Management of malaria at Juba Teaching Hospital: a clinical audit

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Introduction

Worldwide there are 247 million cases of malaria annually and nearly a million deaths [1,2]. In South Sudan, especially during the rainy season, malaria is responsible for most admissions and is the leading cause of mortality in the Medical Department of Juba Teaching Hospital (JTH).

The World Health Organisation (WHO) and the Ministry of Health, South Sudan offers clear guidance on the diagnosis and treatment [2,3] Malaria is divided into:

1. **Uncomplicated -** which can be treated with artemisinin combination therapy (ACT) such as AS/AQ (artesunate plus amodiaquine)
2. **Complicated -** which includes the following features:
    - **Shock:** tachycardia (pulse >100/minute), hypotension (BP <100/60).
    - **Jaundice** with end organ dysfunction (i.e. shock and / or organ failure).
    - **Impaired level of consciousness/convulsion** (may indicate hypoglycaemia and / or cerebral malaria).
    - **Anaemia** (haemoglobin (Hb) <5g/dl).
    - Signs of **renal failure:** acidotic breathing, metabolic acidosis (bicarbonate <15mM/L), serum creatinine >265µM/L.
    - **Haemoglobinuria** (urine test positive for blood without red blood cells seen on microscopy).
    - **Spontaneous bleeding** (may indicate disseminated intravascular coagulation - DIC).
    - **Acute respiratory distress syndrome** (ARDS).
    - **Hyperparasitaemia** (>5% of red blood cells with parasites in endemic areas such as South Sudan)
    - **Hyper-pyrexia** (fever >400C).
    - **Lactate** (>5mM/L).

The WHO guidelines recommend a variety of investigations and treatments for complicated malaria but many of these are not available in JTH. The South Sudan Guidelines are based on the WHO ones but are modified for use in South Sudan.

We have used the following key in the text below.

- Green: Test or treatment available at JTH
- Orange: Test or treatment available in a private clinic but is expensive
- Red: Test or treatment not available

General managment of complicated malaria

- Assess vital signs: temperature, pulse rate, blood pressure, respiratory rate, level of consciousness (Glasgow Coma Score/AVPU).
- Assess for complications: see Table 1.
- Perform the following investigations: blood film for malaria, glucose, full blood count, renal and liver function tests, coagulation screen, lactate, bicarbonate, blood gas analysis, blood cultures.
- Start treatment: first line is IV artesunate (quinine if IV artesunate unavailable). Randomised controlled trials have shown a 34% relative mortality reduction when compared to quinine (WHO 2010)
- WHO advise switching all patients to oral artemesinin combination therapy (ACT) once improved, no matter what IV anti-malarial was given. The South Sudan Guidelines advise switching all patients on IV quinine to oral quinine. Whilst either option was advised, the authors preferred the use of oral ACTs as there were no studies in South Sudan documenting quinine resistance, the side effect profile was better on ACTs, the dosing regime was twice daily and rather than three times a day and the course duration was three days on ACT as opposed to 7 days on quinine (IV and oral combined). The two latter factors would therefore improve patient compliance and increase the likelihood of complete eradication of the malaria parasite.

The specific management of the complications of malaria, according to the WHO and South Sudan Treatment Guidelines, is listed in Table 1.

The aim of this clinical audit was to:

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1. Use the WHO and South Sudan Treatment guidelines as the "Audit Standard" and
2. Compare the management of malaria in the Medical Department against these guidelines
3. Recommend strategies for improving malaria care.

Methodology

In July 2011, the case notes of 50 consecutive patients with malaria were analysed and the data in Table 2 were recorded as 'yes', 'no' or 'unknown' for each patient.

The answers to the questions were collected on a spreadsheet using an Apple Macintosh computer. Once collected, a variety of interventions were undertaken as follows:

1. Training of all (112) nurses in the detection and management of malaria and triage.
2. In association with the head of the Medical Department a malaria protocol was designed and displayed in the medical outpatients department (equivalent of a UK's Accident and Emergency Department).

