

TRIAL EDITION
August 1996

The diagnosis and management of severe and complicated falciparum malaria

Part II Tutor's Guide



Training Unit
Division of Control of Tropical Diseases
World Health Organization
Geneva

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Preface

This training module on the diagnosis and management of severe *P. falciparum* malaria is intended primarily for the training of physicians, nurses, medical students and other health personnel both in malarious areas of the world and non-endemic countries.

The module consists of Part I a Learner's Guide and Part II a Tutor's Guide. Within the Learner's Guide are eight learning units which together provide essential information on clinical features of severe and complicated malaria and guidance on how to proceed in a logical way with diagnosis and management of the disease. The picture quiz in Learning Unit 5 helps the learner to visualize the most striking clinical manifestations of the disease and to distinguish them from similar manifestations of other infectious diseases. Learning Unit 8 is based upon a problem-solving approach to learning and allows the learners to acquire the knowledge required through guided examination of several malaria patients presenting distinct features in the manifestation of the disease.

Part II the Tutor's Guide provides the opportunity to check step by step the learner's reasoning in the interpretation of the results of the clinical examination and laboratory investigations with the most authoritative publications. These are provided in the list of references at the end of this part. Answers are also provided for the picture quiz which could be used to promote a discussion on the signs of severe and complicated malaria. Solutions to the problems posed in Learning Unit 8 are suggested in the Tutor's guide.

This module is part of a series of publications in English and French prepared by the World Health Organization on the subject of severe and complicated malaria that review the latest knowledge and experience on the subject. The other publications include: Management of Severe and Complicated Malaria, A Practical Handbook (H.M. Gilles 1991), and Severe and Complicated Malaria, second edition (D.A. Warrell *et al*). While the Handbook could be used as an aide mémoire for practising physicians, the second document will be helpful for those involved in clinical work and research on malaria to up-date and broaden their knowledge of the subject.

Acknowledgements

The technical content of this module was prepared by Professor M.E. Molyneux, Liverpool School of Tropical Medicine. The module was then developed by Dr. P.F. Beales and Dr R.L. Kouznetsov, Training Unit, Division of Control of Tropical Diseases, WHO, Geneva. Further contributions were made by Professor H.M. Gilles, Dr J.-E. Touze and Dr F.A. Rio.

This is a trial edition intended to be used in the field for one or two years before final publication. Comments on experience with the use of this module would be most welcome and should be addressed to Chief, Training, Division of Control of Tropical Diseases, World Health Organization, 1211 Geneva 27, Switzerland.

The development of this training module was supported by a financial contribution of the Government of the Netherlands.

Introduction

This Tutor's Guide is designed primarily to help those responsible for the training of those health personnel responsible for the diagnosis and management of severe *P. falciparum* malaria. Some parts of it should be useful even to the most experienced teacher. In case of self studies it should be provided to learners together with the Learner's Guide so that the trainee can use it as an "answer book".

This module uses a problem-solving approach. After working through the picture quiz and the case studies, and discussing the suggested answers provided in the Tutor's Guide, the learner will have covered the main aspects of the diagnosis and management of severe and complicated malaria in adults and children. The tutor and facilitators provide guidance and do not in general perform supportive functions. If you are not familiar with this training system, read this introduction carefully.

For whom is this training module intended?

The module is intended for those who, in the course of their work, have to diagnose and treat patients with malaria. It will also be useful for those responsible for organizing, running and evaluating programmes for malaria control. It can be used alone for a special course or as one element of a more comprehensive course on disease control.

Educational level of learners

The training module is intended primarily for the training of physicians, nurses, medical students and other health personnel at the district hospital and intermediate levels of health care in malarious and non-endemic areas of the world.

Apart from educational qualifications, it is important that trainees:

- are able to read, comprehend and write English
- have had some experience in the diagnosis and management of severe malaria.

The complete module is designed to be accomplished in 28 hours (4 days). You will find the suggested timetable in one of the following

paragraphs.

How is the training designed and what is its content?

The principal objectives of the training are listed in the Introduction to the Learner's Guide. Please stop and read these now. This module is conceived to stimulate active learning by working through a series of exercises. These exercises will be performed on the basis of the Learner's Guide preferably in small groups.

Learners are taught the salient clinical manifestations for the diagnosis and management of severe and complicated malaria. Common errors in the diagnosis and management of severe malaria are highlighted.

The learners acquire step by step all the knowledge and skills they need to recognize, diagnose and manage severe and and complicated malaria. This type of training is performance-based and is highly effective.

At the beginning of each Learning Unit of the Learner's Guide is a list of learning objectives. Learning objectives summarize the knowledge, skills and attitudes that each learner should have acquired by the end of that Unit. You and your colleagues must satisfy yourselves that each learner has achieved the stated objectives before proceeding to the next Learning Unit. (Methods of evaluating progress are described later).

It is convenient to have all the learners working in small groups.

Who runs the course?

It is you who are responsible for organizing and running the course. The Learner's and Tutor's Guides will do much to help you, but the final results will depend upon your efforts. This may be the first time that you have organized and run such a course, or you may be an experienced teacher: in either case, we stress the importance of using the Learner's Guide and the Tutor's Guide together as you proceed through the Learning Units.

Who helps you in the course?

Your job will be easier, and your teaching more effective, if you have colleagues who will help you. These assistants, who should have knowledge and experience in the subject, are called facilitators. You

can then divide learners into small groups of four to eight persons, and allocate one facilitator to each group. The greater interaction this allows between the learners and the facilitators results in better learning and understanding.

As overall manager of the training programme, you will be responsible for designing the timetable, explaining the learning tasks to the learners and facilitators, and giving learners and facilitators whatever help they need. Do not worry if the facilitators are not trained as teachers; their task is to explain or demonstrate a particular activity and to watch learners perform it. They must also be able to admit to learners when there is something that they do not know and be prepared to refer the question or problem to you. Impress on your facilitators that no one person can be expected to know everything about a particular subject.

There is no shame in saying "I do not know, but I will find out for you".

Many problems can be avoided by giving your facilitators plenty of time to read the Learner's and Tutor's Guide and discuss with you any part of it that may need clarification. It would be a good idea for you and the facilitators to go through the module together; you could then test their knowledge by asking them appropriate questions.

Why provide a learner's guide?

Providing learners with a full set of notes ensures that:

- All learners have exactly the same basic materials and guidelines on how to proceed, thus avoiding unnecessary note taking.
- You and the facilitators can refer to any part of the Learner's Guide knowing that all learners can find the right page quickly.
- Learners can spend more time reading the Learner's Guide, discussing and formulating ideas. This gives a greater opportunity to understand the subject, because there is no need to take notes during the class.
- There is no chance of learners making errors in note-taking.
- After the course, each learner can take home a copy of the Learner's Guide and the Tutor's Guide as a helpful reference in his or her daily work and perhaps also to use to teach others.

How is the course run?

This subject is dealt with on pages 10 to 12 of the Learner's Guide. Please stop and read these now.

As stated in the Learner's Guide lectures should be kept to a minimum. The use of examples, group exercises and discussion groups are all much more effective ways of teaching.

How will you know whether it was a good course?

Judging whether or not the course was a good one is difficult and involves answering the following questions:

- *How well did the group learn?*

This may be determined by evaluating the learners' performance as they work through the Learning Units and again at the end of the training, by evaluating the level of competence, and knowledge that learners have achieved in this subject. This may be done by the use of a pre-and post-tests and examples of questions that may be used are to be found in Annex 1. More details on evaluation are given later in this Tutor's Guide. A further evaluation of how well they have retained their knowledge and competence may be necessary 10-12 months later.

- *How did the learners view the training?*

Learners' answers to this question will yield valuable information on how useful they find this type of training, especially if they provide a short evaluation during the course and a longer one at the end. (A suitable questionnaire is provided in Annex 2). Frankness can be encouraged by allowing learners to make their responses anonymously.

Feedback provided during the course allows you to assess how well your training is being received and make any improvements that seem necessary. Feedback received at the end of the course will help you to improve future programmes. If you have prepared the course carefully, feedback is likely to be favourable, which is rewarding both for you and for the facilitators.

Whatever the government policy may be regarding the award of a certificate of competence, some record of attendance and level of competence reached by each learner should be kept so that details may be checked later.

Use of the Tutor's and Learner's Guides

The Tutor's and Learner's Guide and answer book may be used together for basic group training and for in-service training. The Learner's Guide alone may be used for refresher training, or by individuals for reference.

The way in which you and your facilitators should make use of the Guides and the audiovisual aids will become apparent as you work through the training module.

Learners will follow the group training activities using the Learner's Guide plus whatever other materials you provide them with. The Tutor's Guide could be handed to them at the end of the training (upon completion of this module).

Training facilities

A number of basic facilities and equipment must be organized before training can begin. In some countries these are readily available but in others you may need to improvise or to modify existing resources. Bear in mind that there may be long intervals between ordering supplies and getting them delivered, but do not delay training unnecessarily because you do not have the best equipment.

Ideally, one large room should be available for presentations and group discussions; pictures projected by the overhead and slide projectors will be seen more easily if the level of lighting can be controlled. Chairs and small tables or desks will be needed for this room. Whatever the conditions, do your best to ensure that the learners are as comfortable as is possible in the circumstances: you may be surprised how much you can achieve even with relatively few facilities.

Teaching equipment

For teaching sessions and group discussions, the following items should ideally be available:

- overhead projector
- slide projector
- screen for slide projection (a white sheet is an adequate substitute but the white-board is unsuitable because it will reflect projected light)
- flipcharts - one for each small group of learners. Supplies of "butcher's paper" or "newsprint" are usually cheap and readily available
- large chalk board or white board
- chalks for blackboard or marker pens for white-board, in a selection of colours
- acetate sheets for overhead projector
- coloured marker pens for acetate sheets (including some permanent markers for diagrams you may wish to keep)
- TV set and a video equipment.

Learner's equipment

The equipment listed below should be provided for each learner. Where supplies have to be ordered, this should be done well in advance of the course, many items are difficult to obtain at short notice.

- copy of the Learner's Guide
- notebook (this should be used only for occasional notes or instructions, as explained earlier, there should normally be no need for notes to be taken during training session)
- sheets of paper for the exercises during the working groups
- ballpoint pen
- set of pencils (medium-hard graphite, plus red, blue, brown and black) for drawing during practical sessions
- pencil sharpener
- eraser
- ruler.

Syllabus and timetable

The contents list of the Learner's Guide represents the syllabus - the list of subjects to be covered - for the training course. Go through each of

the learning units in turn and calculate how much time you will need to devote to it and decide what kind of training activity would be most suitable for the topic. For example, you will find that Learning Unit 1 "What you know about severe and complicated malaria in your country or place of work" will consist of a questionnaire. This unit involves individual work of participants as well as discussions by you with participants' most common misconceptions and errors. On the other hand, subsequent units can be dealt with in small group discussion of exercises, presentation of the results of each group's deliberations and general discussion involving the facilitators and yourself. Planning the course is made easier by the division of this module into a number of learning units or main topics.

The following is a list of the various learning activities that you might consider using:

- *Group discussion*

Once participants get used to group discussions, the two-way exchange of information between them and the facilitators makes this a very effective learning activity. People share their knowledge and experience with the rest of the group and stimulate each other's thoughts on the subject in hand.

- *Clinical work and visits to wards*

A number of these visits may be arranged for bed-side teaching activities. Their purpose is to give learners the opportunity to practise diagnostic principles and the management of severe diseases. The more cases they see the more competence they will acquire.

Visits to health facilities for teaching purposes need to be well planned in advance to be sure that suitable cases are available, and the senior management and medical staff are agreeable to and well informed about the visits. In addition you as the tutor should caution the participants before each visit to conduct themselves in a professional manner and not to criticise procedures or discuss the patient's conditions while inside the facilities. All discussion and critical observations should be made back in the classroom.

- *Demonstrations, examples*

These are designed to reinforce the learning process. Clear

examples help to clarify concepts and establish principles of diagnosis and management of severe and complicated *P. falciparum* malaria.

Evaluation

Whether this module is used for group training or self learning, assessment of progress made by the learner in gaining knowledge and competence in the subject matter is essential to the learner and for the tutor.

This can be accomplished by means of a pre-test in the form of a multiple-choice questionnaire (MCQ), given before the learner reads the Learner's Guide. To be valid it must be clear that the learner must work on it alone. Guidance on writing multiple-choice questions and a few examples are provided in Annex 1. The post-test should be administered only after all the learning units have been completed.

