

HRV – Relevant Conditions

Group 31



Topics Covered

COPD

- Introduction and brief summary
- Significant physiological parameters
- Importance of ECG and PaCO₂
- Available technologies for remote monitoring

Sepsis

- Introduction and brief summary
- Parameters monitored
- Invasive vs. non-invasive monitoring

COPD



- Chronic Obstructive Pulmonary Disease
- 4th most frequent cause of death worldwide
- No definitive cure
- Characterized by *V/Q mismatch*

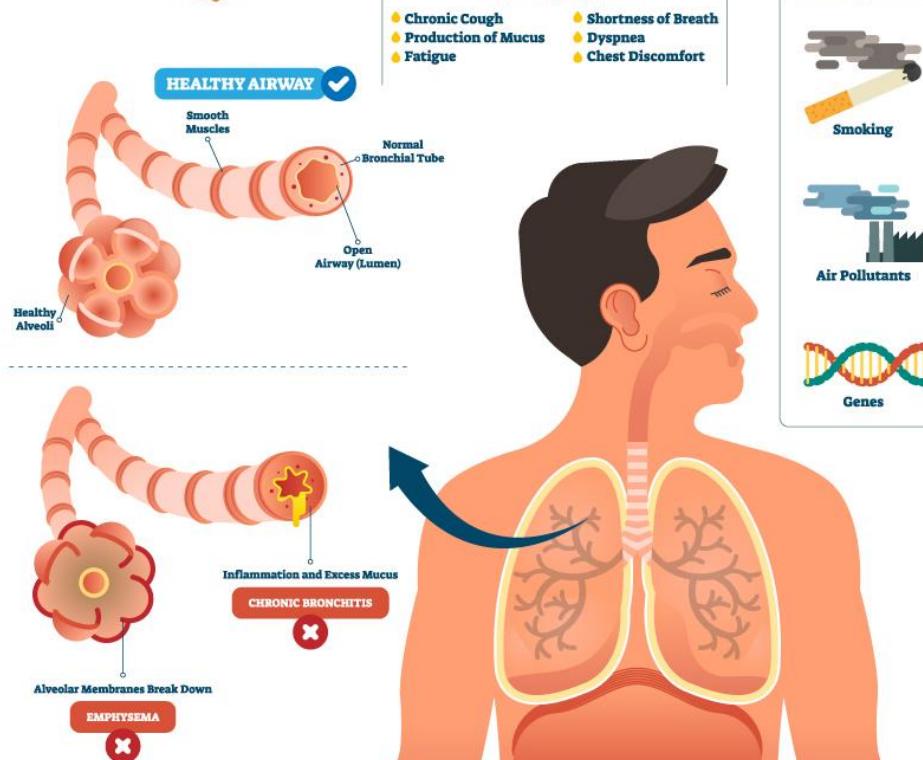


COPD



COPD

Chronic Obstructive Pulmonary Disease



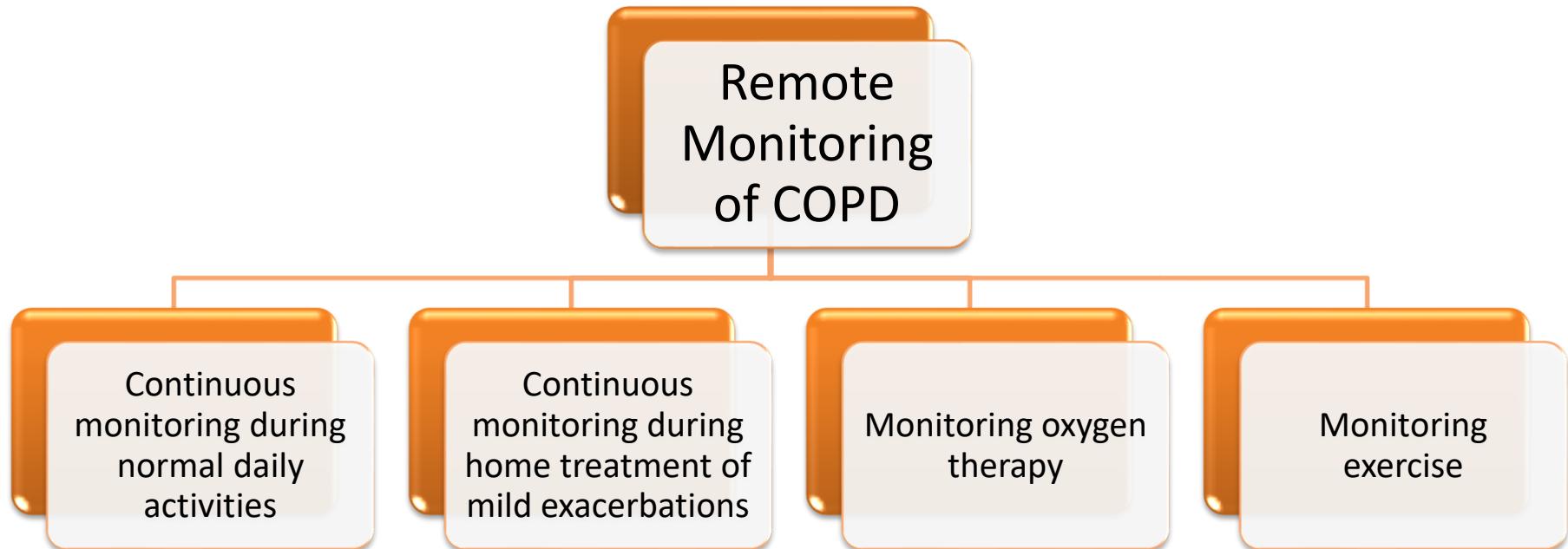
COPD Symptoms

- Chronic Cough
- Production of Mucus
- Fatigue
- Shortness of Breath
- Dyspnea
- Chest Discomfort

