CURRENT TRENDS IN PREVENTION AND CONTROL OF MALARIA, FILARIASIS, DENGUE, CHIKUNGUNYA

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MD SWASTHAVRITTA

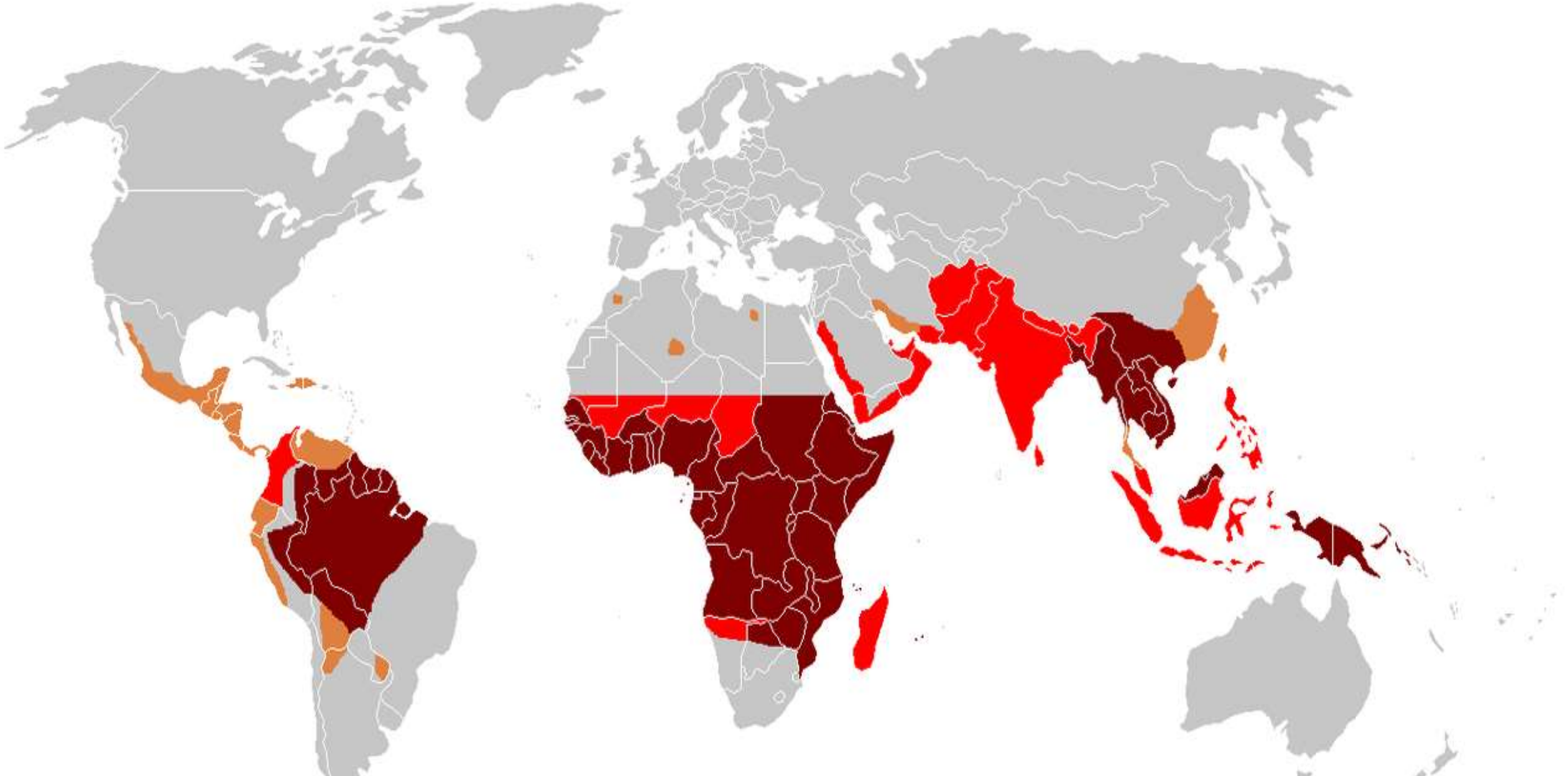
Directorate of National Vector Borne Disease Control Programme (NVBDCP)

- It is the central nodal agency for the prevention and control of vector borne diseases i.e. Malaria, Dengue, Lymphatic Filariasis, Kala-azar, Japanese Encephalitis and Chikungunya in India. It is one of the Technical Departments of Directorate General of Health Services, Government of India.

MALARIA

- Malaria is a life-threatening disease caused by parasites that are transmitted to people through the bites of infected female *Anopheles* mosquitoes.
- In 2015, 95 countries and territories had ongoing malaria transmission,
- About 3.2 billion people – almost half of the world's population – are at risk of malaria.
- Malaria is preventable and curable, and increased efforts are dramatically reducing the malaria burden in many places.

- Between 2000 and 2015, malaria incidence among populations at risk (the rate of new cases) fell by 37% globally. In that same period, malaria death rates among populations at risk fell by 60% globally among all age groups, and by 65% among children under 5.
- Sub-Saharan Africa carries a disproportionately high share of the global malaria burden. In 2015, the region was home to 88% of malaria cases and 90% of malaria deaths.



Distribution of malaria in the world: ♦ Elevated occurrence of chloroquine- or multi-resistant malaria ♦ Occurrence of chloroquine-resistant malaria ♦ No *Plasmodium falciparum* or chloroquine-resistance ♦ No malaria

