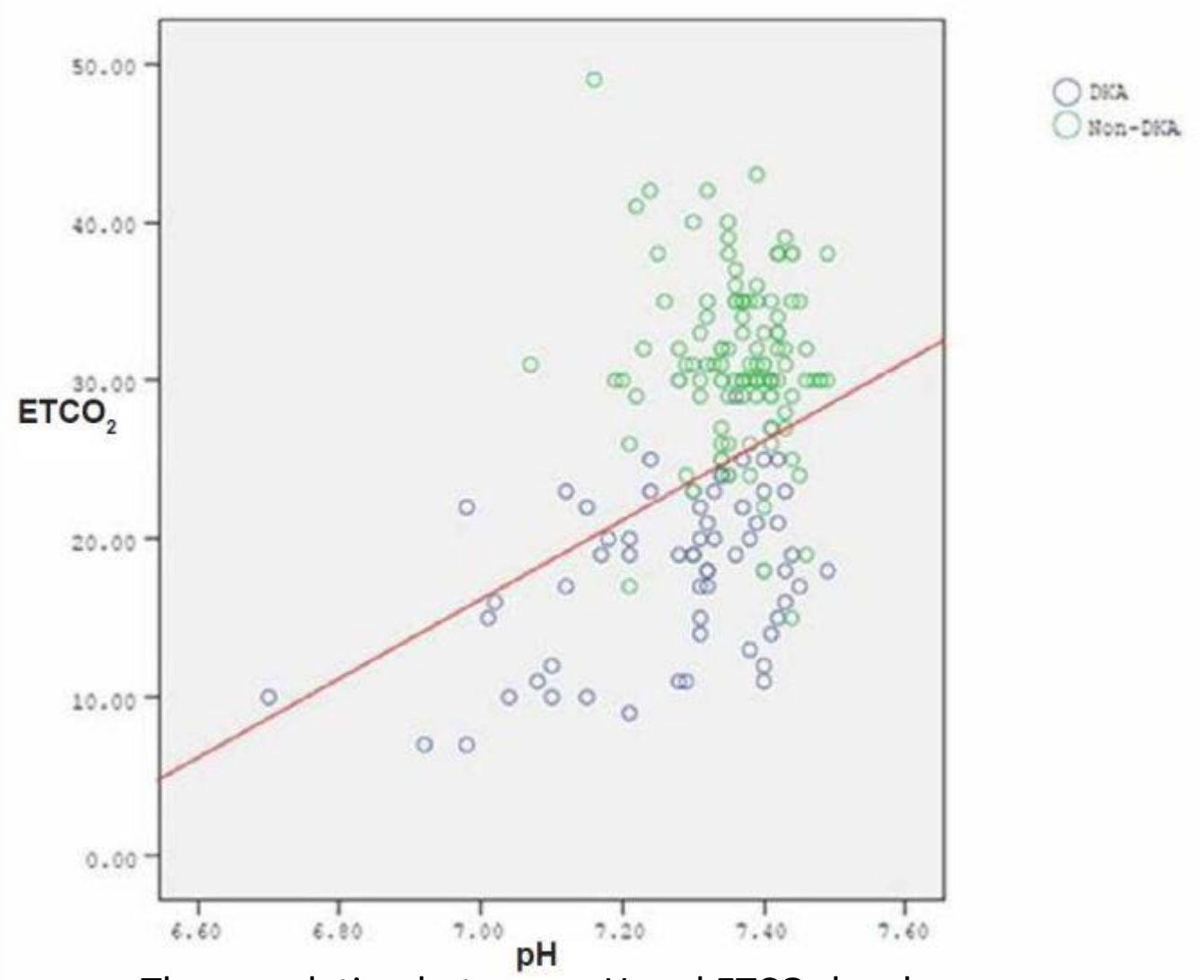
Current Issue, Volume 15, Issue 6, 2014

Predictive Value of Capnography for Suspected Diabetic Ketoacidosis in the Emergency Department

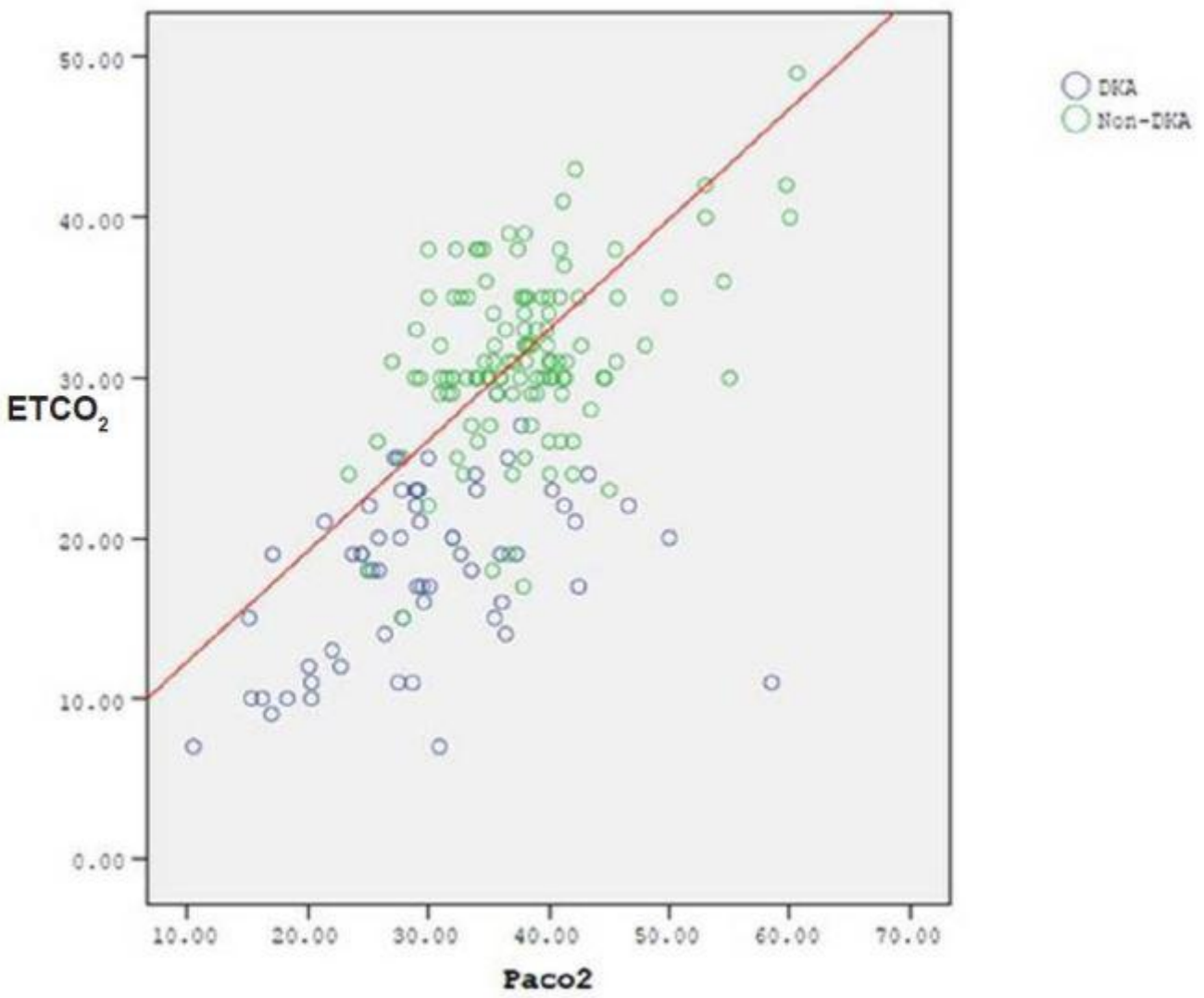
Hassan Soleimanpour, MD
Ali Taghizadieh, MD
Mitra Niafar, MD
Farzad Rahmani, MD
Samad EJ Golzari, MD
Robab Mehdizadeh Esfanjani, MD