COPD Causes

- Smoking
- Air Pollutants
- Genes

Remote monitoring COPD

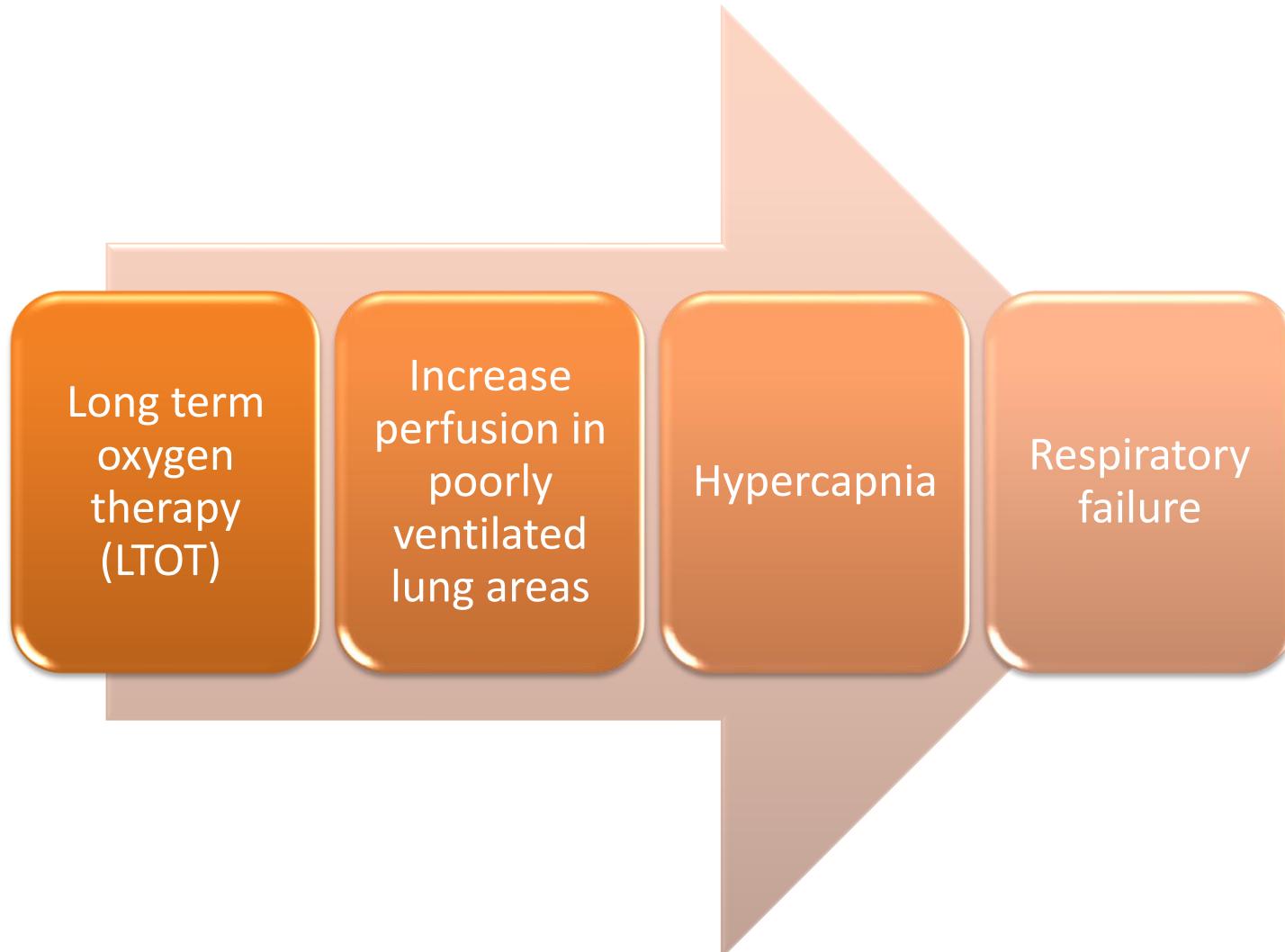


Significant Physiological Parameters

1. **PaCO₂**
2. **PaO₂**
3. **ECG**
4. Spirometry
5. Respiration rate
6. Body temperature
7. Blood pressure
8. Weight



Why monitor PaCO₂?



How to monitor PaCO_2 ?



Problem:

- Gold standard: ABG
 - Invasive, painful, time-consuming and discrete
- PaO_2 can be derived from by pulse oximetry
- In contrast, PaCO_2 measured from PetCO_2
- BUT this is not a reliable estimate for COPD patients!

Solution:

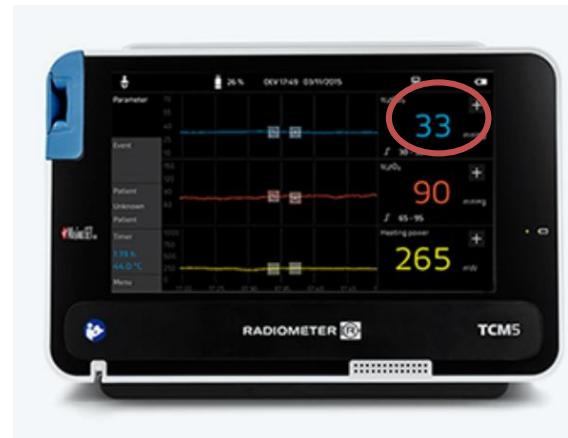
- Transcutaneous monitoring (PtcCO_2)
 - Painless, noninvasive, continuous, minimal disturbance, self-manageable