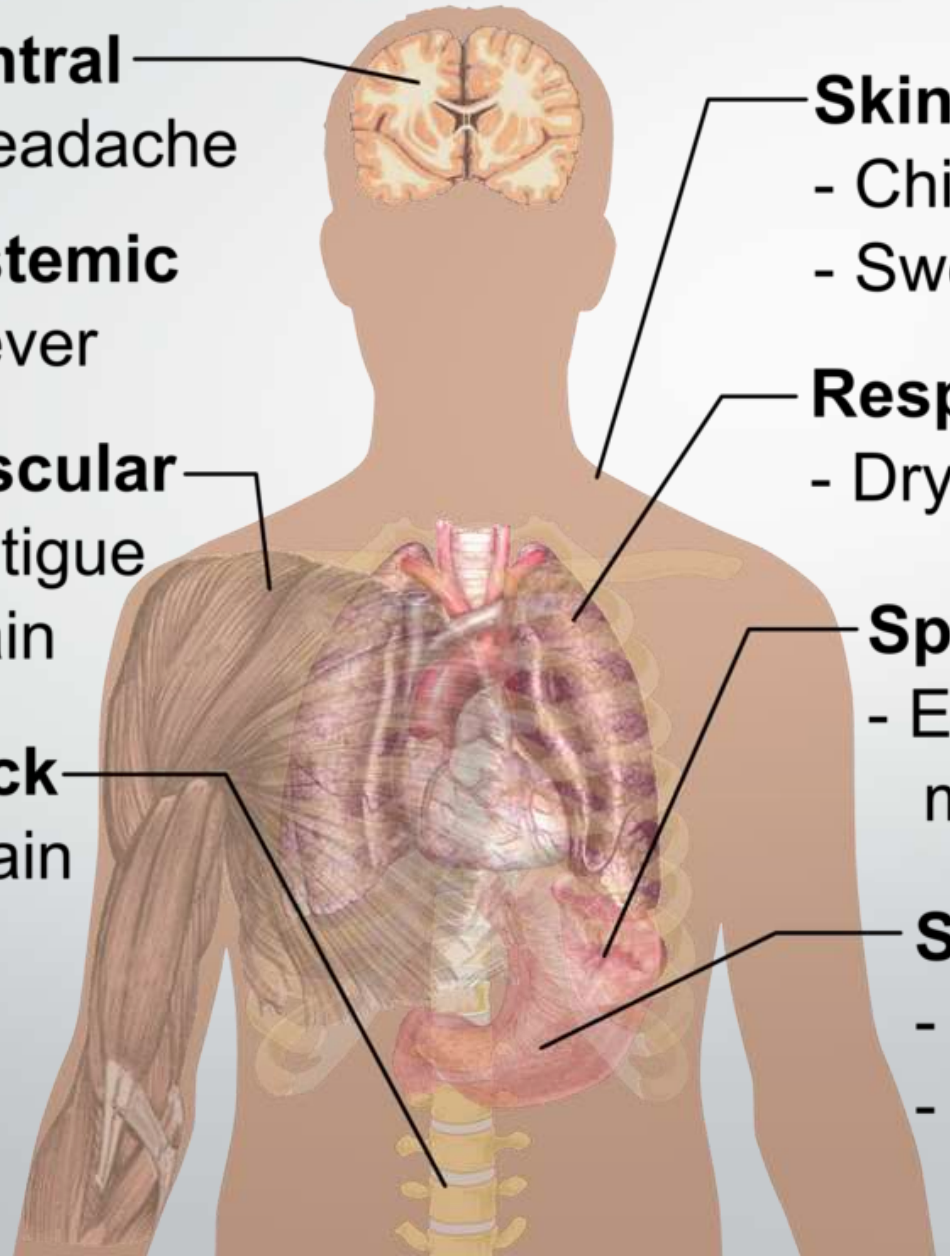
Causative factor

- Malaria is caused by Plasmodium parasites. The parasites are spread to people through the bites of infected female *Anopheles* mosquitoes, called "malaria vectors." There are 5 parasite species that cause malaria in humans, and 2 of these species –*P. falciparum* and *P. vivax* – pose the greatest threat.
- *P. falciparum* is the most prevalent malaria parasite on the African continent. It is responsible for most malaria-related deaths globally.
- *P. vivax* is the dominant malaria parasite in most countries outside of sub-Saharan Africa.

P. malariae, *P. ovale*, and *P. knowlesi are also species of plasmodium.*

Symptoms of

Malaria



Central
- Headache

Systemic
- Fever

Muscular
- Fatigue
- Pain

Back
- Pain

Skin
- Chills
- Sweating

Respiratory
- Dry cough

Spleen
- Enlarge-ment

Stomach
- Nausea
- Vomiting

SYMPTOMS

- Malaria is an acute febrile illness.
- In a non-immune individual, symptoms appear 7 days or more (usually 10–15 days) after the infective mosquito bite.
- The first symptoms – fever, headache, chills and vomiting – may be mild and difficult to recognize as malaria.
- If not treated within 24 hours, *P. falciparum* malaria can progress to severe illness, often leading to death.
- Children with severe malaria frequently develop one or more of the following symptoms:

  severe anaemia, respiratory distress in relation to metabolic acidosis, or cerebral malaria.

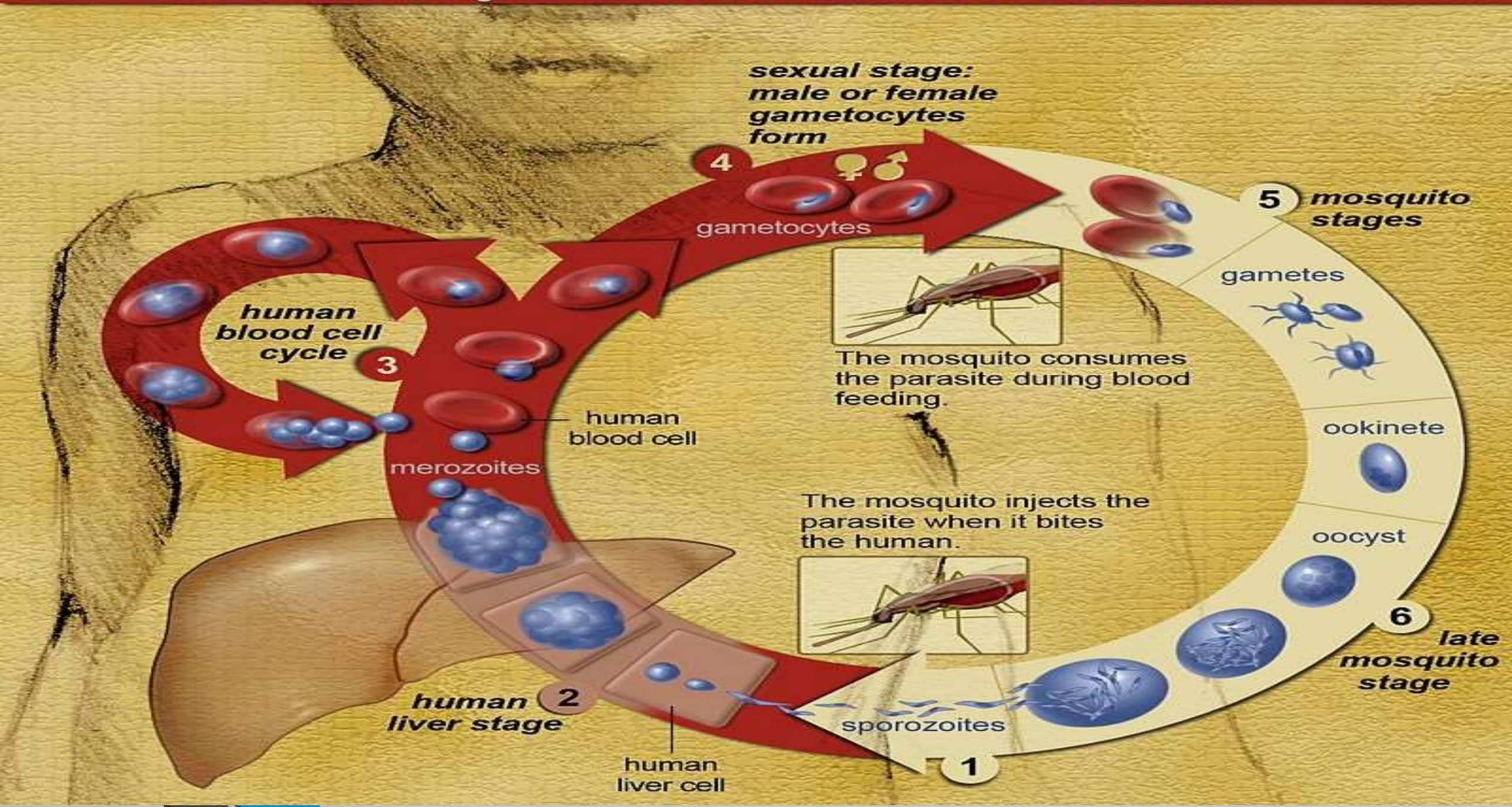
- In adults, multi-organ involvement is also frequent.
- In malaria endemic areas, people may develop partial immunity, allowing asymptomatic infections to occur.

