The State of Malaria in a rural-mission hospital in Nkhoma,

By Bailey Crowley[1] , Éabha O'Brien[1] , Sam Kabota[2]

Reviewed by Dr. Colm O'Tuathaigh[1]
[1]School of Medicine, University College Cork, Cork, Ireland
[2]Nkhoma Hospital, Nkhoma, Malawi

Abstract

Title

The State of Malaria in a rural-mission hospital in Nkhoma, Malawi

Introduction

In recent times, Malaria has fallen out of the limelight due to an economical migration of populations into medium and higher income settings. Despite this, it remains endemic in 31 countries with 228 million cases per annum. In Malawi, the WHO have reported that all of its citizens are at risk of contracting the disease. In this study we hope to expand on the clinical data available at a rural mission hospital in Malawi, as well as highlight some of the external global health factors in such environments.

Methods

An observational retrospective cohort Study looking at severe malaria admission in a paediatric population was conducted. The Nkhoma hospital Paediatric department was the centre of the data collection which focused on the diagnosis of severe malaria, as well as the signs and symptoms and treatment regimens of same.

Results

Severe Malaria accounted for over 40% of all paediatric admissions in the month of May 2019. Patients suffered from anaemia (80%) and cerebral Malaria (41%), as well as a host of generalised symptoms such as fever (95%), vomiting (36%), malaise (30%), and diarrhoea (21%). Promisingly, a strict and comprehensive treatment regime for severe Malaria was in practice with artesunate, Lumefantrine used in ~100% of cases.

Conclusion

Sadly, Malaria continues to create horrendous amounts of morbidity and mortality, but our united commitment to eradicating Malaria is stronger than ever.

Introduction

Malaria has fallen out of the limelight due to an economical migration of populations into medium and higher income settings [1]. It is a communicable disease transmitted by Plasmodium in female mosquitos. Its clinical features include fever, anaemia, jaundice, hepatosplenomegaly, decreased consciousness, convulsions, renal failure, and acidosis. If left untreated, it has a mortality of approximately 100% [2]. Unfortunately, in 2019 Malaria remains endemic in 31 countries with 228 million cases per annum, of which over >90% of which are concentrated in sub-Saharan Africa [3] . While 2.7 billion United States dollars has been put forward by governments and organisations towards the global Malaria fund, this level of fiscal aid will not meet the milestones set by the Global technical strategy for Malaria 2016–2030 [4] . In Malawi, positive strides have been taken by centres such as The International Centers of Excellence for Malaria Research and the Malawi Ministry of Health in an effort to combat Malaria. These include an increase in suspected patient testing from 20% in 2010 to >95% in 2018, and the commencement of indoor residual spray (IRS) use [5] . Moreover, the last 10 years has seen a doubling in patients receiving internationally recommended treatment regimes in recognised healthcare facilities across the sub -Saharan African region. Nevertheless, much work remains unfinished with every citizen of the over 18 million people living in Malawi being classified as high risk for Malaria and less than 50% of those having access to a Long lasting insecticide net (LLIN) last night [3, 6] .

In this study we aim to expand the clinical data of Malaria in developing countries, and to explore the challenges faced by sub-Saharan African communities in combating this disease. We hope to do this by first providing a brief study looking at the classification, symptoms and treatments regimes of paediatric Malaria cases in a rural Presbyterian mission hospital in Nkhoma Malawi, and later providing commentary on both local and global health factors that play a role in healthcare.

Materials and Methods

Study Design

An observational retrospective cohort study was conducted looking at severe malaria admission in a paediatric population. This was facilitated by a research team consisting of two medical students and a paediatric clinical officer, in the department of paediatrics in Nkhoma hospital, Malawi. Appropriate cases were identified and relevant data were extracted from the charts of infants and children admitted during the month of May 2019. The following inclusion and exclusion criteria were utilised:

Inclusion:

- Age: ≤16
- Admitted date: May 2019
- Primary Admission Diagnosis: Severe Malaria

Exclusion:

- MRDT not performed, or the result unrecorded

Study Measures

1. Diagnosis of severe Malaria

   A positive MRDT plus with a minimum of one of the following:

   I. Anaemia
   II. The manifestations of cerebral Malaria
   III. Hyper-parasitaemia
   IV. Blackwater fever
   V. Electrolyte imbalance.

