Malaria deaths in a rural hospital

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Abstract

An audit of all malaria deaths that occurred at Manguzi Hospital between 1 October 1998 to 30 September 1999 was performed. There were 41 deaths from malaria in this time period, which was many more than for the previous three years. The most common causes of death were cerebral malaria, pulmonary oedema, anaemia and renal failure. 21 patients were assessed to have had sub optimal medical or nursing management, where alternative action may have altered the outcome. A total of 28 areas of sub optimal management were found as some patients had more than one. Reasons for the increase in malaria deaths compared were suggested. This study highlights important lessons in caring for patients with severe and complicated malaria in a rural hospital setting.
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INTRODUCTION

Malaria remains one of the world's most serious tropical diseases, causing more than a million deaths each year around the world, of which 90% occur in Africa[1]. Malaria has long been recognised as one of the major obstacles to social and economic development in Africa and is estimated to cost the continent more than $12 billion every year in lost gross domestic product.[1] Malaria is Africa's leading cause of underfive mortality (20%) and in areas with high transmission can account for 30-50% of inpatient admissions and up to 50% of outpatient (OPD) visits[1]. During the years 1996 to 2000 there was a marked increase in malaria transmission in South Africa with the main increase in the Kwa Zulu Natal province[2]. Manguzi hospital is situated in the far North East corner of the Kwa Zulu Natal province in the Ingwavuma magisterial district and is 20 km from the Mozambique border. The hospital serves a predominantly rural population of 100 000 people and malaria forms a significant proportion of the workload of the hospital. Plasmodium falciparum malaria incidence in this district has been found to be 500 cases per 1000 people within 1 km of the border, dropping to less than 5 per 1000 people over 30 km from the border[3]. From 1 October 1998 to 30 September 1999, more malaria deaths were seen at Manguzi hospital than for the same period in the previous three years. ***(See Table I)*** This was of great concern to the staff. An audit was performed to try and ascertain the reason for this and to look for areas where medical management of these patients may be improved.

Table I: Number of malaria cases seen in OPD, the number of malaria cases admitted and the number of malaria deaths at Manguzi hospital and the number of malaria cases in Ingwavuma district from 1 October 1995 to 30 Setember 1999

	1 October 1995 to 30 September 1996	**1 October 1996 to 30 September 1997**	**1 October 1997 to 30 September 1998**	**1October 1998 to 30 September 1999**
Deaths from malaria in Manguzi hospital	32	15	18	41
Admission to Manguzi hospital with malaria	No record	No record	1683	1460
Patients seen in Manguzi hospital OPD with malaria	2779	2279	1979	2455
Total number of cases of malaria in Ingwavuma district	No record	7432	9007	16439

METHODS

All deaths at Manguzi hospital due to malaria from 1 October 1998 to 30 September 1999 were included in this study. A patient was considered to have died from malaria only if a malaria smear or a rapid diagnostic immunochromatographic assay test was positive. Stillbirths from malaria were excluded. The file numbers of patients having died from malaria were extracted from the hospital mortuary register. These files were then retrieved and the course of hospital stay noted by the researcher. From each of the patient's files haemoglobin, urea, creatinine and glucose blood results and Glasgow coma scale (GCS) were noted. (These were the first results noted in the file and not necessarily those from the time of admission.) The time from admission to death was noted as was the cause of death and whether any alternate management could have prevented the death. This was a clinical decision made by the researcher but where the exact cause of death or alternative management was uncertain, the decision was made by the whole medical team at a special review meeting of all the deaths of that year. Other malaria statistics were collected by the district malaria control programme in Jozini.

RESULTS

Forty one patients died during the study period. As one patient died in outpatients department, no detailed hospital record could be traced. One additional file could not be found. The remaining 39 files were found and the clinical information analysed.

There were considerably more deaths than for the corresponding period of the previous three years. While the total number of malaria cases in the district increased, the number of admissions did not.