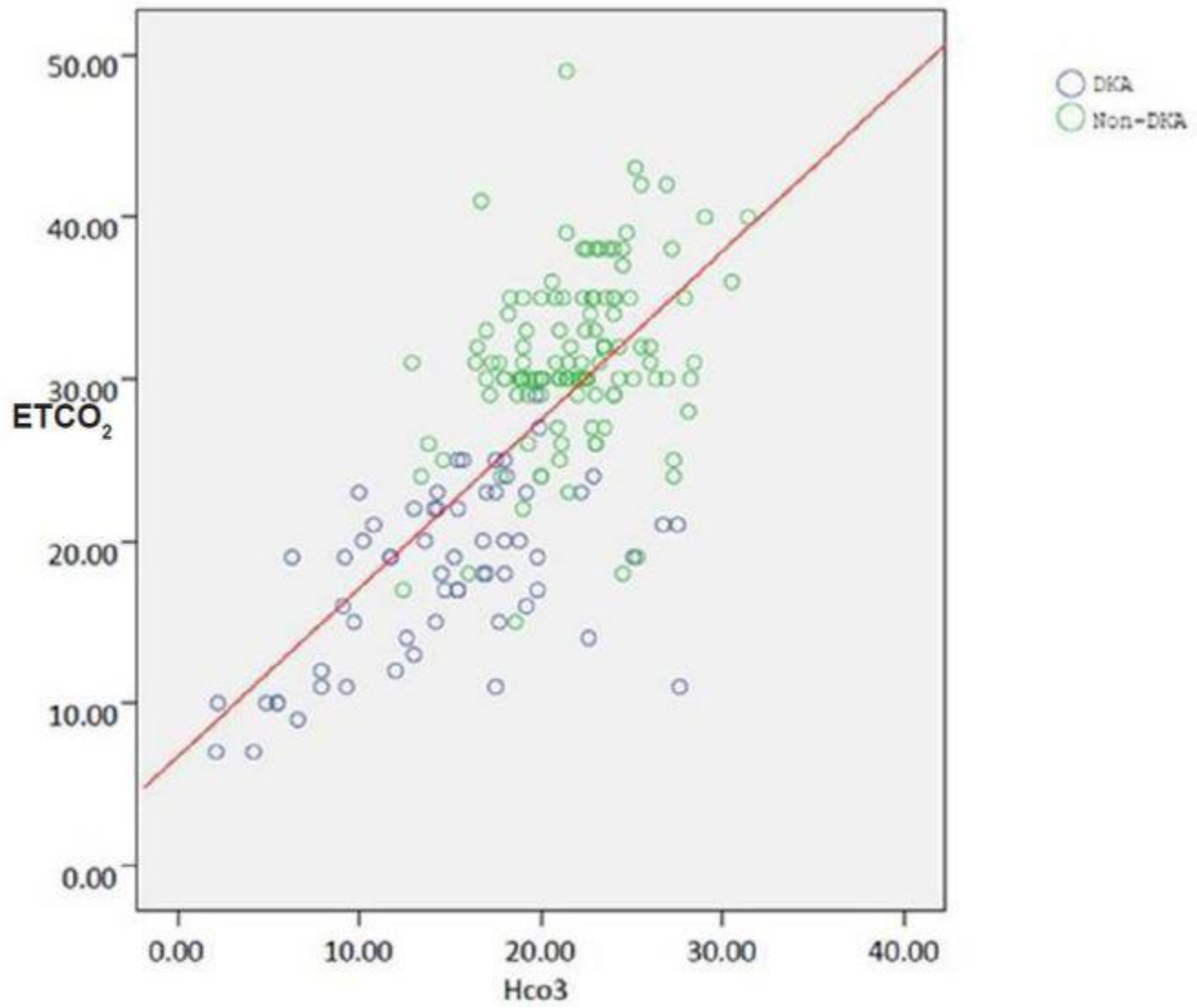
Flow diagram of study involving patients with suspected diabetic ketoacidosis.



The correlation between pH and $ETCO_2$ levels in 2 groups (diabetic ketoacidosis [blue], non-DKA [green])



The correlation between $PaCO_2$ and $ETco_2$ levels in two groups (diabetic ketoacidosis (DKA) [blue], non-DKA [green])

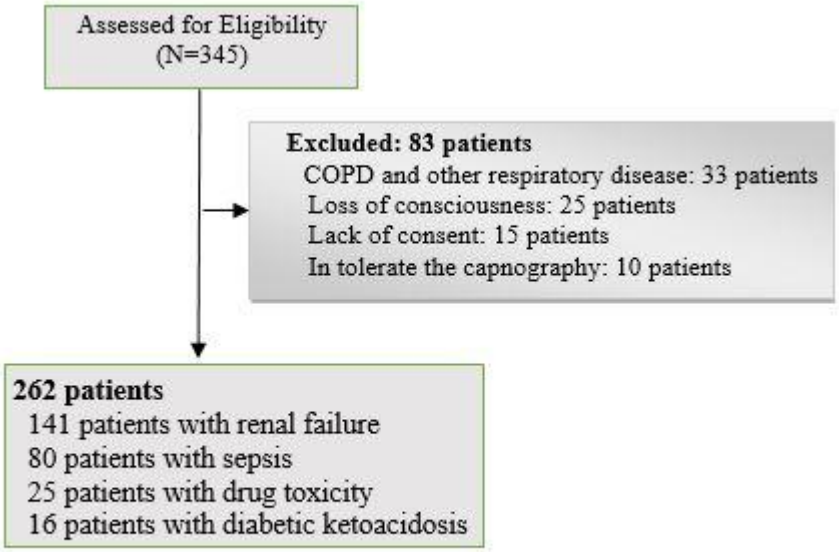


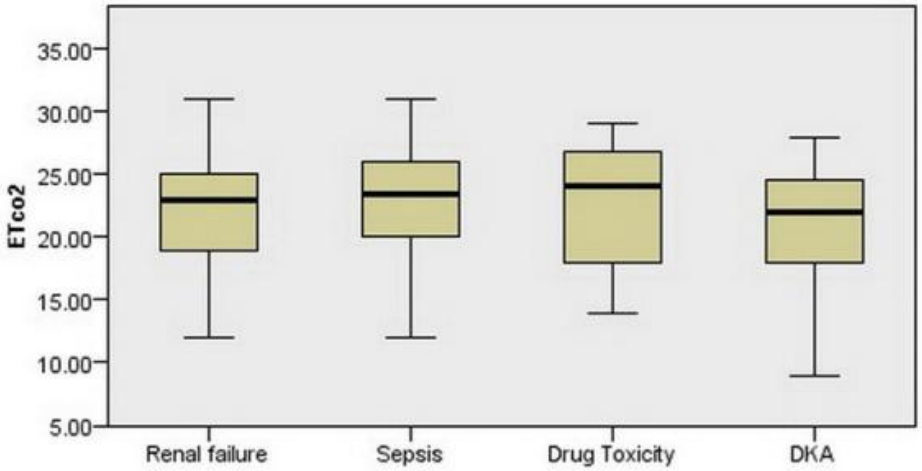
The correlation between HCO_3 and $ETco_2$ levels in two groups (diabetic ketoacidosis (DKA) [blue], non-DKA [green]).

