Learning Objectives:

- Discuss the normal structure of the different parts of bronchial tree and correlate them with their function.
- Discuss the anatomy of muscles involved in normal breathing and those used during respiratory distress.
- Discuss the physiology of gas exchange.
- Use basic sciences to explain the patient's symptoms and signs
- Discuss pathology and pathogenesis of bronchial asthma.
- Discuss the pharmacology of drugs used in the management of bronchial asthma.
- Discuss the use of peak expiratory flow measurement (PEF) in bronchial asthma.
- Discuss the importance of patient s' education in asthma management

Trigger

(40 Minutes)

Saleh Alnaami, a 19 years old university student, comes to the Emergency Department with a friend because of shortness of breath for the last couple of days. He also has cough and feels tired.

Discussion Questions:

- Are there any difficult words you do not understand?
- List the key information about Saleh.
- Identify Saleh's presenting problems.
- For each problem make a list of how it may be caused (generate hypotheses).
- What further information would you like to know to help you differentiate between your hypotheses? (What questions would you like to ask Saleh?)

Trigger

(40 Minutes)

Saleh Alnaami, a 19 years old university student, comes to the Emergency Department with a friend because of shortness of breath for the last couple of days. He also has cough and feels tired.

Hypotheses

1. Shortness of breath

- Respiratory causes – e.g., pneumonia
- Airway obstruction – e.g., bronchial asthma.
- Chronic obstructive lung disease
- Cardiac causes – e.g, heart failure, pulmonary oedema.
- Blood causes – e.g., aenemia
- Psychogenic – e.g., anxiety, panic attack

Infection

Hypotheses

2. Cough

- Irritation of airways.
- Foreign body in the airways.
- Smoker cough.
- Infection – e.g., upper respiratory tract.
- Lower tract respiratory infection.
- Cardiac causes – e.g., pulmonary oedema, heart failure.
- Gastroesophageal reflux.
- Bronchial asthma, bronchospasm.
- Postnasal discharge.

obstruction

Hypotheses

3. Tiredness

- Didn't sleep well
- Chronic infection.
- Chronic anaemia.
- Exhaustive exercise – decrease in ATP, increased lactic acid, increase in ADP
- Increased catabolism
- Chronic diseases – heart failure, lung failure, kidney failure, liver failure.
- Depression., chronic fatigue syndrome Psychogenic

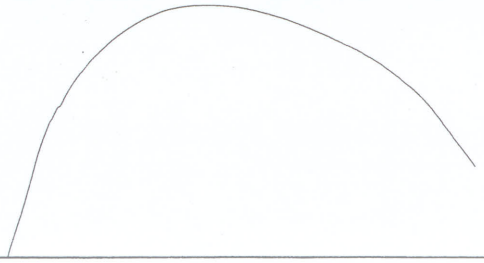
Further Questions

- What exactly triggers shortness of breath?
- Any history of shortness of breath ?
- Any past history of cough?
- Any history of chronic diseases, such as heart, lung, kidney, or liver problems?
- Any history of allergy ? / Smoking
- Any history suggestive of bronchial asthma?
- Is he on any medication? if yes , what are they ?
- Family history
- Social history

Facilitation questions

- Which anatomic structures are involved in normal breathing?
- What might cause Saleh's difficulty in breathing? Which structures could possibly be effected?

Please Read The History



History

A few days ago Saleh and 5 of his friends spent the weekend in a motorbike show, racing in red sands in rural Riyadh. The weather was dusty and cold. On the second day of their stay Saleh felt unwell and he had repeated coughing particularly at night. Despite feeling unwell he was pressured by his peers to continue in the motorbike racing.

However, that night he was unable to sleep because of the progressive increase in his shortness of breath and cough. His cough is dry and he has no phlegm. The other students sharing the room with him noticed that Saleh's chest is wheezing during his breathing and he was not comfortable. He needed to place two pillows behind his head.

History (continue)

Saleh thought that he would be better in a few hours and there is no need to return back to Riyadh. He didn't want to spoil their racing. One of his friends offered him two tablets of Aspirin hoping that he will be better. An hour later Saleh's breathing is not better and his friends decided to take him to King Khaled University Hospital.