Complications

- Development of respiratory distress, which occurs in up to 25% of adults and 40% of children with severe *P. falciparum* malaria.
- Possible causes include respiratory compensation of metabolic acidosis, non cardiogenic pulmonary oedema, concomitant pneumonia, and severe anaemia.
- Although rare in young children with severe malaria, acute respiratory distress syndrome occurs in 5–25% of adults and up to 29% of pregnant women.

- Coinfection of HIV with malaria increases mortality.
- Renal failure is a feature of black water fever, where hemoglobin from lysed red blood cells leaks into the urine.

Life Cycle of the Malaria Parasite

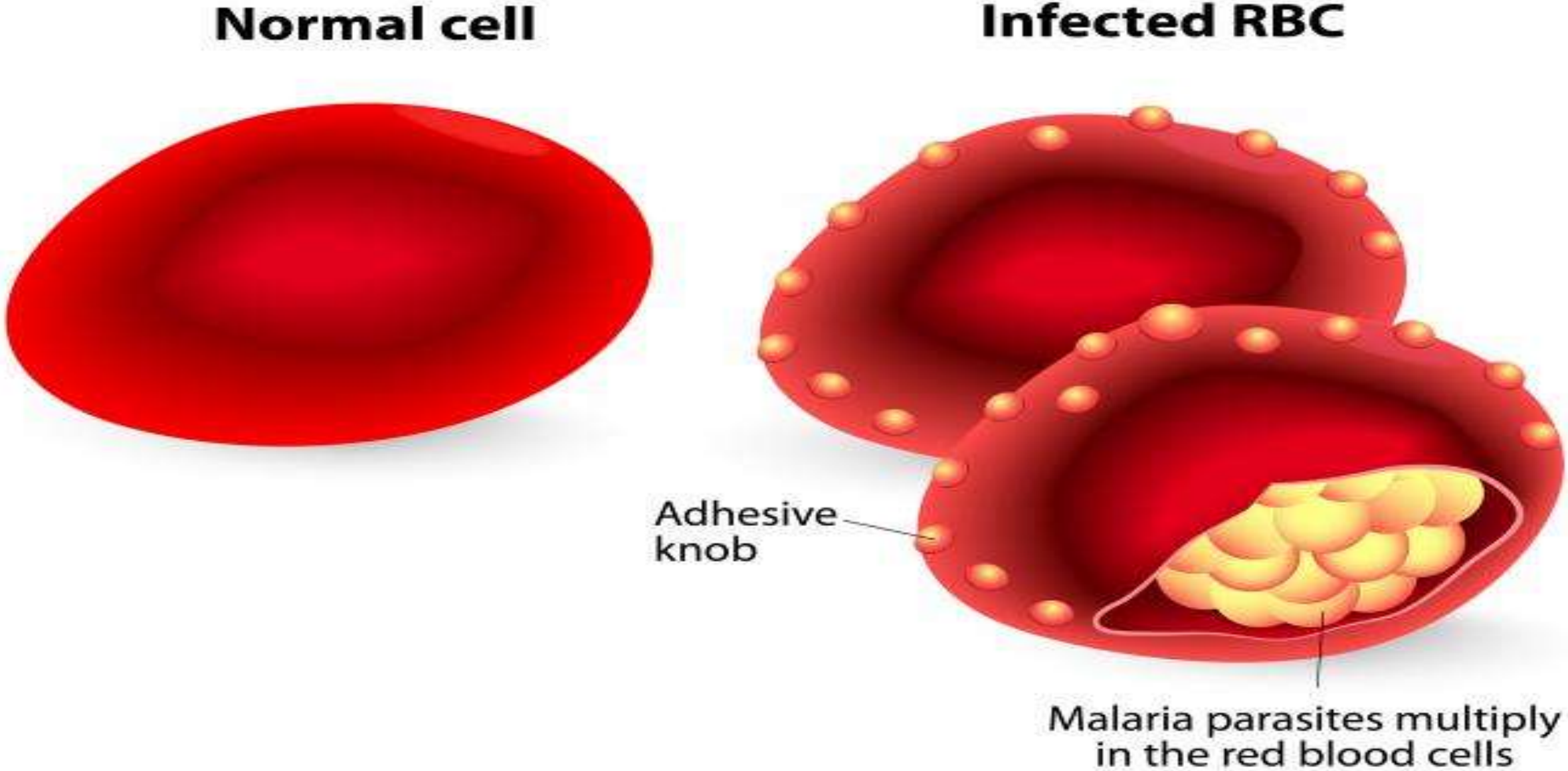


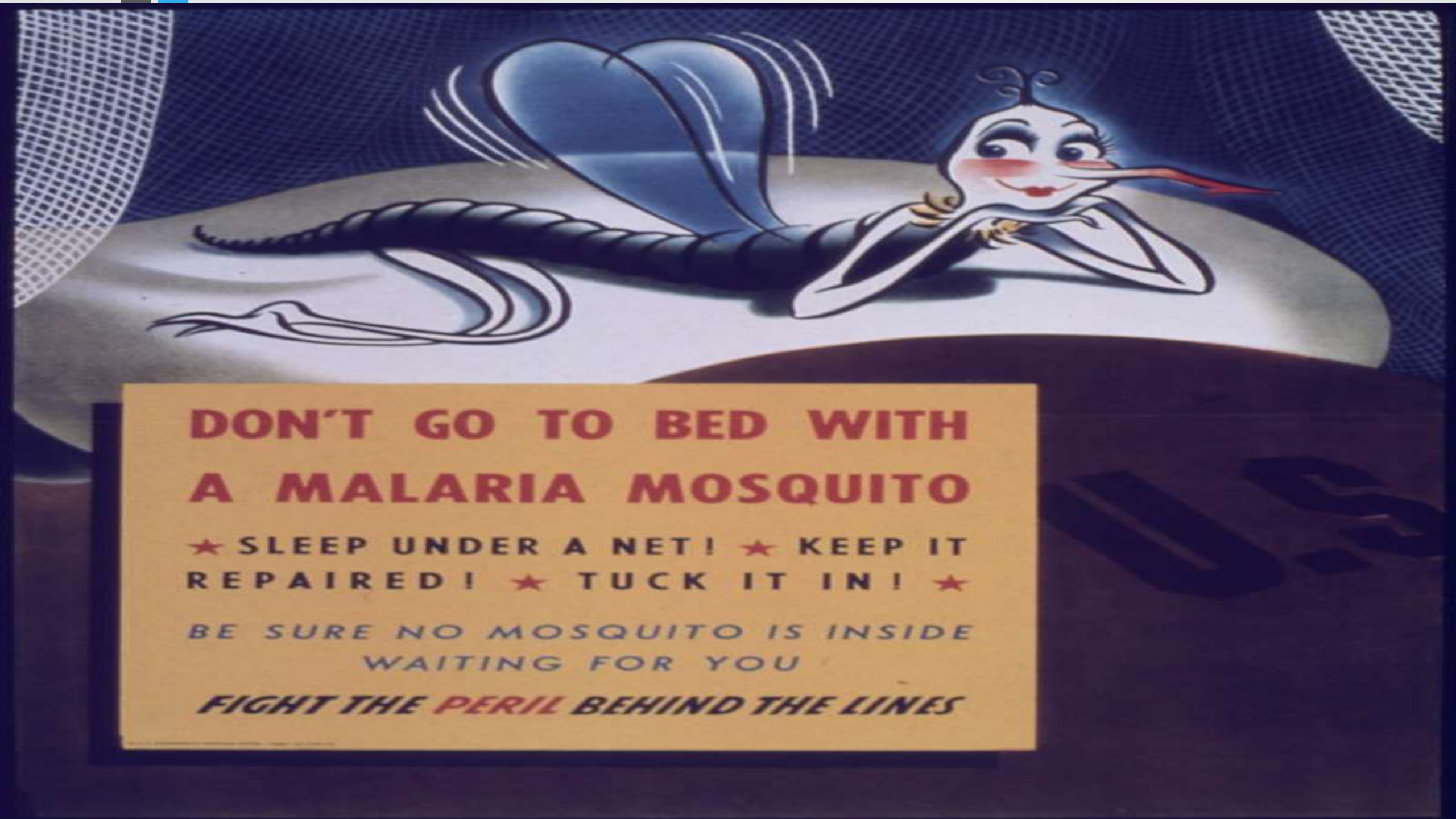
- In the life cycle of *Plasmodium*, a female *Anopheles* mosquito (the definitive host) transmits a motile infective form (called the **sporozoite**) to a vertebrate host such as a human (the secondary host), thus acting as a transmission vector.
- A sporozoite travels through the blood vessels to liver cells (**hepatocytes**), where it reproduces asexually (tissue **schizogony**), producing thousands of merozoites.
- These infect new red blood cells and initiate a series of asexual multiplication cycles (blood **schizogony**) that produce 8 to 24 new infective **merozoites**, at which point the cells burst and the infective cycle begins a new.