The results of the pre-test can be used in two ways. The Tutor may use it to ascertain the general level of knowledge on the subject amongst the group, and have an indication of general weak areas that need emphasis and areas of general knowledge that can be de-emphasized. It could also be used to identify individuals who might be used as facilitators for certain subject areas. The other major use for the pre-test is as an individual base-line comparator for measuring the gain in knowledge and competence at the end of the training as revealed by the post-test.

To be valid the questions in the post-tests should be of the same difficulty as the questions in the pre-test and both tests should be given under the same conditions and the same length of time. The only sure way of knowing that the questions in the post-test are of equal difficulty to those in the pre-test is to give the same questions but in a different order and in the case of multiple choice-questions with the answers also in a different order. It is thus essential that the pre-test papers be collected and retained (not handed back to the participant). In any event, it is not necessary for the participant to know the results of the pre-test until the end of the training when it is used to determine progress.

We encourage the tutor to develop a bank of questions that can be used for pre- and post-testing in subsequent training sessions. The answers to the sample pre- and post-test questions are provided separately in the Tutor's Guide to enable you to easily reproduce the question

papers. The answers are scored equally because all questions are considered, in the instance, to be of equal value.

Other evaluation instruments can be used to evaluate the training module itself, also by means of a comprehensive questionnaire completed by all learners at the end of each learning unit. Examples of such questionnaires can be obtained from the Training Unit, Division of Control of Tropical Diseases, WHO HQ, Geneva.

The timetable

Once you have calculated the amount of time that needs to be spent on each unit, all the various learning activities must be fitted into the framework of the training programme. The duration of the programme may be something over which you have little control; for instance, you may be told to limit the programme to 3 days because of shortage of funds, even though you have calculated that it should ideally be spread over 4 days. You and the facilitators will then need to spend time reorganizing the timetable so that all the learning activities can be fitted into the time available.

In planning the timetable, remember to allow time for evaluation both during and after the course, and for the hidden activities, such as getting settled into group work, delays in transportation to the training facility and so on.

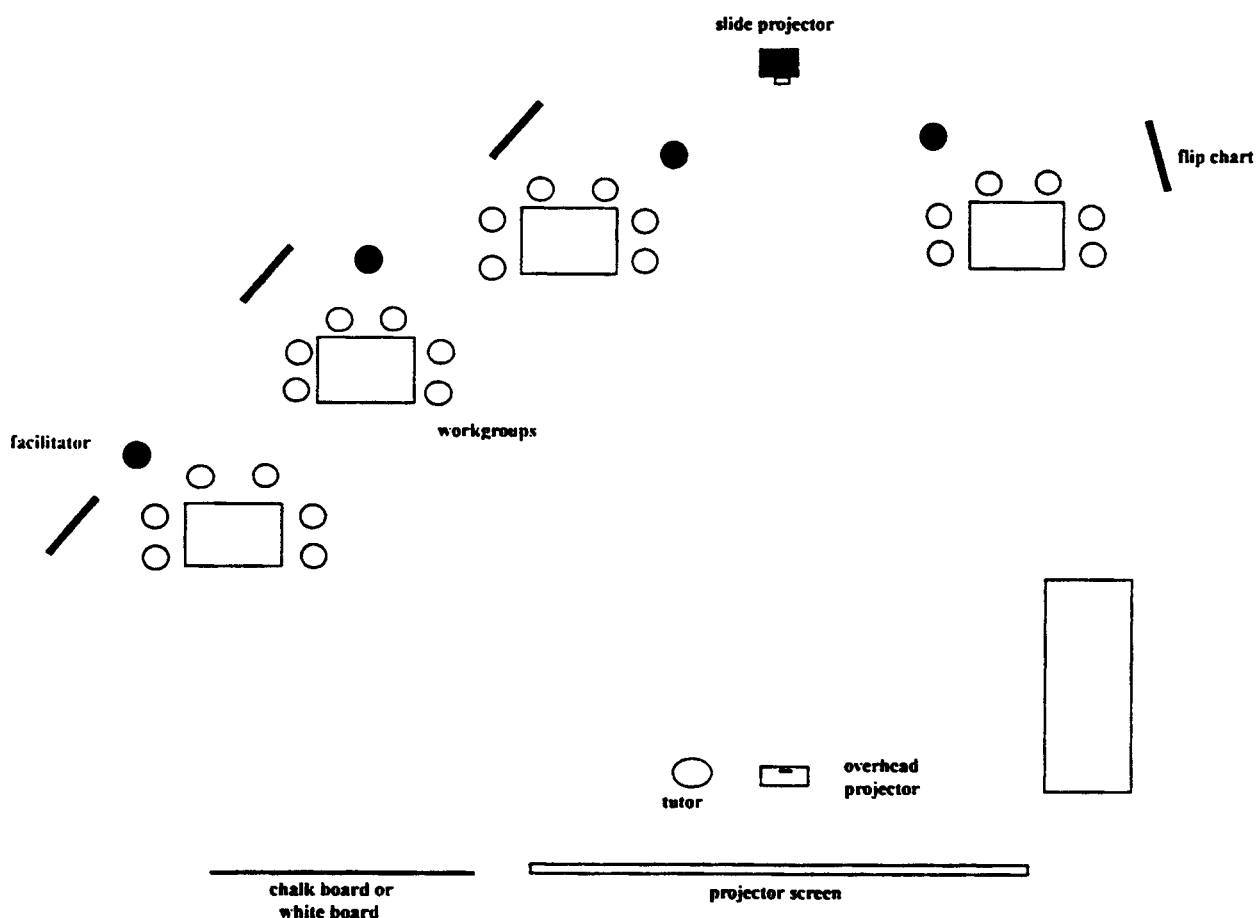
A suggested timetable for a 4-day training course is shown in Table 1, but again is provided only as a guide. It is based on a 7-hour working day - four hours in the morning and three in the afternoon but this may not be suitable for your purposes and can be adapted approximately. A certain amount of time is unallocated especially in the morning sessions. As the course progresses you may feel that further discussion is necessary on some topics. These activities can be fitted into the "free" periods and a discussion session on the afternoon of the last day can also be used in a flexible manner.

Arrangement of the meeting room

Decide on the number of working groups ahead of time. Groups of four to eight are best. This will depend upon the number of learners and number of facilitators available. Try to arrange the room so that participants sit in groups in more or less a semi-circle as in the diagram. Make sure everybody will have a clear view of the blackboard and

projector screen.

The group compositions can be changed occasionally if you wish or left the same throughout the course. But, for the pre- and post-test evaluations, participants must be seated apart from one another under examination conditions. However, the group activities can all take place in the same room and time is saved by not having to change places.



Introduction to the course

Your very first session with the learners in the meeting room should be preferably with the seating in a semicircular arrangement as indicated in the diagram. If the chairs do not have fixed supports for notebooks, it would be helpful to have small desks or tables available.

Introduce yourself first. Write your name on the board or flipchart and tell the learners a little about your background and your job. Then ask each of the facilitators to do the same thing.

The learners should introduce themselves next. It might be helpful to divide the learners into pairs and ask them to exchange names, information about jobs, home towns, etc. Each learner can then introduce his or her partner to the whole group. This method often has the effect of reducing tension, and a relaxed atmosphere is a good learning atmosphere.

The learners will have been given their copies of the Learner's Guide. Allow 10 minutes or so to read through its Introduction and then briefly, but carefully, deal with the various topics covered. Explain, for instance, that working in small groups with facilitators should make learning easier. Stress that the course will involve a great deal of exercises, since this is the best way to acquire the necessary skills.

Go through the objectives of the various Learning Units so that the learners understand exactly what they should have achieved by the end of the course. Explain that the learners should keep these objectives in mind throughout the course and always ask for help if they feel uncertain of having achieved them. Each learner is likely to be more aware than the facilitators of how well he or she has understood a particular topic or has mastered a particular skill; it is the job of the facilitators to make the learning process as effective as possible.

There may be other subjects you want to raise at this time, but try also to encourage the learners to discuss the training programme - what they expect of it, what aspects of it are worrying them, and so forth. Explain that you and the facilitators will welcome feedback throughout the course - constructive criticism from the learners may well help you to improve the training programme.

Finally, talk to the learners about evaluation. Explain that evaluation will be a continuous process throughout the training course. Stress that the pre- and post-tests should be enjoyed rather than feared; they are part of the learning experience. Their purpose is to allow you and the facilitators to assist the learners' starting level and to correct mistakes and clarify misunderstandings. Emphasize the importance of the learners reading all the questions (and any supplementary instructions) very carefully. Explain that everyone will learn at different speeds and that you and the facilitators will make as much allowance for this as possible.

Table 1. Suggested timetable

	Day 1	Day 2	Day 3	Day 4
A.M. (4 hours)	Introduction to the course Pre-test Learning Unit 1 Discussion	Learning Unit 4 Visit to health facility	Learning Unit 6 Learning Unit 7 Small group exercise	Case Study C Case study D
Lunch break	Break	Break	Break	Break
P.M. (3 hours)	Learning Unit 2 Learning Unit 3	Learning Unit 5 Small group exercise (Picture quiz)	Learning Unit 8 Case study A Case study B	Case Study E Post-test General discussion

What you know about the diagnosis and management of severe falciparum malaria in your country or place of work

Learning objective

The learning objectives for this Unit are for the learners to:

- understand more clearly the situation of severe and complicated falciparum malaria in their country or place of work, and how it is managed.

It should be made clear to the participants that this Unit is **not** an examination but is designed to make the learners think about the situation of severe and complicated malaria in their own country or place of work. They will also have to think about how it is being managed and through this process and with your subsequent help as a tutor, they will realize the deficiencies that exist in their own situation. Participants should be encouraged to answer the questions as precisely and briefly as possible and not more than 60 minutes should be allowed for this. In plenary session open a discussion between the participants regarding their experience in completing the questionnaire, paying particular attention to difficulties encountered and the reason, and missing information. Approximately one hour should be spent on this activity.

During lunchtime and at the end of the day you should then review the papers and identify any specific areas which are the cause of common difficulties and which will need special emphasis in the Units that will follow.

Severe malaria

Learning objectives

The learning objectives for this Unit are for the learners to:

- define what is severe malaria
- identify the high risk groups likely to get severe malaria
- diagnose severe malaria
- appreciate the importance of early treatment.

The learner's guide enumerates the salient features of severe malaria. Stimulate discussion on each of these features and other possible diagnoses that may have to be considered.

Be particularly careful to explain why some people are at risk and others are not.

We strongly recommend that you prepare visual aids (overhead transparencies and slides) in advance, and use them to demonstrate and reinforce the important features discussed.

Pathophysiology of severe falciparum malaria

Learning objectives

The learning objectives for this Unit are for the learners to:

- describe the mechanism believed to be responsible for the main complications of malaria
- show how an understanding of the mechanism of disease can help to determine appropriate treatments.

The Learner's Guide gives a succinct overview on pathophysiology of severe malaria. Make sure that all the learners have carefully read the Learning Unit, and stimulate a discussion.

Be particularly careful to explain that, in spite of the enormous amount of studies undergone on the topic, there are still some gaps in the understanding of the pathogenesis of malaria.

Guidelines for diagnosis and assessment of severe malaria

Learning objectives

The learning objectives for this Unit are for the learners to:

- record a complete history from the patient
- conduct a physical examination of the patient looking for significant signs
- request the most urgent tests necessary for the diagnosis and management of severe malaria.

You should spend 10 minutes asking questions to the participants as a whole to ascertain the overall understanding of the subject and to identify any serious misconception. Questions you may pose might be: what is the aim of taking a history? what are the elements of a history? what are the points for alternative diagnosis? what are the markers for severity of malaria? what coma score do you know? what important laboratory investigation should be carried out to confirm the diagnosis and assessment of the patient?

Based upon the outcome of the question and answer session, make a structured presentation of the subject using good quality overheads that you have prepared in advance. Go through the various elements carefully allowing plenty of time for discussion feed back.

With regard to assessing the coma score it will be important to note that there are many scales of which two are proposed here, being the most widely used. These are the Glasgow coma scale for adults and the Blantyre coma scale for children.

There is no precise age at which one score becomes more useful than the other. But as a rough guide we suggest that the Glasgow coma score should generally be used for people-aged > 12 years, and the

Blantyre score for younger patients.