 - Expensive (device usually shared among patients)
 - 2-min lag for changes in PaCO_2 to be seen in PtcCO_2

Existing Devices & Technologies

SenTec monitor



TCM5 FLEX



V-Sign™



OxiVenT™



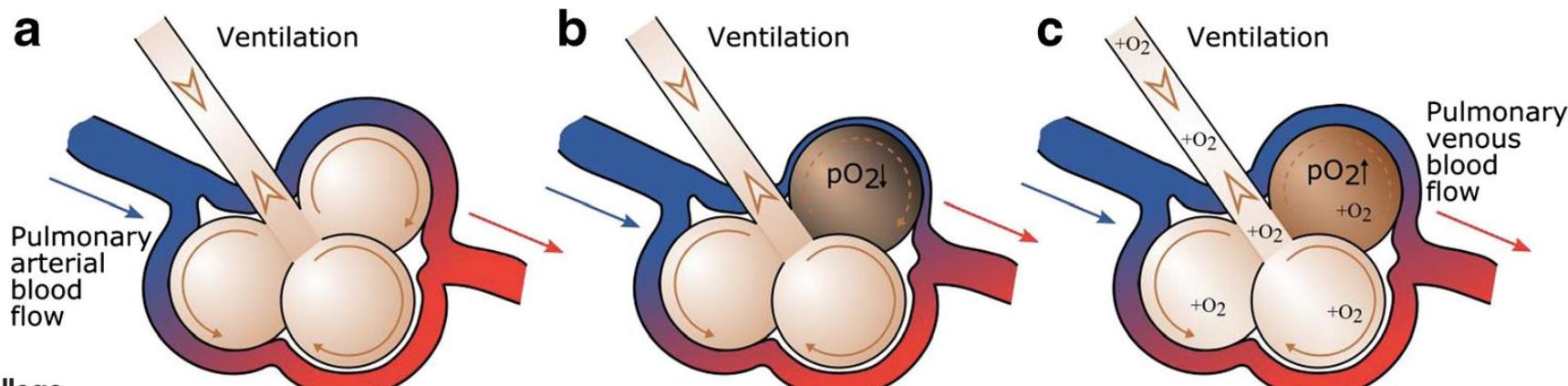
Sensor 84
tcpO₂ tcpCO₂

Sensor 54
tcpCO₂

Sensor 92
SpO₂ tcpCO₂ pulse rate

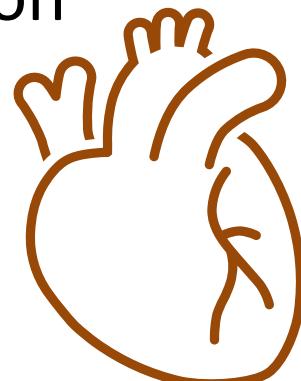
COPD and Related Cardiac Diseases

- Cardiac failure is the main cause of death for COPD patients
- Arrhythmias and cardiac arrest (observe HR)
- Hypertension, coronary artery disease, breakdown of pulmonary capillaries
- Hypoxemia results in hypoxic pulmonary vasoconstriction



Why monitor ECG?