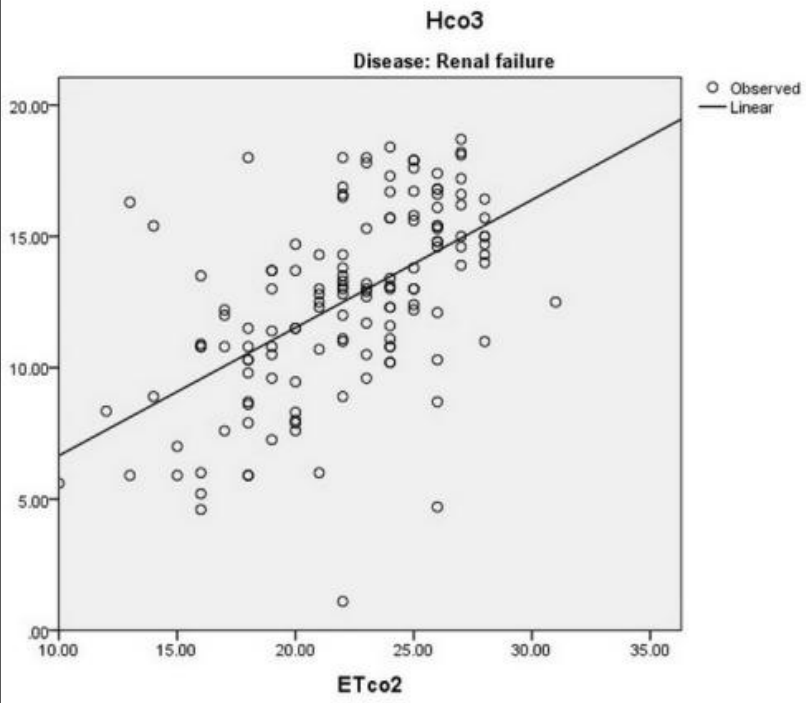
J. Cardiovasc. Thorac. Res. 2016, 8(3): 98-101

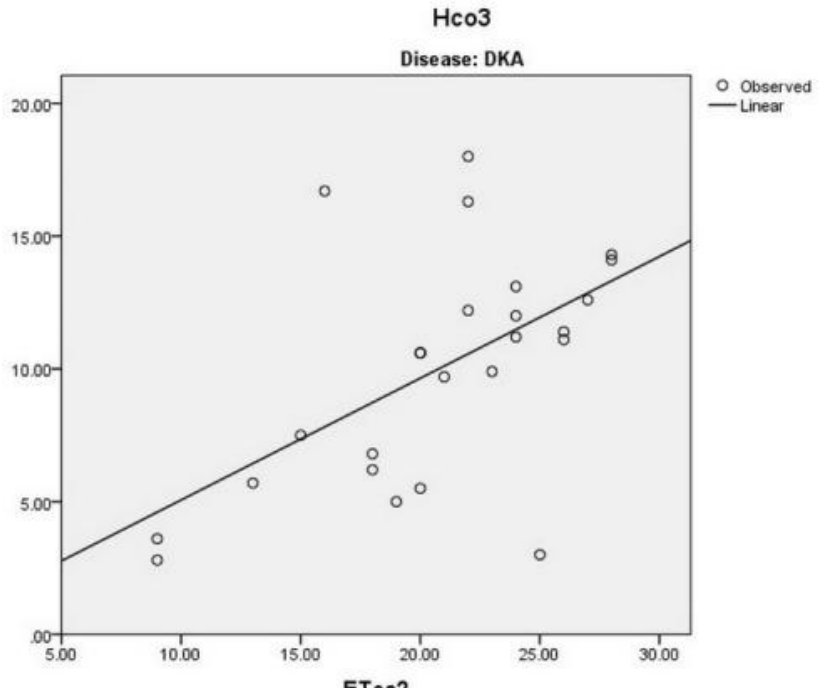
Comparison of end-tidal carbon dioxide and arterial lood bicarbonate levels in patients with metabolic acidosis referred to emergency medicine

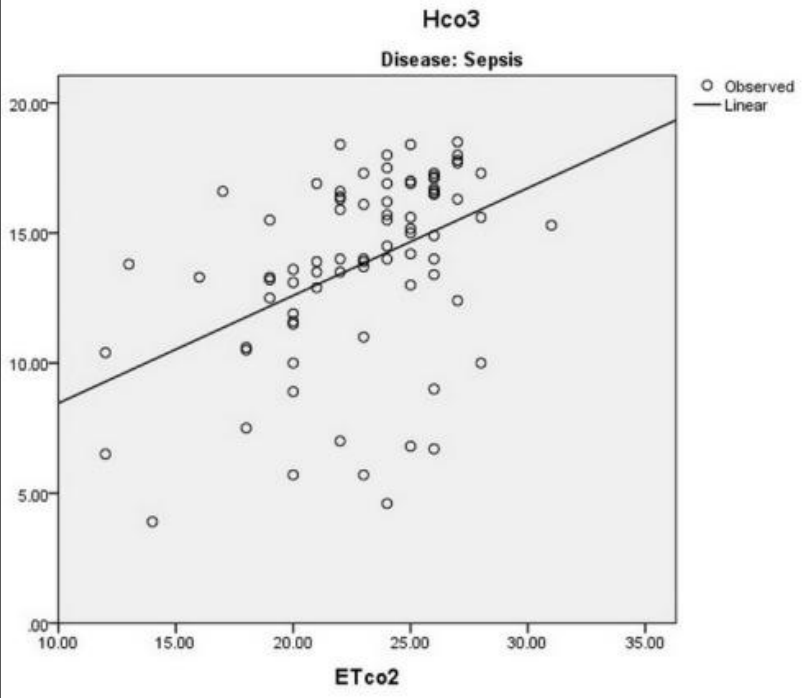
Ali Taghizadieh, Mahboub Pouraghaei, Payman Moharamzadeh, Alireza Ala, Farzad Rahmani, Karim Basiri Sofiani

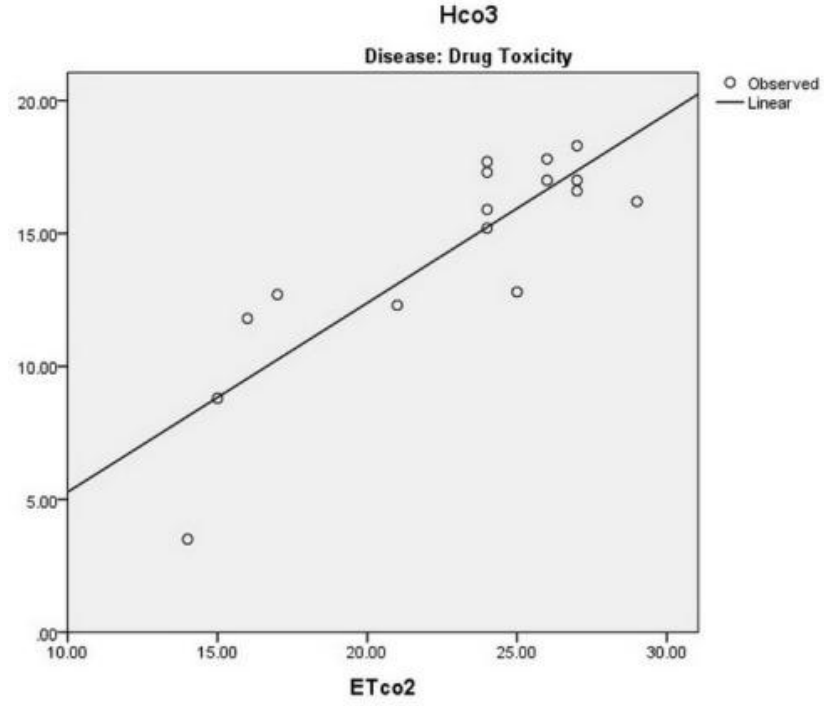

Assessed for Eligibility
(N=345)
Excluded: 83 patients
COPD and other respiratory disease: 33 patients
Loss of consciousness: 25 patients
Lack of consent: 15 patients
In tolerate the capnography: 10 patients
262 patients
141 patients with renal failure
80 patients with sepsis
25 patients with drug toxicity
16 patients with diabetic ketoacidosis


ETco2
35.00
30.00
25.00
20.00
15.00
10.00
5.00
Renal failure
Sepsis
Drug Toxicity
DKA


Hco3
Disease: Renal failure
Observed
Linear
20.00
15.00
10.00
5.00
.00
10.00
15.00
20.00
25.00
30.00
35.00
ETco2