Table 1. Management of complicated malaria

Complication Clinical features	Clinical features	Investigations/management
Cerebral malaria	Altered level of consciousness, convulsions.	Recovery position, maintain airway, nil by mouth. IV diazepam for convulsions and consider loading on phenytoin or phenobarbitone. **Consider CT head and lumbar puncture.** Other causes of coma e.g. hypoglycaemia, meningitis, must be considered. Serial assessments of level of consciousness using the GCS and / AVPU.
Hypoglycaemia (glucose <2.2mmol/l)	Altered level of consciousness, convulsions.	Blood glucose, 50ml 50% glucose.
Renal failure	Acidotic breathing, oliguria.	Metabolic acidosis (plasma bicarbonate <15mmol/l), creat >265umol/l. Exclude pre-renal causes. Carefully monitor fluid balance. Consider dialysis.
Shock	BP<100/60 and pulse >100.	Lactate >5mmol/l Fluid resuscitation: Fluid boluses with 0.9% normal saline or ringer lactate (unless in renal failure).
Evidence of severe intravascular haemolysis: •Severe anaemia (Hb<5g/dl) •Jaundice with end organ dysfunction. •Haemoglobinuria	Pallor, jaundice, "coca cola" coloured urine.	Hb, blood group, **bilirubin. Transfuse if Hb <5g/dl or more than 5 and symptomatic.**
DIC	Spontaneous bleeding.	Coagulation tests. Give fresh frozen plasma or whole blood if not available. Give vitamin K.
Acute respiratory distress syndrome (ARDS)	CXR signs and profound hypoxia.	Sit up, oxygen, furosemide and consider steroids, although there is very limited evidence of benefit.
Hyperpyrexia	Fever >400C.	Paracetamol if conscious. Tepid sponging if not able to take medications. Avoid nephrotoxic drugs such as diclofenac.
Super added septicaemia.		Use broad spectrum antibiotics if in any doubt.

Table 2. Data recorded for each patient

Audit Standard
Age, Sex, Residence
1. Recorded vital signs:
Pulse
Blood pressure
Respiratory rate
Temperature
Level of consciousness (GCS/AVPU)
2. Assessment for complicated malaria:
Shock (pulse>100 and/or BP<100/60)
Renal failure (RR>20 or oliguria)
Haemoglobinuria
Cerebral malaria/hypoglycaemia (coma, confusion, fits)
Pallor
Jaundice
3. Investigations requested
Blood film for malaria (BFFM)
Random blood sugar (RBS)
Haemoglobin concentration (Hb)
4. Treatment given
Quinine IV on admission
Dextrose IV with quinine
Artemether IM on arrival
Artesunate IV on arrival
Reduced level of consciousness, or seizures was 50% dextrose given?
Shock: were boluses of ringer lactate or normal saline given?
Fever: was paracetamol or tepid sponging administered?
Fever: was diclofenac administered?
Vomiting: was an anti-emetic given?
Dyspepsia: was an anti-dyspeptic given?
Was the patient switched to an oral ACT once improved?
Was the patient switched to oral quinine once improved?
Pulmonary oedema: was furosemide and oxygen given?
If evidence of bacterial infection, was an appropriate antibiotic given?
Severe anaemia (Hb <5): was the patient transfused?
Convulsions: was diazepam administered?

3. Bedside teaching of all doctors in the Emergency Medical Ward (EMW) on malaria.
4. Departmental professional standards were discussed and clarified with the agreement of the Head of the Department. The responsibilities at all levels aimed at creating team work and job satisfaction and hence improved patient care.
5. A new system for note-keeping was created, where doctors would write using the SOAP acronym:

   S - subjective or what the patients said;

   O - objective or what was found on examination;

   A - assessment or the diagnosis;

   P - plan or what investigations and medications should be done.

Once this was accomplished, a re-audit of forty patients took place in December 2011.

Results

The results are summarised in Figures 1-4 and Table 3. More details are in full report of the audit which will be uploaded on the SSMJ website.

Table 3 compares the management of all the patients in the July and December audits. The quality of case notes in the July audit was poor making it difficult to know if an action had been done or omitted. Vital signs and assessment for complications of malaria were not consistently recorded.

