

Acute Respiratory Failure in Children



Gökhan KALKAN M.D.

Division of Pediatric Critical Care

Gazi University, School of Medicine, Ankara

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Disclosure

I have no conflict of interest

Definition

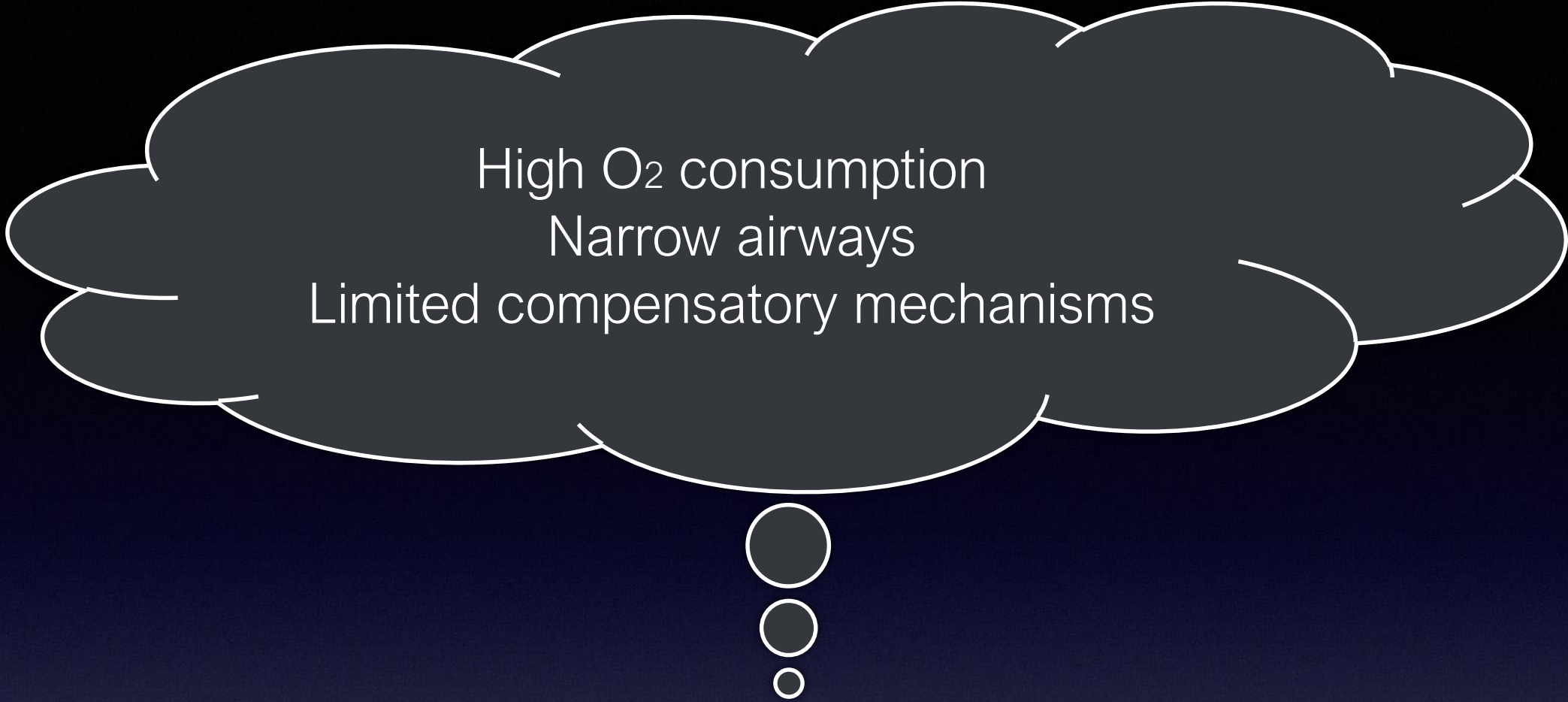
Respiratory distress

Acute

Respiratory

Failure

ARDS



High O₂ consumption
Narrow airways
Limited compensatory mechanisms

Respiratory failure may lead to cardiac arrest very quickly

Unrecognized respiratory failure is the leading cause of cardiorespiratory arrest in pediatrics

Question

6 yo

GBS

Extremity weakness

Tachypnea

Weak cough

Which of the following might be the first sign of respiratory failure?