He has no fever, no running nose or sore throat.

History (continue)

Past Medical History

Saleh had similar attacks of shortness of breath over the last three years particularly when he exercises, but they were all mild. He didn't seek any medical attention.

No past history of investigations or surgery.

No past history of hospital admission.

Allergy and Medication

Nil

History (continue)

Tobacco & alcohol use

Nil

Family History

Nothing relevant

Social History

Saleh is a university student. His family is living in Abha. He is living with his friend in a rental flat since he started Business College in Riyadh. He enjoys going out for sports with his friends.

Discussion Questions

- List the key information in this progress.
- Identify any new problems and add to your list.
- For each new problem make a list of how it may be caused (generate hypotheses).
- What body system would you like to examine to help you in refining your hypotheses?

vital signs
chest { Resp. exam & Abdominal exam
cardiac exam.
Peakflow meter PEF

New Words/Terms

Wheezing

An abnormal high or low pitched sound heard either by unaided ear or through the stethoscope. Usually indicates a bronchospasm, chronic bronchitis or bronchial asthma.

New Words/Terms

Phlegm

(Also know as *sputum*) A material coughed up from the respiratory tract, white, yellowish or green in colour. Changing colour to yellowish green is the indication of infection.

Key Information

- Weather dusty and cold
- Repeated cough at night
- Progressive increase in shortness of breath and cough
- Cough dry and no phlegm
- No fever
- No running nose or sore throat
- Wheezing
- Could not breath easily when lying down
- Took two tablets of aspirin
- Previous shortness of breath and cough attacks, all mildly. Did not seek medical attention
- No tobacco use
- Saleh is a university student living in Riyadh, since last year

Hypotheses

1.Shortness of breath

- Respiratory causes – pneumonia +/0
- Airway obstruction – bronchial asthma ++/+++
- Chronic obstructive lung disease 0/?
- Cardiac causes – e.g. heart failure, pulmonary oedema 0/?
- Blood causes – anaemia 0/?
- Psychogenic – anxiety, panic attack 0/

Hypotheses

2. Cough

- Irritation of airways ++/+++
- Airway foreign body +/++
- Smoker cough 0/
- -Upper respiratory tract infection /0
- Lower respiratory tract infection ?/+
- Cardiac causes – e.g. pulmonary oedema, heart failure 0/?
- Gastroesophageal reflux 0/?
- Bronchial asthma, bronchospasm ++/+++
- Postnasal discharge 0/?

Hypotheses

3. Tiredness

- Didn't sleep well +/++
- Chronic infection 0/?
- Chronic anaemia 0/?
- Exhaustive exercise – decrease in ATP, increased lactic acid, increase in ADP +/++
- Increased catabolism +/++
- Chronic diseases – e.g. heart failure, lung failure, kidney failure, liver failure 0/?

Facilitation Questions

- What possibly go wrong with the functions of breathing?
- Do you know any triggering factors might cause the problems with Saleh's breathing?

Please Read The Clinical Examination

Clinical Examination

Saleh looks anxious. He is only able to speak a few words, not full sentences. His speech is fragmented when he tries to answer questions. He uses his sternocleidomastoid muscles and alae nasi during breathing. He is sitting on the edge of examining table and leaning forward.

Body weight: 76 kg
Height: 179 cm

His vital signs are summarized below:

Vital signs	Saleh results	Normal range
Pulse rate	120/min	60-100/min
Blood pressure	110/70 mmHg	100/60 – 135/80 mmHg
Temperature	37.0 °C	36.6-37.2 °C
Respiratory rate	28/min	12-16/min

Clinical Examination (continue)

Examination of the respiratory system:

- No pallor and there is no cyanosis of lips and under surface of tongue.
- Upper respiratory tract airway is normal.
- Air entry is normal all over on both sides.
- On auscultation expiratory wheezing on both sides.
- No clubbing of fingers.

Examination of the cardiovascular system:

Normal.

Examination of the abdomen:

Normal.