Hco3
Disease: DKA
Observed
Linear
20.00
15.00
10.00
5.00
.00
5.00
10.00
15.00
20.00
25.00
30.00

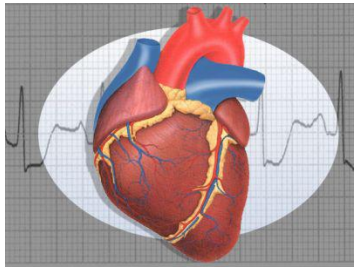

Hco3
Disease: Sepsis
Observed
Linear
20.00
15.00
10.00
5.00
.00
10.00
15.00
20.00
25.00
30.00
35.00
ETco2


Hco3
Disease: Drug Toxicity
Observed
Linear
20.00
15.00
10.00
5.00
.00
10.00
15.00
20.00
25.00
30.00
ETco2

Ipoperfusione

- **Riduzione Gittata Cardiaca**
- **Shock**
- **Embolia Polmonare**

LE VARIABILI FISIOPATOLOGICHE NEL PAZIENTE CRITICO



ETCO2

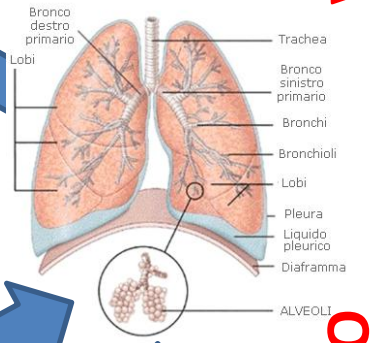
VENTILAZIONE

DO2=COxHb xSaO2

O2

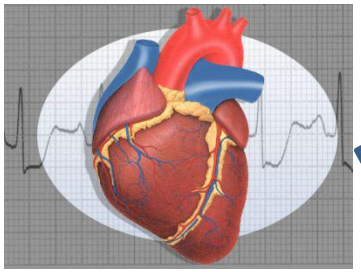
METABOLISMO

PERFUSIONE



ScvO2

CO2



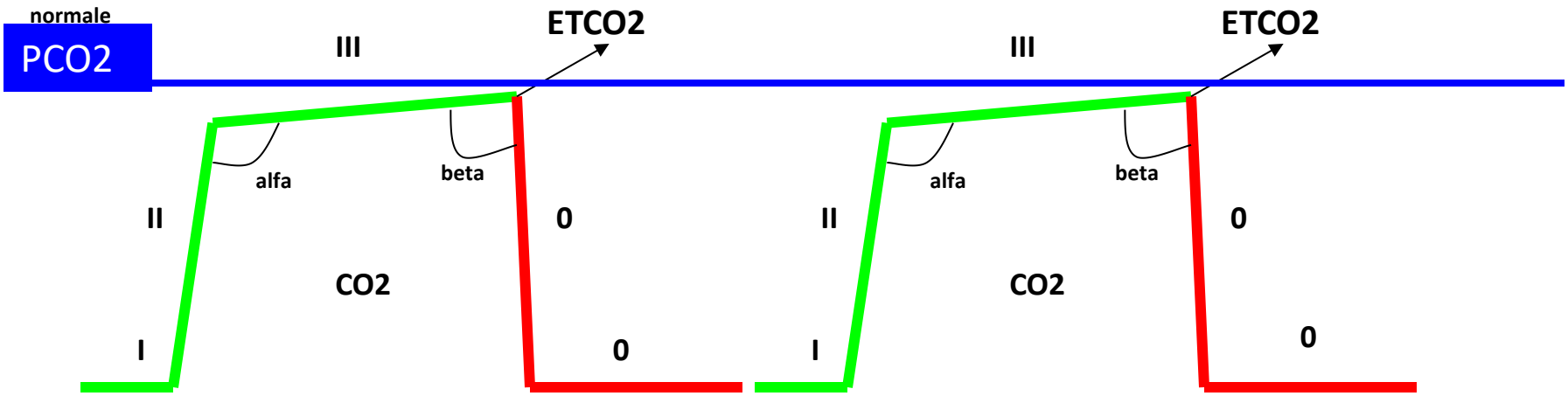
CO2

OSSIGENAZIONE

IPOPERFUSIONE
ScvO2 < 70%
PvCO2>PaCO2

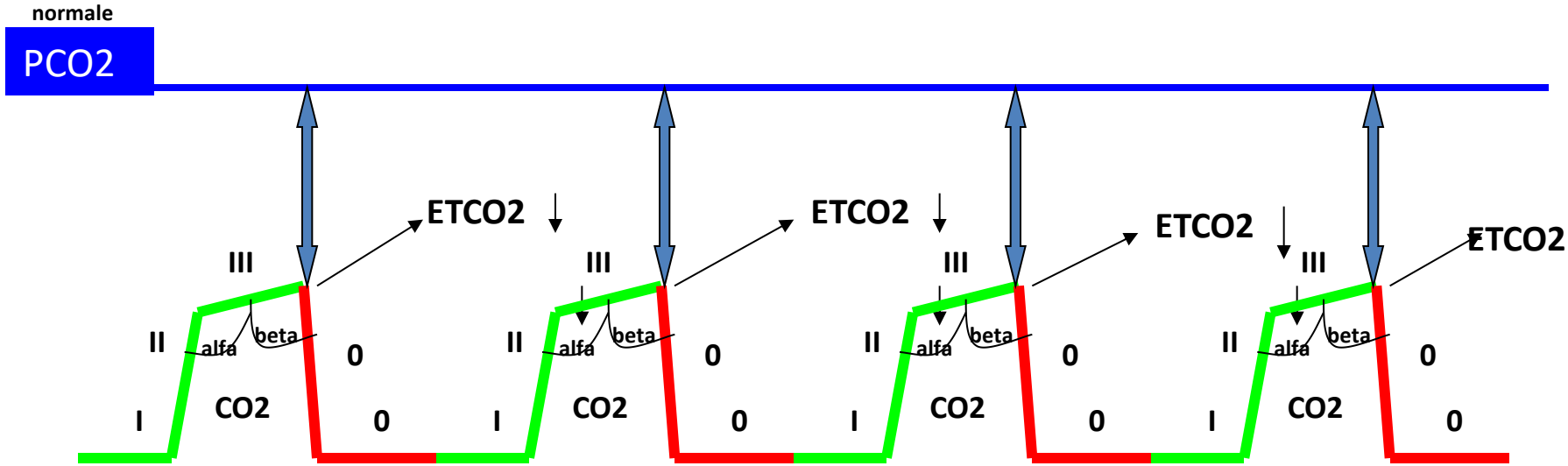
PETCO2 RIDOTTA
Pa-ETCO2>5 MMhG

O2
ATM



PCO2 – PETCO2 normale

CAPNOGRAMMA NORMALE



PCO2 – PETCO2 elevato

CAPNOGRAMMA NELLA IPOPERFUSIONE

Lo Scompenso Cardiaco Acuto

Emerg Med J doi:10.1136/emermed-2013

Prehospital end-tidal carbon dioxide differentiates between cardiac and obstructive causes of dyspnoea

Christofer L. Hunter, Salvatore Silvestri, George Ralls, Linda Papa

Objective To assess if prehospital levels of end-tidal carbon dioxide (ETCO2) differed in obstructive compared to cardiac causes of dyspnoea, and could suggest one diagnosis over the other.

Methods We conducted a retrospective cohort study among patients transported by emergency medical services during a 29-month period who were diagnosed with either obstructive pulmonary disease or congestive heart failure (CHF) by ICD-9 codes. Initial prehospital vital signs, including ETCO2, were recorded. Records were linked by manual archiving of emergency medical services and hospital data.