With respect to laboratory investigations you as the tutor must decide beforehand what are the most practical tests than can be carried out in the local situation prevailing in your area. The Learner's Guide at the end of this Unit has some investigations which perhaps will be appropriate and possible in research studies.

It would be important to arrange a visit to a health facility with inpatients to allow the participants to have practice in history taking, eliciting physical signs and if possible assessing the level of consciousness. Remember that all the necessary health authorities should be alerted well in advance, and that you should caution the participants to act in a professional manner.

At the end of the visit to the health facility arrange a session in the classroom to allow a free discussion of the findings and possible difficulties of the experience.

Picture quiz

Learning objectives

The learning objectives for this Unit are for the learner to:

- interpret physical signs of severe disease in children and adults
- decide on differential diagnoses
- determine tests that need to be carried out.

You as the tutor should make this Learning Unit as enjoyable as possible. This can be done by prospecting the slides provided with the Tutor's Guide, which although these are the same as the pictures in the Learner's Guide they are in colour.

You may supplement these slides with your own, in which case you will need to develop your own questions and answers. If you cannot provide slides, good quality overhead transparencies can be used.

Working in small groups each set of question should be answered, then in plenary the group results of the group work can be compared and this can be done by projecting the pictures one by one and at the same time having a participant at the flip-chart noting the different answers of the group. This should be followed by discussion and consensus regarding the correct interpretation.

As you use this module over time you may wish to build up a bank of pictures which could be used for a picture-quiz as part of the pre- and post-test to evaluate the participants.



Figure 1

Figure 2

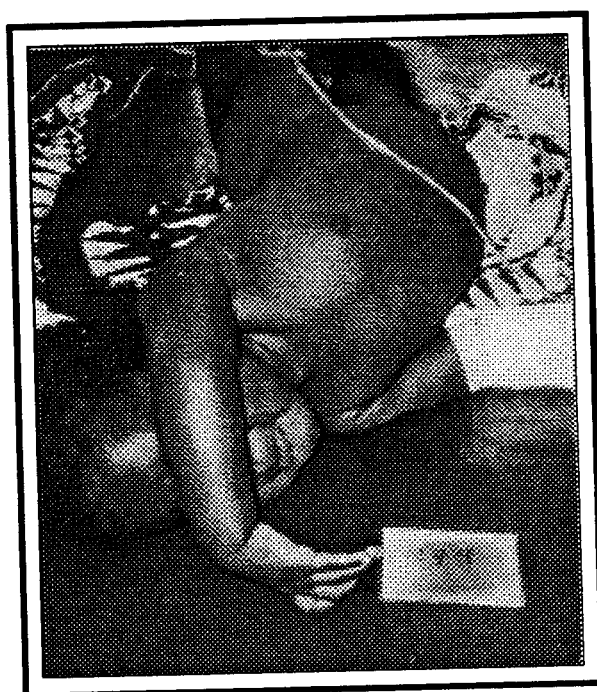
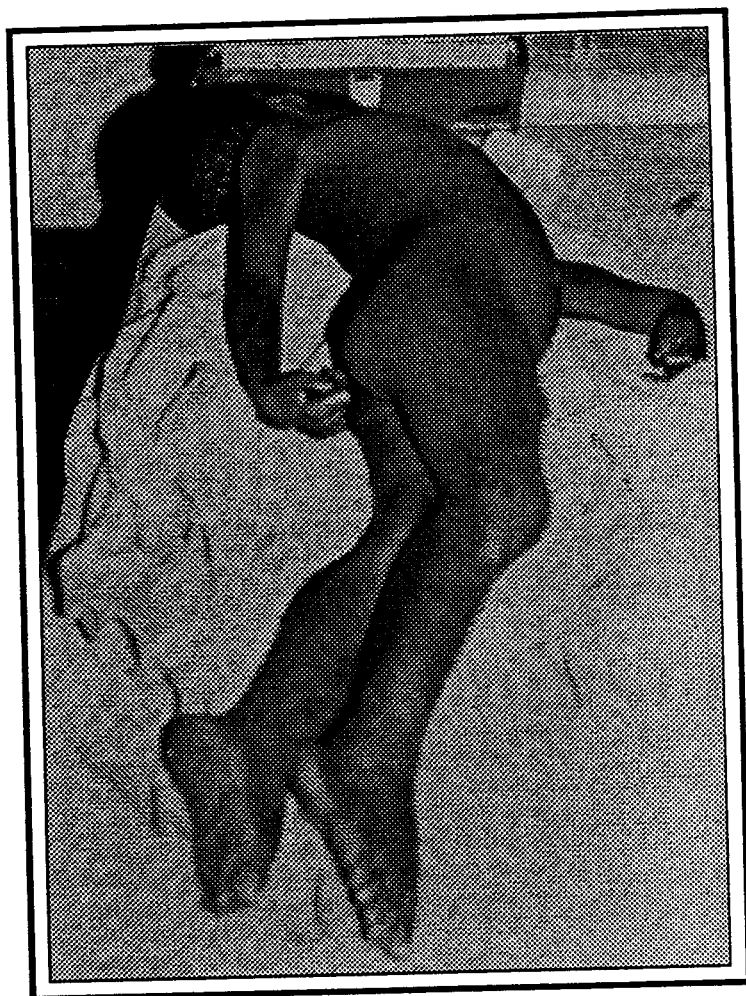


Figure 3

The children seen in Figures 1, 2 and 3 were all brought to a clinic in an area where *P. falciparum* is hyperendemic. Each child is unconscious and has a heavy *P. falciparum* parasitaemia. The children were 3 to 5 years old. They were febrile (38°C - 40°C). The children had been immunized against the communicable diseases of childhood through the EPI programme.

Question 1

What do the pictures show?

Answer: Opisthotonos. There is also posturing of the arms in various positions. These features indicate severe cerebral dysfunction.

Question 2

What is the differential diagnosis?

Answer: All these features may be due to cerebral malaria. The most important differential diagnosis is meningitis; you should also consider any form of meningoencephalitis (including rabies) may present in a similar way; and hypoglycaemia due to any cause (one of which is malaria) may present with this clinical picture. Kernicterus can cause cerebral dysfunction.

Question 3

What tests would you do?

Answer: Blood glucose; lumbar puncture; other tests depend on the particular circumstances and response to treatment. Total blood count; viral antibodies in blood; blood bilirubin. CT scan, if possible.

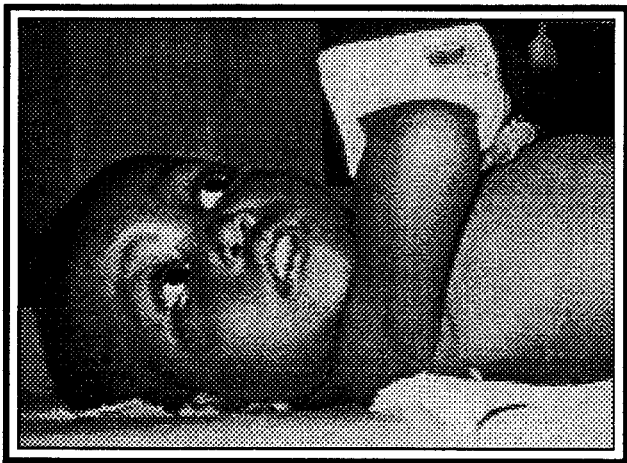


Figure 4



Figure 5

The children seen in Figures 4 and 5 each have a short history of fever followed by progressive loss of consciousness. Both are in deep coma and have a heavy *P. falciparum* parasitaemia. They are 3 and 4 years old. Neither of them had been immunized against the common childhood diseases.

Question 4

What do the pictures show?

Answer: Conjugate deviation of the eyes to the left (Figure 4) or upwards (Figure 5). The patient in Figure 4 also has a sustained posture of the right arm, and the child in Figure 5 appears to have contraction of lower facial muscles, causing a grimace.

Question 5

What could be the explanation for this?

Answer: These features, like those of Figures 1 to 3 indicate a cerebral disorder. They may also be part of, or follow immediately after, a convulsion of any cause. All the conditions discussed under Figures 1, 2 and 3 should be considered in these patients, and the same tests should be done.

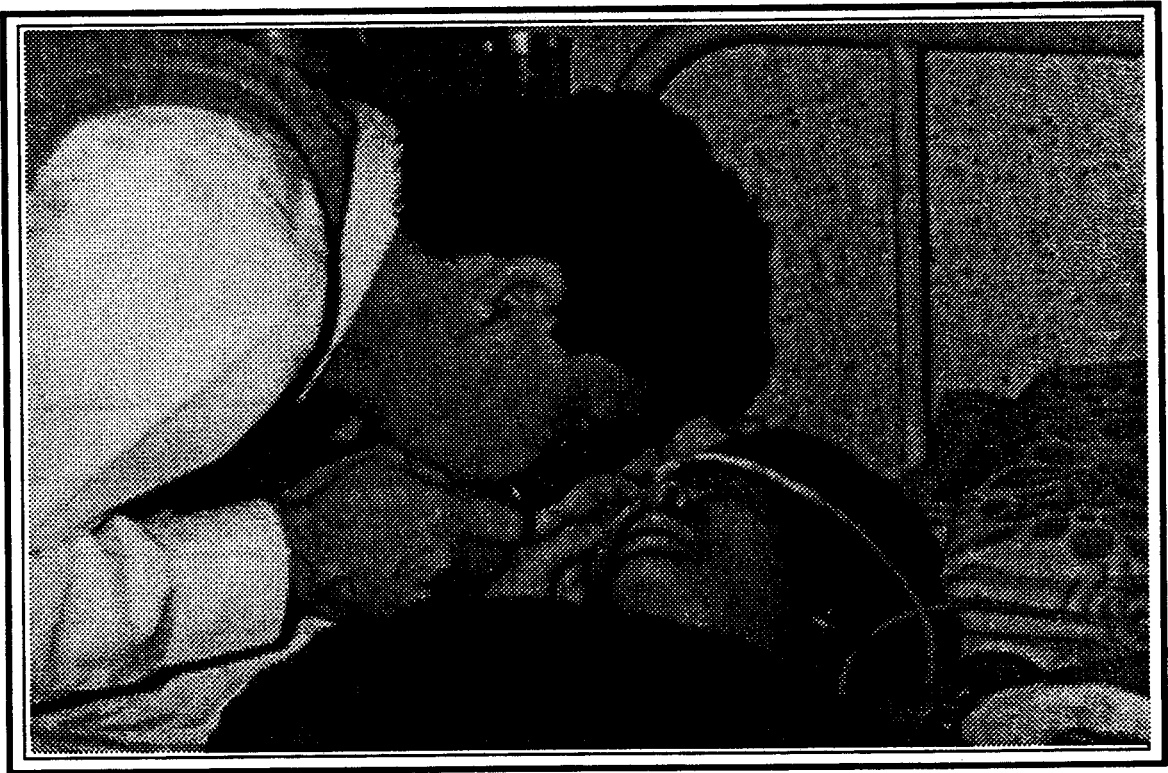


Figure 6

The patient seen in Figure 6 has severe *P. falciparum* malaria. She was admitted in coma, treated with quinine and recovered consciousness. Two days later he had a convulsion and collapsed into coma again.

Question 6

What are the possible causes of the convulsion and subsequent coma?

Answer:

1. Hypoglycaemia
2. May have a recrudescence of malaria because not responding to quinine.
3. Meningitis.

Question 7

What investigations would you do to ascertain the cause?

Answer:

1. Blood glucose test, using a "stix" method if available.
2. Blood film (thick film)
3. Lumbar puncture.
4. Blood culture.

Question 8

How would you manage this patient?

- The comatose patient should be given meticulous nursing care. The nurse should turn the patient every two hours or so. Allowing the patient to lie in a wet bed will promote bed sores.
- If hypoglycaemia is detected by blood testing or suspected on clinical grounds, give 50% glucose, 50 ml (1,0 ml/kg for children) by intravenous bolus injection.
- Follow with an intravenous infusion of 5% or 10% glucose.

- Continue to monitor blood glucose level in order to regulate the glucose infusion. Remember that hypoglycaemia may recur even after intravenous bolus of 50% glucose.
- The patient should be treated with broad spectrum antibiotics without waiting for culture results. If the results of blood culture and sensitivity testing are available, give the appropriate antibiotics, if not continue with the broad spectrum antibiotics.
- Monitor and record the level of consciousness (using the Glasgow coma scale, or for small children the Blantyre scale), the temperature, respiratory rate, blood pressure and vital signs.