Peakflow meter:

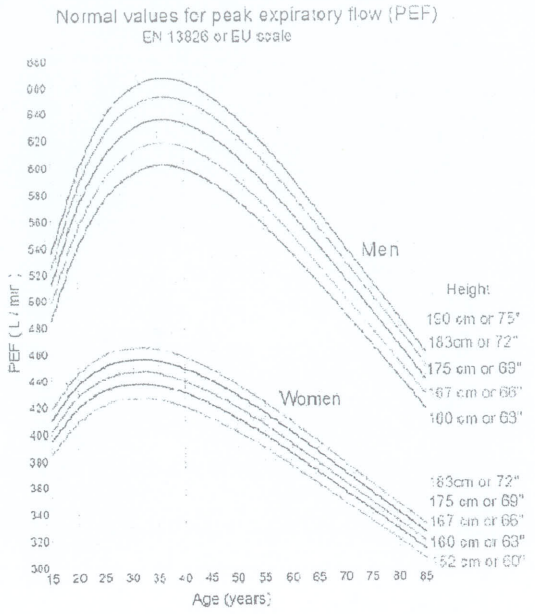
PEF = 350 L/min (60% of predicted value)

Dr. Faisal, the registrar in the emergency department, gives him a bronchodilator (Salbutamol) by inhalation for 7-10 minutes . A repeat PEF measurement shows improvement with a reading of 475 L/min (80% of predicted value).

Discussion Questions

- List the key information in this progress.
- Identify any new problems and add to your list.
- For each new problem make a list of how it may be caused (generate hypotheses).
- Use PEF sheet provided and plot Saleh's

  - Normal expected value for his age and height (use black colour pen)
  - PEF value before bronchodilator (use red colour pen).
  - PEF value after bronchodilator (use green colour pen).
- What are your learning issues?



Difficult Words

- Sternocadiomastoid muscles.
- Alae nasi.
- Peak expiratory flow (PEF).
- Predicted value.

Key information

- Looks anxious.
- Fragmented speech.
- Increased respiration rate
- Increased pulse rate
- Uses sternocladiomastoid muscles and alae nasi during respiration
- Bilateral expiratory wheezing chest.
- Initial PEF reading below expected value (by 60%).
- After the use bronchodilator, his PEF increased 80% of the predicted value.

Facilitation questions

- Saleh is using his sternocladiomastoid muscles and alae nasi, is this normal? Justify your answer.
- What does it mean PEF value under expected? How it is calculated?
- Do you know any other measures for respiratory volumes?

Facilitation questions

- What are the pathophysiological basis behind cyanosis?
- Normally we do not have cyanosis. How would you explain this?
- How does gas exchange occur in the lungs? Discuss the anatomical and physiological basis for this process.

Hypotheses

1. **Shortness of breath**

- Respiratory causes – pneumonia /o
- Airway obstruction – bronchial asthma ++/+++
- Chronic obstructive lung disease /o
- Cardiac causes – heart failure, pulmonary oedema /o
- Blood causes – anaemia /o
- Psychogenic – anxiety, panic attack /o

Hypotheses

2. Cough

- Irritation of airways ++/+++
- Airway foreign body /o
- Smoker cough /o
- Infection – upper respiratory tract, lower respiratory tract /o
- Cardiac causes - pulmonary oedema, heart failure /o
- Gastro-esophageal reflux /o
- Bronchial asthma, bronchospasm /++/+++
- Postnasal discharge /o

Hypotheses

3. Tiredness

- Didn't sleep well ?/o
- Chronic infection /o
- Chronic anaemia o/?
- Exhaustive exercise – e.g., decrease in ATP, increased lactic acid, increase in ADP ?/+
- Increased catabolism o/+
- Chronic diseases – heart failure, lung failure, kidney failure, liver failure /o

Refining Hypotheses

Most likely:

Saleh has presented with cough and shortness of breath after exercising in a cold and sandy environment. He has a past history of similar attacks on exercising. There is an improvement his PEF readings after the use of a bronchodilator. These findings are consistent with:

-Bronchial obstruction such as bronchial asthma (exercise induced asthma).