- Other **merozoites** develop into immature gametocytes, which are the precursors of male and female gametes. When a fertilised mosquito bites an infected person, gametocytes are taken up with the blood and mature in the mosquito gut.
- The male and female gametocytes fuse and form an **ookinete—a** fertilized, motile zygote.
- **Ookinetes** develop into new **sporozoites** that migrate to the insect's salivary glands, ready to infect a new vertebrate host.
- The **sporozoites** are injected into the skin, in the saliva, when the mosquito takes a subsequent blood meal.

- Only female mosquitoes feed on blood; male mosquitoes feed on plant nectar, and do not transmit the disease.
- The females of the *Anopheles* genus of mosquito prefer to feed at night.
- They usually start searching for a meal at dusk, and will continue throughout the night until taking a meal.
- Malaria parasites can also be transmitted by **blood transfusions**, although this is rare.

MALARIA


Normal cell
Infected RBC
Adhesive knob
Malaria parasites multiply in the red blood cells


DON'T GO TO BED WITH
A MALARIA MOSQUITO
★ SLEEP UNDER A NET! ★ KEEP IT REPAIRED! ★ TUCK IT IN! ★
BE SURE NO MOSQUITO IS INSIDE WAITING FOR YOU
FIGHT THE PERIL BEHIND THE LINES

High risk area

- Presumptive treatment
- Day 1
- Tab: Chloroquine-10mg/kg body weight (600mg adult dosage)
- Tab Primaquine-0.75mg/kg body weight (45mg adult dose)
- Day 2
- Tab: Chloroquine-10mg/kg body weight (600mg adult dosage)
- Day 3
- Tab: Chloroquine-5 mg/kg body weight (300 mg adult dosage)
- Radical Treatment
- P Vivax
- Tab Primaquine 0.25mg/kg body weight
- P falciparum no further treatment

Low risk area

- Presumptive treatment
- Day 1
- Tab: Chloroquine-10mg/kg body weight (600mg adult dosage)
- Radical Treatment
- P Vivax
- Tab: Chloroquine-10mg/kg body weight (600mg adult dosage)
- And Tab Primaquine 0.25mg/kg body weight daily for 5 days
- P falciparum
- Tab: Chloroquine-10mg/kg body weight (600mg adult dosage)
- And Tab Primaquine 0.75mg/kg body weight single dose

Severe complicated

- Artimisinine 10mg/kg body weight once a day for 5 days
- Artesunate 1mg/kg body weigh IM/IV at an interval of 4-6 hours on first day and once in a day for four days
- Artemether-1.6mg/kg bdy weight 2 doses at 4-6 hours on first day followed by once a day for 4 days
- Artether – 150mg daily IM for 3 days for adults only

AYUSH - 64

An Ayurvedic Anti-Malarial Drug

CENTRAL COUNCIL FOR RESEARCH IN AYURVEDIC SCIENCES
Ministry of AYUSH
(Ayurveda, Yoga & Naturopathy, Unani, Siddha and Homoeopathy)
Government of India

Kuberaksa (*Caesalpinia crista* Linn.)

Chirayata (*Swertia chirata* Buch-Ham)

Katuki (*Picrorhiza kurroa* Royle)

Background

Among all tropical diseases, Malaria is one of the most prevalent, destructive, widely spread disease condition and well known to Ayurvedic Physicians since ancient times. Descriptions concerning aetiopathogenesis, clinical features and line of management are detailed under Vishamajvara in ancient classical literature of Ayurveda. Considering its wide prevalence and developing drug resistance to malarial parasite, CCRAS has developed a polyherbal non-toxic, anti-malarial drug-Ayush-64 through extensive pharmacological, toxicological and clinical studies. This has been pented by the Council through National Research Development Corporation, New Delhi

AYUSH - 64

Composition

Each tablet contains :

Saptaparna Stem Bark *(Alstonia sholaris)*	Aqueous Extract	100 mg
Katuki Root *(Picrorhiza kurroa)*	-do-	100 mg
Chirayata Whole plant *(Swertia chirata)*	-do-	100 mg
Kuberaksha Seed *(Caesalpinia crista)*	Power	200 mg

Pharmacological and Toxicological Studies

Ayush-64 in the dose of 500 mg per kg body weight for 12 weeks has been proved safe and non-toxic.

Clinical Trials

General Clinical Trial : Clinical trials of Ayush-64 were conducted on 1442 positive cases of malaria at various Research institutes and Centres of the Council located in different parts of the country. The response of treatment was 89% and the findings were comparable with known Anti-malarial drugs-Chloroquine and Primaquine.

Double Blind studies : OPD & IPD level double blind clinical studies were conducted on 178 patients which revealed that the drug is effective in 95.4% of patients. The drug showed effect both against fever and the Parasite.

Epidemic Malaria Control Programme (Western Rajasthan 1984, Assam, 1995)

During Epidemic Malarial control programmes at Rajasthan and Assam approximately 3,600 and 10,000 P-vivax cases ware treated respectively. Clinical improvement was observed in almost all cases. Positive P. falciparum was observed in some cases and parasite clearance and clinical improvement was found in few number of cases.

Side Effects : No side/toxic effect in prescribed doses

Dose : As mentioned below or as directed by the physician.