Results There were 106 patients with a diagnosis of obstructive or cardiac causes of dyspnoea that had prehospital ETCO2 levels measured during the study period. ETCO2 was significantly lower in patients diagnosed with CHF (31 mm Hg 95% CI 27 to 35) versus obstructive pulmonary disease (39 mm Hg 95% CI 35 to 42; p<0.001). Lower ETCO2 levels predicted CHF, with an area under the Receiver Operating Characteristics Curve of 0.70 (95% CI 0.60 to 0.81). Using ETCO2 <40 mm Hg as a cut-off, the sensitivity for predicting heart failure was 93% (95% CI 88% to 98%), the specificity was 43% (95% CI 33% to 52%), the positive predictive value was 38% (95% CI 29% to 48%), and the negative predictive value was 94% (95% CI 89% to 99%).

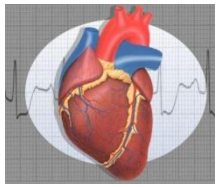
Conclusions Lower levels of ETCO2 were associated with CHF, and may serve as an objective diagnostic adjunct to predict this cause of dyspnoea in the prehospital setting.

Moret Iurilli C, Brunetti ND, Di Corato PR, Salvemini G, Di Biase M, Ciccone MM, Procacci V

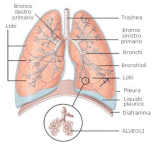
J Intensive Care Med. 2018 Feb;33(2):128-133. doi: 10.1177/0885066617740849. Epub 2017 Nov 15

Hyperacute Hemodynamic Effects of BiPAP Noninvasive Ventilation in Patients With Acute Heart Failure and Left Ventricular Systolic Dysfunction in Emergency Department.

ALTERAZIONI DELLA MECCANICA POLMONARE IN CORSO DI SCOMPENSO CARDIACO ACUTO



SCOMPENSO ACUTO



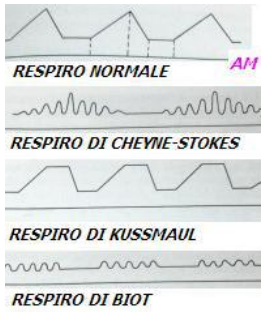
Ipertensione Capillare Polmonare

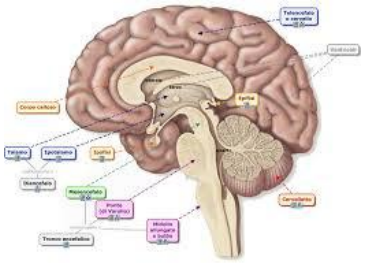
Deficit
Di scambio

IPOSSIA

Stretching
Barocettori
polmonari

Alterazione
Della sensibilità
Chemoricettoriale
Per la CO_2





ALTERAZIONE DEL
DRIVE
RESPIRATORIO

IPERCAPNIA

IPERTONO SIMPATICO

JACC Vol. 54, No. 19, 2009 Triposkiadis et al. November 3, 2009:1747–62
Sympathetic Nervous System in Heart Failure

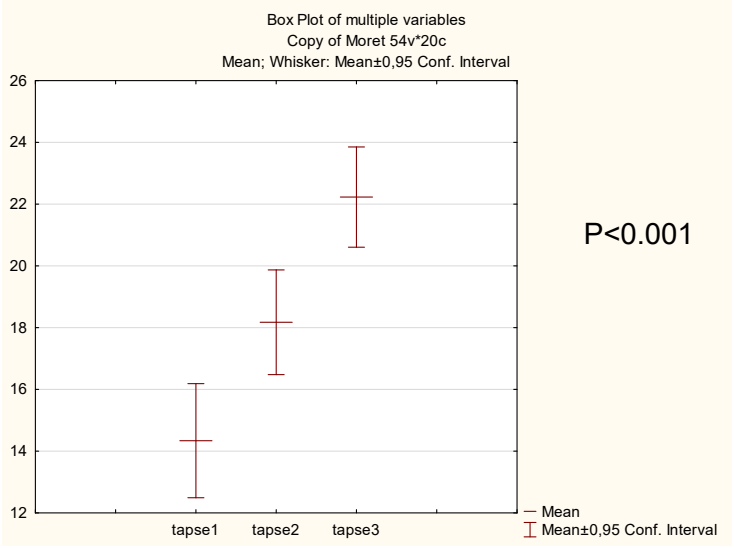
Valutazione degli effetti dell'applicazione della BiLevel PAP sui seguenti aspetti fisiopatologici in pz con HF ipossiemico-ipercapnico

Aspetti emodinamici	TAPSE – Funzione Sistolica Ventricolo Dx Gradiente Transpolmonare - Pressione circolo polmonare Vena Cava Inferiore – PVC/Precarico Gradiente Transaortico - Resistenze Sistemiche/Postcarico BNP
Perfusione Tissutale	ETCO2 – Capnografia Lattato
Aspetti Elettrofisiologici	QT/QTc - Sistole elettrica ventricolare QRS - Depolarizzazione Ventricolare So-Tm - Durata media potenziale d'azione Tm-To - sincronismo di ripolarizzazione
Aspetti Emogasanalitici	PH - PCO2 - PO2/FiO2