SpO₂<95%

Retractions

Increase in CO₂ levels

Classification

$\text{PaO}_2 < 60$

Hypoxic / Hypercapnic

Classification

Airway obstruction
Decreased compliance
Neuromuscular disease
CNS disease

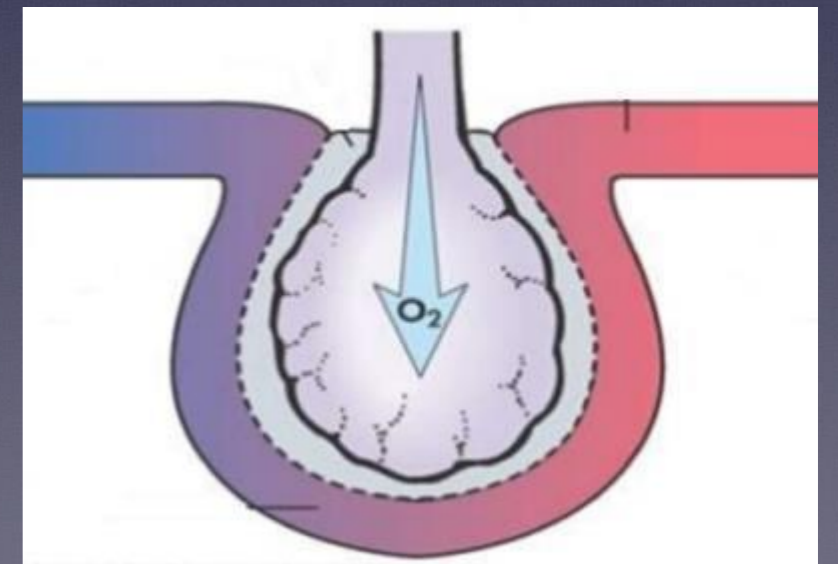
Hypercapnic

Neuromuscular disease
Thoracic deformities

Hypoventilation
V/Q mismatch
Shunt
Diffusion limitation

Hypoxic / Hypercapnic drive

Mechanism



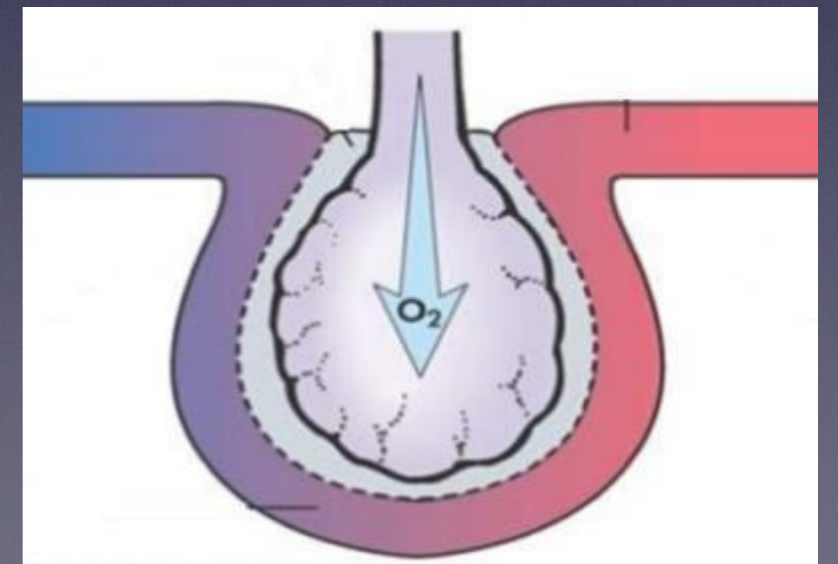
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Airway diseases
Pulmonary emboli

