

# MALARIA CASE STUDY

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# BACKGROUND

- Malaria is a parasitic infection caused by the genus Plasmodium.
- Malaria affects approximately 5% of the world's population (Mahajan et al 2015).
- In 2015, an estimated 212 million malaria cases were diagnosed (WHO 2017), which resulted in 1-2.5 million deaths annually (Mahajan et al 2014).
- Malaria is spread by the female anopheles mosquito, and is preventable. Five species affect humans (Fletcher & Beeching 2013):
  - Plasmodium falciparum
  - Plasmodium vivax
  - Plasmodium ovale
  - Plasmodium malariae
  - Plasmodium Knowlesi





# CASE STUDY

- 16 year old female.
- Previously fit and well.
- 2 week history of headache, fatigue, muscle aches and irregular fever.
- Presented to the Emergency Department with a reduced level of consciousness.
- Emergency admission to intensive care.



# DIFFERENTIAL DIAGNOSIS

- Influenza
- Viral hepatitis
- Meningitis
- Sepsis
- Pneumonia
- Gastroenteritis
- Typhoid
- Tick fever
- Viral haemorrhagic fever
- Acute HIV

(de Wit E et al. 2016. Bisanzo et al 2016. Cox et al 2016)

# DIAGNOSIS

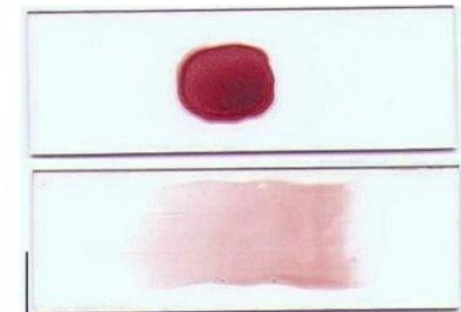
- Generalised signs and symptoms (de Wit E et al., 2016. Cox et al., 2016)
- Microscopy
- Rapid Diagnostic Tests (RDT)
- UK: EDTA-anti-coagulated venous blood sample
  - Laboratory to receive sample within 1hour



Two types of blood film for malaria parasites

Thick Blood Smear – use to determine if parasite is present.

