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# “...ALL HAPPENED IN THE KITCHEN”

## **Nervous System- Case 4**

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## Trigger

Muneera Farid, a 58-year-old widow is brought by her two sons to the Accident & Emergency Department. Her elder son, Ibrahim, tells the doctor, "about half an hour ago, we found our mother on the kitchen floor, we tried to talk to her but she is unable to talk. She is also unable to walk or move her right arm."

## Trigger (Problem)

Muneera Farid, a 58-year-old widow is brought by her two sons to the Accident & Emergency Department. Her elder son, Ibrahim, tells the doctor, “about half an hour ago, we found our mother on the kitchen floor, we tried to talk to her but she is unable to talk. She is also unable to walk or move her right arm.”

# Problems/Hypotheses

- 1- Unable to move her right arm:**
- Problem in motor cortical area of brain
- Problem with tracts emerging from motor area
- Problem in internal capsule
- Problem in the cerebral peduncles
- Problem in the midbrain
- Problem in the spinal cord
- Problem in motor nerves from the spinal cord
- Problem in neuromuscular junction
- Problem in skeletal muscles



## Facilitation Questions

What are the anatomical structures & functions that we need for normal walking

- Nervous system (motor area, motor tracts, nerve connections, spinal cord, motor nerves, neuromuscular junction, skeletal muscles).
- Back
- Pelvis
- Joints ( hip, knee and ankle )
- Muscles ( flexor & extensor group )
- Arteries. veins , heart, and blood circulation
- Nerves and tracts.
- Balance system.

## Facilitation Questions

What could possibly cause an area in the brain or a group of nerve cells, non-functioning?

1. Problem in the blood supply ( e.g. stenosis, atherosclerosis, thrombosis, narrowing of the lumen and hence decreasing blood flow)
2. Problem in the blood ( polycythaemia, deficiency of proteins C, deficiency of thrombin)
3. Problem with the heart function (such as arrhythmias, AF, neural thrombus )
4. Tumor
5. Head trauma
6. Haemorrhage

**Tutor:** encourage students to scribe a diagram showing group of cells and possible changes.

## Facilitation Questions

### **What could possibly contribute to the arterial changes and narrowing?**

*If students find it difficult to answer the above question, you might ask what diseases could Mrs. Muneera have for some time and contribute to her current presentation?*

- Diabetes mellitus (why & explain how)
- Hypertension (why & explain how )
- Blood disease ( why & explain how )
- High blood cholesterol (why & explain how)
- Obesity
- Family history of stroke and CVA
- Heart problems such as arrhythmias.

# **Please Read The History**



# History

## Past Medical History

She has no history of heart disease or blood disease. She was admitted to hospital about 3-4 times over the last 3-4 year to control her diabetes and high blood pressure

## Family History

Muneera's mother and aunty died of stroke when they were 60 and 65 years old.

## Medication and Allergy

Metformin  
Glibenclamide  
Lisinopril  
Atorvastatin  
Low dose aspirin

## Allergy:

Nil

## Smoking:

Nil

## Social History

Mrs. Muneera lives with her son Ibrahim since she became a widow, about 6 years ago. Ibrahim is a father of 5 children and he works in the government sector.

## **New Terms**

**(Tutor: encourage students to use their medical dictionary to find out more about these words )**

- Blood cholesterol
- Metformin
- Glibenclamide.
- Lisinopril.
- Atorvastatin

**Tutor:** Encourage students to use a pharmacology resource to discuss the pharmacological group, mechanism of action, indications, side effects, and contraindications of each drug.

# Problems/Hypotheses

## 1- Unable to move her right arm and right leg:

- Problem in motor cortical area of brain +++
- Problem with tracts coming from motor area +
- Problem in internal capsule +
- Problem in the cerebral peduncles
- Problem in the midbrain +/+++ ?
- Problem in the spinal cord 0
- Problem in motor nerves from the spinal cord 0
- Problem in neuromuscular junction 0
- Problem in muscles 0

## Problems/Hypotheses

### Numbness of her right arm and leg:

- Problem with the sensory nerve supply.
- Problem with the blood supply to these organs (e.g., decreased blood flow).

