Lesson 3: Severe and Complicated Malaria

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Contents

INTRODUCTION

Welcome to Unit 3 on severe and complicated Malaria. In the last unit we discussed clinical assessment of Malaria and learnt about the common findings in a patient with malaria as well as its clinical presentation.

In this unit we shall learn about severe and complicated Malaria. Let us start by looking at our objectives for this lesson. Severe and complicated Malaria is caused by the plasmodium species known as P. falciparum , and is a medical emergency and serious threat to life.

In recent years, there has emerged a better understanding of severe and complicated malaria in the fields of:

- Clinical presentation;
- Pathophysiology;
- Diagnosis;
- Management.

Before we proceed, let us look at our learning objectives for this lesson.

Objectives

By the end of this unit you should be able to:

- Define severe and complicated malaria;
- List the clinical presentation of severe and complicated malaria;
- Describe the pathophysiology of severe and complicated malaria;
- Describe the diagnosis of severe and complicated malaria;
- Identify the high risk groups of people likely to suffer from severe and complicated malaria;
- Explain the importance of early treatment of malaria.

what is Severe and Complicated Malaria?

Before we define severe and complicated malaria, it is important to remind ourselves what simple or uncomplicated malaria is.

Malaria may be described as simple or uncomplicated when the malaria infection is **NOT** life threatening and is easily treatable.

Before you read on spend about 3 minutes to do the following activity.

Activity

1

1. Define severe and complicated malaria.

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2. List down the clinical features.

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Now compare your answers with the information given in the following discussion.

Severe and complicated malaria is caused by *P. falciparum* infection. It usually occurs as a result of delay in treating an uncomplicated attack of *P. falciparum* malaria, though in children it can develop very rapidly. Recognizing and promptly treating uncomplicated *P. falciparum* malaria is therefore of vital importance. Severe and complicated malaria is a medical emergency and requires urgent and intensive medical management. A blood slide shows the presence of actual forms of P. falciparum in the blood.

The definition of severe and complicated Malaria is based on clinical presentation. The patient presents with any of the following clinical features:

- A change in behaviour, confusion or drowsiness;
- Impaired consciousness or unarousable coma;
- Multiple/recurrent convulsion;
- Deep breathing or respiratory distress;
- Difficulty in breathing or demonstrable pulmonary oedema as may be seen radiologically;
- Circulatory collapse or shock;
- Jaundice;
- Haemoglobinuria;
- Bleeding tendency;
- Prostration i.e generalized weakness so the patient cannot walk, or sit up without assistance;
- Severe anaemia with or without congestive cardiac failure.

Reflection

Has any of your patients presented to you with any of the signs and symptoms mentioned above?

Before you read on do activity 2, it should take you five minutes to complete.

Activity

2

What specimens and laboratory findings would you get when investigating patient with severe/complicated Malaria?

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Well done! We believe that you mentioned the following two specimens in your answer:

1. Blood.
2. Urine.

Your laboratory findings would include:

- P. falciparum malaria with possibly hyperparasitaemia.
- Hypoglycaemia,
- Acidosis i.e metabolic acidosis,
- Severe normocytic anaemia packed cell volume < 20%, Hb < 6 gldl).
- Haemoglobinuria,
- Hyperlacticaemia,
- Renal impairment, as indicated by normal creatinine and urea levels. (See Glossary for definition of certain terms).

Which of the above investigations are done in your health facility?

When reviewing the laboratory findings of a patient suspected to have malaria, it is good to keep the following in mind:

- An individual patient may have one or more of the features listed above;
- A patient with one or some of the features described may go on to develop all;
- You should look out for other possible diagnosis in such a patient. Such as meningitis, typhoid fever and food poisoning.

We have so far defined severe and complicated Malaria including its clinical presentation, let us now discuss its pathophysiology.

Pathophysiology of Severe Malaria

In this section you will learn about the mechanisms which are believed to be responsible for severe and complicated malaria and how an understanding of pathophysiology can help you to determine the correct treatment. But before you read on, do the following activity. It should take you 5 minutes to complete.