In the December audit, ninety eight percent of patients were assessed for jaundice and pallor and 7.5% of these had pallor. Half of these had a haemoglobin check and no patients needed a blood transfusion for a Hb <5g/dl. The December audit also demonstrated improvements in the patients' symptomatic management. Pyrexia was predominantly controlled with paracetamol and tepid sponging.

In Figure 4, not all of the items are indicated for every case: e.g. not every patient with malaria is shocked or vomits. In this case the management for shock or vomiting is not needed. When collecting the data, the notes were examined to see if an item of management was clinically indicated. The following rules were applied:

1. Yes - management clinically indicated and given
2. No - management clinically indicated and not given

Not applicable (NA) - not clinically indicated as condition not present.

So Figure 4 shows a percentage breakdown of the management items where clinically indicated and the NA group was removed.

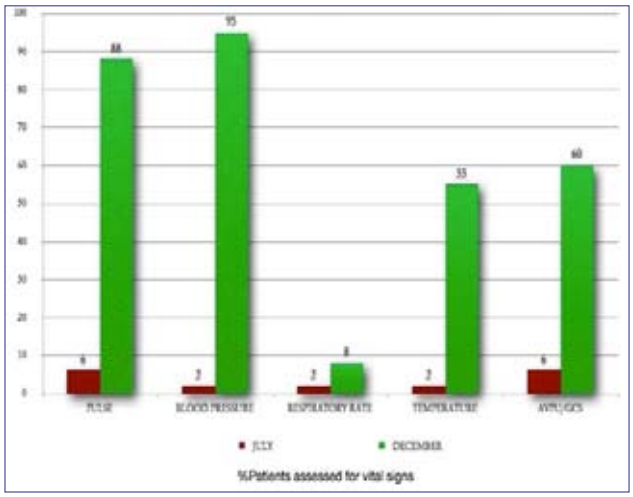

Figure 1. Percentage of patients in July and December with vital signs recorded (pulse, blood pressure, respiratory rate, temperature, and level of consciousness).

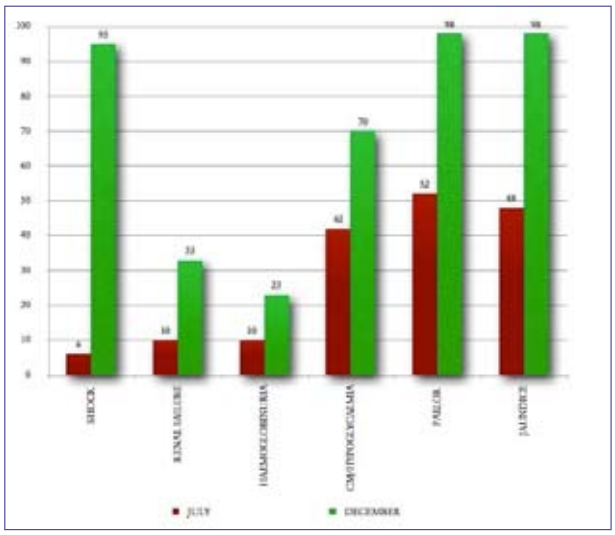

Figure 2. Percentage of patients assessed for complications of malaria in July and December. CM- cerebral malaria.

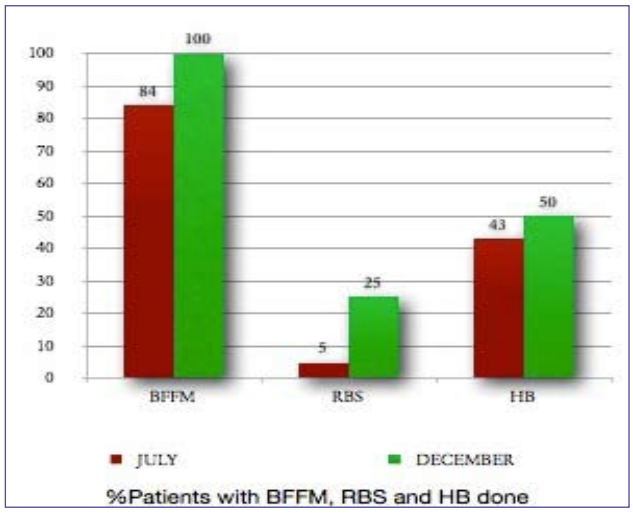

Figure 3. Percentage of patients in July and December 2011 for whom blood tests where clinically indicated.