### Headache

- Neck pain.
- Contraction of the scalp muscle (tension headache)
- Eye problems (errors of refraction).
- Sinusitis.
- Gum/teeth problems.
- Problems with the 5<sup>th</sup> cranial nerve (facial pain).
- Increased intracranial pressure.
- Head trauma.
- Vascular (e.g., migraine)



## **Facilitation Questions?**

**Why do some patients have poor compliance?**

- *Lack of education about their disease and the needs to take her medications on regular basis.*
- *No one to take her to the doctor.*
- *Poor management and organization skills.*
- *Depression.*
- *Very busy and not giving his/her health a priority.*

**-Do you know a Nobel prize winner whose work has helped in understanding a physiological principle related to this case? Discuss how his/her work helped in advancement of knowledge in this area.**

# Clinical Examination

Results of her nervous system examination are summarized in the table below:

	Right side	Left side
Cranial nerves examination	7 <sup>th</sup> cranial nerve: Weakness of the right lower part of her face. Normal upper right part.	All cranial nerves are normal
Motor power examination	<p><u>Upper Limb:</u></p> <ul style="list-style-type: none"> <li>- She cannot move her right arm.</li> <li>- Increased muscle tone of the her right arm.</li> <li>- Hyper reflexia of the biceps, triceps, and brachioradialis reflexes.</li> </ul> <p><u>Lower Limb:</u></p> <ul style="list-style-type: none"> <li>- She cannot flex her knee or raise her leg up straight.</li> <li>- Increased muscle tone of her right leg.</li> <li>- Hyper-reflexia of the knee and ankle reflexes.</li> <li>- Plantar reflex is dorsiflexion.</li> </ul>	Motor power and reflexes are all normal.
Sensory sensations examination	Loss of pain and temperature sensations on her right upper and lower limbs.	All sensations are normal

## **Discussion Questions**

- Are there any difficult words that you do not understand?
- On the basis of new information from the clinical examination refine your final hypothesis.
- Work out as a team to identify your “learning issues” .

## Refining their Hypotheses

### Most likely:

- A problem affecting the 7<sup>th</sup> cranial nerve on the right side and decreased blood supply to brain areas supplied by the middle cerebral artery (motor, sensory and language area).
- On going chronic problems: diabetes mellitus, high blood pressure, high blood lipids, obesity, arterial atherosclerosis (carotid bruit). These chronic problems are risk factors for the development of cerebro-vascular accident.

### Less likely:

- Internal capsule.
- Brainstem problem.
- Cerebellar problem.
- Spinal cord problem.
- Peripheral nerve problem.
- Neuromuscular junction problem.
- Muscle problem.
- Heart problem (e.g., arrhythmia)



## Learning Issues

- Anatomy of the cerebral hemisphere and its blood supply.
- Functions of the different parts of the cerebral hemisphere.
- Speech area and mechanisms used for speech.
- Differences between upper and lower motor neuron lesions.
- Risk factors for cerebral infarction.
- To interpret the patients' symptoms and signs.
- Discuss the pathology of cerebral infarction.

## Discussion Questions

*After the students spent about 60 minutes addressing their learning issues. You might spend 10-15 minutes on these questions:*

- How would you explain the clinical findings found on Muncera's right side? Use your knowledge from basic sciences to explain your views.
- Discuss the risk factors that might have contributed to her current illness.
- What investigations would you like to order for her at this stage?



# Discussion Questions

## **Nobel Laureates**

Do you know a Nobel prize winner whose work has helped in understanding a physiological principle related to this case or helped in the develop of a medication for this disorder? Discuss how his/her work helped in advancement of our knowledge in this area.

Students may spend 10 minutes discussing this issue. Those interested could submit a written submission to my on my email [sazer@ksu.edu.sa](mailto:sazer@ksu.edu.sa)



## Progress 1

The doctor arranges for urgent investigations including brain CT-scan and some blood test. The results of these investigations are shown below:

### Brain CT-Scan (2-3 hours after her current illness):

The brain CT-scan shows minimal changes in the left frontal lobe. Recommended for an urgent MRI scan of the brain.

### Brain MRI Scan (about 4 hours after her current illness):

**Report:** Extensive changes in the left middle cerebral artery territory. Another radiological study called Perfusion Weighted Images (PWI) confirms that Mrs Muneera has a reduced cerebral blood flow in the left middle cerebral territory.



## Discussion Questions

- Are there words that you do not understand?
- Summarize key information that you have obtained from this progress.
- On the basis of the new information, what is your final hypothesis?
- Summarise your management goals and your management options.

## Progress 2

Further blood test results for her blood lipids are show below:

- Blood Cholesterol: 7.9 (Normal Range 0.0-5.5 mmol/L)
- Blood triglycerides: 3.3 (normal range 0.5-2.0 mmol/L),

About 5 days after her stroke, Mrs Muneera is commenced on a calcium channel antagonist (amlodipine) for her high blood pressure, a cholesterol lowering agent (simvastatin) and an oral hypoglycaemic agent (glibenclamide), and continued on a low dose aspirin.