Activity

3

List down the factors which you think influence the severity of a Malaria infection?

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The following are some of the factors known to play a role in the clinical manifestations of severe/complicated malaria infection. Some of these factors are known beyond doubt, while others remain speculative. You could have noticed some of them in your day-to-day practice.

These factors include:

- The species of parasite: Only P. falciparum causes severe/complicated malaria. However, it also causes simple/ uncomplicated malaria;
- Immunity of the individual: Adults who have lived all their lives in an endemic area are less susceptible to severe disease than others such as:
  - Adults who visit an endemic area for the first time and young children living in severe endemic area;
  - Pregnant mothers, especially first time pregnancy because of diminished immunity;
  - Young children living in the same endemic area;
- The availability and efficacy of antimalarial drugs;
- The degree of parasite drug resistance that prevails locally;
- Some genetically inherited conditions in the human host e.g sickle cell trait which reduces the risk of P. falciparum infection.

Other factors that are suspected to affect the severity of illness but have not yet been proved include:

- A particular strain of P. falciparum;

- Early infections which occur at less than 3 months of age;
- Very intense infections;
- Other genetic differences between people e.g. RBCs abnormalities, Glucose -6 Phosphate Dehydrogenase (G6PD) deficiency;
- The extent of individual response to an infection;
- The number of sporozoites injected by the mosquito or by several mosquitoes.

The effects of these factors shall become clear as more information about them is availed through research.

(Which ones among the factors listed above seem to cause severity of malaria in the community you serve?)

Processes Contributing To Specific Complications

Certain processes are known to contribute to specific complications in patients suffering from malaria. These are

• Altered consciousness or coma.

It is believed that coma or alteration of the level of consciousness is caused by sequestration of infected RBCs in the brain.

• Hypoglycaemia

This is as a result of impaired production or release of glucose in the liver and

increased utilization in the tissues. Hypoglycaemia may also result from reduced intake or use of drugs such as quinine.

• Convulsions

These may be due to sequestration of infected RBCs in the brain or to severe accompanying metabolic disorders e.g. Hyponatraemia.

• Raised intracranial pressure

The cause of this is not exactly known but has been noted present from time to time during the illness and may be due to increased mass of red blood cells sequestered in the brain, or because of dilatation of vessels in the brain in response to locally generated cytokines.

Raised intracranial pressure is not the primary cause of coma or death in a majority of cases.

• Anaemia

This is partly due to the destruction of red cells that contain parasites.

Several other mechanisms may accelerate the development of anaemia. These include destruction of non-parasitised red blood cells, bone marrow suppression, intravascular haemolysis, abnormal bleeding and renal failure.

• Acidosis

Acidosis is probably due to a relative shortage of oxygen in tissues occupied by sequestered parasites. This shortage of oxygen is made worse by hypovolaemia and/or severe anaemia as both of these conditions may impair the supply of oxygen to tissues. This lack of oxygen in tissues forces the tissues to get their energy by other biochemical pathways not dependent on oxygen. The result of this is the release of lactic acid, leading to metabolic acidosis. There is evidence that drugs containing salicylates e.g. Aspirin often given to lower fever may exacerbate this metabolic acidosis.

• Acute renal failure

Acute tubular necrosis is a common complication in adults, but it is rarely seen in children. It is fully reversible if the patient is kept alive e.g. by peritoneal dialysis, for a period ranging from a few days to 3 weeks. Renal failure is most likely to develop if there has been a period of low blood pressure or shock.

• Pulmonary oedema and Adult respiratory distress syndrome (ARDS)

Pulmonary oedema (non-cardiogenic) may result from excessive fluid replacement by intravenous (iv) fluids especially if there is renal failure. Adult respiratory distress syndrome (ARDS) appears to be due to a direct effect of parasites sequestered in the lungs, possibly through release of cytokines. Both of these complications are usually found in children in endemic areas.

• Haemoglobinuria

Haemoglobinuria results from the rapid breakdown of red blood cells in the circulation (massive intravascular haemolysis).