Most deaths occurred during the peak transmission months of March to May (24). ***(See Figure I)*** Most deaths occurred in adult patients between 12 and 65 years of age (28). ***(See Figure II)***

The most common cause of death was cerebral malaria (21), followed by pulmonary oedema (6), anaemia (5) and renal failure (4). ***(See Table II)***

Twenty one patients were assessed to have had sub optimal medical or nursing management, where alternative action may have altered the outcome. A total of 28 areas of sub optimal management were found as some patients had more than one. ***(See Table III)***

DISCUSSION

The fact that numbers of admissions or OPD cases did not change with increasing numbers of malaria cases in the district can be explained by two factors. Firstly in 1999, in response to large numbers of patients being admitted, the admission criteria for malaria patients were changed. Not all

Figure 1: Months of death of malaria patients at Manguzi hospital from 1 October 1998 to 30 September 1999

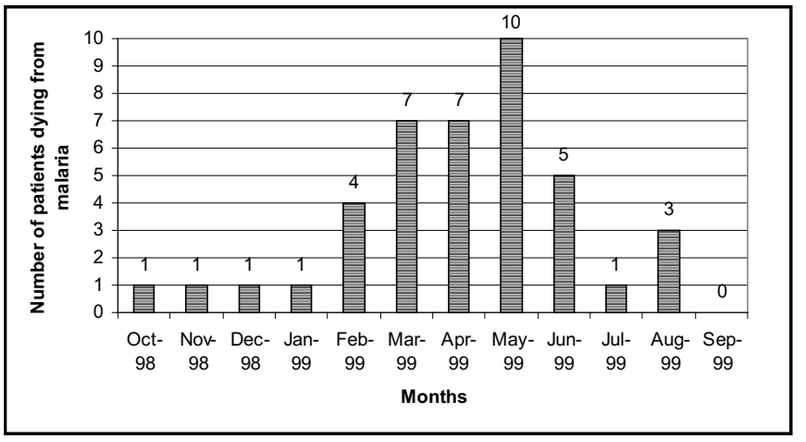

Figure 2: Ages of patients who died from malaria at Manguzi hospital from 1 October 1998 to 30 September 1999

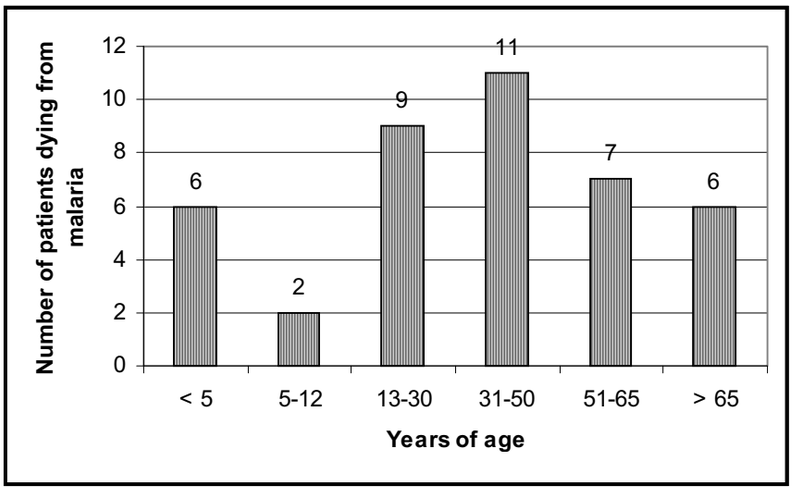

Table II: Causes of death in patients dying from malaria at Manguzi hospital from 1 October 1998 to 30 September 1999

Causes of death in patients dying from malaria	
Cerebral malaria	21
Pulmonary oedema	6
Anaemia	5
Renal failure	4
Associated illness	1
Electrolyte imbalance	1
Unknown	3
Total	41

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Table III: Number of errors in management of patients who died from malaria at Manguzi hospital from 1 October 1998 to 30 September 1999

Errors in management of patients who died from malaria	
Low glucose	6
Delay in starting quinine	7
Delay in referral to tertiary centre	6
Delay in starting blood transfusion	4
No Phenobarbital Sodium given	2
Delay in giving frusemide	2
No lumbar puncture performed	1
28 errors in management were found in 21 patients	

children or pregnant women were admitted as they had been previously. Also the opening of several new clinics in late 1998 meant that many more cases were being treated in the community rather than in hospital OPD.