C. Moret Iurilli et Al. 2016

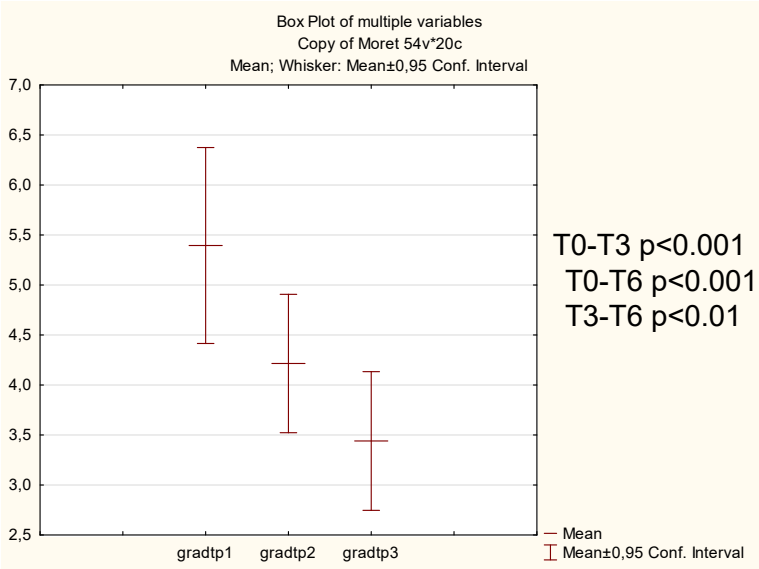
Aspetti Emodinamici

TAPSE ai tempi T0 – T3- T6



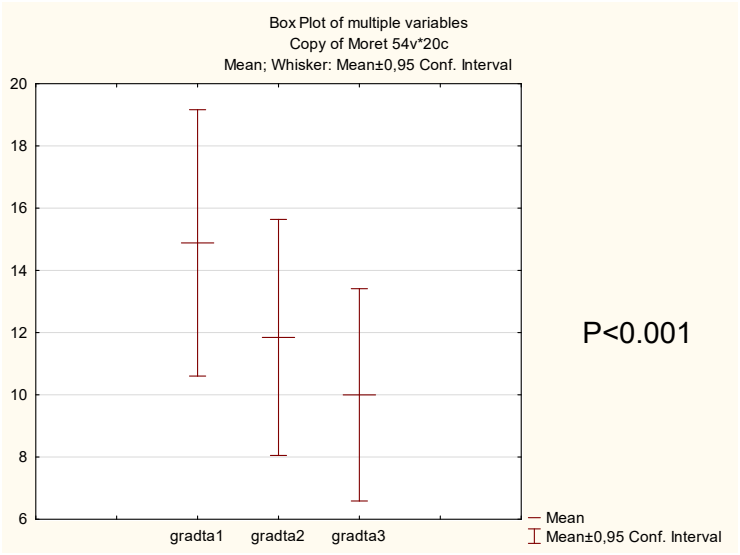
P<0.001

Gradiente Trans Polmonare ai tempi T0-T3-T6



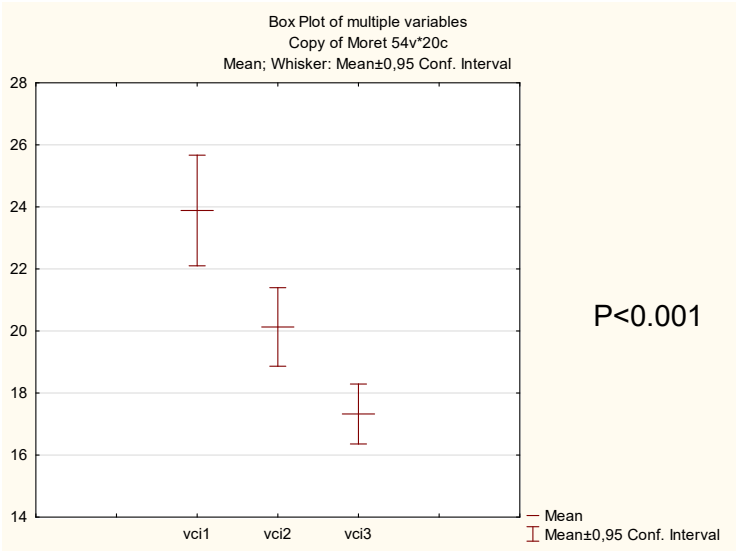
T0-T3 p<0.001
T0-T6 p<0.001
T3-T6 p<0.01

Gradiente Trans Aortico ai tempi T0 – T3 – T6



P<0.001

Calibro Vena Cava Inferiore ai Tempi T0-T3-T6

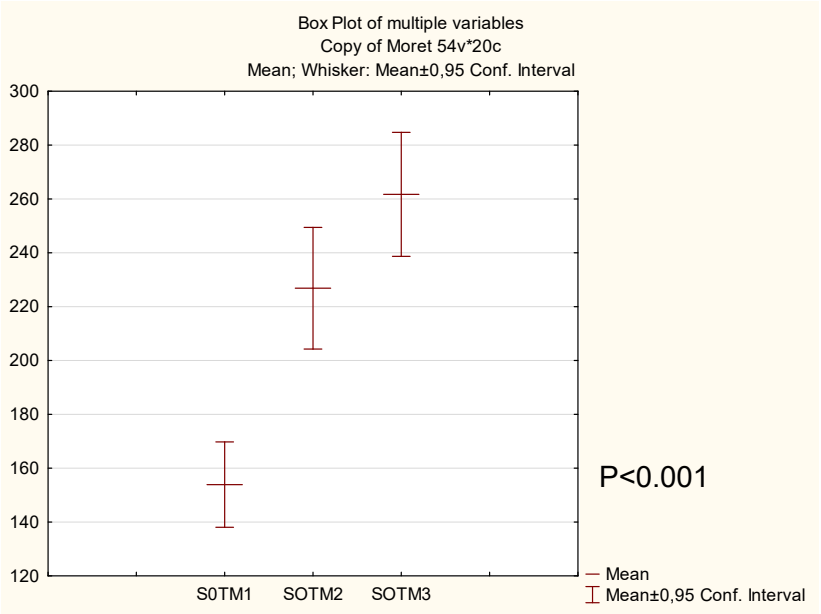


P<0.001

C. Moret Iurilli et. Al. 2016

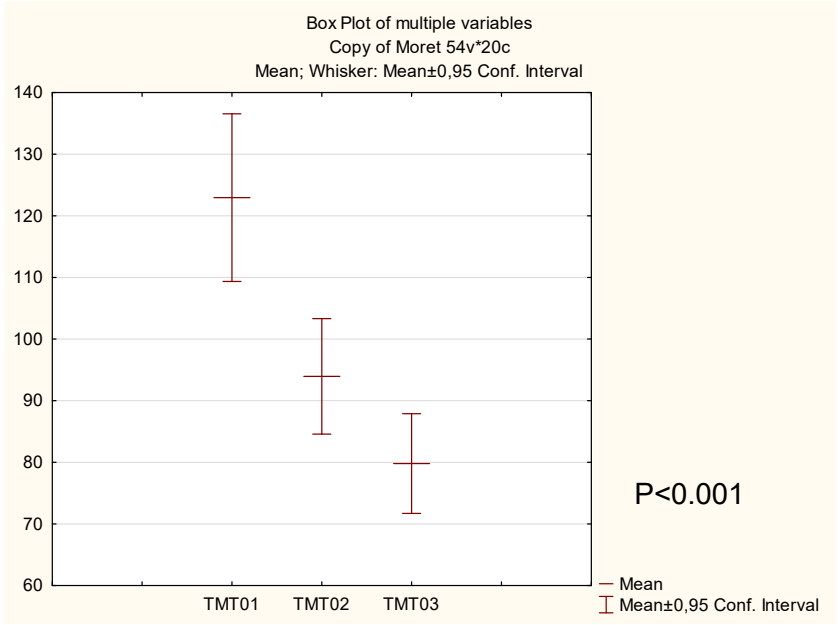
Aspetti Elettrofisiologici

Intervallo So-Tm ai Tempi T0-T3-T6



Durata media del potenziale d'Azione

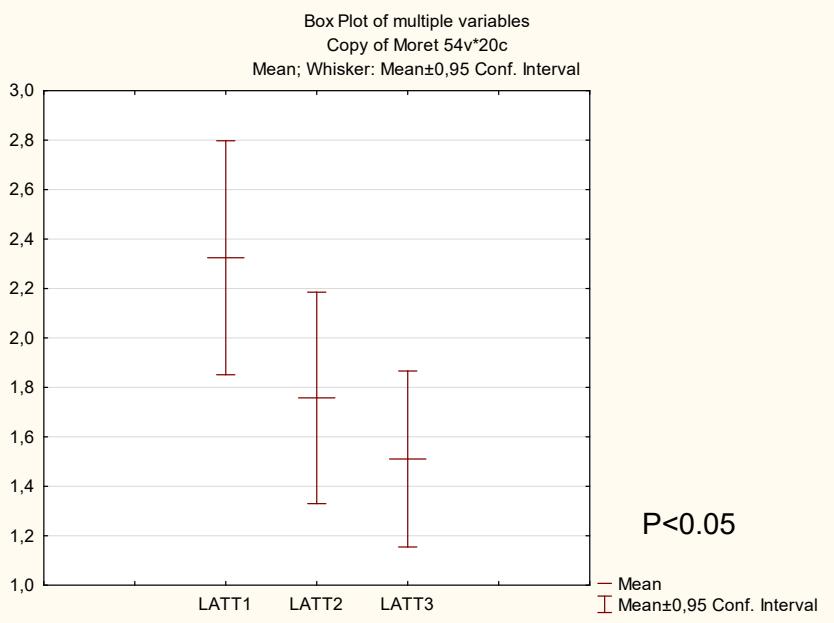
Intervallo Tm-To ai Tempi T0-T3-T6



Sincronismo di ripolarizzazione

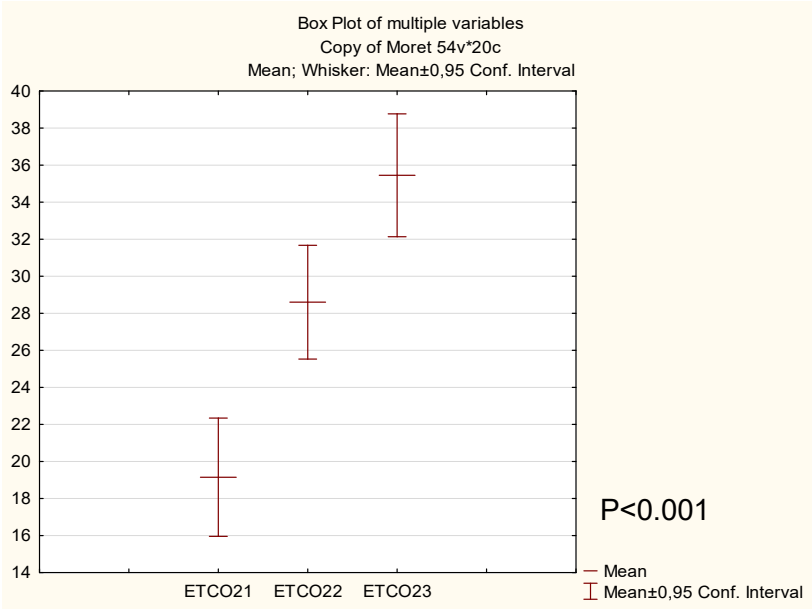
La Microperfusione

Lattato ai Tempi T0-T3-T6



P<0.05

End Tidal CO2 ai Tempi T0-T3-T6



P<0.001

La Sepsi

Evaluation of end-tidal carbon dioxide role in predicting elevated SOFA scores and lactic acidosis

McGillicuddy et Al.