Figure 7 shows the supportive treatment given to a patient with severe malaria.

Question 9

What exactly does the picture show?

Answer: The peritoneal dialysis in progress in a township hospital in a rural location. A patient with acute tubular necrosis can be kept alive by peritoneal dialysis, until the kidneys recover, usually in a period of a few weeks.

Question 10

What is the most frequent complication in severe malaria that leads the physician to perform this approach?

Answer: Renal failure. Peritoneal dialysis is indicated if the patient remains oliguric after adequate rehydration and the blood urea and creatinine rise progressively.

Question 11

What are the complications to be afraid of in carrying out this technique in rural hospitals?

Answer: Peritoneal dialysis should not be undertaken lightly in a rural hospital setting. Bleeding and secondary infections are common complications and the mortality associated with the procedure is high. Early referral to a dialysis centre is usually preferable.

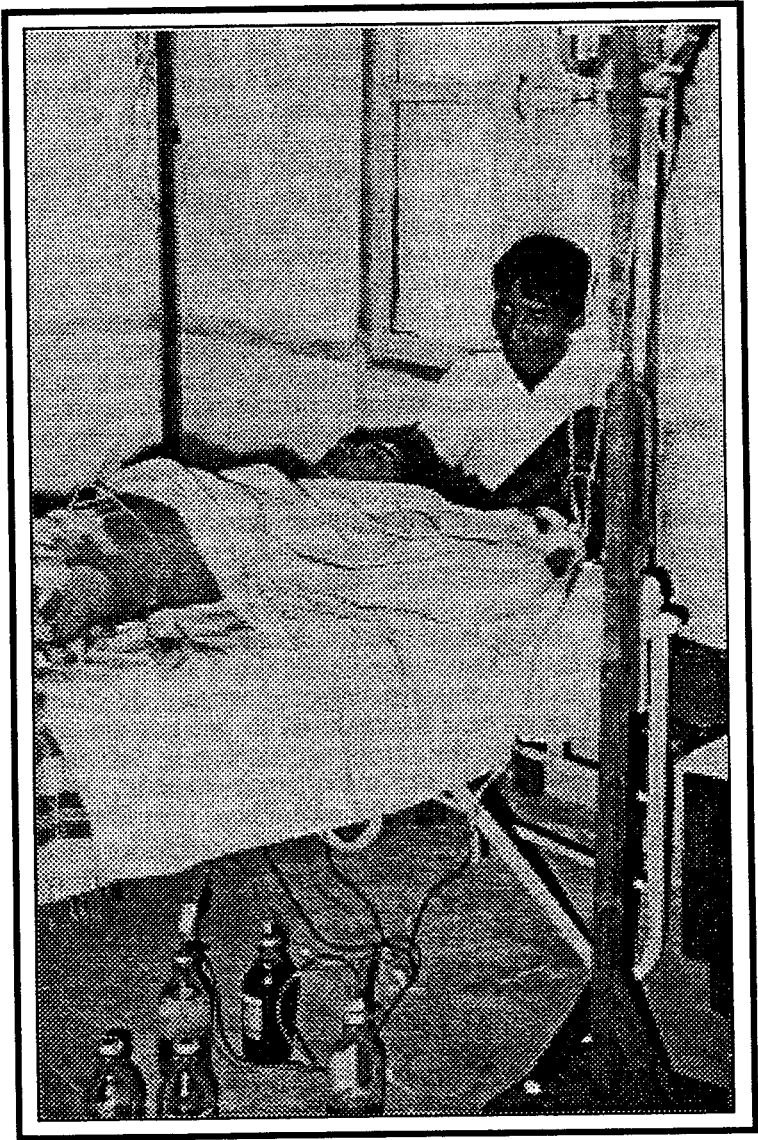


Figure 7

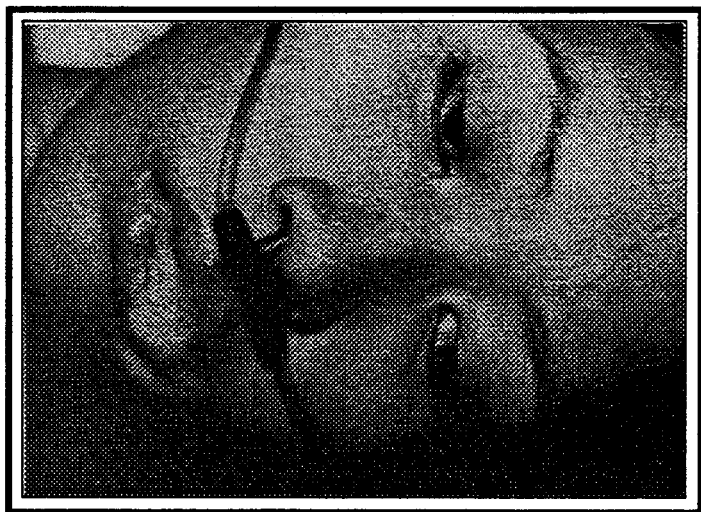


Figure 8

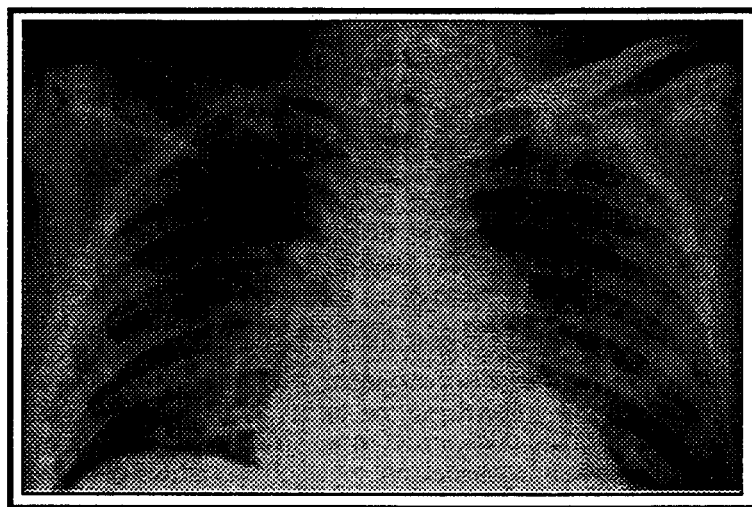


Figure 9

Pictures 8 and 9 refer to the clinical and radiological presentation of a woman soon after labour.

She has severe malaria with hyperparasitaemia and the condition shown in pictures 8 and 9 was preceded by an increase in the respiratory frequency.

Question 12

What is the condition shown in these pictures?

Answer: Acute pulmonary oedema that developed suddenly after delivery. The fluid balance of the woman was positive. Figure 9 is the radiographic appearance of acute pulmonary oedema.

Question 13

What is the differential diagnosis?

Answer: Aspiration bronchopneumonia and metabolic acidosis. Without good facilities for emergency radiography it may be difficult to differentiate acute pulmonary oedema from aspiration bronchopneumonia and metabolic acidosis although, in the latter, examination of the chest is usually normal.

<p>You should read carefully the next Unit of this module before the session to which it relates.</p>
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Selected further reading

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Bench aids for the diagnosis of malaria. Plates No. 1-8, Geneva, World Health Organization.

International travel and health. Vaccination requirements and health advice. Geneva, World Health Organization (updated annually).

WHO model prescribing information: drugs used in parasitic diseases, Geneva, WHO, 1990.

WHO Technical Report Series, No 805, 1990 (*Practical chemotherapy of malaria: report of a WHO Scientific Group*).

The management of severe and complicated malaria

Learning objectives

The learning objectives for this Unit are for the learner to:

- provide urgent treatment to a severely ill patient
- provide maintenance treatment throughout the period of illness
- arrange for regular monitoring and appropriate action as necessary.

You as the tutor should ascertain that the learners have understood that severe and complicated *P. falciparum* malaria is an emergency and urgent treatment is required. Discuss with the group the various steps to be followed and explain the reasons why each treatment is recommended.

Stress the importance of the maintenance treatment throughout the period of illness and related ancillary treatments.

Show an overhead transparency of the treatment/progress/observation chart highlighting the importance of its correct compilation. Note that the appropriate coma score should be chosen for the admission assessment, and that the same type of score should then be used for all observations on that patient.

A discussion in plenary should precede the presentation of the treatments which are not usually recommended. This will allow you to pinpoint the misconceptions that the learners may have on this matter.

Finally remind the learners that the use of paracetamol is suggested as an antipyretic in preference to aspirin, since the use of the latter is controversial in that adverse effects, especially in children, have been observed (bleeding, Reye's syndrome). Nevertheless if aspirin is the only choice then it should be used unless clearly contra-indicated.

A visit to a health facility should be arranged (ahead of time) in order to allow working groups to practice filling out the treatment progress/observation chart. Only upon return to the classroom should any discussion on deficiency be observed.

Assessment of recovery

Learning objectives

The learning objectives for this Unit are for the learner to:

- assess the extent to which the patient has recovered
- record any residual sequelae
- arrange for follow up
- write a summary of the events and outcome.

This is an important unit, although it happens to be short. It would be appropriate to organize group work based on the outcome of the health facility used for Learning Unit 6. The participants could be asked to write a summary of the events and outcome of cases seen.

A brief structured presentation and discussion session should highlight the importance of neurological sequelae in children and adequate follow-up. Ideally follow-up should continue until a child is completely well. Stress the importance of haematocrit one month after discharge especially if the patient was anaemic. Sequelae and their frequency should be discussed.

Working in groups the participants should develop a form for entering the relevant information for review and synopsis of patients being discharged from a health facility. It will be important to use the outcome of this exercise to emphasize the elements of such a synopsis.

Exercises in the diagnosis and management of severe malaria

Learning objectives

The learning objectives for this Unit, after having worked through the five case studies and having discussed the answers, are for the learner to have a very good knowledge of the :

- clinical features
- complications
- laboratory aspects
- chemotherapy
- management of severe malaria.

The tutor should satisfy himself that each of the participants has a good grasp of each and everyone of the above objectives in particular the chemotherapy and management of severe malaria. Poor knowledge of the latter is often responsible for the unacceptably high mortality of hospitalized patients.

Answer book available

Working in no more than three groups the learners should discuss each case study and come to a consensus on the answers to the questions to be answered.

No more than 30 minutes should be allowed for each case study.

In plenary each group should then present its findings for each case study in ten minutes, to be followed by a discussion of thirty minutes. This process is extremely important because of the problem solving

approach on which this module is based.

Sufficient time should be allowed to accomplish this properly and the cases should be taken in the sequence that they occur in the Learner's Guide.

As the tutor, you should be fully satisfied that all participants understand the reasoning behind the answers to each question before proceeding to the next case study.

Time should be allotted for a final round table discussion giving the learners full opportunity to clarify any issue that they may not have fully understood. You may wish to stimulate their active participation by way of a revision of the subjects. This gives you the opportunity to make a clear synthesis of the subject as a whole, prior to the post-test evaluation.

The suggested answers to the case studies, which should help you in the discussion session following the presentation of the group work, are set out in the following pages. They can be photocopied and used as handouts after the case studies have been completed.

Case study: Patient A

The place: a country where *P. falciparum* malaria is transmitted in forested areas but not in the main cities.

A woman aged 25 years is brought to the outpatient department of the central hospital in the capital. She is a local resident, the wife of a business executive, and is in the 32 week of her first pregnancy.

The patient became ill five days ago, with chills, sweating and headaches. An antibiotic was prescribed and her condition seemed to improve, but yesterday she developed rigors and persistent vomiting. A blood film at the local clinic revealed malaria parasites, and oral quinine (600 mg every 8 hours) was prescribed. She took two doses.

Today she has been referred to your hospital here because of restlessness and increasing mental confusion. Examination reveals a semiconscious woman, who is unable to converse. She withdraws her hand from a painful stimulus but cannot localize a stimulus applied to the sternum or forehead. There is no neck stiffness, jaundice, pallor or rash. Axillary temperature is 39°C, pulse 90 beats/min., blood pressure 110/70 mmHg. The uterine fundus is palpable (26-28 weeks), and the foetal heart can be heard.

Question 1

What tests are urgently required?

Answer: Blood glucose. Pregnant women are susceptible to hypoglycaemia with any stress or infection, and they are particularly likely to develop hypoglycaemia (due to hyperinsulinaemia) during treatment with quinine. This patient is pregnant and has already received some quinine; she has altered consciousness. Hypoglycaemia is therefore a strong possibility and must be checked for urgently.