Cerebral Malaria

Cerebral malaria was the leading cause of death in this study. This is in keeping with the situation in many countries where it can account for up to 80% of all deaths.[4] Cerebral malaria has a mortality of 20% even with the best medical care.[5] Cerebral malaria, for research purposes, is defined as the presence of a non-rousable coma, for which no other cause is found. This corresponds to a Glasgow coma scale of 4 or below[4]. However for treatment purposes any patient with an altered level of consciousness should be treated as having cerebral malaria. In our series 6 of the patients (40%) that were assessed of having died from cerebral malaria had a GCS of 14 to 15 at the time of admission showing that death from cerebral malaria cannot be predicted from the mental state on admission. Death from cerebral malaria is usually within 6 to 96 hours[4] and in our series an average time from admission to death was 24,5 hours.

Meticulous medical and nursing care is necessary to manage these patients. The World Health Organisation (WHO) has published guidelines highlighting the errors commonly made in managing these patients at a district hospital.[4] In our series, 8 patients errors were found that might have altered outcome. Some patients had more than one error in their management; these included a delay in staring quinine therapy, using sulfadoxine-pyrimethamine instead initially (3) or no treatment at all (1). This was probably because the admitting medical officer underestimated the severity of the disease. In 5 patients there was a failure to respond to a low plasma glucose level. As hypoglycemia is a frequent problem in patients with malaria especially after starting quinine therapy, it is hospital policy to measure finger prick glucose 6 hourly. Often this is difficult to achieve when the wards are full and there is a shortage of nursing staff. This task may be delegated to the most junior of staff who then do not realise the urgency of responding. Or the finger prick may not be taken at all. In two patients, Phenobarbital sodium was not given prophylactically to prevent seizures. In one patient where features suspicious of co existing meningitis existed, a lumber puncture was not done.

Pulmonary oedema

Pulmonary oedema was the second leading cause of death. This is a serious complication and has a fatality rate of above 50%.[4]

Of the 6 patients who died from pulmonary oedema, in 4 cases an earlier transfer to a tertiary centre may have altered the outcome. At Manguzi this usually means air transfer due to lack of paramedic support by road ambulance and due to the distance involved (approximately 500 km) Air transfer usually takes about 3 to 4 hours to arrive at the hospital from the time when first contact is made with the emergency services and at the time of the study the aircraft was only available to fly during daylight hours. On review of these cases it would seem that all patients with signs of pulmonary oedema should be referred as soon as possible to a tertiary centre for Intensive Care Unit (ICU) support. An increased respiratory rate is a good indicator of early pulmonary oedema.[4]

In one case pulmonary oedema was worsened by a sudden infusion of fluid given in an attempt to correct renal failure. In two cases frusemide was not given although signs of pulmonary oedema were present.

The final case of pulmonary oedema was also the only pregnant patient who died in our series. Pulmonary oedema is said often to complicate malaria in pregnancy.[4] This lady presented to a remote clinic about 90 km from the hospital at 30 weeks duration in her pregnancy. She was tested for malaria and once found to be positive was treated with sulfadoxine-pyrimethamine and asked to sleep over at the clinic that night. This she refused to do and instead went home. She returned the next day in labour and acutely short of breath. She delivered a 1,1 kg baby at the clinic and was urgently referred to the hospital. On arrival to the hospital the baby was resuscitated and whilst this was occurring the mother arrested and subsequently died. The baby later died too.

Pulmonary oedema may be present in pregnant women on admission, may develop several days later or, as in this patient, may develop immediately after childbirth. In general malaria in pregnancy is said to be more severe with a two to ten fold increase in mortality[4] usually secondary to pulmonary oedema or hypoglycaemia. Malaria in pregnancy is also associated with an increased risk of abortion, stillbirth, premature deliveries and low birth weights[4]. In spite of this recorded greater risk, there was only one pregnancy related death in our series. A similar study in Mpumalanga had only two[6]. This probably reflects the difference in patterns of malaria in endemic and epidemic areas. In regions where malaria is endemic, resistance develops in the general population so that it is mainly the young and pregnant that are vulnerable. In areas where malaria is seasonal, such as in KwaZulu Natal, no such resistance develops and so all are vulnerable[7].

The average time from admission to death in patients with pulmonary oedema was 51,5 hours i.e. much later than deaths from cerebral malaria. Pulmonary oedema may develop several days after commencing chemotherapy and at a time when the patient's general

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condition is improving and the parasite loads are decreasing[4].