Thin Blood Smear – use to confirm the *Plasmodium* species present



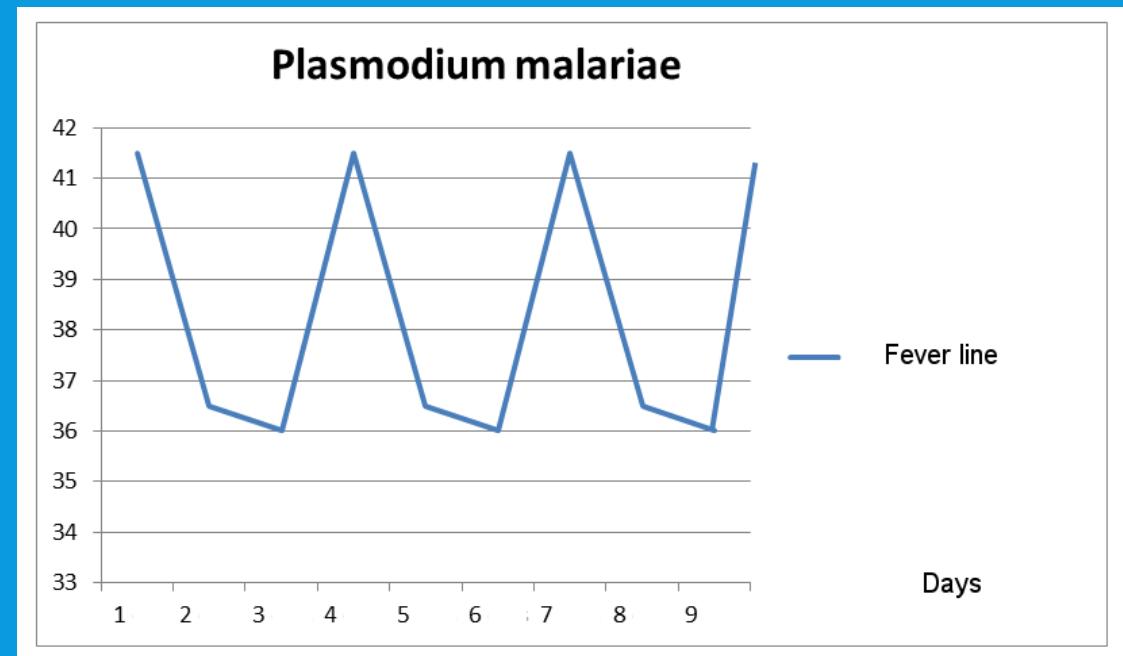
# RESPIRATORY

- Intubated due to:
  - Respiratory failure (RR>35/min, un-recordable saturations)
  - Reduced level of consciousness (airway protection)
- Ventilated
  - Observation for potential complications:
    - Pulmonary Oedema
    - Acute Respiratory Distress Syndrome (ARDS)
  - Mortality from ARDS in malaria can be as high as 80%, even with mechanical ventilation mortality can exceed 50% (Taylor et al 2012)



# CIRCULATION

- Invasive monitoring
- Shock
- Metabolic acidosis
- Fever management
- Anaemia
- Disseminated Intravascular Coagulation
- Bloods (U&E, FBC, Coag)





# RENAL

- Urinary catheter
  - $<0.5\text{ml/kg/hr}$
  - Anuric
- Observation for haemoglobinuria.
- Haemoglobinuria due to severe renal failure.
- 'Blackwater Fever' is an obsolete term, but can still be used by some clinicians to describe this condition.
- Renal replacement therapy.

# NEUROLOGICAL

- Coma
- Seizures and retinal changes common; papilloedema is rare
- Management of seizures
  
- Neurological protection
  
- Observation for hypoglycaemia
  - Hourly monitoring
  - IV fluids
  - NG tube

# DRUG REGIMEN

- Artesunate 2.4mg/kg
- 0, 12 and 24 hours then daily, until taking oral fluids and diet.
- Alternatives:
  - Quinine 10mg/kg alternative

## GUIDELINES FOR ADMINISTRATION OF INJECTABLE ARTESUNATE FOR SEVERE MALARIA

**1 WEIGH THE PATIENT**

**2 DETERMINE THE NUMBER OF VIALS NEEDED**

Weight	5 kg-25 kg	26-50 kg	51-75 kg	76-100 kg
60 mg vial	1	2	3	4

**3 RECONSTITUTE**

■ Activate the drug: artesunate powder + bicarbonate ampoule (immediately before use)

**4 DILUTE**

■ Reconstituted artesunate + saline solution (or dextrose 5%)

	IV	IM
Bicarbonate solution volume	1 ml	1 ml
Saline solution volume	5 ml	2 ml
<b>Total volume</b>	<b>6 ml</b>	<b>3 ml</b>
Artesunate 60mg solution concentration	10 mg/ml	20 mg/ml

**IMPORTANT**

Water for injection is not an appropriate dilutant

**5 CALCULATE THE DOSE**

■ Calculate and withdraw the required dose in ml according to route of administration:

For intravenous route (IV)	For intramuscular route (IM)
$2.4 \text{ mg} \times \text{body weight (kg)}$ IV artesunate solution concentration 10 mg/ml Round up to the next whole number. Discard if total dose is less than 0.5 ml.	$2.4 \text{ mg} \times \text{body weight (kg)}$ IM artesunate solution concentration 20 mg/ml Round up to the next whole number. Discard if total dose is less than 0.5 ml.
<b>Example:</b> Dose needed IV for 6 kg child: $2.4 \times 6 = 14.4 \text{ ml}$ 14.4 rounded up to 15 ml	<b>Example:</b> Dose needed IM for 6 kg child: $2.4 \times 6 = 14.4 \text{ ml}$ 14.4 rounded up to 15 ml

**IMPORTANT**

Total doses less than 0.5 ml should be rounded up to 0.5 ml (not 1 ml).  
For example, if the dose is 0.3ml, rounded up to 0.5 ml.