Haematocrit and parasite density; because she is pregnant she may already be anaemic due to iron or folate deficiency and increased plasma volume. Malaria may rapidly exacerbate anaemia. The risk of developing pulmonary oedema is increased in patients with severe anaemia.

Lumbar puncture, and blood culture if possible. Meningitis may co-exist with malaria and can be impossible to identify without examination of the cerebrospinal fluid. Septicaemia may complicate severe malaria. In pregnancy there is increased susceptibility to bacterial infections - e.g. pneumococcal - including septicaemia and meningitis.

Question 2

If the whole-blood glucose is 1.2 mmol/l, what treatment will you give?

Answer: Intravenous 50% dextrose, 20ml by intravenous bolus injection. Remember, hypoglycaemia may be recurrent and severe in pregnancy; monitor the blood glucose level frequently.

Question 3

If the blood film shows *P. falciparum* rings "++++", and the cerebrospinal fluid is normal except for low glucose, then:

- (a) What antimalarial drug will you administer and by which route?

Answer: Quinine by intravenous infusion. An alternative route for quinine is intramuscular, but the intravenous route is preferable in a centre where a drip can be set up.

- (b) Would you prefer an alternative to quinine because the patient is pregnant?

Answer: Malaria is more dangerous for this patient than quinine; she should receive quinine because it is the best available antimalarial for severe malaria. Studies have shown little oxytocic effect of quinine in these circumstances.

- (c) Would you give a loading dose of quinine?

Answer: A loading dose of quinine should not be given, because the patient has received quinine within the last 24 hours, and a loading dose may therefore lead to dangerously high blood levels of the drug.

- (d) What nursing procedures are important during this treatment?

An important nursing responsibility is in the control of the rate of infusion. If quinine is allowed to run too rapidly, hypotension and hypoglycaemia may develop and the patient may become dangerously overloaded with fluid. On the other hand, if the infusion is too slow, inadequate blood levels of the drug may be achieved, and the patient may become dehydrated. Meanwhile, care of the semiconscious patient is essential. As she is restless she must be protected from falling and from pulling out drip lines. Other important nursing procedures are discussed in the following sections.

Question 4

After six hours the patient becomes increasingly restless. The respiratory rate increases to 40/minute. The blood glucose level is normal. Under these conditions, what special observations would you make?

Answer:

Look for evidence of pulmonary oedema, which may complicate falciparum malaria, especially in pregnancy.

Review the urinary volumes passed, the volumes of intravenous fluid (including glucose) given, and the fluid balance. This emphasizes the need for precise monitoring and recording of fluid intake and output - another important responsibility of those who nurse the patient.

Assess the central venous pressure (clinically or, if possible, with the help of a central venous pressure line).

Examine carefully for gallop rhythm, basal crepitations and hepatic enlargement.

Question 5

A chest X-ray gives the picture shown (Fig. 10). What is the diagnosis and treatment?

Answer: This picture could be pulmonary oedema or adult respiratory distress syndrome (ARDS). The mechanisms of these two conditions are different, but the clinical and radiological pictures are similar. Both are grave complications. The most important treatment is to correct fluid overload if present, using intravenous diuretics, fluid restriction and even careful venesection. ARDS requires assisted ventilation with careful attention to blood gases; even with these facilities the prognosis is poor.

Question 6

What other observations are particularly important in this patient?

Answer: Foetal heart rate. Foetal distress is common in malaria, especially if there is high fever. Assisted vaginal delivery or even Caesarian section must be considered if foetal distress is severe.

Question 7

What is the first question that you would ask this patient's relatives?

Answer: Ask about travel - when had she visited parts of the country where transmission of malaria occurs? Had she received a blood transfusion in the recent past (an alternative source of malarial infection)?

Case study: Patient B

The place: a rural clinic in a hyperendemic *P. falciparum* area. Various antimalarial drugs are available, but intravenous infusions cannot be given.

A child aged 20 months became feverish two days ago and has vomited several times today. One hour ago the child had a convulsion, described by the mother as a repetitive twitching of limbs and mouth, followed by unresponsiveness for a few minutes. The child is now febrile (39°C), conscious, and able to localize and respond to a painful stimulus. A thick blood film shows *P. falciparum* rings "++++". The child repeatedly vomits any antimalarial drug given by mouth.

Question 1

- (a) Does the child have cerebral malaria?

Answer: The fact that the child is now fully conscious suggests that the convulsion was a "febrile convulsion" rather than a component of cerebral malaria. Convulsions occur in cerebral malaria but they are not followed by a rapid recovery of consciousness.

- (b) What should you do about the convulsion?

Answer: Make sure that the risk of a further convulsion is minimized by reducing the child's temperature (paracetamol, tepid sponge and fan).

Question 2

The district hospital is 30 km away; the journey will probably take several hours by bus.

- (a) Should the patient be referred to hospital?

Answer: The decision to refer will depend on facilities at the health centre. This child needs antimalarial drugs and fluids, and should receive these at a centre able to give them and able to observe the child's progress carefully.

- (b) What treatment would you give meanwhile?

Answer: Because the child is persistently vomiting, the first dose of antimalarial drug should be given parenterally. Ideally, this should be by slow intravenous infusion, but since this is not possible in this case, it may be given by intramuscular injection: quinine (10 mg salt/kg) or, if most local parasites are known to be chloroquine sensitive, chloroquine (2.5 mg/kg intramuscularly).

Recent studies suggest that a loading dose of quinine (20 mg salt/kg) can safely be given by the intramuscular route, as long as the patient has not received quinine or quinidine in the preceding 24 hours or mefloquine in the preceding 3 days.

A reasonable approach is to give quinine 10 mg/kg intramuscular immediately, then 10 mg/kg intramuscular (the remainder of the loading dose) after 4 hours).

Because of the history of a febrile convulsion, make sure the mother continues to give her child tepid sponging and fanning to reduce the risk of further convulsions.

This child may cease to vomit soon after the injection, especially if the temperature has been successfully lowered. It may then be possible to continue treatment by mouth, without referral to a larger centre.

Question 3

The child successfully took the second and third doses of quinine by mouth and was brought back to the clinic the next day; there had been little change; the child was still febrile, and the parasitaemia was similar to the previous day.

Does this suggest that the child has drug-resistant malaria?

Answer: No. Fever commonly persists, and the degree of parasitaemia may remain similar for up to 24 hours after the start of treatment, even if the parasite is fully sensitive to the drug being given. By 48 hours, however, the density of parasitaemia should be greatly reduced and the patient should be considerably better.

Question 4

The child was well and aparasitaemic on the third day, and went on to complete a seven-day course of oral quinine. At the end of that time a further blood test showed gametocytes "+".

What should be done about the gametocytes present in the blood after treatment?

Answer: Gametocytes are commonly found in the blood for several days or even weeks after successful treatment of falciparum malaria; they do not indicate failure of treatment, and no action is required.

Case study: Patient C

The place: a country where *P. falciparum* is hyperendemic.

The patient, a 28-year-old male economist, was born and brought up locally, but attended university in Northern Europe for five years. He returned home last month.

One week ago he developed fever. He decided this could not be malaria because he had grown up in a malarious area and believed he was therefore immune. Two days ago he became confused, especially at night. He stayed in bed and was attended by a servant who today called the doctor because the patient was increasingly confused. The last urine he had passed was a small volume of very dark fluid 24 hours ago.

On examination, the patient was a well nourished adult man. He was a-febrile (rectal temperature 36.5°C). He was restless but could make brief appropriate answers to questions, and could localize the site of a painful stimulus. He was jaundiced and his mucous membranes were pale. There was some bleeding from the gums, and there were a few retinal haemorrhages in each eye.

Question 1

- (a) What is the differential diagnosis?

Answer: Consider all diseases that may progress to encephalopathy with jaundice: fulminant hepatitis, yellow fever, other viral fevers, relapsing fever, septicaemia, lobar pneumonia (which is commonly accompanied by jaundice), leptospirosis, alcohol excess, sickle crisis, trypanosomiasis, etc.

Nevertheless, in the circumstances of this patient, in particular the failure to pass urine, severe falciparum malaria must be the most likely diagnosis.

Retinal haemorrhages are common in severe malaria, and do not on their own indicate the presence of abnormal bleeding tendency.

- (b) Was the patient right to think he was immune to malaria?

Answer: No. immunity to malaria is partial, and may be almost completely lost after an absence of a few years from the endemic area.

Question 2

The thick blood film shows *P. falciparum* "++++" and the thin blood film shows that 26% of red cells are parasitized.

- (a) What else would you look for in the thin blood film?

Answer: Platelets. Thrombocytopenia is usual in falciparum malaria, but may be particularly severe in this patient who has signs of a bleeding tendency. Severe thrombocytopenia may be evident on a thin blood film.

- (b) What other tests would you do to investigate the bleeding tendency?

Answer: Platelets count and prothrombin time. In addition a bedside test that might be positive in the presence of a low platelet count is Hess's test. If possible it would be interesting to know the plasma fibrinogen and fibrin degradation products

(FDPs). If the platelet count and plasma fibrinogen are very low in a patient with spontaneous bleeding, the bleeding can be attributed to disseminated intravascular coagulation (DIC). However, if only the thin blood film can be done, scantiness of platelets in the presence of bleeding in a patient with malaria suggests DIC: Hess's test may or may not be positive. The best bedside test for the presence of abnormal bleeding due to DIC is the bleeding time (described in Learner's Guide, page 34). In this patient this is likely to be prolonged, since there is abnormal bleeding spontaneously from the gums. A record of bleeding time would be useful in order to monitor progress in response to treatment.

- (c) What treatment is needed for the bleeding?

Answer: Fresh blood transfusion (HIV negative). Alternatives that are rarely available are fresh frozen plasma (this replaces fibrinogen but not platelets) and platelet-rich-plasma. Vitamin K is not helpful since the bleeding is not due to vitamin K deficiency. Since this patient may need blood transfusion for malarial anaemia also, it would be wise to prepare urgently as many safe units of whole fresh blood as possible. It is assumed that specific treatment for malaria has already been given.

Question 3

The patient has not passed urine for 24 hours. What kind of investigations and actions are appropriate?

Answer: Palpate the abdomen to see if the bladder is distended. Try to get the patient to pass urine. If he cannot, catheterize with **full sterile** procedure, in order to record urine volumes carefully. Test the urine (if any) by all routine methods and if possible, for sodium concentration and specific gravity. The management needed is then that of any patient with suspected acute tubular necrosis - i.e. attempt to correct any underhydration by careful saline infusion (urine specific gravity >1.015 and sodium <20 mmol/l suggests dehydration), and if necessary, use drugs such as furosemide and dopamine to attempt to achieve flow of urine. Measure plasma urea, creatinine and electrolytes if possible; an electrocardiograph helps to demonstrate hyperkalaemia. If acute tubular necrosis becomes established, intensive care is required, with peritoneal dialysis or haemodialysis if necessary.

Question 4

15 ml of dark brown urine was obtained by catheter. The urine 'stix' tests revealed albumin "++", blood "++++", bilirubin "++", urobilinogen "++". Microscopy of the urine showed no cells and a few casts

How do you interpret the results of the urine test?

Answer: The presence of "blood" in the urine (i.e. haemoglobin) in the absence of red blood cells indicates that there is free haemoglobin in the urine, as a result of intravascular haemolysis, a complication of severe falciparum malaria. Bilirubinuria indicates that there is some increase in the conjugated bilirubin in the plasma, as a result of hepatic involvement in malaria. Urobilinogen appears in the urine when there is unconjugated hyperbilirubinaemia, as in haemolysis. Proteinuria is usual in the presence of acute tubular necrosis, which is the commonest form of renal failure to complicate falciparum malaria.

Question 5

Acute renal failure is confirmed. Is it possible that the kidneys may recover?

Answer: Yes. In acute tubular necrosis, recovery commonly takes place within a period of a few weeks. It is therefore important to keep the patient alive, if possible, by dialysis (usually peritoneal dialysis) - because full recovery is then likely, without the need for continued long-term dialysis.

How should quinine therapy be given to this patient with acute renal failure?

Answer: If acute renal failure is confirmed, the first dose of quinine should be the same as in any patient with severe malaria, but if acute renal failure becomes established, doses should be reduced by 50% from the third day onwards.