2. Signs & symptoms of severe Malaria:

   Specifically:
   I. Fever
   II. Malaise
   III. Vomiting
   IV. Diarrhoea
   V. Abdominal pain
   VI. Headache

3. Treatments of severe Malaria administered:

   Specifically:
   I. Artesunate
   II. Lumefantrine
   III. Paracetamol
   IV. Ferrous Fumarate
   V. Diazepam
   VI. Ceftriaxone
   VII. Blood Transfusion

Data Analysis

Descriptive data analysis was completed using Microsoft Excel V16.38. Clinical data was recorded using frequency and percentages.

Ethics

All data were collected and stored within Nkhoma Hospital paediatric department. No patient files were removed from the department and all data were anonymised as to not identify any participants. The nature of this study is exempt from ethical committee review. This is in keeping with the regulatory bodies of the Malawian Ministry of Health, the National Health Sciences Research Committee, the Malawi College of Medicine, and the Kamuzu College of Nursing.

Results

Classification of Malaria

During the month of May 2019, there were 253 admissions to the Nkhoma hospital paediatric unit. Within this there were 10 unused cases in the data. These cases charted the patient as having Malaria but no Malaria rapid diagnostic test (MRDT) was documented. In addition to this, there were 112 admissions of severe Malaria.

In this study, severe Malaria features were defined as anaemia, the manifestations of cerebral Malaria, hyper-parasitaemia, blackwater fever and electrolyte imbalance. Anaemia was the most common feature of severe Malaria with it being present in 89 admitted patients. Moreover, 27 of those cases had severe anaemia, a classification of haemoglobin levels of <6g/dL. Admissions with cerebral Malaria was the next largest group with 46, and an additional 1 admission had hyper-parasitaemia. There were no documented cases of either Blackwater fever or electrolyte imbalances. Finally, there were 5 cases where there was no charted documentation as to the reason for a severe Malaria diagnosis.

Table 1. Paediatric admissions.

Group	Admissions (n)	(%)
Total[1]	253	100
MRDT undocumented[2]	10	4
Severe Malaria	112	44

[1] The Total group refers to all paediatric patients admitted regardless of diagnosis.
[2] The MRDT undocumented group refers specifically to the paediatric patients admitted without a MRDT mentioned in the patient notes.

Symptoms of Malaria

Cases of severe Malaria noted six main symptoms. These included fever, vomiting, malaise, diarrhoea, abdominal pain, and headache. Fever was the most common symptom with it being resent in 106 of the 112 severe Malaria admissions. The next most common symptoms included: vomiting seen in 40 cases; malaise in 34 cases; diarrhoea in 23 cases, and abdominal pain in 9 cases. Headache was the least common symptom with only 7 admissions noting same.

Treatments of Malaria

A succinct group of medications were used in the treatment of severe Malaria. Artesunate, lumefantrine and paracetamol were staples to treatment with them being used in almost 100% of cases. Ceftriaxone was the next most common drug used with prescription at 69 cases. This was due to precautionary measures where cerebral Malaria and bacterial meningitis were unable to be distinguished clinically. Transfusions, ferrous fumarate and diazepam were some of the other drugs prescribed for anaemia for the former two options, and cerebral Malar-

Table 2. Distribution of Severe Malaria admissions.

Group	Admissions (N = 112) (n)	(%)
Anaemia	89	80
Severe Anaemia[1]	27	24
Cerebral Malaria	46	41
Hyper-parasitaemia	1	1
Blackwater fever	0	0
Electrolyte Imbalance	0	0
Unspecified[2]	5	4

[1] The Severe anaemia group refers to any patient with severe Malaria with a haemoglobin level of <6 g/dL.