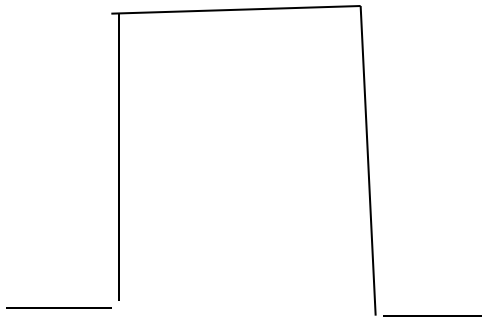
Intern. Emer. Med. 2009 Feb;4(1):41-4

Pazienti Studiati	**97**
PETCO2/SOFA Score	r=-0.35 p<0.01
PETCO2/Lattato	r=-0.35 p<0.01

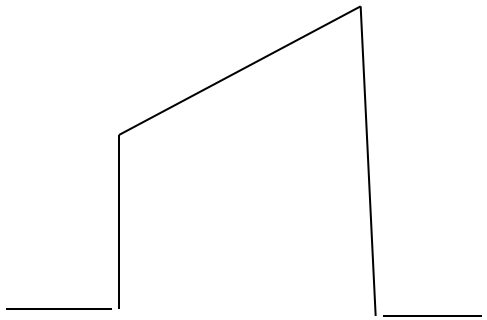
Broncospasmo

From Lines and Curves--Shapes of capnograms - Capnography.mht

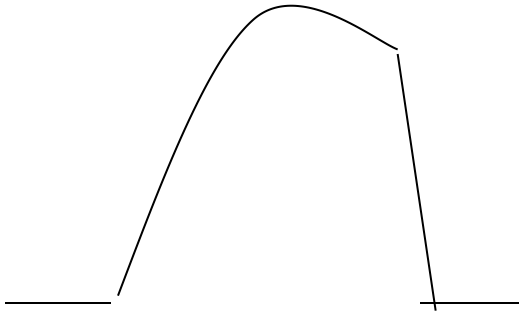
Angolo Alfa → **Resistenze Bronchiali**



Normale

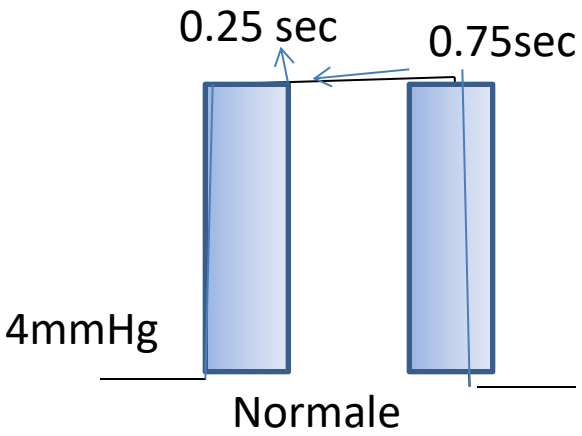


Broncostenosi

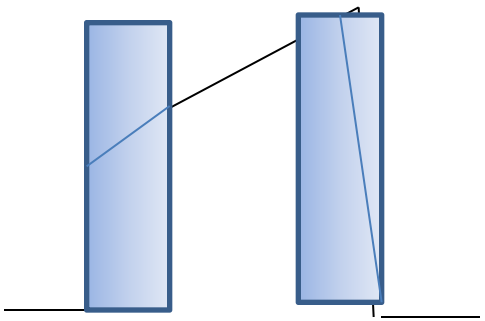


Broncostenosi Grave

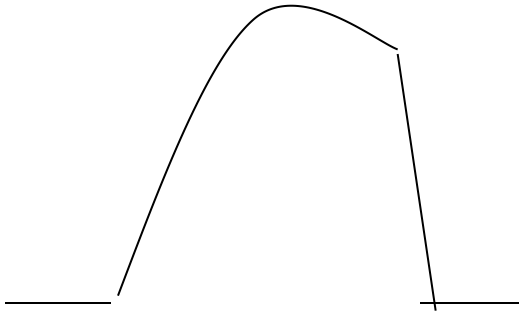
Angolo Alfa → **Resistenze Bronchiali**



Normale



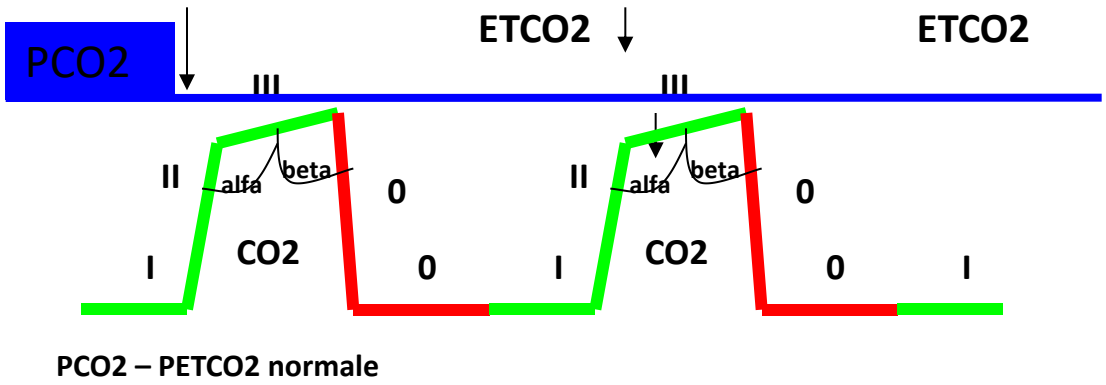
Broncostenosi



Broncostenosi Grave

Interazioni Capnografia – Critical Ultrasound

CAPNOGRAFIA

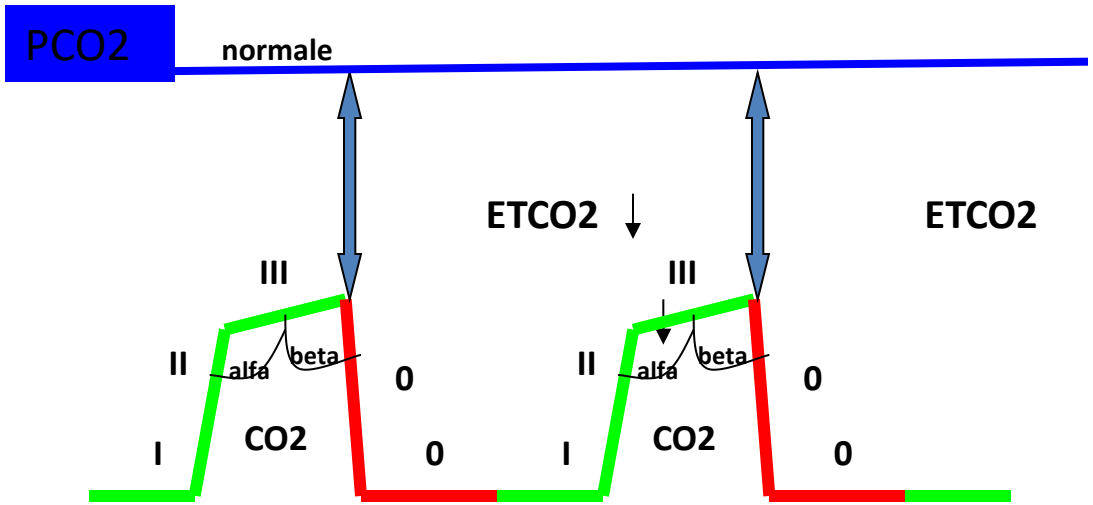


PCO2 – PETCO2 normale

ACIDOSI METABOLICA

ECOGRAFIA

SINDROME IPERCINETICA:
- Kissing Ventricolo Dx
- Ipercinesia Ventricolo Sx
- Vena Cava Inferiore collabita
- Polmone Normale