NOTE: peritoneal dialysis can be life-saving and is achievable without excessively expensive equipment. However, it requires experience and competence. Guidelines for indications and methods of peritoneal dialysis are available and should be taught to hospital staff who may be responsible for management of patients with severe malaria. Fortunately, acute renal failure is very rare in African children with severe malaria.

Case study: Patient D

The place: a country with hyperendemic *P. falciparum* malaria in low-lying areas but no malaria transmission on the high central plateau.

A nineteen-year old woman was brought to a clinic in the malaria-endemic area. The medical officer recorded that the patient gave a history of fever for the past three days with rigors and vomiting. On examination she was febrile (axillary temperature 39°C) and slightly jaundiced. She was fully conscious. Because she had never been out of the country, the doctor considered it unlikely that she was suffering from *P. falciparum* malaria, but nevertheless checked a thin blood film. No malaria parasites were seen on the film so he diagnosed hepatitis and advised rest and a fat-free diet.

Question 1

No ! Because the doctor did not take into consideration the history and investigation.

Answer:

- (a) Poor knowledge of the epidemiology of malaria in the country. The medical officer considered malaria unlikely because the patient had not been out of the country. He/she should have enquired about the patient's travel history: if the patient had lived all her life in the highlands, she would be highly susceptible to malaria when visiting the lowlands. The possibility of blood transfusion and contact with jaundiced persons should also be enquired.
- (b) Inadequate knowledge of procedures for laboratory malaria diagnosis. A diagnosis of malaria was dismissed because there were no malaria parasites on the thin film. It is much easier to identify a scanty parasitaemia on a thick film than a thin film. A thick film should have been done. Even if that was negative for malaria parasites, the doctor should have been prepared to consider a diagnosis of malaria and repeat the film after a few hours. Laboratory test to detect serum bilirubin and SGOT levels should have been performed.

Question 2

Two days later the patient was brought back to the clinic by anxious relatives. She had become drowsy and was not answering questions properly. On examination the patient was afebrile, slightly jaundiced and confused. She could not answer questions but could withdraw her hand from a painful stimulus. The possible diagnoses considered were fulminant hepatitis, sickle cells crisis, relapsing fever and cholecystitis. Malaria was ruled out because she was apyrexial. Treatment was started urgently with tetracycline intravenously and enemas to empty the large bowel. She remained unconscious and her temperature rose to 38°C.; a blood film now revealed scanty *P. falciparum* parasitaemia. This was considered 'probably incidental' because low-grade parasitaemia was common among young adults in the area, but "to cover malaria", chloroquine was prescribed: 600 mg intravenously, to be followed by 300 mg intravenously every eight hours.

What errors were made:

- (a) in clinical judgement?

Answer: First, malaria was ruled out because she was afebrile. Malarial fever is variable and a single measurement is never sufficient to indicate the absence of malaria. Some patients with severe malaria remain afebrile for long periods despite being severely ill.

Second, the low-grade parasitaemia was considered unimportant. Patients with severe malaria usually do have heavy parasitaemia, but some patients have low-grade peripheral parasitaemia despite having severe and complicated malaria. This is because of withdrawal of trophozoites and sequestration of parasites in the capillaries of the internal organs.

- (b) in patient treatment?

Answer: First, a young woman should not be treated with tetracycline unless she is definitely known to be non-pregnant. No mention is made of any attempt to discover whether she is pregnant. Tetracycline is also likely to be harmful in viral hepatitis, thus this disease should be excluded.

Second, intramuscular chloroquine was prescribed. This is satisfactory treatment for non-severe falciparum in areas where there is little chloroquine resistance, but for this patient with complicated disease, intravenous quinine is the treatment of choice.

Question 3

The next day the patient was increasingly febrile and the parasitaemia had increased, so quinine 20 mg base/kg was given to run intravenously over one hour in normal saline, to be repeated 8-hourly. Twenty-four hours later the patient became increasingly breathless. There were no signs in the chest but pneumonia was diagnosed and treated with penicillin. After a further twelve hours the patient was still breathless and suddenly had a convulsion. Her level of consciousness deteriorated and she died ten hours later.

- (a) What errors were made in administration of quinine?

Answer: Quinine 20 mg **base**/kg. This dose is too high; a loading dose is 20 mg of quinine dihydrochloride **salt** (16.7 mg base)/kg. One hour is too quick for an intravenous infusion (especially of a loading dose) of quinine; three or four hours is preferable.

- (b) What errors were made in diagnosis of clinical complications?

Answer: When the patient became breathless a diagnosis of pulmonary oedema, or of respiratory distress syndrome, should have been considered, especially in this patient with severe malaria who has been on a saline infusion: the venous pressure should have been assessed, fluid balance reviewed and, if possible, a chest X-ray should have been done.

When a patient on a quinine infusion has a convulsion or becomes more deeply unconscious - especially if she is or may be pregnant - the blood should be tested for glucose concentration. Hypoglycaemia may complicate the use of quinine, and requires immediate correction.

Case study: Patient E

A four-year-old girl is brought to the outpatients department of your hospital by her mother, late in the evening.

The child was well until yesterday morning (36 hours ago), when she began to have fever. Yesterday she took meals but seemed listless; today she has refused food, but has drunk a little. The mother says the child had a "fit" this morning; she regained consciousness immediately. For the past few hours the child has been increasingly drowsy, and for the last hour has been unconscious.

At the examination the child is a well-nourished, unconscious, not dehydrated. The axillary temperature is 40.2°C; pulse 120/beats/min, regular; blood pressure 90/70 mmHg. No neck stiffness. Pupils are equal; a few retinal haemorrhages seen; no papilloedema. Some yellowish sticky fluid is seen filling the left external auditory meatus. Reflexes are normal. No rash.

Question 1

If facilities are limited which laboratory tests are essential for this child as a guide for immediate action?

Answer:

- (a) Blood films for malaria parasites.
- (b) Blood glucose.
- (c) Lumbar puncture.
- (d) Haematocrit.

These tests should be possible in any centre seeing ill patients. Whether other tests are done may depend on the results of the above tests, and on available facilities - blood culture, chest X-ray, biochemical studies. They are less likely to add substantially to the value of careful clinical assessment in the planning of immediate treatment.

Question 2

- (a) Why does the blood glucose test have the priority in this case?

Answer: Hypoglycaemia may complicate any childhood fever, including malaria (White, *et al* 1987; Taylor *et al*, 1988) and dysentery (Bennish *et al* 1989). Hypoglycaemia cannot be easily recognized clinically, so must be tested for; immediate correction can reverse coma and prevent cerebral damage.

- (b) Should you wait for the result of the blood glucose test if it will take 2 hours?

Answer: In this patient 2 ml venous blood was taken into a fluoride oxalate sample tube and sent to the laboratory to determine the blood glucose. However, two hours is too long to wait. If the child is hypoglycaemic this should be corrected at once.

- (c) If not, what should you do?

Answer: either do a bedside test for whole-blood glucose (finger-prick and test "stix") or, if that is not possible, give 50% dextrose 1 ml/kg by intravenous injection.

Question 3

In this child a "stix" test on finger-prick capillary blood revealed a glucose level of 1.0 mmol/l (18 mg dl). 50% dextrose intravenously was given, but the child remained unconscious.

What does this suggest?

Answer: There is another cause of coma in addition to hypoglycaemia. Alternative possibilities are: that insufficient dextrose has been given; or that hypoglycaemia has already been prolonged enough to cause brain damage. In this case it is likely that continuing coma is due to malaria itself.

Question 4

Figure 11 is the thick and thin blood film from this patient as seen under the high power microscope (magnification x700).

- (a) What does the blood film show?

Answer: Malaria: all parasites are at the "ring" stage, and the infection is extremely heavy ("++++").

- (b) What species of parasite is present?

Answer: For these reasons it is almost certainly *P. falciparum*. This patient needs urgent treatment; an accurate count of the parasitaemia can wait until treatment is started.

- (c) How heavy is the infection?

Answer: It is very important to have a rough idea of how heavy the parasitaemia is because children with heavy parasitaemia are at greater risk of death. Remember that all parasitized red cells will be destroyed: therefore a patient with heavy parasitaemia will have a large drop in haemoglobin level over the next few hours; knowing the approximate degree of parasitaemia can help predict the need for blood transfusion in good time.

- (d) How could you quantify it more accurately?

Answer: Methods of quantifying parasitaemia are discussed in Appendix I.

Question 5

This child has *P. falciparum* parasitaemia "++++" with hypoglycaemia:

- (a) Does this exclude a diagnosis of meningitis?

Answer: In highly endemic areas the children may have heavy parasitaemia without severe illness. The fever and coma in this child may be due to something else and meningitis is a possibility.

- (b) If stiffness of neck is absent, is it still necessary to do the lumbar puncture?

Answer: The absence of neck stiffness does not exclude meningitis, since young children with meningitis may have no neck stiffness especially if deeply unconscious, sedated or post-ictal. Therefore, lumbar puncture is still indicated.

- (c) Does clear colourless fluid exclude meningitis?

Answer: Not quite, but it makes it less likely. A child as ill as this from meningitis would be highly likely to have cloudy cerebrospinal fluid. But remember, you need 400 cells/mm³ in cerebrospinal fluid to make it visibly cloudy, so a fluid containing 300 cells/mm³ might be clear. Microscopy of the fluid should therefore be carried out if possible.

Question 6

If in this patient microscopy of the cerebrospinal fluid revealed 3 wbc/mm³ and 7 rbc/mm³ (normal).

- (a) Could the ear discharge be important in this patient?

Answer: If the child has chronic middle ear disease, a cholesteatoma may have developed and infection could have spread to the brain or meninges. Intracerebral, subdural or extradural abscess - or meningitis - could result. However, the normal C.S.F. findings exclude meningitis.

- (b) What should be done about it?

Answer: The external meatus should be mopped out carefully so that the ear drum can be examined. In this child remnants of an insect were found in the external auditory meatus; after gentle mopping with cotton-wool on a stick, the drum was seen to be normal.

Question 7

What is your decision on how to proceed with antimalarial treatment?

- (a) Which drugs to use?

Answer: The decision may be guided by a national or regional policy. Otherwise consider: known local parasite drug-sensitivities; drug availability.

- (b) Which route to use?

Answer: Choice between i.v., i.m., or nasogastric tube depends on available skills and staffing. See Appendix II (simplified Table 1) (Warrell, *et al*, 1990; Gilles, 1991).

- (c) What dosage schedule to use?

Answer: For dosage, see Appendix II (White, *et al*, 1987).

Question 8

Apart from antimalarial drug(s), is any other drug therapy indicated for this patient?

Answer: Consider specific treatment for:

- **Fever.** Paracetamol is an effective antipyretic, which can be given by suppository. While waiting for this to have an effect (or if it is unavailable), apply tepid-sponging and fanning - the child's mother (or father) may be pleased to help with this. Fever is only dangerous if very high, moderate fever ($<39^{\circ}\text{C}$) may have some beneficial effects on host response and some anti-parasitic action.
- **Convulsions.** Anticonvulsant drugs given on admission will reduce the frequency of convulsions in adults (White *et al*. 1988),

and the same result is likely to be achieved in children in whom convulsions are linked with poor prognosis (Molyneux *et al.* 1989). However, in children with convulsions due to high fever or hypoglycaemia, correcting these abnormalities may be sufficient to prevent further convulsions.

- **Complicating infection.** Septicaemia occasionally complicates severe malaria (Warrell *et al.*, 1982), although this was not encountered in a large series of Malawian children with cerebral malaria. Other potential bacterial infections include aspiration pneumonia, and urinary tract infection if the patient is catheterized. These complications should be looked for and only treated if they develop.

Question 9

How should fluid replacement be given?

Answer: Assess each individual's requirements. Pay special attention to:

- Prevention or correction of hypovolaemia, because the patient with severe malaria is at risk of developing acute renal insufficiency.
- Prevention or correction of fluid overload, especially if renal failure has developed; pulmonary oedema may result from fluid overload, and may also be a direct complication of severe malaria.
- Prevention of hypoglycaemia. Children who are fasting are liable to develop hypoglycaemia, especially during a febrile illness; furthermore, quinine promotes pancreatic insulin secretion. The likelihood of hypoglycaemia developing can be reduced by maintaining a continuous 5% dextrose infusion (e.g. 80 ml/kg/24hr).

Question 10

The patient's haematocrit is 19%. What are the implications of the levels of parasitaemia and haematocrit in this patient?