[2] The Unspecified group refers to a documented case of severe Malaria as per Nkhoma Hospital criteria.

ia for the latter.

Discussion

Severe Malaria accounted for over 40% of all paediatric admissions in the month of May 2019. Patients suffered from anaemia (80%) and cerebral Malaria (41%), as well as a host of generalised symptoms such as fever (95%), vomiting (36%), malaise (30%), and diarrhoea (21%). Promisingly, a strict and comprehensive treatment regime for severe Malaria was in practice with artesunate, Lumefantrine used in ~100% of cases.

Table 3. Symptoms of Severe Malaria admissions.

Group	Admissions (N = 112) (n)	(%)
Fever	106	95
Vomiting	40	36
Malaise	34	30
Diarrhoea	23	21
Abdominal Pain	9	8
Headache	7	6

Classification of Malaria

Disease seasonal variation, management of non-severe cases, and criteria for severe diagnosis provide much insight into the significance of the results. It is well established that Malaria epidemiology contains a notable seasonal shift. In some countries, a seasonal Malaria chemoprevention (SMC) programme has been commenced to help deal with the issue [3] . Anecdotal evidence from the Nkhoma hospital claim that the dry season of April - September demonstrate the fewest number of cases of Malaria. With their almost 100 bed paediatric unit being nearly overrun in the wet season. Despite this, Malaria still accounted for 44% of all hospital admissions in the month of May 2019. Moreover, Hospital policy and healthcare guidance dictates that non-severe Malaria can be effectively treated as an outpatient [7] . This further emphasises the scale of Malaria cases that present overall. Further exploration of this statistic would be most beneficial in understanding the problem of Malaria in the community. Finally, this study had considerable differences in how severe Malaria was diagnosed. Guidance was taken using the WHO Malaria treatment guidelines 2015, oxford handbook of clinical medicine second edition [2, 7] . However, the definitive diagnosed was made by the paediatric clinical officers at the hospital, whose clinical decision was based off the inclusion of any of the criteria seen in table 2.

Table 4. Medications used in treatment of Severe Malaria admissions.

Group	Admissions (N = 112) (n)	(%)
Artesunate	112	100
Lumefantrine	111	99
Paracetamol	111	99
Ceftriaxone	69	62
Transfusion	38	34
Ferrous Fumarate	25	22
Diazepam	10	9

Symptoms of Severe Malaria

The symptom profile of severe Malaria in this setting provides important information to further enhance diagnosis. In particular, the near universal presentation of fever and the wide variety of generalised symptoms are of note. Fever was present in 106 of the 122 severe Malaria admissions. Therefore fever as a symptom was present in 95% of severe Malaria cases, and moreover in 40% of all admissions during the same timeframe. Modern developed hospitals' PEWS systems do not distinguish any serious clinical significance for fever [8] . Such a development, where Malaria is endemic, may lead to less than favourable patient outcomes. In addition to this, the remaining symptoms of vomiting, malaise, diarrhoea, abdominal pain and headache create diversity in presenting cases. There is a wide scope of variation within the symptom profile of Malaria. Therefore caution must be taken not to rule out Malaria. This is accounted for by the use of the MRDT, which is now used by over 80% of healthcare centres in the African region [3]

Treatment of Malaria

The committed adherence to treatment guidelines, despite the harshness of the disease rings loud. We see the implementation of Artesunate, Lumefantrine as staples in the treatment of all cases of Malaria [7] . It is admirable to see this trust by research centres out of their control given the despair seen with the disease. This is best seen with not only the levels of anaemia, but stark numbers of severe anaemia present in the population. Nevertheless, while understandable, its saddening to see the over prescription of antibiotics in the form of ceftriaxone. This has been employed in the hospital as not to miss any cases of bacterial meningitis, given the oftentimes striking clinical similarity between same and cerebral Malaria. These unfortunate developments have led to accelerated rates of antimicrobial resistance [9].