- Cardiovascular diseases – *most frequent comorbidity* with COPD
- ECG changes can help identify these various cardiovascular diseases
- Provides HR and RR intervals
- Some medications like corticosteroids cause hypertension



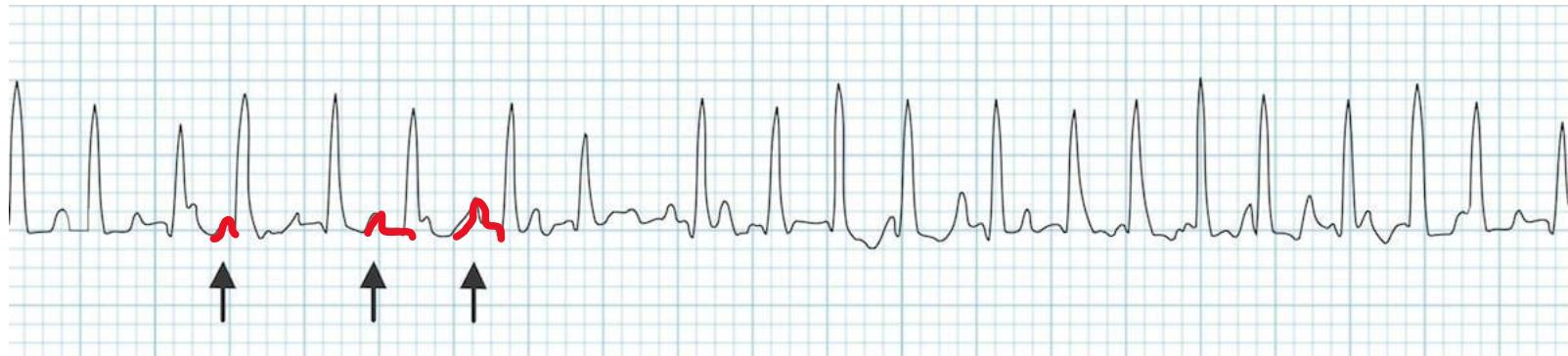
ECG Changes

- P wave axis farther right than +75 degrees
- Right ventricular hypertrophy
- Late R wave progression in precordial leads
- Low voltage
- Abnormal Q waves in the inferior or anterior leads
- Acute right bundle branch block
- Changes in corrected QT interval
- Due to: Tachycardia, arrhythmias, AF



Example: Multifocal Atrial Tachycardia

- Rapid irregular rhythm > 100bpm
- At least 3 distinct P wave morphologies
- Associated with *increased mortality in COPD patients*



Patch ECG (PECG)

Benefits:

- Small and wireless
- functions even during sleep and taking a shower
- Sends life-threatening events and alarms to clinicians
- Useful for remote monitoring
- Can obtain HR, heart rate corrected QT interval and estimate RR

Problems:

- Only 1 lead
- Approximated RR interval is less accurate for elderly
- High cumulative consumer costs
- Data processing time varies depending on company