Anaemia

The third most common cause of death was anaemia. Of the 5 patients who died due to anemia, 3 were babies below 18 months. In fact, of the 6 children below 5 years who died of malaria, anaemia was the cause of death in 3 and possibly associated with another one. In 2 of these patients anaemia was not detected early enough due to clinician error. In these two patients no formal haemoglobin value was measured although the patients were noted to be pale. An earlier checking of the haemoglobin may have resulted in action that may have altered the outcome. In one other case anaemia was recognised, with a haemoglobin measurement of 2,2g/dl but there was a delay in starting the blood transfusion due to nursing staffing problems.

Two adults died of anaemia in our study. In one, who had in initial haemoglobin of 10,1g/dl, but was later noted to be pale, an earlier transfusion may have prevented death. In another, a co existent haemolytic disease was suspected and earlier transfer may have prevented death. This patient died with a haemoglobin of 2,7 g/dl.

Anaemia is a common presenting feature of malaria in African children and along with cerebral malaria makes up the two most important complications of malaria in children.[4] The recommendation is to transfuse blood when the haematocrit drops to below 20% and to give this together with 20mg frusemide if the renal function is normal[4].

The rate and degree of anaemia depends on the severity and duration of the parasitaemia. It can either be due to repeated episodes of malaria giving a normocytic, normochromic picture, or from acute haemolysis with high parasite loads. These cases often present with tachycardia and dyspnoea leading to cerebral signs and cardio pulmonary signs[4].

Renal failure

The fourth leading cause of death was renal failure. A study of malaria deaths in Durban showed that patients who died from renal failure had a mean crea-tinine of 476 micromol/L, compared to a mean creatinine of 246 micromol/L in those who survived with renal failure.[8] In our study the mean creatinine of patients who died from renal failure was 497 micromol/L. The Durban study found that cerebral malaria and renal failure were the most common causes of death and had a much lower incidence of deaths from pulmonary oedema than our study. This may be because in Durban, ICU facilities are immediately available, or may be due to the fact that Durban is a referral centre away from the at risk areas. Many malaria patients seen in Durban are in fact referrals from outlying rural hospitals such as Manguzi and so it may be that patients with pulmonary oedema die at these hospitals before reaching Durban.

Renal failure from malaria usually occurs only in adults. The progression is from deranged renal function, to anuria to acute tubular necrosis[4]. It is important to distinguish between pre renal and intra renal failure. In the former, fluid for rehydration should be given, but cautiously to prevent overload.

If the patient is anuric after rehydration, the patient will need dialysis. If the patient passes small amounts of urine after rehydration it may be possible to maintain fluid balance without dialysis. Fluid given should be restricted to urine output and insensible losses. Indications for dialysis included metabolic acidosis, hyperkalaemia, fluid overload and clinical evidence of uraemia[4]. Progressive renal failure may require dialysis or may improve as malaria is treated.

Haemodialysis is preferable to peritoneal dialysis[4]. This is because patients with malaria have decreased flow of blood to the peritoneal cavity. Peritoneal dialysis has also been associated with high rates of complications and mortality in peripheral hospitals[4].

OTHER CAUSES OF DEATH

Other causes of death included multi organ failure in an elderly man, and in another patient, severe electrolyte imbalance .In one patient co incidental meningitis was suspected but a lumbar puncture was not done. In 3 patients the cause was unknown.

In our study the increased number of deaths seen during 1998/9 may be related to several factors:

1. A rapid turnover of medical staff meant that more than half of the doctors were new or inexperienced.
2. Crowded wards led to problems with nursing care.
3. The total cases in the district for the year were more although admissions and cases seen in OPD were similar in numbers to previous years.
4. Difficulty in transfer.
5. Logistics such as the lack of available blood, high care facilities etc.

CONCLUSION

Several important lessons can be learned from this study in how to better care for critically ill patients with malaria. These include:

1. The importance of starting quinine early in patients with severe disease.
2. The need to refer early to a tertiary centre cases of pulmonary oedema and worsening renal failure.
3. The importance of regularly checking for anaemia and the renal function indicators.
4. The importance of early blood transfusion in patients with a low haemoglobin.
5. The importance of regularly checking for hypoglycaemia in patients on quinine therapy and in taking the correct action when the glucose is low.

Clinical audit such as this can help to highlight these issues to hospital staff in order to learn from their own experience.❐

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