Malawi, Nkhoma, and Nkhoma Hospital

To better understand the significance of these results, we must apply them to the healthcare systems they affect. This will be examined by focusing on Malawi as a nation, the village of Nkhoma, and in particular its long established mission hospital.

Malawi

Malawi's economic and political landscape create a harsh environment for success. Located in sub-Saharan Africa, and bordered by its neighbour nations of Mozambique, Tanzania, and Zambia, Malawi is home to some of the poorest people in the world. Their GDP per capita (PPP) being consistently in the bottom ten of all countries worldwide [10] , with majority of its population living in extreme poverty, with >95% surviving on <5 USD daily [11] . In addition to this, Malawi has been victim to numerous scandals in government with international intervention needed to aid the democratic process. These have included "tip-ex" ballot tampering, presidential annulments, and the Democratic political party food rations scandal [12-14] . This degree of financial and administrative turmoil creates untold uncertainty across any nation. Despite this, however, Malawi still holds the titles of the warm heart of Africa by many internationally for the amicable behaviours of its people.

Nkhoma

Nkhoma village is best described through its religious, communal, and economic influences. At its core Nkhoma is a Presbyterian mission village with its synod having created a bright environment for its members to flourish [15] . Nkhoma is well known throughout Malawi for its opportunities in education with multiple primary schools as well as a third level institution with nursing and theology departments among others . Unfortunately however, Nkhoma's monetary divided position leaves much to be desired. In the grand scheme of things, Nkhoma is a wealthy Malawian village. But a clear financial split is seen throughout its citizens, and local businesses. In one circumstance numerous villagers live in well decorated red brick buildings, and use their own cars for transportation. These same people have the

privilege of working in the mission hospital or the large charity Peanut Butter and Jesus [16] . At the other extreme, people are living in straw-roofed huts or on the side of the road, and make ends meet by selling their produce or craft at the local bi-weekly market. Nevertheless, there is a proud sense of community in Nkhoma. There are plenty of sports facilitates which the locals use to full effect. These include association football, volleyball and squash, and are accessible to all ages and backgrounds. This commitment to community is also apparent at the dusk of nightfall with volunteers giving their time to patrol the area given historical thievery.

Nkhoma hospital

Nkhoma hospital is the pride of the village with its robust funding model, an extensive list of specialties, and international recognition [17] . Hospital Income is divided into roughly three equal parts of private donations, private patients, and government funding. This broad financial platform creates certainty for staff and patients as together a fall in one income source shouldn't discourage patient care. Furthermore, Nkhoma hospital boasts an impressive spectrum of facilitates. Its medical wards has TB isolation units, its Surgical wards have a specialised burns assembly, its Paediatrics department have the capacity for 100 in patients as well as a neonatal ward, It has a world class HIV unit, its OPD provides care for 200 patients a day, and its outreach clinic gives vaccinations to children from neighbouring towns. Additionally, Nkhoma has garnered international respect. Not only do patients come from hundreds of kilometres away to seek healthcare, and expected mothers sleep at the hospital's doorstep to have access to a safe birth. But organisations such as MSF have used Nkhoma hospital's palliative care department as a template for their own endeavours in the field [18] ; world renowned institutions such as the university of Edinburgh have partnered with the hospital for research purposes [18] , and the WHO have granted them access to be one the distributors of the trial Malaria vaccine RTS,S [19] .

Limitations and Future Studies

This study is naturally flawed due to its structure, its lack of mortality statistics, and its limited demographic detail. The study consisted of an external pair of retrospective data collectors succeeded by data analysis and global health commentary. It therefore contains inherent paucity in communicating with health professions who cared for the patients in the study. Moreover, due to hospital policy there is limited access to retrospective charts regarding levels of mortality. This creates a skewed view of the data presented, but perhaps illustrates the frightening reality of Malaria as only discharged patients were recorded in the study. Finally, there is a notable absence of a rich exploration into the demographics of the patients. This decision was largely based as a time constraints coupled with the sparse data collection equipment made available for the study.