Discussion

The audit clearly demonstrates an improvement in the care of patients with malaria since July 2011.

There were no additional financial costs to implement this higher standard. A restructuring of the Department reduced delays in management to a minimum. The key changes were:

1. Bringing small quantities of medicine from the Pharmacy and stores into a drugs and equipment cupboard on the ward which the nurses regularly checked.
2. Introducing a rule that all patients admitted to the ward were re-clerked.
3. Teaching doctors about good clinical note-keeping.

However, compared to the WHO and South Sudan Treatment Guidelines, areas that continue to require attention are:

1. Vital signs. There was a failure to document a respiratory rate, an exact temperature, and a level of consciousness in many cases
2. Assessing patients for renal complications. All this requires is an assessment for oliguria (urine output <500ml/day) and haemoglobinuria ('coca cola' coloured urine)
3. Appropriate ordering of tests such as RBS and Hb where indicated.
4. Giving 50% dextrose to patients with altered conscious level.

Conclusions

The Audit has led to a positive change in the management of malaria at Juba teaching Hospital, though areas of concern still remain such as failure to:

- Document a respiratory rate, an exact temperature, and a level of consciousness in many cases
- Assess for renal complications.
- Appropriately order tests such as RBS and Hb where indicated.
- Give 50% dextrose to all patients with altered conscious level.

Recommendations

1. A mortality study to assess the impact of the restructure on malaria related deaths.
2. A study to assess quinine and artemisinin resistance in South Sudan. This would allow doctors to improve anti-malarial therapy for their patients.

3. Appropriation of IV artesunate as a priority.
4. Allocation of more nurses to the Emergency Medical Ward which is one of the busiest wards. An increase in the nursing staff from twenty to thirty would enable a significant improvement in the recording of vital signs.
5. Improvement of laboratory services to include analysis of cerebrospinal fluid and estimation of serum electrolytes, bicarbonate and (ideally) lactate and renal function (i.e. serial creatinine assays).
6. A re-audit when the above has been accomplished.