Hypoventilation
V/Q mismatch
Shunt
Diffusion limitation

Hypoxic / Hypercapnic

Mechanism



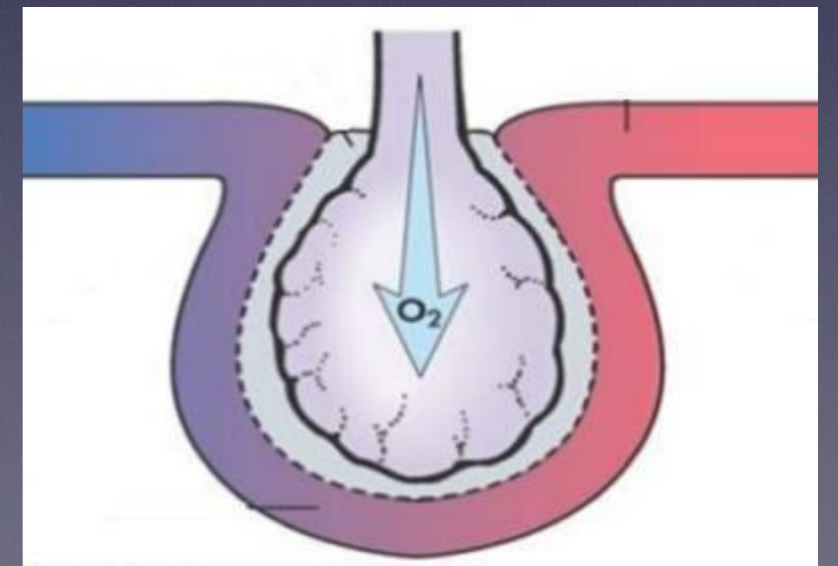
Classical

ARDS
Pneumonia
Pulmonary edema

Hypoventilation
V/Q mismatch
Shunt
Diffusion limitation

Hypoxic / Hypercapnic

Mechanism



Clinical findings

Tachypnea

Grunting

Nasal flaring

Retractions

Different in patients with NMD

Clinical findings

Retractions

Lungs/ airways

Shallow breathing

Respiratory muscles

Apnea

Central/ peripheric chemoreceptors

4 mo

Fever & nasal congestion for 4 days

Tachypnea

HR: 169/min

SpO₂: 92% at room air

Intercostal & subcostal retractions

Scattered wheezing

XR: increased aeration

Nasopharyngeal swab: RSV +

Increase in respiratory distress in the first day of his hospitalization

RR:86/min, HR: 189/min

Nasal flaring, grunting, ↑ retractions

What to do?