• Jaundice

Jaundice is more common in adults than children and is due to haemolysis and partly to liver dysfunction.

• Shock

Shock is due to inadequate cardiac output and poor tissue perfusion. In some patients it may occur concurrently with bacteraemia.

• Platelets

In P. falciparum malaria, the platelet count is typically low. Nevertheless, spontaneous bleeding is rare in both children and adults. When it develops it results from disseminated intravascular coagulopathy (DIC).

We have so far discussed pathophysiology in severe and complicated Malaria. Let us now turn to diagnosis of severe Malaria.

Diagnosis OF Severe Malaria

In the last unit we discussed the process of clinical diagnosis in malaria. We shall use the same process in the diagnosis of severe malaria. Can you remember the steps in this process? This process involves history taking, examination and investigations.

Let us now go through the following "case study" to highlight important features of severe Malaria. We shall also be referring to this case study as we go along.

Case Study

1

Dynah, a 4 year old girl child, was diagnosed with *P. falciparum* (+), 3 days prior to visiting your health facility. She completed a full course of the nationally recommended first line antimalarial drugs. The mother reports that the girl had high temperature and convulsions associated with confusion and excessive body weakness. She noticed yellow colouration of eyes and passed little but coffee coloured urine. The mother now concludes by saying I think my child has "yellow fever".

Before you read on do activity 4, it should take you 5 minutes to complete.

Activity

4

In reference to the case study you have just read, what additional history would you elicit from Dynah's mother?

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Now read on and compare your answer with the following text.

We assume that you would welcome Dynah and her mother with a greeting before inviting them to sit on a chair.

You should then proceed to gather the following history from the mother:

- History of fever, chills and rigors. Characterize the fever in terms of whether it is "on" and "off" , persistent or intermittent;
- Find any association of fever with convulsions. Are they index (first time) convulsions or not, did the convulsions occur at the peak of fever, how long did they last (duration), did the child go into coma or appear confused after the convulsion? If so, for how long? If the mother mentioned noted confusion after the convulsions, you should also ask whether the child continued being drowsy or if her level of consciousness deteriorated in any way. Also ask whether there is change in behaviour.
- The mother reported that Dynah passed coffee coloured urine. Ask her how frequently the child passed the urine, how much she passed (quantity) and if possible see the color of urine for yourself.
- Ask whether the child has shown signs of breathlessness since the problem started;
- Find out if Dynah is able to eat, drink, talk, stand or walk;
- Ask the mother about the treatment history. Verify her information with medical records if any, and if this is not possible let her give details of the drugs given to Dynah and whether they were actually taken;
- Ask about any recent febrile illnesses, history of previous episodes of dark coloured urine, convulsions, diagnosis of sickle cell disease, etc;
- Ask whether Dynah has had any blood transfusion;
- Ask about other illnesses in the family;
- Exclude history of trauma, dog bite, drug over dose, etc.

The above may not be "all inclusive" but suggests some common areas/questions requiring emphasis.

Once you take Dynah's history the next thing for you to do is to examine her.

Before you read on complete the following activity. You should spend about 2 minutes on this activity.

Activity

3-5

What are the aims of the physical medical examination you intend to carry out on Dynah?

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I hope in your answer you said that the aims of carrying out a physical examination on Dynah are to:

- Identify other possible diagnosis;
- Assess the Malaria, its severity and any complications of Malaria.

Before you embark on the physical examination on Dynah do the following Activity .

Activity

6

What should you look out for during Dynah's physical examination?

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During Dynah's general examination you should note the following:

- General condition and any danger signs like lethargy, comas, stupor etc.
- Hydration status, pallor, cyanosis, fever, jaundice and oedema;
- Respiratory system: Look for signs of dyspnoea and basal crepitations;
- Central nervous system: ascertain level of consciousness, stiff neck, kernings sign, prostration, tone of muscles;
- Ear, nose, mouth and throat for signs of sepsis, koplik spots of prodromal measles, tonsillitis, diphtheria;
- Skin: for rash that may suggest other illness such as measles, typhoid etc;
- Abdomen for enlarged spleen, areas of guarding, signs of peritonitis.