Nkhoma Hospital's engagement in research provides much hope for future studies. Other endeavours in Malaria studies that may provide great insight include an inquiry into seasonal variation, as well as detailed comparisons across other healthcare centres. Such studies would put central in understanding the disease and further put patient care at the core of the research.

Conclusions

This study has been successful in expanding the clinical data of Malaria in the developing world, and in providing insight into the local and global health factors at play. This was done by examining the classification of Malaria, understanding the symptoms of the disease, and recognising extent and logic of the treatment regimes. To further comprehend this we provided a brisk overview of some of the external yet integral factors for health including political, economic and international unity. Sadly, Malaria continues to create horrendous amounts of morbidity and mortality, but our united commitment to eradicating Malaria is stronger than ever.

Acknowledgements

Bailey Crowley

At the time of research Dr. Crowley was a medical student at University College Cork on an Elective at Nkhoma Hospital. He was one of the two key data collectors. Almost one year after the data collection he decided to organise the scripture of the project and was one of the main contributors to the paper.

Éabha O'Brien

Dr. O'Brien was another medical student at the same mission hospital. She was the other key data collector and was instrumental in safe keeping of the data. Dr. O'Brien also played an important role in writing the project.

Sam Kabota

Sam Kabota is the paediatric clinical officer at Nkhoma Hospital. As principal investigator of the project, he provided guidance and support across the study.

References

1. Talapko J, Škrlec I, Alebić T, Jukić M, Včev A. Malaria: The Past and the Present. Microorganisms. 2019;7(6):179.
2. Longmore M, Wilkinson I, Baldwin A, Wallin E. Oxford Handbook of Clinical Medicine: Oxford University Press; 2014 2014-01.
3. Organization WH. World malaria report 2019. Geneva; 2019.
4. Orginisation WH. The global technical Strategy for Malaria 2016-2030. Geneva; 2015.
5. Mathanga DP, Walker ED, Wilson ML, Ali D, Taylor TE, Laufer MK. Malaria control in Malawi: current status and directions for the future. Acta Trop. 2012;121(3):212-7.
6. Programme TDaHS. Stat Complier - DHS 2017 [Available from: https://www.statcompiler.com/en/.
7. Orginisation WH. Guidelines for the treatment of Malaria. Third ed. G neva: WHO; 2015.
8. Health IDo. National Clinical Guidelines 2019 [Available from: https://www.gov.ie/en/collection/c9fa9a national-clinical-guidelines/.
9. Musicha P, Cornick JE, Bar-Zeev N, French N, Masesa C, Denis B, et al. Trends in antimicrobial resistance in bloodstream infection isolates at a large urban hospital in Malawi (1998–2016): a surveillance study. The Lancet Infectious Diseases. 2017;17 (10):1042-52.
10. Fund IM. World Economic Outlook - GDP per capita. 2019.
11. Bank W. Poverty headcount ratio at $1.90 a day (2011 PPP) (% of population). 2011.
12. Henry Kijimwana Mhango AP-M. Malawi's 'Tipp-Ex' president set to appeal ruling that found his May election win was unlawful. The Telegraph. 2020.
13. BBC. Malawi's President Mutharika and the police food scandal 2018 [Available from: https://www.bbc.com/news/world-africa-44714224
14. Harding A. Malawi election: What the annulment means for democracy across Africa: BBC; 2020 [Available from: https://www.bbc.com/news/world-africa-51369191
15. Churches WCOr. Members 2020 [Available from: http://wcrc.ch/members
16. Inc. PBaJ. Peanut Butter and Jesus Inc.: Peanut Butter and Jesus Inc.; 2020 [Available from: http://pbjfoods.org/.
17. Hospital N. Nkhoma Mission Hospital Strategic Plan 2019-2022. 2019.
18. Scotland Go. Scottish Government Malawi Development Programme. University Of Edinburgh; 2019.
19. Malaria vaccine pilot launched in Malawi [press release]. geneva, 23rd of April 2019.