Adult : 4 tablets (500 mg per tab.), thrice daily for 5-7 days

Children (5-12 yrs) : 2 tablets, thrice daily for 5-7 days

Infants (below 5 yrs) : Powder of 1 tablet with honey, three times a day

IPR Status - Patent No. 152863

Further information can be obtained from :

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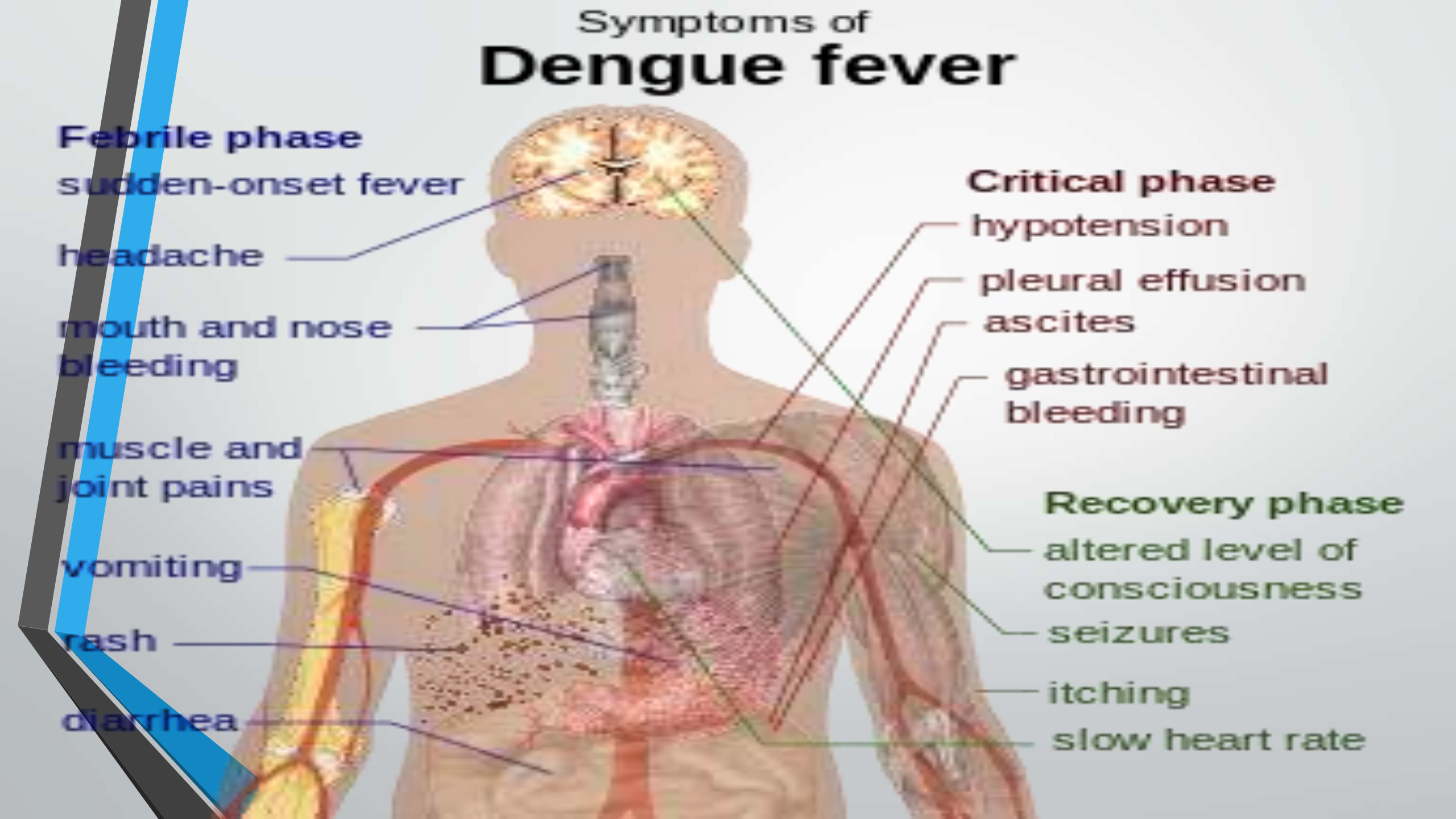
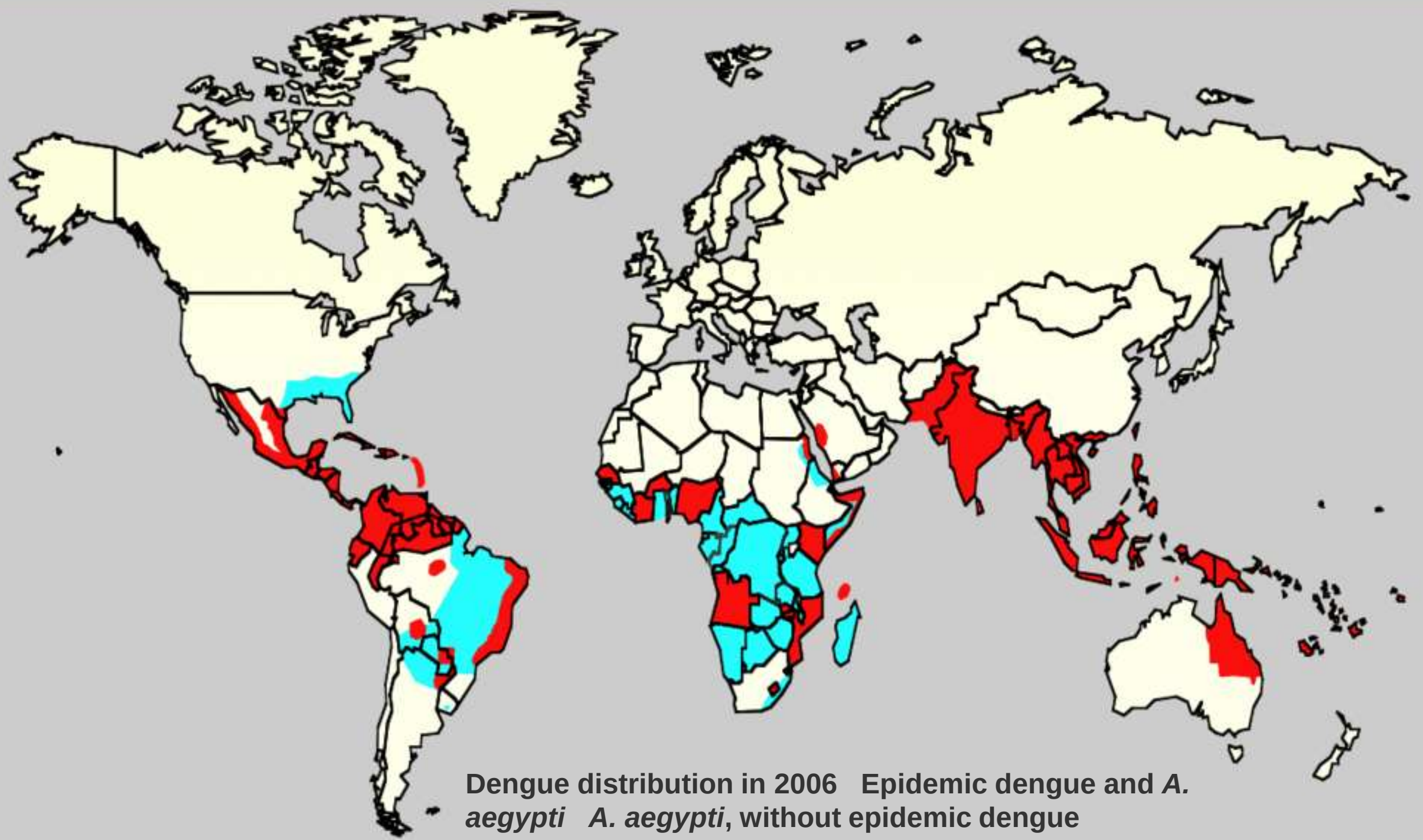
No. 61-65, Institutional Area, Opp. 'D'-Block, Janakpuri, New Delhi-110058
Telephone : +91-11-28525520/28524457, Fax : +91-11-28520748
E-mail : dg-ccras@nic.in
Website : www.ccras.nic.in
www.indianmedicine.nic.in