She is also commenced on a rehabilitation program in which a team from physiotherapy , speech pathology, and occupational therapy departments has shared in her management.

**Please Read the  
Closure**

# Learning Objectives:

This PBL Package targets the following objectives:

- Understand the anatomy and physiology of the cerebral hemisphere and the cerebral blood circulation.
- Identify the risk factors that could contribute to the development of cerebral infarction.
- Use basic sciences to interpret the symptoms and signs of a patient presenting with hemiplegia.
- Understand the pathology and pathogenesis of cerebral infarction and the sequence of biochemical changes that might occur in the nerve cells as a result of ischemia.
- Discuss the physiology of *Broca's and Wernicke's* areas of the language and the consequences of their malfunction in a patient with middle cerebral artery occlusion.
- Discuss the main differences between upper and lower motor neuron lesions

## Discussion Questions:

- Are there any difficult words you do not understand?
- List the key information about Muneera.
- Identify Muneera's presenting problems.
- For each problem, generate a list of possible causes (hypotheses).
- What further information would you like to know from history to refine your hypotheses?



## **New Terms/Difficult words**

### **•Accident and Emergency Department**

*Widow*

# Problems/Hypotheses

## 2- Unable to walk:

- Problem in nervous system as above
- Fracture in the bones (e.g., pelvis, femur, tibia, fibula )
- Joint problems (hip, knee, ankle )
- Muscle problems ( flexors, extensors of the leg )

## 3- Unable to speak

- Problem in receptive area of the language
- Problem in understanding
- Problem in the motor area of the language
- Problem in the vocal cords
- Problems with muscles of articulation ( tongue, soft palate, hard palate, muscles of lips, buccinators, maxilla & para sinuses ).

## Facilitation Questions

**When a person asks you a question, what are the anatomical structures and functions do you need to respond?**

1. To receive his/her question: ear , auditory nerve, auditory centre.
2. To understand his/her question or know what he/she is asking about, trigger your memory of information for what will you say (understanding).
3. To send messages to the muscles of the lips, tongue, lips, soft palate, and vocal cords.

Structures of articulation e.g. tongue, soft palate, hard palate, lips, muscles of the checks, vocal cords and larynx

## Facilitation Questions

What are the anatomical structures and functions that we need to move a limb?

- *The motor cortical area in the brain*
- *Tracts out of cortical area*
- *Internal capsule*
- *Cerebral peduncles*
- *Spinal cord*
- *Spinal motor neurons*
- *Neuromuscular junction*
- *Muscles, joints, bones, arteries, veins good circulation*



## Further Questions

- Did your mother have any numbness or tingling of her right arm and leg?
- Any history of headache or problem with her speech?
- Did your mother have any problem with her bones, joints, back, muscles, or any problem with her walking?
- Any history of diabetes, high blood pressure, high blood lipids, or blood disease?
- Is your mother on any medications?
- When was the last time she saw her doctor?
- Have your mother ever been admitted to the hospital, any investigations?
- Any family history of stroke or heart attacks at a young age?



## History

Muneera's elder son Ibrahim says, "my mother has always been well and active. She has no problems with her walking or speech". About 4-5 months ago she had numbness of her right arm and leg which came from time to time. He also remembers that recently his mother was very angry, trying to resolve a quarrel in the family and she became a little unable to move her right arm. She recovered after 5 minutes. She also has headaches from time to time. Ibrahim remembers that she had headaches last night. Today she is unable to move her right arm and right leg. On further questions Ibrahim mentions that his mother was diagnosed of diabetes mellitus about 10 years ago and high blood pressure about 7-8 years ago. She also has high blood cholesterol. She is on medication but she does not take them regularly and does not see the family doctor on regular basis.

## **Discussion Questions**

- Are there words that you do not understand?
- Summarize key information that you have obtained from this progress.
- Identify Muneera's new problems. Provide hypotheses for each problem.
- Use the new information obtained to refine your hypothesis.
- What further information could you obtain by examining Mrs Muneera?

## **Problems**

### **Presenting problems (trigger)**

- Unable to speak.
- Unable to walk.
- Unable to move her right arm.

### **Recent problems:**

- Numbness of the right arm and leg.
- Recent history of TIAs (unable to move her right arm for about 5 minutes).
- Headache.

### **On going chronic problems:**

- Diabetes mellitus.
- High blood pressure.
- High blood cholesterol.
- Poor compliance (does not take her medications regularly, and does not review her doctor regularly).