Existing Devices & Technologies



Sawy ECG senzor



ZIO® XT Patch

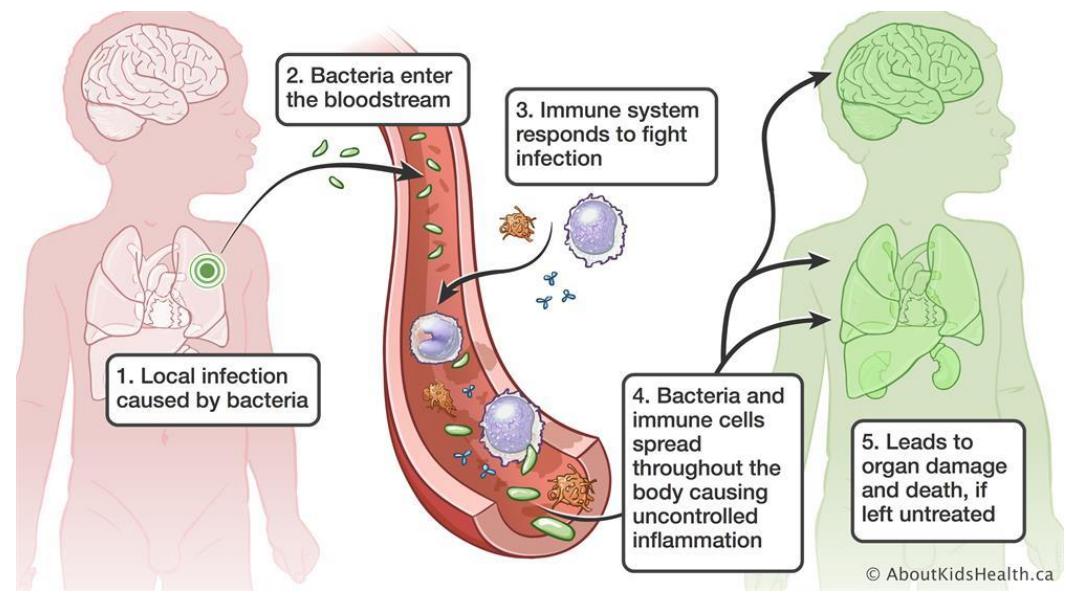


SEEQ™ MCT patch device
by Medtronic, Inc.

Sepsis

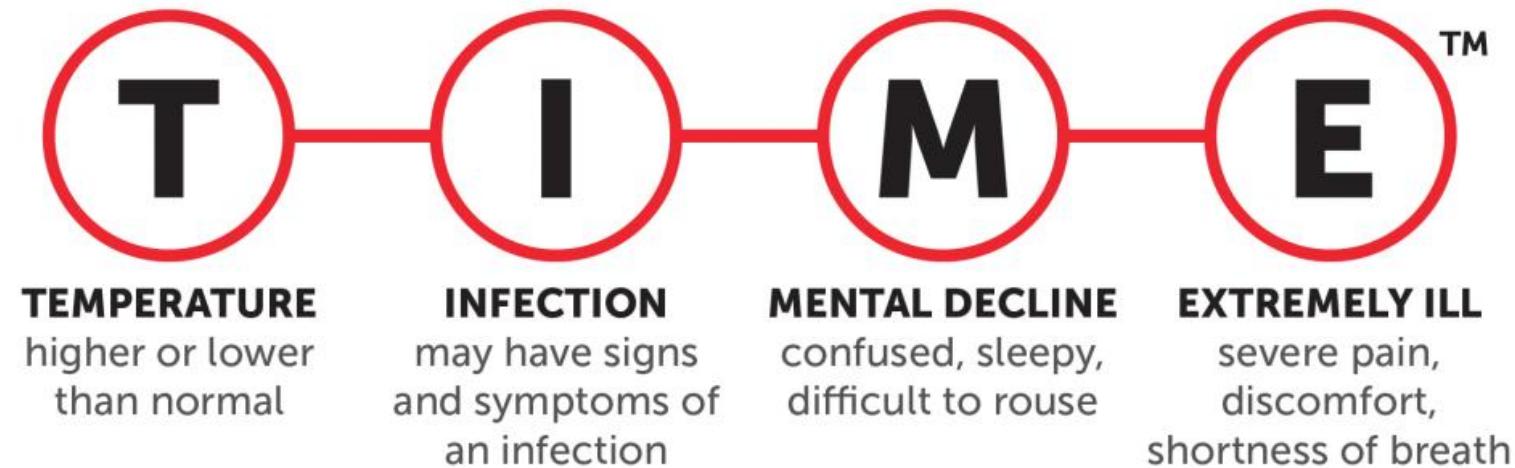
Sepsis

- Chemical imbalance during immune response
- Infection of internal organ(s)
- More common in:
 - Pregnant women
 - Children and elderly
- Sepsis → severe sepsis → septic shock



Recognising Sepsis

When it comes to sepsis, remember
IT'S ABOUT TIMETM. Watch for:



If you experience a combination of these symptoms: seek urgent medical care, call 911, or go to the hospital with an advocate. Ask: "Could it be sepsis?"

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sepsis.org



Recognising Sepsis

NHS

OPEN WIDE AND JUST ASK 'COULD IT BE SEPSIS?'

Sepsis is a life-threatening condition triggered by an infection anywhere in the body – including a dental or throat infection. It kills 44,000 people a year in the UK, yet can be treated easily if caught early. So if someone on antibiotics, or who has a fever or flu-like symptoms, becomes very unwell, always ask 'could it be sepsis?'