After you examine Dynah you decide to do a blood slide for malaria. The results comes back as " B/S = P. falciparum (++) Malaria".

(What does this diagnosis mean?)

I hope your diagnosis here would be **severe complicated malaria.**

Before you arrive at this diagnosis, we are sure you had other diseases in mind which you wanted to exclude during history taking, physical examination and investigation.

Before you continue do Activity 7 below. It should take you 5 minutes to complete.

Activity

3/7

What differential diagnosis did you make out of Dynah's case?

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Compare your answers with the information given in the following discussion.

The differential diagnosis includes the following:

- Meningitis:

Because of the fever, convulsions, confusion and lethargy. This should be excluded by doing lumber puncture and cerebral spinal fluid analysis;

- Urinary tract infections:

Because of fever, passing dark coloured urine. This is excluded by doing urinalysis;

- Respiratory Tract Infections –

Because of fever. Thorough history, physical examination and investigations should be done to exclude these;

- Tonsilitis –

Because of fever;

- Measles and other viral

infections;

- Septicaemia

because of fever, jaundice, convulsions, lethargy etc;

- Typhoid

fever;

- Pyomyositis

/abscess;

- Ear

infection.

Key points

Diagnosis of severe complicated Malaria is based on clinical assessment of a patient who presents with the clinical features discussed and a positive blood slide for Plasmodium falciparum Malaria.

High Risk Groups for Severe Malaria

Whereas severe malaria may affect any person, some people are at higher risk of contracting severe malaria than others.

Before you read on do the following activity. You should spend 5 minutes to complete.

Activity

8

Which special groups of people are at high risk of getting severe malaria?

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I hope you included the following category of people who are at high risk of severe Malaria. These are:

- Children between the age of 6 months and 5 years;
- People of all ages from areas of low Malaria endemicity;
- Travellers from non malaria to malaria endemic areas;
- Returnees to highly endemic areas;
- Indigenous pregnant women especially primigravida;
- People with sickle cell disease.
- People of all ages, no matter their location, who have lowered immunity and have exposure to Malaria.

Having learnt about severe Malaria, let's now consider the importance of its early treatment.

Importance of Early Treatment for Severe Malaria:

As we mentioned earlier, severe malaria is a life threatening disease. It is therefore important to pay special attention to these cases for the following reasons:

- Severe P. falciparum Malaria is a common cause of avoidable death;
- The diagnosis is often not made early enough;
- Correct early treatment and careful nursing can greatly improve the outcome;
- Antimalarial treatment/drugs should, if possible, be given parenterally under close supervision;
- Treatment should therefore be in hospital if possible;
- Treatment should conform with your National guidelines for the treatment of severe malaria.

CONCLUSION

You have now come to the end of this unit on severe and complicated Malaria. In this unit, you have learnt that severe and complicated Malaria is a medical emergency and so it requires early diagnosis and prompt treatment. You have also learnt that the absence of fever or a negative first blood slide should not exclude severe Malaria. A repeated blood film may confirm the diagnosis. Remember that since severe malaria is an emergency, you may not be able to follow the protocol of clinical assessment until the patient is stabilised.

Now go back to the beginning of this unit and review the learning objectives to see if you have achieved all of them. If there is any objective which you are not sure about, go to the relevant section and read it again. If you feel confident that you have achieved all the learning objectives, complete the attached Tutor Marked Assignment and send it to us for marking.

Annexe A Table 1 The Glasgow Coma Score (for Adults and Children over 12 yrs)

Eyes open	Spontaneously	1
Eyes movement	Directed (e g follows mother's face)	1
	Not directed	0
Verbal response	Appropriate cry	2
	Moan or inappropriate cry	1
	None	0
Best motor response	Localizes painful stimulus (a or c)	2
	Withdraws limb from pai n **(b)**	1
	Non-specific or absent response	0
	Total	**0–5**

To obtain the Glasgow coma score obtain the score for each section add the three figures to obtain a total.