## Problems/Hypotheses

### 2- Unable to walk:

- Problem in nervous system as above
- Fracture in the bones (e.g, pelvis, femur, tibia, fibula ) -0
- Joint problems (hip, knee, ankle ) -0
- Muscle problems ( flexors, extensors of the leg )-0

### 3- Unable to speak

- Problem in receptive area of the language -0
- Problem in understanding -0
- Problem in the motor area of the language ++ / +++
- Problem in vocal cords -0
- Problems with muscles of articulation ( tongue, soft palate, hard palate, muscles of lips, buccinators, maxilla & para sinuses ). -0



## **Facilitation Questions?**

**How would you explain her inability to move her right arm for 5 minutes?**

*Temporary disturbance in her cerebral blood supply to motor area that has resulted in temporary motor changes (unable to move her right arm). This was a warning sign that she has a higher risk of developing a stroke.*

**What is the significance of her high blood pressure, blood cholesterol, and diabetes?**

*These disease are risk factors for cerebro-vascular accidents and are responsible for the development of atherosclerosis, and blockage of arterial supply (thrombosis) and hence the development of stroke.*



## Clinical Examination

Mrs. Muneera is able to understand orders from the examining doctor such as, look at me, raise your left arm. She may respond to questions with one or two words which are hard to understand. She looks obese. Her Body Mass Index (BMI) is expected to be over 33. Her vital signs are shown in the table below.

Vital Signs	Patient	Normal range
Blood pressure	170/110	100/60- 135/80 mmHg
Pulse rate	90	60-100/min
Respiratory rate	20	12-16/min
Temperature	36.9	36.6-37.2 °C

# **Clinical Examination**

## **Cardiovascular system examination**

Normal heart sounds, no added murmurs.

Carotid auscultation reveals a bruit over the left carotid artery.

## **Respiratory system examination**

Normal

## **Abdominal examination**

Normal

## **Difficult words**

- hyper-reflexia
- plantar reflex
- increased muscle tone
- carotid bruit

# Learning Issues



# Tutorial Two

# Nobel Laureates



# Please Read Progress

# Progress 1

## Full Blood Examination

Blood test	Patient	Normal range
Haemoglobin	139	115-160 g/L
PCV	0.42	0.37-0.47
White blood cells	5.5	4.0-11.0 x 10 <sup>9</sup> /L
Platelet count	350	150-400 x 10 <sup>9</sup> /L

## Blood Biochemistry:

Serum levels of sodium, potassium, calcium, blood urea and creatinine levels are all within the normal range.

Fasting blood glucose: 7.9 mmol/L (Normal Range 3.6-5.3 mmol/L).

## Electrocardiogram (ECG):

Normal sinus rhythm. Evidence of left ventricular hypertrophy (most likely due to the longstanding high blood pressure)..



## Progress 2

The neurologist responsible for treating Mrs Muneera reviews her investigations and re-examines her. He explains to her sons the nature of Mrs Muneera's illness. He says, "the clinical examination, the radiological images and the blood tests show that Mrs Muneera has ongoing problems including her uncontrolled high blood glucose (diabetes), high blood pressure and obesity. She also has high blood lipids which we will assess when her condition settles. These ongoing problems are called risk factors because they cause significant changes in the inner wall of blood vessels causing their hardening. As a result of these changes, a blood thrombus (clot) blocked one of the vessels supplying her brain; causing a brain damage. Because the damage has affected areas of the brain responsible for movement, sensations, and language, Muneera has lost her ability to move her right limbs, to feel the pain and temperature on her right side, and her ability to speak. When we further examined Mrs Muneera we found a bruit (noises) over her left carotid artery in the neck. This indicates narrowing and hardening of the carotid artery and it is possible the source of the clot (thrombus). The doctor arranges for a Carotid Duplex Doppler which reveals high grade internal carotid stenosis on the left side.

## **Discussion Questions**

- Are there words that you do not understand?
- Summarize key information that you have obtained from this progress.
- Construct a mechanism summarizing your final hypothesis with regard to the site of the lesion, the mechanisms underlying Muneera's weakness. Provide supportive evidence from history, clinical examination and investigation results.

## **Case Closure**

Over the next 6-7 weeks Mrs Muneera showed some improvement. She is able to move her right arm, speak a few words, and able to walk with assistance from one person. She undergoes left carotid endarterectomy about 6 weeks after her stroke. She continues taking her medications and her serum blood sugar, blood lipids are within the normal range. Her blood pressure is in the range of 110/70 to 120/80 mmHg and she has lost about 7 kg in body weight. The physiotherapy team plan to reduce her body weight further and she has improved significantly in regard to her ability to walk with little assistance and her ability to say a few short phrases. Her family supports her a lot and this has contributed to her recovery.