ANY ADULT WHO HAS:

- Slurred speech or confusion
- Extreme shivering or muscle pain
- Passed no urine in a day
- Severe breathlessness
- Illness so bad they fear they are dying
- Skin mottled or discoloured

ANY CHILD WHO:

- Is breathing very fast
- Has a 'fit' or convulsion
- Looks mottled, bluish or pale
- Has a rash that does not fade when you press it
- Is very lethargic or difficult to wake
- Feels abnormally cold to touch

**MIght HAVE SEPSIS:
CALL 999 AND JUST ASK 'COULD IT BE SEPSIS?'**

THE SEPSIS SIX

1. Give 02 to keep SATS above 94%
2. Take blood cultures
3. Give IV antibiotics
4. Give a fluid challenge
5. Measure lactate
6. Measure urine output

JUST ASK
COULD IT BE SEPSIS?
IT'S A SIMPLE QUESTION, BUT IT COULD SAVE A LIFE.

SEPSIS IN ADULTS IS A SERIOUS CONDITION

that can initially look like flu, gastroenteritis or a chest infection. Sepsis affects more than 250,000 people every year in the UK.

The UK Sepsis Trust registered charity number (England & Wales) 1158043

Seek medical help urgently if you develop any or one of the following:

Slurred speech or confusion
Extreme shivering or muscle pain
Passing no urine (in a day)
Severe breathlessness
It feels like you're going to die
Skin mottled or discoloured

JUST ASK
COULD IT BE SEPSIS?
IT'S A SIMPLE QUESTION, BUT IT COULD SAVE A LIFE.

KNOW YOUR SEPSIS SIX.

1. GIVE HIGH-FLOW OXYGEN
2. TAKE BLOOD CULTURES
3. GIVE IV ANTIBIOTICS
4. GIVE A FLUID CHALLENGE
5. MEASURE LACTATE
6. MEASURE URINE OUTPUT

BY DOING THESE SIX SIMPLE THINGS IN THE FIRST HOUR,
YOU CAN DOUBLE YOUR PATIENT'S CHANCE OF SURVIVAL.

POSTER DESIGNED BY
HUGO BEAUMONT



THE
UK
SEPSIS
TRUST

For symptom cards and information,
visit www.sepsistrust.org



ANY CHILD WHO:

- 1 Is breathing very fast
- 2 Has a 'fit' or convulsion
- 3 Looks mottled, bluish, or pale
- 4 Has a rash that does not fade when you press it
- 5 Is very lethargic or difficult to wake
- 6 Feels abnormally cold to touch

MIght HAVE SEPSIS
Call 999 and ask: could it be sepsis?

The UK Sepsis Trust registered charity number (England & Wales) 1158043

ANY CHILD UNDER 5 WHO:

- 1 Is not feeding
- 2 Is vomiting repeatedly
- 3 Hasn't had a wee or wet nappy for 12 hours

MIght HAVE SEPSIS

If you're worried they're deteriorating call 111 or see your GP

JUST ASK
COULD IT BE SEPSIS?
IT'S A SIMPLE QUESTION, BUT IT COULD SAVE A LIFE.

**ACTING QUICKLY
CAN SAVE
14,000 LIVES FROM
SEPSIS**

For more information visit www.sepsistrust.org

NHS

ALWAYS SEEK MEDICAL HELP URGENTLY
IF YOU DEVELOP ANY OF THE FOLLOWING

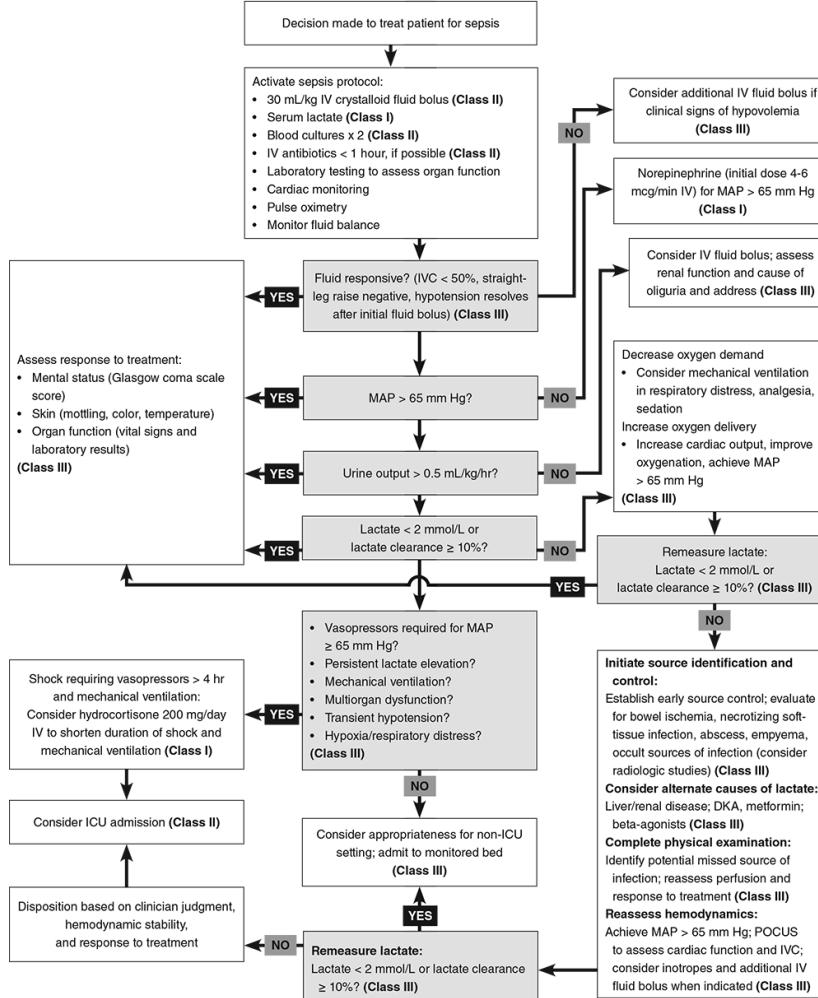
Slurred speech or confusion
Extreme shivering or muscle pain
Passing no urine in a day
Severe breathlessness
It's the worst you've ever felt
Skin mottled or discoloured