Transferred to PICU

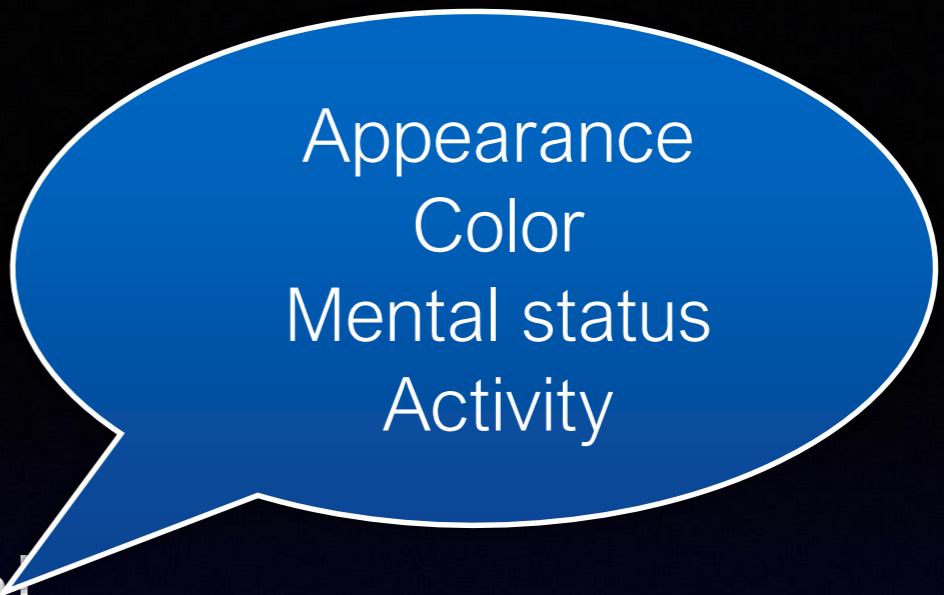
Intubated

Increased aeration in XR

Post-intubation ABG: pH: 7.16, PCO₂: 70 mm Hg

How bad is th

General



Appearance
Color
Mental status
Activity

How bad is the patient?

General

How much O₂?

O₂ delivery methods

Nasal cannula 25-40%

Simple O₂ mask 30-65%

O₂ mask with reservoir 50-95%

Nasal cannula



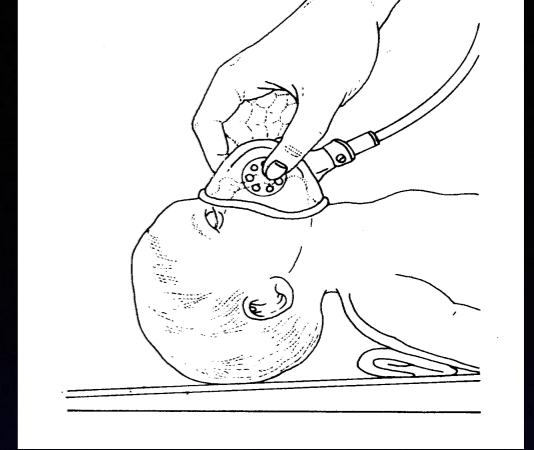
Supports ventilation
Good for CO₂ retention

Concentrate the O₂

Pressure

Dry mucosa
Tympanic membrane rupture
O₂ flow should be < 4-5 L/min

O₂ mask



More concentrated O₂

Risk of CO₂ retention

O₂ flow should be > 4-5 L/min

How bad is the patient?