Intravenous route (IV)			Intramuscular route (IM)		
Weight	Dose	Concentration: 10mg/ml	Weight	Dose*	Concentration: 20mg/ml
kg	mg	ml	kg	mg	ml
< 5	10	1	< 5	10	0.5
5 - 8	20	2	5 - 8	20	1
9 - 12	30	3	9 - 12	30	2
13 - 16	40	4	13 - 16	40	2
17 - 20	50	5	17 - 20	50	3
21 - 25	60	6	21 - 25	60	3
26 - 29	70	7	26 - 29	70	4
30 - 33	80	8	30 - 33	80	4
34 - 37	90	9	34 - 37	90	5
38 - 41	100	10	38 - 41	100	5
42 - 45	110	11	42 - 45	110	6
46 - 50	120	12	46 - 50	120	6
51 - 54	130	13	51 - 54	130	7
55 - 58	140	14	55 - 58	140	7
59 - 62	150	15	59 - 62	150	8
63 - 66	160	16	63 - 66	160	8
67 - 70	170	17	67 - 70	170	9
71 - 75	180	18	71 - 75	180	9
76 - 79	190	19	76 - 79	190	10
80 - 83	200	20	80 - 83	200	10
84 - 87	210	21	84 - 87	210	11
88 - 91	220	22	88 - 91	220	11
92 - 95	230	23	92 - 95	230	12
96 - 100	240	24	96 - 100	240	12

Parallels: the upper line for each weight band is 0.9 mg/kg, i.e. 10 kg covers 13 - 14.9 kg  
\* Half the IV dose rounded up to 1 mg

**6 ADMINISTER**

■ Inject slowly. For young babies, parrot doses of more than 2 millilitres over different sites.

**7 DOSING SCHEDULE**

Give 3 parenteral doses for a minimum of 24 hours once started, irrespective of the patient's ability to tolerate oral medications earlier.

- Day 1: Dose 1: on admission (0 Hours); Dose 2: 12 hours later
- Day 2: Dose 3: 24 hours after first dose

■ If the patient can take oral medication, prescribe a full 3-day course of recommended first-line oral Artemisinin Combination Therapy (ACT).

■ If the patient cannot take oral medication, continue with parenteral treatment (one dose a day) for a maximum of 7 days, until oral medication can be given.

■ A course of injectable artesunate should always be followed by a 3-day course of ACT.

■ Evaluate the patient's progress regularly.

**IMPORTANT**

- Prepare a fresh solution for each administration.
- Discard any unused solution after use.

**WHO RECOMMENDED TREATMENT\***

\* For intravenous route (IV) and intramuscular route (IM) artesunate solutions are available in 10 mg/ml and 20 mg/ml concentrations respectively. The WHO recommends the use of the 20 mg/ml concentration for intramuscular injection. The WHO recommends the use of the 10 mg/ml concentration for intravenous injection.

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# FAMILY

- In Zambia, families take an active role in patient care.
- This patient was admitted from a rural village, this had an impact on:
  - Economic
  - Community
  - Family
- Whilst emergency treatment including malaria drugs are free, families have to pay for other items.



# PREVENTION

- Malaria is preventable.
- Within the hospital environment transmission can continue between patients and staff due to overcrowding and a lack of nets, this allows mosquitoes to continue bite patients (Carter & Mukonka 2017. Shepherd et al 2010).
- In malaria season, precautions may include spraying of wards, doors and windows covered with nets and if available every bed should have a mosquito nets.
- Sufficient bed nets should be available to allow them to be changed between patients, as this may in turn become an infection risk.



# LESSONS LEARNT & SUMMARY

- Critical care nurses experiences limited (Bates 2008)
- Early diagnosis – detailed history (including travel history)
- 1400 cases and 6 reported deaths in 2015 (Public Health England 2016).
- Notifiable disease



**malaria**  
**NO MORE**  
united kingdom

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### Further reading:

Carter C. Mukonka P. (2017). Malaria: diagnosis, treatment and management of a critically ill patient. *British Journal of Nursing*. 26 (13): 762-767

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