Dengue fever

- **Dengue fever** is a mosquito-borne tropical disease caused by the dengue virus.
- The alternative name for dengue, "breakbone fever", comes from the associated muscle and joint pains
- Symptoms typically begin three to fourteen days after infection.
- This may include a high fever, headache, vomiting, muscle and joint pains, and a characteristic skin rash.
- Recovery generally takes less than two to seven days.
- In a small proportion of cases, the disease develops into the life-threatening **dengue hemorrhagic fever**, resulting in bleeding, low levels of blood platelets and blood plasma leakage, or into **dengue shock syndrome**, where dangerously low blood pressure occurs.


Symptoms of
Dengue fever
Febrile phase
sudden-onset fever
headache
mouth and nose bleeding
muscle and joint pains
vomiting
rash
diarrhea
Critical phase
hypotension
pleural effusion
ascites
gastrointestinal bleeding
Recovery phase
altered level of consciousness
seizures
itching
slow heart rate

- The febrile phase involves high fever, potentially over 40 °C (104 °F)
- Associated with generalized pain and a headache; this usually lasts two to seven days.
- Nausea and vomiting may also occur. A rash occurs in 50–80% of those with symptoms in the first or second day of symptoms as flushed skin, or later in the course of illness (days 4–7), as a measles-like rash. A rash described as "islands of white in a sea of red" has also been observed.
- Some petechiae (small red spots that do not disappear when the skin is pressed, which are caused by broken capillaries) can appear at this point, as may some mild bleeding from the mucous membranes of the mouth and nose.
- The fever itself is classically biphasic or saddleback in nature, breaking and then returning for one or two days.
- Incubation Period- 8 to 10 days



Dengue distribution in 2006 Epidemic dengue and *A. aegypti* *A. aegypti*, without epidemic dengue