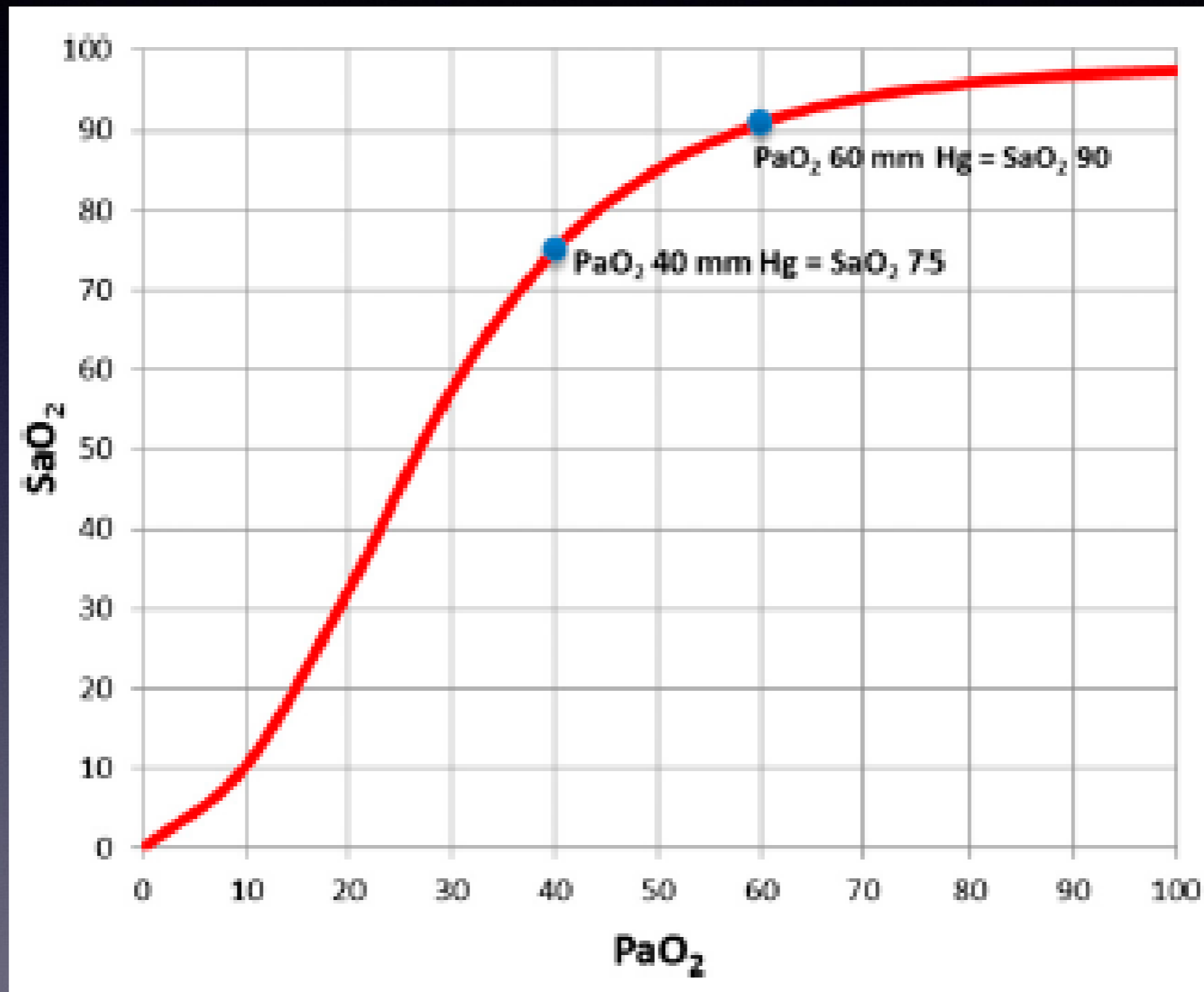
General

How much O₂?

RR

SpO₂

Pulse oxymetry



How bad is the patient?

General

How much O₂?

RR

SpO₂

Retractions

Respiratory sounds

Arterial blood gas

Arterial blood gas

Normal values

Lactate

Vein or artery

Interpretation

Normal values

pH	7.35 - 7.45
PaCO ₂	35 - 45 mm Hg
PaO ₂	70 - 100 mm Hg
SaO ₂	93 - 98%
HCO ₃ ⁻	22 - 26 mEq/L

12 yo girl

Meningomyelocele, scoliosis & nosocomial pneumonia

Increased tachypnea & retractions

PE:

Subcostal, intercostal, suprasternal retractions

Nasal flaring

Bilateral rales

XR: increased infiltration

pH: 7.35

pCO₂: 41 mmHg

pO₂: 70 mmHg

(while receiving O₂ via face mask @ 15 lt/min)

HCO₃: 22 mmol/l

SaO₂: 92%

What to do?

Signs of respiratory failure

Normal ABG

Intubated for impending respiratory failure

ARDS

New findings- 1 week

Imaging- Bilateral opacities

R/O: Heart failure/ fluid overload

Disrupted oxygenation

ARDS

New findings- 1 week

Imaging- Bilateral opacities

Q: Heart failure/ fluid overload

Disrupted oxygenation

PaO₂/FiO₂



300

200

100

Hypotonic?

CO₂ retention

Recurrent pneumonia

go with Down syndrome

May not show much retractions!

tracheostomy

and activity and sleepy

RR: 35/min & shallow breathing

ABG @ room

pH: 7,33

CO₂: 62 mm Hg

pO₂: 54 mm Hg

HCO₃: 28 mEq/L

Hb: 15 g/dl

Chronic CO₂
retention
Her normal PCO₂ ≈
50

Chronic hypoxia

After 10

O₂ may be harmful in
chronic respiratory
failure

pH: 7,23

CO₂: 80 mm Hg

pO₂: 118 mm Hg

HCO₃: 32 mEq/L

Hypoxia stimulates
respiratory center

Thank you