Answer: Blood transfusion may be lifesaving, but because of its dangers should only be used if strongly indicated. Do not apply rules of thumb (e.g. a haematocrit level) but assess the individual. In this case, the degree of parasitaemia will help with the decision. A count on the thin film indicates 29% of red cells are parasitized.

(a) Would you transfuse?

Answer: At least 29% of this child's red cells will soon be destroyed. The real figure may be higher:

- Because non-parasitized RBCs may also be lysed.
- Because the total body parasitaemia may be considerably higher than 29%, with many parasitized RBCs being sequestered in deep tissues.

You can therefore predict a fall of haematocrit at least to 12%; transfusion is therefore indicated.

(b) If blood transfusion is or becomes necessary, how would you give the blood?

Answer: The need in this child will be for red cells, not blood volume or plasma factors; packed cells should therefore be infused.

Question 11

What clinical observations would you make during the course of treatment in this patient?

Answer: Important physical signs to record include:

- Vital signs (temperature, pulse, respiratory rate, blood pressure).
- Level of consciousness (we suggest scoring system - see page 36 in part I, Learner's Guide).
- Occurrence of any convulsions or other clinical events.
- Urine output.

- Signs of dehydration or overhydration (skin, jugular venous pressure, heart, lung bases, liver size).

Question 12

What laboratory tests would you repeat (and when) during treatment?

Answer:

- Haematocrit at least 12 hourly.
- Parasite count 12 hourly until negative.
- Whole-blood glucose - frequency depends on condition. Repeat immediately with any convulsion or deterioration of consciousness.
- Creatinine, electrolytes if urine output impaired.
- Blood culture if fever and coma fail to resolve or if state of shock develops.

Question 13

What should be done if the patient fails to pass urine?

Answer: Catheterise with full sterile procedures; correct any volume-depletion, attempt general measures to forestall acute renal failure - furosemide, dopamine. If oliguria persists, instigate management for acute tubular necrosis: careful fluid balance, regular creatinine/electrolyte checks, peritoneal dialysis when indicated for fluid overload or hyperkalaemia. In these circumstances the dose of quinine should be reduced by 50% from the third day onwards. Refer to central hospital if necessary.

Question 14

What should be looked for after the child has recovered?

Answer: Assess neurological recovery. Sequelae may occur, especially in children who have been hypoglycaemic or have had repeated convulsions. Neurological sequelae include blindness, deafness, motor impairments and disorders of behaviour and intellect. There is often considerable recovery over time.

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Appendix 1

Enumeration of malaria parasites

In addition to definitive diagnosis of malaria and differential diagnosis of the species of malaria parasites, microscopical examination also enables their number in a unit volume of blood to be determined. Knowledge of the degree of parasitaemia is of diagnostic and prognostic value in the case of severe *P. falciparum* malaria infection and also helps in following up the changes produced by treatment.

Methods of counting malaria parasites in thin blood films

To count parasites as a percentage of red cells on the thin film, use two tally counters, one for red cells and the other for parasites. Count all the red cells in an oil immersion field, then all the parasites in the same field. Repeat the exercise until 500 red cells have been counted. Percentage parasitaemia is then the total number of parasites \times 100 divided by the total number of red cells counted.

$$\text{Percentage parasitaemia} = \frac{\text{No. of parasites counted (total)}}{\text{No. of red blood cells counted (total)}} \times 100$$

Methods of counting malaria parasites in thick blood films

1. Parasites per μ l

The following is a practical method of adequate accuracy. It is based on the number of parasites per μ l of blood in a thick film, these being counted in relation to a predetermined number of leukocytes. An average of 8000 leukocytes per μ l is taken as the standard. Despite inaccuracies due to variations in the number of leukocytes between individuals in normal health and greater variations in ill health, this standard allows for reasonable comparisons. Before counting begins, the equivalent of 0.25 μ l of blood (about 100 fields, using a 7 \times ocular and a 100 \times oil-immersion objective) should be examined in the thick film to determine the parasite species and stages that may be present.

When this has been established, a suitable counting method for positive blood films is:

1. Two tally counters are required to count parasites and leukocytes separately.
2.
 - (a) If, after 200 leukocytes have been counted, 10 or more parasites have been identified, record the results in the record form, showing parasites per 200 leukocytes;
 - (b) If, after 200 leukocytes have been counted, 9 or less parasites have been counted, continue counting until 500 leukocytes have been counted and record the parasites per 500 leukocytes.
3. In each case, the parasite count in relation to the leukocyte count can be converted to parasites per μl by the simple mathematical formula:

$$\frac{\text{No. of parasites} \times 8000}{\text{No. of leukocytes}} = \text{parasites per } \mu\text{l}$$

This means that if 200 leukocytes are counted, the parasites are multiplied by 40, and if 500 leukocytes are counted the parasites are multiplied by 16.

4. It is normal practice to count all the species present and to include both sexual and asexual parasites together. Occasionally a separate count is made of the gametocytes of *Plasmodium falciparum* but when this is done, they should still be included in the general parasite count. It is rarely possible to separate the gametocytes of *P. vivax* or *P. malariae* from the asexual parasites with sufficient accuracy to justify a gametocyte count.

II. The Plus System

A more simplified method of enumerating parasites in thick blood films is to use the plus system. This indicates the relative parasite count and entails using a code of from one to four pluses, as follows:

+	= 1-10 parasites per 100 thick film fields	4-40 parasites per mm^3
++	= 11-100 parasites per 100 thick film fields	40-400 parasites per mm^3
+++	= 1-10 parasites per one thick film field	400-4000 parasites per mm^3
++++	= more than 10 parasites per one thick film field	4000-40000 parasites per mm^3

This system should be used only when it is not possible to undertake the more acceptable parasite count per μl of blood.

Appendix 2

Table 2. Antimalarial chemotherapy of severe falciparum malaria in adults and children

Chloroquine-sensitive malaria Chloroquine 5 mg base/kg of body weight in isotonic fluid by constant-rate intravenous infusion over 6 hours, calculated from the beginning of the previous infusion (continuous administration) for a total of 5 doses or (If intravenous infusion is not possible) chloroquine 3.5 mg base/kg of body weight every 6 hours intramuscularly or subcutaneously ^a	Chloroquine-resistant malaria or sensitivity not known Quinine dihydrochloride 20 mg salt/kg of body weight (loading dose) by infusion over 4 hours, in 5% dextrose saline (5-10 ml/kg of body weight depending on the patient's overall fluid balance). Eight to twelve hours after the start of the loading dose, given a maintenance dose of quinine 10 mg salt/kg of body weight dextrose saline diluted as above over 4 hours. This maintenance dose should be repeated every 8-12 hours, calculated from the beginning of the previous infusion, until the patient can take oral medication ^b (e.g. 08h00, 16h00, 24h00). <u>Note:</u> Use quinine every 12 hours in areas without known quinine-resistance. Use the 8-hourly regimen where there is known or increasing quinine resistance.
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^a Total dose 25 mg base/kg of body weight; change to oral therapy when patient can swallow.

^b The choice of oral medication will be governed by drug availability and sensitivity of the parasites. The following may be used:

- quinine tablets, 10 mg/kg of body weight, every 8 hours, to complete 7 days of treatment or a single dose of sulfadoxine/pyrimethamine (Fansidar) following a shorter course of quinine.
- sulfadoxine/pyrimethamine (Fansidar) or sulfalene/pyrimethamine (Metakelfin) as a single oral dose; sulfadoxine/sulfalene, 25 mg/kg of body weight; pyrimethamine, 1.25 mg/kg of body weight. These drug combinations should preferably not be given to pregnant women.
- mefloquine, 15 mg/kg body weight up to a maximum of 1000 mg, in two doses 12 hours apart. Mefloquine should not be administered until 12 hours have elapsed after the completion of parenteral quinine administration. This drug should not be given to women in the first trimester of pregnancy.

Some important points to note in relation to Table 2.

1. In areas with a significant degree of quinine resistance (e.g. Cambodia, Thailand, Viet Nam), add an oral course of tetracycline 250 mg four times a day for 7 days, as soon as the patient can swallow. It is unnecessary and dangerous to give tetracycline intravenously. Tetracycline is contraindicated for children under 8 years and pregnant women. As an alternative, mefloquine could be given as indicated in footnote b to Table 2.
2. In patient requiring more than 48 hours of parenteral therapy, reduce the quinine or quinidine maintenance dose by one-third to one-half (i.e. 5-7 mg salt/kg of body weight every 8-12 hours).
3. Total daily doses of intravenous quinine are as follows:
 - day 0 (first day of treatment): 30-40 mg/kg of body weight
 - day 1: 20 mg/kg of body weight
 - day 2 and subsequent days: 15 mg/kg of body weight

It is unusual to have to continue intravenous infusions of quinine for more than 4-5 days. In children the infusion can usually be stopped after 1-2 days.
4. If it is more convenient, quinine may be given by continuous infusion. (Infusion rates should not exceed 5 mg per kg of body weight per hour.)
5. A loading dose should **not** be used if the patient received quinine or quinidine within the preceding 24 hours, or mefloquine within the preceding 24 hours.
6. If for some reason quinine cannot be administered by infusion, quinine dihydrochloride can be given in the same dosage by intramuscular injection in the anterior thigh. The dose of quinine should be divided between two sites - half the dose in each anterior thigh. If possible, for intramuscular use, quinine should be diluted in sterile normal saline to a concentration of 60 mg/ml.

Directions for writing multiple-choice questions

1. Make certain that the stem consists of a complete statement, not just a single word.
2. Place all common elements in the stem of the item. This adds simplicity and compactness to the item.
3. Make each item completely independent of answers to other items (for instance, the stem of one should not suggest the answer to another).
4. Eliminate all unrelated details from an item.
5. In general, avoid negative statements, but if a negative expression does appear in the stem of the question, underline it to draw the student's attention to it.
6. Use *plausible* or logical *distractors*. Each distractor should, by its content or nature, be such that it appears to have something to do with the question. Unrelated distractors appear silly to a thoughtful examinee. Since the number of possible answers is thereby cut down, the item loses some of its value.
7. Avoid the use of clues that may suggest the correct answer.
8. Be sure that the distractors and the correct response possess homogeneity, that is, they should be fairly similar in content or in the total number of words.
9. Be cautious of the use of "none of the above" as a distractor or as a correct answer.
10. If it is impossible to obtain more than three plausible responses, do not waste time trying to invent some others.
11. When dealing with items that have numerical answers, arrange the answers in order from large to small or vice-versa.
12. Arrange the place for the correct answer in such a way that, for the test as a whole, no letter corresponding to a given answer appears more frequently than some other letter.

Examples of multiple-choice questions

One "best response" type

Question 1

In differentiating cirrhosis of the liver from chronic constrictive pericarditis, a useful physical sign is:

- (a) hepatomegaly;
- (n) ascites;
- (c) distension of the neck veins;
- (d) pitting oedema of the ankles and legs;
- (e) splenomegaly.

Question 2

Active immunisation is available against all of the following diseases *except*:

- (a) tuberculosis;
- (b) smallpox;
- (c) poliomyelitis;
- (d) malaria;
- (e) yellow fever.

The multiple-true-false type (also called "multiple-response item").

This type consists of a stem followed by several true or false statements. The candidate is to determine whether or not *each of the four* statements which follows

is true or false. He then responds according to a code which permits one out of five possible combinations or responses whereby one, two, three, or all four statements may be true.

- when properly written, the multi-true-false item type tests the student's knowledge or understanding of several related aspects of a substance, a disease, or a process;
- each of the statements or completions offered as possibilities must be clearly true or false. This is in contrast to the type "1" format in which alternatives which are "partially correct" may be used as distractors;
- this type of item should be written so that no two of the alternatives are mutually exclusively, i.e. the answer "all are correct" *must be a possible response*.

The directions for this item type are as follows:

For each of the incomplete statements below, *one or more* of the completions is correct. On the answer sheet blacken space under:

- (a) if only 1, 2 and 3 are correct;
- (b) if only 1 and 3 are correct;

- (c) if only 2 and 4 are correct;
- (d) if only 4 is correct;
- (e) if all are correct.

Question 3

A child suffering from an acute exacerbation of rheumatic fever usually has:

1. an elevated sedimentation rate;
2. a prolonged P - R interval;
3. an elevated antistreptolysin O titre;
4. subcutaneous nodules.