References

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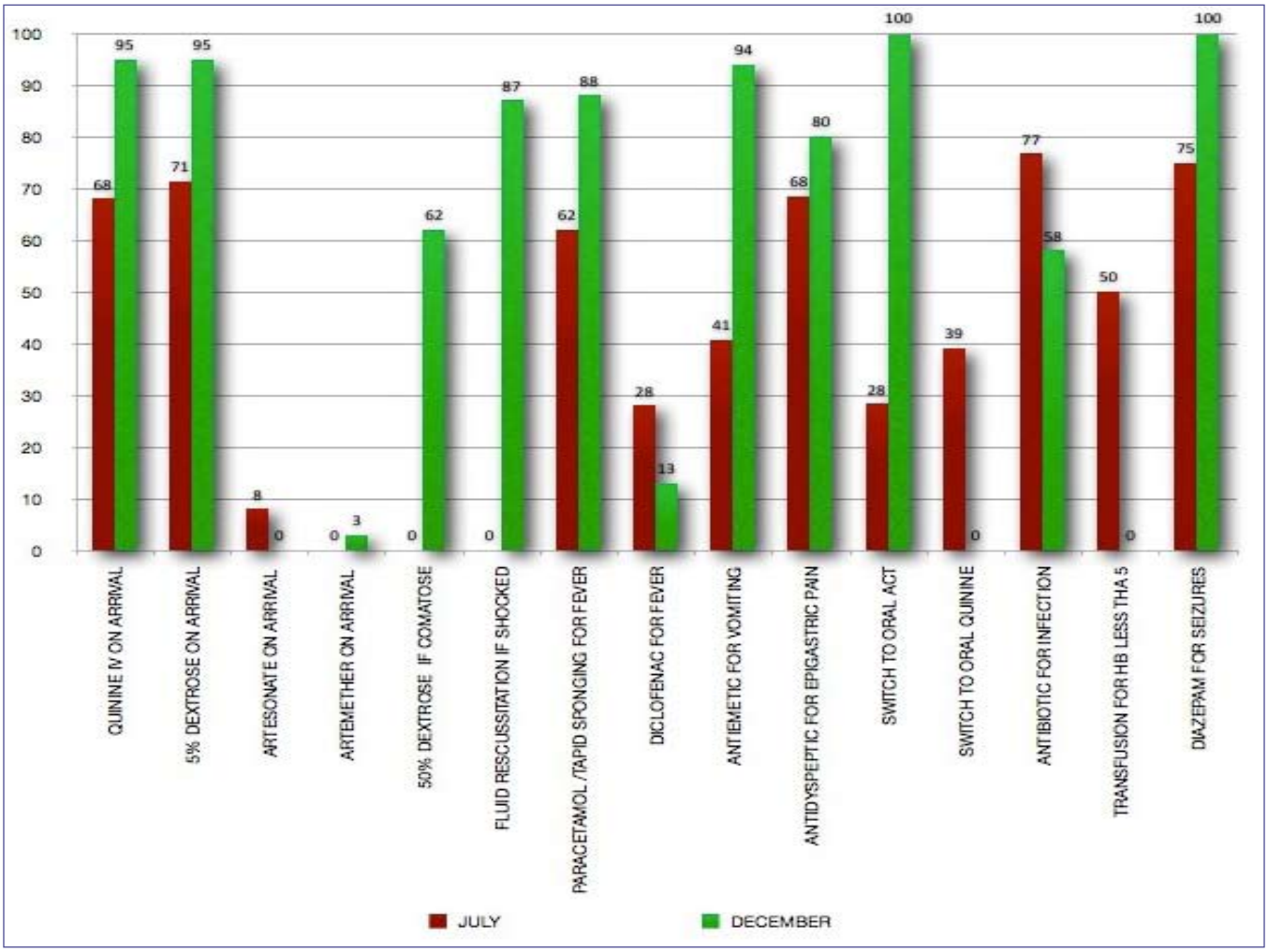

Figure 4. Percentage breakdown of the specific items of management in July and December.

Table 3. Management of all patients in the July and December audits

Management	Percent of audited patients receiving:	
	July n= 50	December n= 40
Patients who received quinine	68	95
Patients who received resuscitation fluids	0	87
Patients who received 50% dextrose if comatose	0a	50
Patients switched to an oral artemisinin combination therapy (ACT) on improvement	28b	100
Patients given diazepam for convulsions	75	100
Patients given an anti-emetic for vomiting	48	94
Patients given an antidyspeptic if indicated	68	80
Patients given diclofenac for fever	28c	13

Notes:

a. This was extremely worrying given the large number of presentations with impaired conscious ness and shock.

b. Most were switched to oral quinine.

c. Malaria can cause acute kidney injury and any non-steroidal anti-inflammatory drug should be avoided as this may compound the problem.

How to do an audit (4,5)

A clinical audit cycle has a number of phases:

1. Identification of clinical issue of concern: such as the diagnosis and management of patients with malaria.
2. Setting of audit standards against which to compare current practice: Use published guidelines such as the WHO or national guidelines. Agree a target to which standards of practice must conform, such as 80% of all patients with malaria must have vital signs estimated. A performance below this standard is deemed to have failed this particular Audit standard.
3. Determining the percentage of met and unmet audit standards to indicate the performance of the team or department being audited.
4. Displaying the data in tabular form and/or graphs for ease of reading comparing the audit data with the standards used in the Audit.
5. Drawing conclusions from the data collected, commenting on the data.
6. Learning from the results and make appropriate recommendation to change practice, make recommendations to implement the changes using tutorials or protocols depending on local practice. This should be reinforced with planned staff training.
7. Identifying a person to see through the recommended changes.
8. Re-auditing after an agreed period, such as six months, to determine any improvements in practice.

Nodding Syndrome—South Sudan. The first reference in this article from the Journal of the American Medical Association (May 16, 2012—Vol 307, No. 19 p2021; MMWR. 2012;61:52-54) is from the South Sudan Medical Journal! Please let us know if you find other items on Nodding Disease so we can publish an occasional summary update on this difficult and intriguing disease.