Days of illness

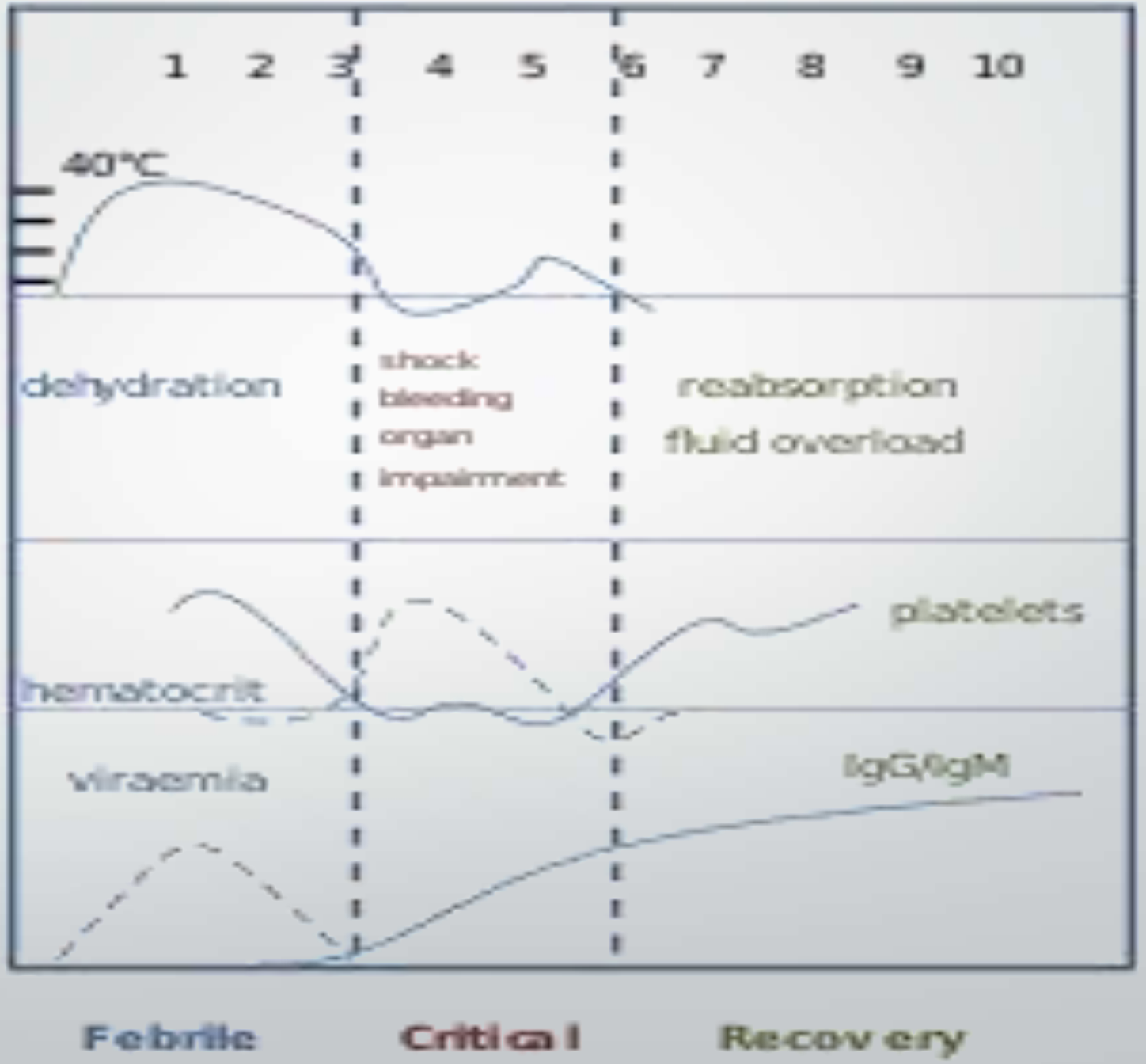
Temperature

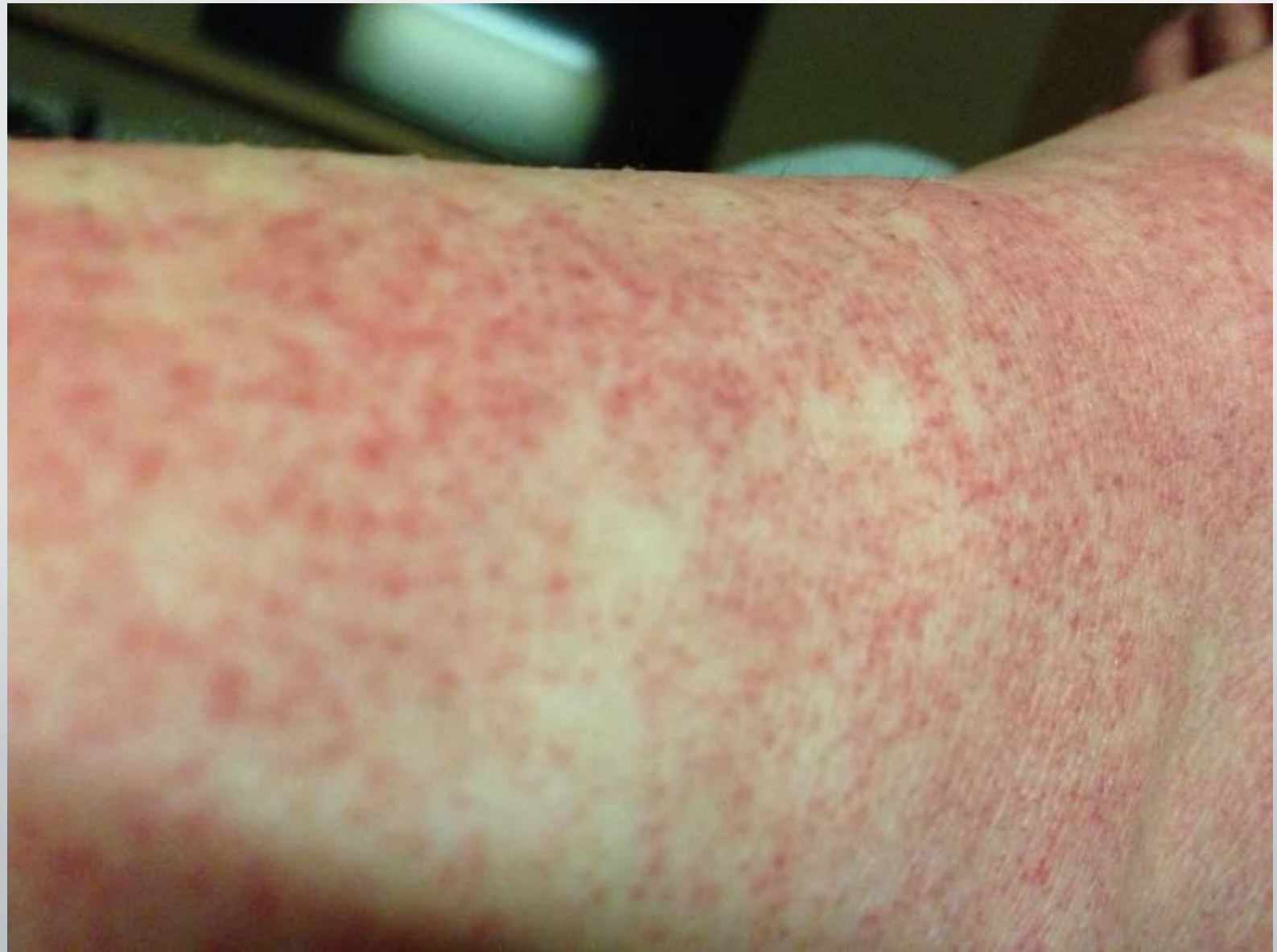
Potential clinical issues

Laboratory changes

Serology and virology

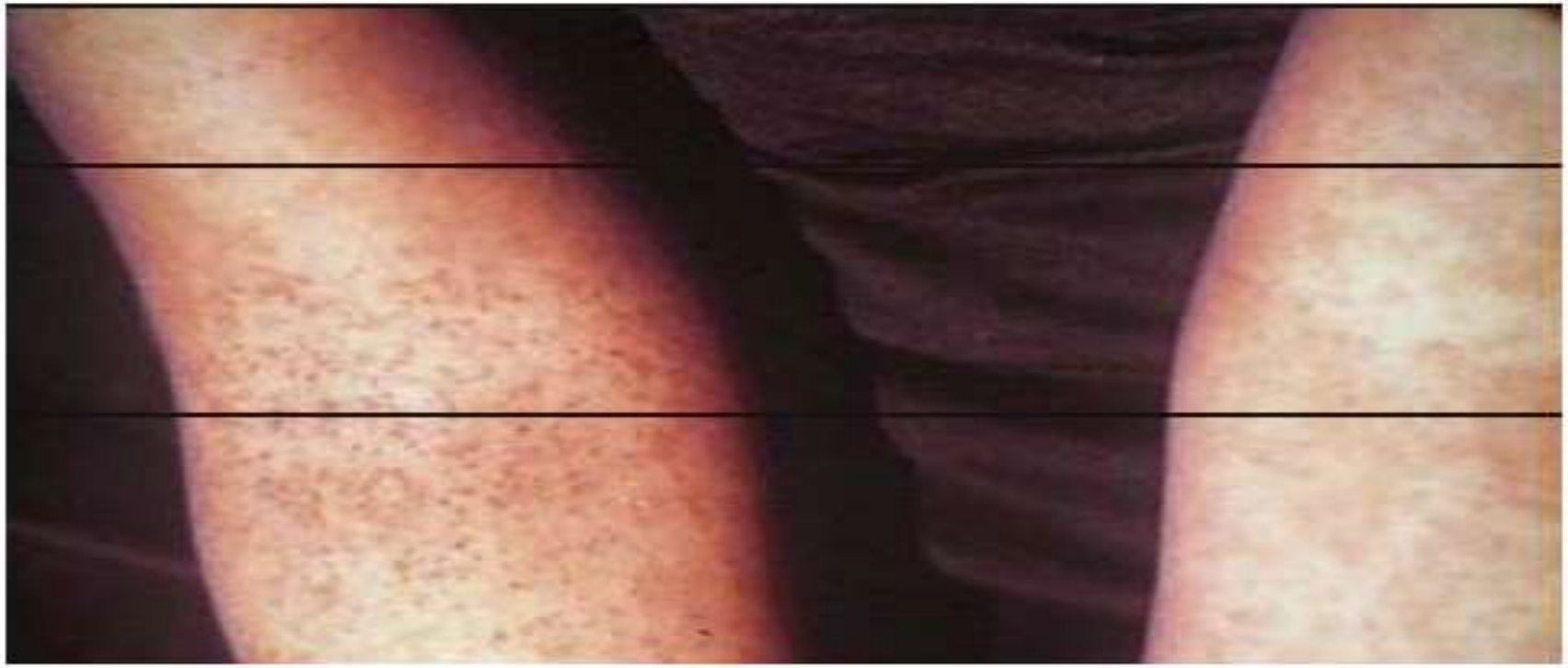
Phases of illness