The matching type

Directions for constructing matching items

- Limit the number of entries to about 10. If situations arise where 20 or 30 entries must be considered, construct two or three matching items. When long lists have to be matched, the student wastes too much time in trying to find the correct response.
- Do not break items by the bottom of the page. The complete item should be on the same page.
- Have a longer list of questions than of possible answers and state in the directions that these may

be used more than once. When there are an equal number of questions and answers, it is possible for the student, after responding to some of them, to complete this task by elimination and guessing.

- Strive for homogeneity.

The directions given to examinees for this type of item are as follows:

"Each group of questions below consists of lettered headings followed by a list of numbered words or statements. For *each* numbered word or statement, select the *one* heading that is most closely associated with it and blacken the corresponding space on the answer sheet. Each lettered heading may be selected once, more than once, or not at all.

Examples:

Questions 4 to 9

- (a) increased metabolic activity;
 - (b) hyperinsulinism;
 - (c) lack of storage of glycogen in the liver;
 - (d) storage of an abnormal glycogen in the liver;
 - (e) decreased secretion by pituitary or adrenal glands;
4. adenoma of islets of Langerhans;

5. violent physical exercise;
6. hyperthyroidism;
7. Simond's disease;
8. Von Gierke's disease;
9. epidemic hepatitis.

demulcent which can be converted to liver glycogen.

The comparison type

The "comparison" type permits one to compare and contrast two diseases, signs, symptoms, laboratory findings, etc.

When using this type of item, one must be careful to:

Questions 10 to 14

- (a) sodium bicarbonate;
 - (b) sodium carboxymethylcellulose;
 - (c) aluminium hydroxide gel;
 - (d) none of the above;
10. a gastric antacid which is also used in the therapy of hypoparathyroidism because of its property of reducing the absorption of phosphorus;
 11. because it is absorbed, it may cause alkalosis, particularly in infants and elderly patients;
 12. a gastric antacid which has the disadvantage of causing "acid-rebound";
 13. a gastric antacid which precipitates and inactivates gastric pepsin;
 14. a gastric antacid and

- avoid the trivial;
- avoid selecting as one of the pair something that is rare or unusual. For example, if the item asks about the relation of a certain symptom to disease "x" or "y", and the frequency of the symptom in the two diseases is 90% and less than 1% respectively, then the examinee is in a dilemma. If he follows the principle of the "general rule", he may select answer A ("x" only); but if he is aware that the symptom does occur in the exceptional case of disease "y", then he may select answer C ("both"). Which response is correct?

The instructions for this type of item are as follows:

"Each set of lettered headings below is followed by a list of numbered words or phrases. For each numbered word or phrase, blacken the space on the answer sheet under:

- | | |
|--|-----------------------|
| (a) if the item is associated with (a) <i>only</i> . | (a) hookworm disease; |
| (b) if the item is associated with (b) <i>only</i> ; | (b) ascariasis; |
| (c) if the item is associated with both (a) <i>and</i> (b); | (c) both; |
| (d) if the item is associated with neither (a) <i>nor</i> (b). | (d) neither; |
15. eosinophilia;
16. hypochromic anaemia;
17. infection through the skin.
- Examples:**

Questions 15 to 17

Test and measurement, or the study of tests used in measurement techniques, is a fairly new science. It was introduced into the world of health sciences teaching about 50 years ago against some opposition, and the problem has certainly aroused the interest of teachers; however, some of them feel that the evaluation "specialists" are trying to poach on their preserves, and that this will limit their academic freedom. This is often due to a lack of information.

Better information would help to disarm the defence mechanisms displayed by teachers when the problem is tackled scientifically, and would thus reduce heated reactions.

If no reference is made to questions of the true-false type it is not a chance omission! They are really very bad and should not be used.

Questionnaire for evaluation of training

Instructions for completion of questionnaire

Use the following code to indicate the extent to which you agree or disagree with each of the statements made in the questionnaire:

- 1 Disagree strongly
- 2 Disagree
- 4 Agree
- 5 Agree strongly

These numbers are printed alongside each question. You should circle the number that corresponds most closely to your opinion.

The difference between options 1 and 2 and between options 4 and 5 is one of degree only. To oblige you to express a definite opinion, no code 3 has been included (except for question 12); this allows a "satisfaction index" to be calculated for each question.

Take your time over completing the questionnaire. You do not have to put your name on it if you would rather not, but *please answer the questions as frankly as possible.*

Section I. Overall assessment of the training activity

1. Overall the organization of the training programme was satisfactory. 1 2 4 5
2. The training programme covered all the subject matter in adequate detail. (If you disagree with this, state which subjects should have been given greater coverage.) 1 2 4 5

Comments:

3. The tutors and facilitators for this training course had sufficient knowledge and teaching ability to provide you with the necessary skills and competence. 1 2 4 5

Comments:

4. The time allocated to each part of the training was adequate relative to the total time available. (If you disagree with this, state which particular topic should have been allotted more or less time.) 1 2 4 5

Comments:

Section II. Relevance and usefulness of the different teaching methods

5. Overall, the teaching methods used in this training course were effective. 1 2 4 5
6. The use of the various teaching methods listed below was quite appropriate.

Large group presentations

1 2 4 5

Comments:

Practical demonstrations (laboratory)

1 2 4 5

Comments:

Laboratory work and facilities (including equipment)

1 2 4 5

Comments:

Field work

1 2 4 5

Comments:

Small group discussions

1 2 4 5

Comments:

Self-study

1 2 4 5

Comments:

Quizzes, tests and other evaluation exercises

1 2 4 5

Comments:

Section III. Assessment of teaching materials

7. The audiovisual materials (slides, overhead projection transparencies) used in the training were very helpful.

1 2 4 5

Suggestions for improvement:

8. The teaching materials provided were satisfactory in all respects.

1 2 4 5

Suggestions for improvement:

Section IV. Implementation of training; attitude of tutor and facilitators

9. The general atmosphere of the training course made this a good learning experience.

1 2 4 5

Comments:

10. Every effort was made to help you achieve the learning objectives.

1 2 4 5

Comments:

11. You were able to achieve all the learning objectives of the training programme.

1 2 4 5

Comments:

Section V. Overall evaluation of the training

12. What overall rating would you give to this training programme?
(Circle your response)

1 2 3 4 5
Lowest Highest

13. With regard to this training experience, state the following giving actual examples):

(a) the three aspects that impressed *you most favourably*

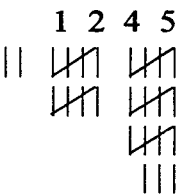
(b) the three aspects that impressed *you least favourably*

14. Do you have any additional comments regarding any aspect of the training programme? If so, please make them below.

Analysing response to the questionnaire

The following method will allow you to analyse the responses to the questionnaire quite simply and quickly. Take a fresh (uncompleted) copy of the questionnaire; against each question, mark the learners' responses. For example:

5. Overall, the teaching methods used in this training course were effective.



This shows that two learners considered the teaching methods were not effective while 28 agreed that they were effective.

Now multiply the number of answers by the corresponding coefficient:

$(2 \times 2) + (10 \times 4) + (18 \times 5) = 4 + 40 + 90 = 134$

The “satisfactory index” is calculated as a percentage. For the above example, the number 134 is multiplied by 20 (i.e. 100 divided by the maximum coefficient, 5) and divided by 30 (the number of learners):

$$\frac{134 \times 20}{30} = 89.3\%$$

Since the satisfaction index is calculated in such a way that 60% represents “average” satisfaction, you should make a note of any questions for which the index is below 60% (if there is none, identify the five questions for which the index is lowest and the five for which it is highest). Let the learners know the results of this questionnaire at the final evaluation session on the last day of the training programme.

Commonly used methods of teaching and their objectives

Teaching method

Audio tapes

May be used with large or small groups of learners or by the individual learner.

"Brainstorming"

Intensive discussion focusing on a single problem. Participants are asked to develop as many solutions as possible to a problem within a limited time - generally not more than 10 minutes. No critical evaluation of solutions is offered.

"Buzz-groups"

Groups of 2-4 people discuss a particular topic for a short time - generally no more than 5 minutes - within the context of a large-group lecture.

Purposes

- To guide practical work.
- As a variation in the method of presentation of material.
- For the acquisition of new knowledge.
- For developing new and creative ideas.
- As a prelude to detailed, in-depth problem-solving.
- To encourage all learners to participate.
- To develop group cohesion and encourage learners to help one another.
- To "rehearse" understanding and thus consolidate factual learning.
- To stimulate creative thinking.

Case discussion

Real or hypothetical problems are analysed in detail. Learners are encouraged to find solutions and make decisions.

- To help in understanding the facts underlying the problems and to eliminate misconceptions.
- To show how various principles are applied to real problems.

Controlled discussion

Under the control of the tutor, learners are encouraged to ask questions, raise problems and make comments following a lecture.

- To provide further consideration of factual learning.
- To bring together and synthesize the contents of a lecture and provide feedback to tutor and learners.

Demonstrations

Certain procedures are performed by the tutor to demonstrate skills that must be acquired by learners.

- To help develop learners' power of observation.
- To provide knowledge of principles as a prelude to learners practising the skills for themselves.

Video tapes

- For development of skills in interviewing, counselling, etc.
- To allow learners to see themselves "in action".
- To provide learners with direct feedback.

Free group discussion

Discussion in which the content and direction are principally under the learners' control. The role of the tutor is that of an observer.

- To develop effective small-group functioning.
- To help learners establish the practice of self-learning.
- To allow the tutor to observe developments in the learners' problem-solving skills.

Group tutorial

Tutorial with 12-15 learners. The subject and direction are usually, but not invariably, under the control of the tutor.

- To facilitate understanding of particular topics, and bring together ideas.
- To develop group-functioning skills.

Projects

Varied in format and content, but generally submitted as a written exercise by a small group of learners or by individuals.

- To develop skills in gathering organizing, applying and illustrating information in the context of a particular problem.
- To provide practice in the presentation of data.

Private reading

- To assist in acquiring and understanding new information.
- To assist the development of critical thinking skills.
- To develop an ability to select and retrieve relevant information.

Role-playing

Learners are assigned or select certain roles (e.g. village leader, mosquito collector), then create and act out typical situations. It is essential that the content of the role-play is discussed at length by participants and observers; without this, the exercise has little value.

- To develop "self-awareness", i.e. to help the learner appreciate the effect that his or her attitudes have on other people.
- To improve attitudes and behaviour by encouraging the learner to "get into the skin" of another person.

Seminar

Presentation of material by one learner to a group of fellow learners, followed by critical analysis and discussion. It is not essential that the tutor be present.

- To present new information.
- To help with understanding of new material.

Individual tasks

The type of task assigned to the individual learner may vary, but it will generally be a problem to be solved within or outside the classroom situation.

- To foster active, direct learning.
- To develop problem-solving skills.
- To provide a context in which the tutor can help learners to remedy particular weaknesses.

Lecture

The "classical" lecture is an uninterrupted talk by the tutor to a group of learners, generally lasting about 1 hour. The form may be modified and used in conjunction with "buzz groups", syndicate groups, etc.

- To transmit information.
- To impart general background knowledge of a particular subject.
- To synthesize a wide variety of information into a coherent whole.

Practical classes

Learners perform experiments, write up their results, and draw appropriate conclusions.

- To develop powers of observation.
- To develop familiarity with equipment and skill in its use.
- To develop problem-solving through collection, analysis and evaluation of data.

Problem-centred groups

Problem solving in the classroom situation by groups of 4-8 learners, partly under the direction of the tutor.

- To develop skills in analysing and solving problems and in decision-making.
- For practice in applying theoretical knowledge to "real" problems.

Step-by-step lecture

A lecture format linked to an organized around, for example, a set of 35-mm slides or a number of multiple-choice question.

- To impart new information and reinforce its understanding.

Step-by-step discussion

Working with a small group (8-10) of learners, the tutor directs a discussion centred on a particular issue or a set of pre-prepared questions. The intention is to draw out from the learners the required information.

- To present a new factual material.
- To help learners in the process of scientific and deductive reasoning and of drawing appropriate conclusions.

Syndicate group

The class is divided into groups of 4-6 people; all groups work on the same, or closely related, problems, with occasional teacher contact. Each group prepares a report, which is presented to the rest of the class. The syndicate group technique can be used in conjunction with tutorials.

- To develop skills in seeking out, organizing and presenting information.
- To foster cooperation between learners in planning, writing and presenting a report.