PCO2 – PETCO2 elevata

IPOPERFUSIONE POLMONARE

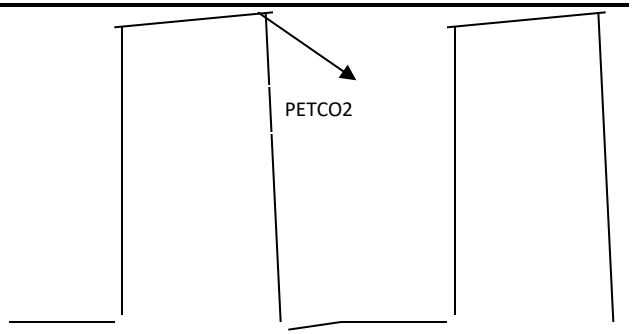
SINDROME IPERCINETICA:
- Kissing Ventricolo Dx
- Ipercinesia Ventricolo Sx
- Vena Cava Inferiore collabita
- Polmone Normale

PATTERN TEP:
- Dilatazione Ventricolo Dx
- Vena Cava Inferiore Dilatata
- Polmone Normale

CAPNOGRAFIA

ECOGRAFIA

PCO2

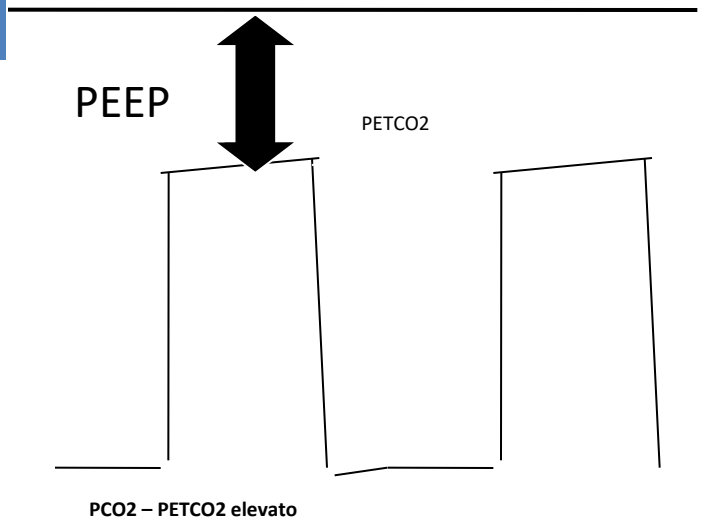


PCO2 – PETCO2 normale

IPOVENTILAZIONE CENTRALE

- RIDUZIONI ESCURSIONI DIAFRAMMATICHE

PCO2

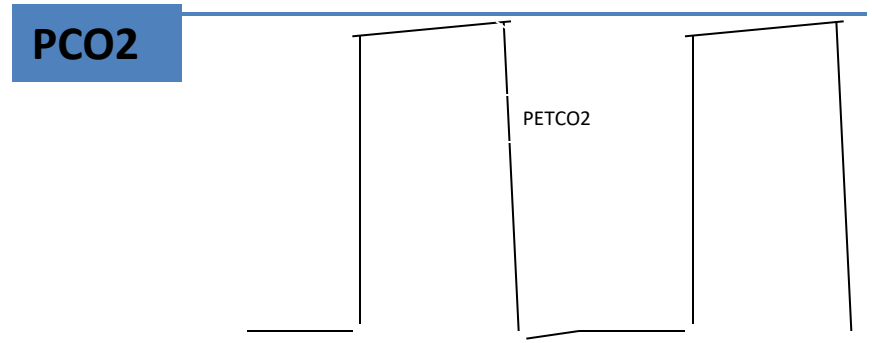


PCO2 – PETCO2 elevato

IPOVENTILAZIONE PERIFERICA

- POLMONE UMIDO O SECCO
- EV ADDENSAMENTI
- EV. VERSAMENTO PLEURICO
- VENTRICOLO DX DILATATO

CAPNOGRAFIA

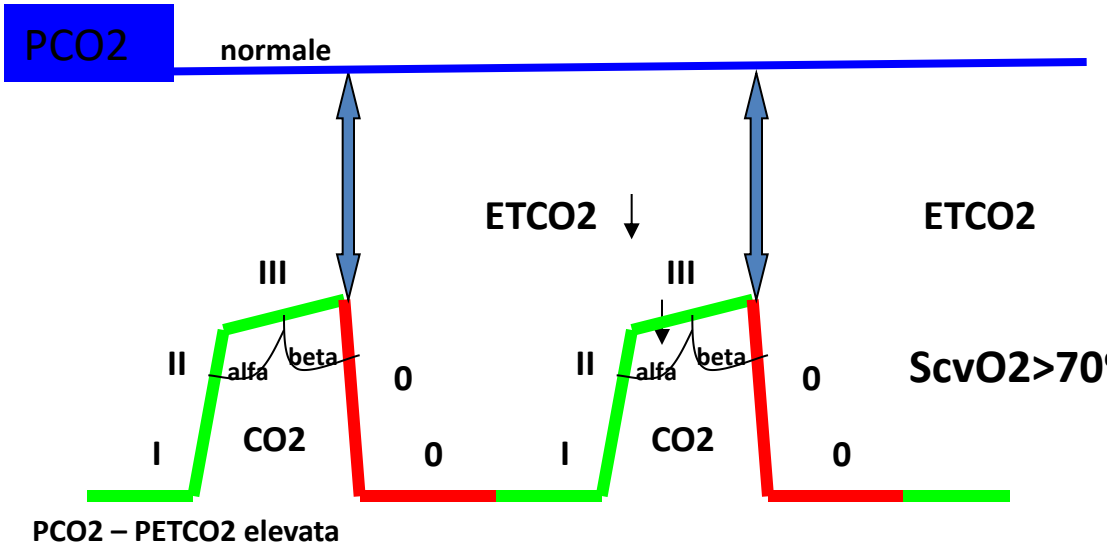


ScvO2<70%

SEPSI E
SINDROME IPERMETABOLICA
CON NORMOPERFUSIONE

ECOGRAFIA

- SINDROME IPERCINETICA
- EV. EVIDENZA DI LOCALIZZAZIONI SETTICHE (POLMONI, VALVOLE ECC.)



ScvO2>70%

SEPSI GRAVE, IPOPERFUSIONE E SHOCK SETTICO
CON DISFUNZIONE MULTIORGANO

- POLMONE UMIDO CON PATTERN ARDS
- EV ADDENSAMENTI
- EV. VERSAMENTO PLEURICO
- VENTRICOLO DX DILATATO
- VENA CAVA INFERIORE DILATATA
- DISFUNZIONE SISTOLICA VENTRICOLO SX

Take Home Points

- **Il Monitoraggio Capnografico/Capnometrico consente una valutazione beat to beat, totalmente non invasiva, dei principali parametri fisiopatologici del paziente critico (ossigenazione, perfusione, ventilazione e metabolismo)**
- **Essa fornisce informazioni aggiuntive riguardanti la frequenza, il ritmo e il sincronismo ventilatorio**
- **In associazione alla critical ultrasound e all'emogas artero-venoso assume un ruolo importante nel monitoraggio semintesivo del paziente critico**

Grazie !

Vito Procacci

XI congresso nazionale
simeu
ROMA 24-26 MAGGIO 2018