Table 2: The modified Glasgow Coma scale (The Blantyre Coma Scale) (for children < 12 years)

1. Press knuckles firmly on the patient's sternum
2. Press firmly on the thumbnail bed with side of a horizontal pencil
3. Press firmly on the supra-orbital groove with the thumb

The scales can be used repeatedly to assess improvement or deterioration.

AFEBRILE:

Without fever.

ANAEMIA:

A reduction in the quantity of the oxygen-carrying pigment haemoglobin in the blood.

ANTI-PYRETIC:

A drug such as paracetamol that relieves fever without affecting the causative agent (in this case the parasite).

BASE:

The main active part of a drug (see salt).

CHEMOPROPHYLAXIS:

The protection from, or prevention of, disease by the use of drugs.

CINCHONISM:

Poisoning caused by an overdose of cinchona or the alkaloids quinine, quinidine, or cinchonine derived from it.

ENDEM1C1TY:

Occurring frequently in a particular region or population

FEBRILE:

With an increase in temperature compared with the normal.

FEVER:

Arise in body temperature above the normal temperature i.e. above an oral temperature of 37.5°C.

FEBRILE CONVULSIONS:

Convulsions occurring in children aged 6/12 - 6yrs due to fever caused by infection outside the central nervous system

HYPERPYREXIA:

Temperature over 39.5°C

IMMUNITY:

All those natural processes which prevent infection, re-infection, or superinfection, or which assist in destroying parasites or limiting their multiplication, or which reduce the clinical effects of infection.

HEAMOGLOBUNURIA

Pass urine with blood (Haemoglobin)

HYPERSENSITIVITY:

Prone to respond abnormally to the presence of a particular antigen, which may cause a variety of tissue reactions ranging from serum sickness to an allergy.

HYPERLACTICAEMIA

High lactic levels in the blood

LUMBAR PUNCTURE:

The insertion of a needle into the fluid-filled space of the spinal cord in the lumbar region and the removal of a sample of fluid for examination.

NON-IMMUNE:

Having no immunity at all to a particular organism or disease.

PARENTERAL:

The provision of medication into the body by any means other than through the alimentary canal (oral route or rectal), such as by subcutaneous, intramuscular or intravenous injection.

PRURITUS:

Itching caused by local irritation of the skin or sometimes nervous disorders.

RECRUDESCENCE:

Renewed manifestation of infection believed due to the survival of malaria parasites in the blood.

RESISTANCE:

The ability of a parasite to multiply or survive in the presence of concentrations of a drug that normally destroys parasites of the same species or prevents their multiplication.

SALT:

Any compound of a base and an acid, e.g. Quinine dichloride or quinine sulphate.

SENSITIVE:

Possessing the ability to respond to a stimulus.

STEVEN-JOHNSON SYNDROME:

An inflammatory condition characterized by fever, large blisters on the skin, and ulceration of the mucous membranes. It may be a severe allergic reaction to certain infections or drugs.

TREATMENT FAILURE:

Treatment failure can be defined as a failure to achieve the desired therapeutic response after the initiation of therapy. Treatment failure is not synonymous with drug resistance.

Assignment

AMREF DIRECTORATE OF LEARNING SYSTEMS

DISTANCE EDUCATION PROGRAMME

Student Name _____

Student Number: _____

Student Postal Address: _____

_____

DISTANCE LEARNING COURSE ON MALARIA

Tutor Marked Assignment
Unit 3: Severe and Complicated Malaria

1. List down at least 5 complaints of people suffering from severe Malaria.

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2. List down ten complications of P. falciparum Malaria. ……
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3.(a) Name the malaria parasites that cause severe malaria. ……
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(b)List the special groups of people at a high risk of malaria. ……
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4. Give five reasons why it is important to do early diagnosis and prompt proper treatment of cases of severe and complicated malaria?
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Congratulations! You have now come to the end of this assignment. Your assignment will be marked and returned to you with our comments. Please make sure that you clearly indicate your name, student identification number and address on this assignment. Post or bring it in person to AMREF.

Enjoy the rest of the course!

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