JUST ASK "COULD IT BE SEPSIS?"

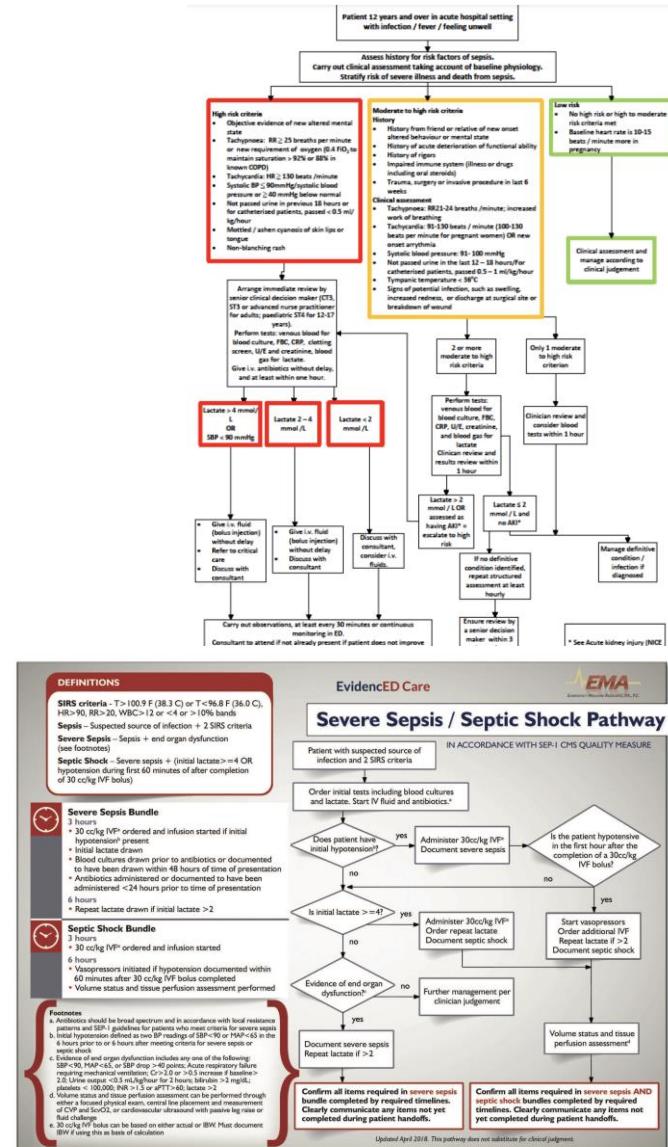


Management of Sepsis

Clinical Pathway for Initial Management of Patients With Sepsis

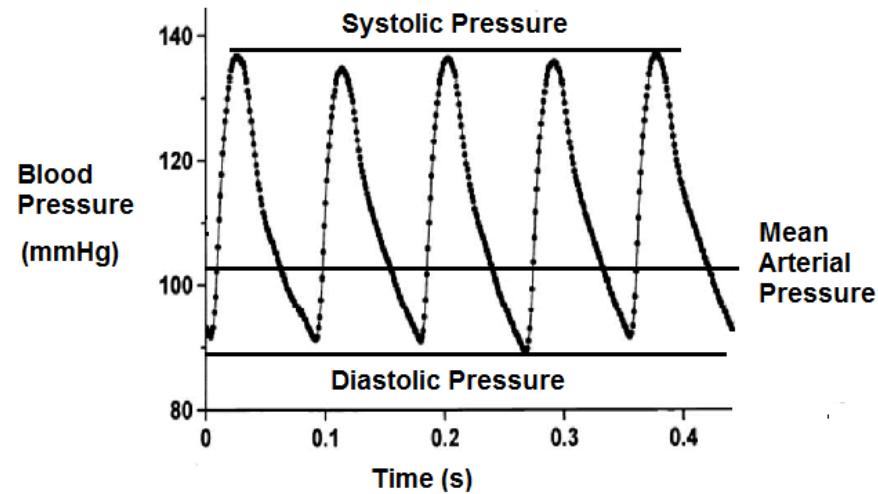


Abbreviations: DKA, diabetic ketoacidosis; ICU, intensive care unit; IV, intravenous; IVC, inferior vena cava; MAP, mean arterial pressure; POCUS, point-of-care ultrasound.



Significant Physiological Parameters

- Lactate: $>2\text{ mmol/L}$
- ECG: HR, BP
- SpO₂, RR: >25 breaths/min
- **MAP:** $>65\text{ mmHg}$
- Urine output: none in $>18\text{h}$



MAP Monitoring: Invasive