Least likely

- upper respiratory tract infection.
- pneumonia.
- chronic diseases (such as heart failure, respiratory failure)
- anaemia
- chronic obstructive pulmonary disease.
- drug induced-cough
- smoker cough.
- foreign body in the airways.
- emphysaema

Learning Issues

Learning Issues

- The normal structure of the different parts of bronchial tree and correlate structures with their functions.
- The anatomy of muscles involved in normal breathing and muscles involved in respiratory distress.
- The physiology of gas exchange
- Use basic sciences to explain the patient's symptoms and signs
- Pathology and pathogenesis of bronchial asthma
- Pharmacology of the drugs used in the management of bronchial asthma.
- The use of peak expiratory flow (PEF) in bronchial asthma
- Patient education in asthma management.

Tutorial Two

TUTORIAL TWO

Students will discuss their learning issues for 50 minutes. Then:

- What is your refined hypothesis? Justify your views.
- Discuss the mechanisms underlying Saleh's respiratory problem.
- What do you think the doctor will do at this stage?

- Oxygen mask & pulse oximeter
- IV line → blood sample → CBC
  → Fluids (± bronchodilator ?)
- Salbutamol inhalation
- Chest X-ray

Please Read Progress 1

Progress 1

After examining Saleh, Dr. Faisal the registrar in the Emergency Department connects a pulse oximeter to Saleh's index finger, and places him on oxygen via a mask. He also inserts an IV line and initiates him on normal saline/glucose solution, given via the IV line. He uses a big caliber needle to take blood samples for laboratory investigations. Dr Faisal continues Saleh on Salbutamol inhalation through a spacer.

Complete Blood Count

Blood test	Saleh results	Normal range
Hemoglobin (Hb)	130 g/L	115-145 g/L
White blood cell count	$10.2 \times 10^9/L$	$4.5\text{-}13.5 \times 10^9/L$
Platelet count	$350 \times 10^9/L$	$14\text{-}450 \times 10^9/L$

Progress 1 (continue)

Plain Chest X-Ray (Postero-anterior view)

- Both lung fields are clear.
- No pneumothorax
- No patches of consolidation.

Pulse oximeter before oxygen inhalation:

Oxygen saturation: 89%

Discussion Questions

- Are there any terms that you do not understand?
- Summarise the key information that you have obtained from this progress.
- Use the results to refine your hypothesis.
- What are your management goals and management options?

- Long term control of asthma: bronchodilator during attack
- Patient education: how to prevent attacks:
  - avoid predisposing factors
  - ? prophylaxis

New Words/Terms

Pulse oximeter

A device that measures the oxygen saturation of arterial blood in a subject by utilizing a sensor attached typically to a finger, toe, or ear to determine the percentage of oxyhemoglobin in blood pulsating through a network of capillaries and that typically sounds an alarm if the blood saturation becomes less than optimal

Salbutamol

A beta-agonist bronchodilator that is administered as an inhalational aerosol to treat bronchospasm associated especially with asthma and chronic obstructive pulmonary disease

Spacer

A device by means of which usually inhalation drugs are delivered

Please Read the Closure

Case Closure

Saleh continues on the bronchodilator inhalation for two hours. Dr. Faisal repeats the PEF measurement and the reading is showing improvement (80% of predicted value) and the oxygen saturation has improved to 94%. He feels much better. Dr Faisal tells him that, "you have a moderate athma attack. This may be related to exerciseing and exposure to dusty and cold air. Saleh becomes worried to hear that he has asthma.

Case Closure (continue)

The doctor explains to him that the diagnosis is based on his presenting symptoms and the fact that he has had similar attacks when he exercises. The clinical signs and the peak flow meter values show improvement after the inhalation of a bronchodilator. All these findings are in support of the diagnosis of bronchial asthma. He asks him to see the pulmonary consultant tomorrow at the respiratory clinic. He explains to him that the doctor in respiratory clinic will discuss with him a management plan for long-term control of asthma and will educate him how to prevent these attacks.