- Arterial cannula and saline tubing: conduction to transducer

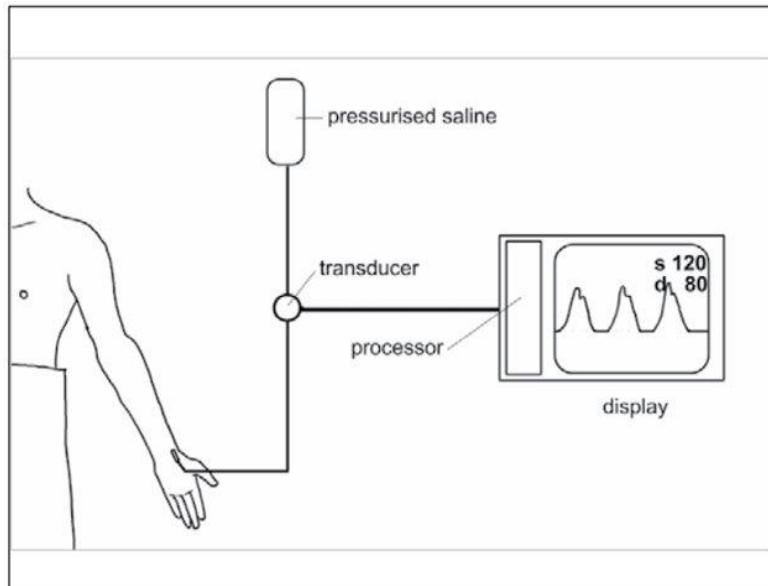


Figure 1. Components of an arterial monitoring system.

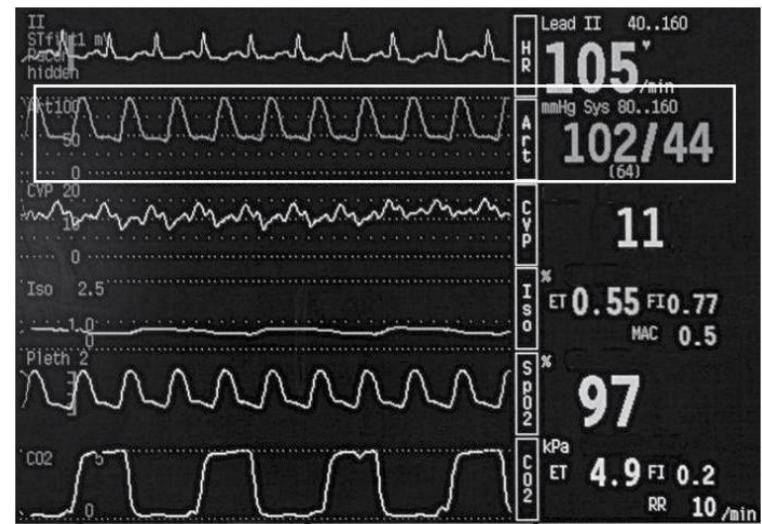


Figure 2. Invasive blood pressure monitoring (boxed). The waveforms are usually colour coded (red for the arterial trace) and the monitor displays the systolic/diastolic BP, with the mean arterial BP in brackets below.

MAP Monitoring: Non-Invasive



- Comfort vs efficiency/accuracy – trade-off
- $MAP = DP + \frac{1}{3}(SP - DP) = DP + \frac{1}{3}(PP)$

Questions