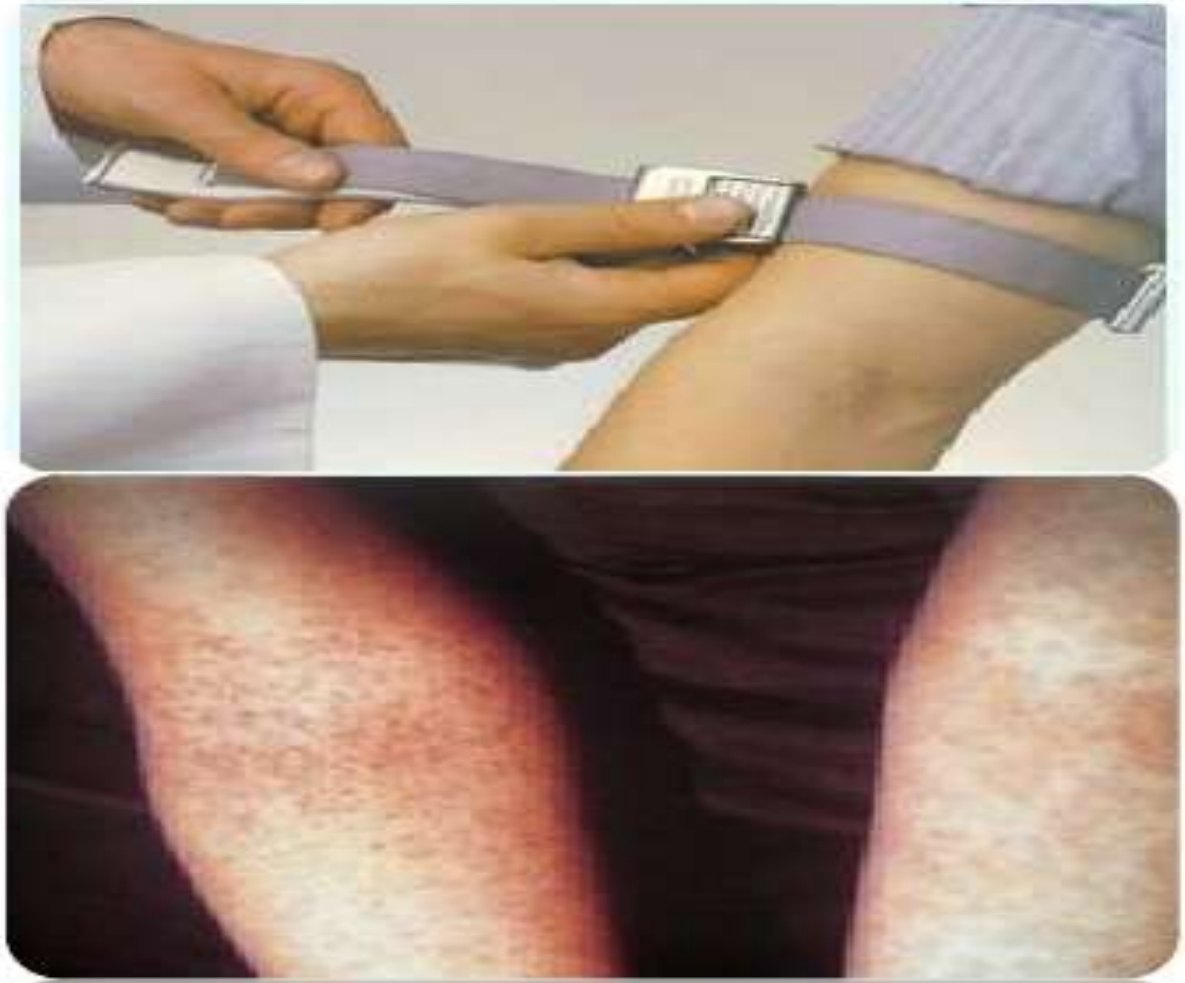
Positive Tourniquet Test

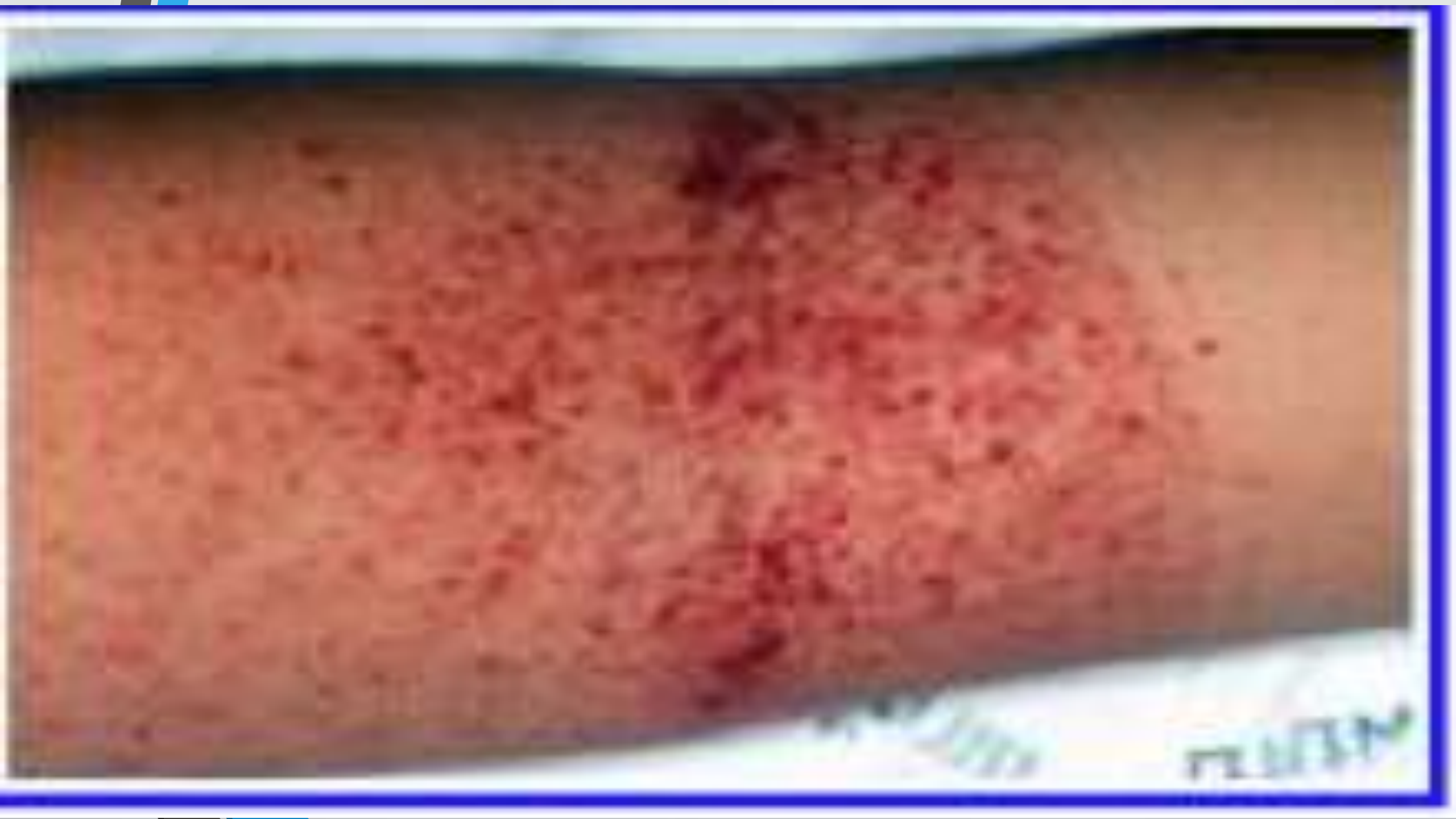
- A typical positive result from a tourniquet test may look like. This patient has more than 20 petechiae per square inches.

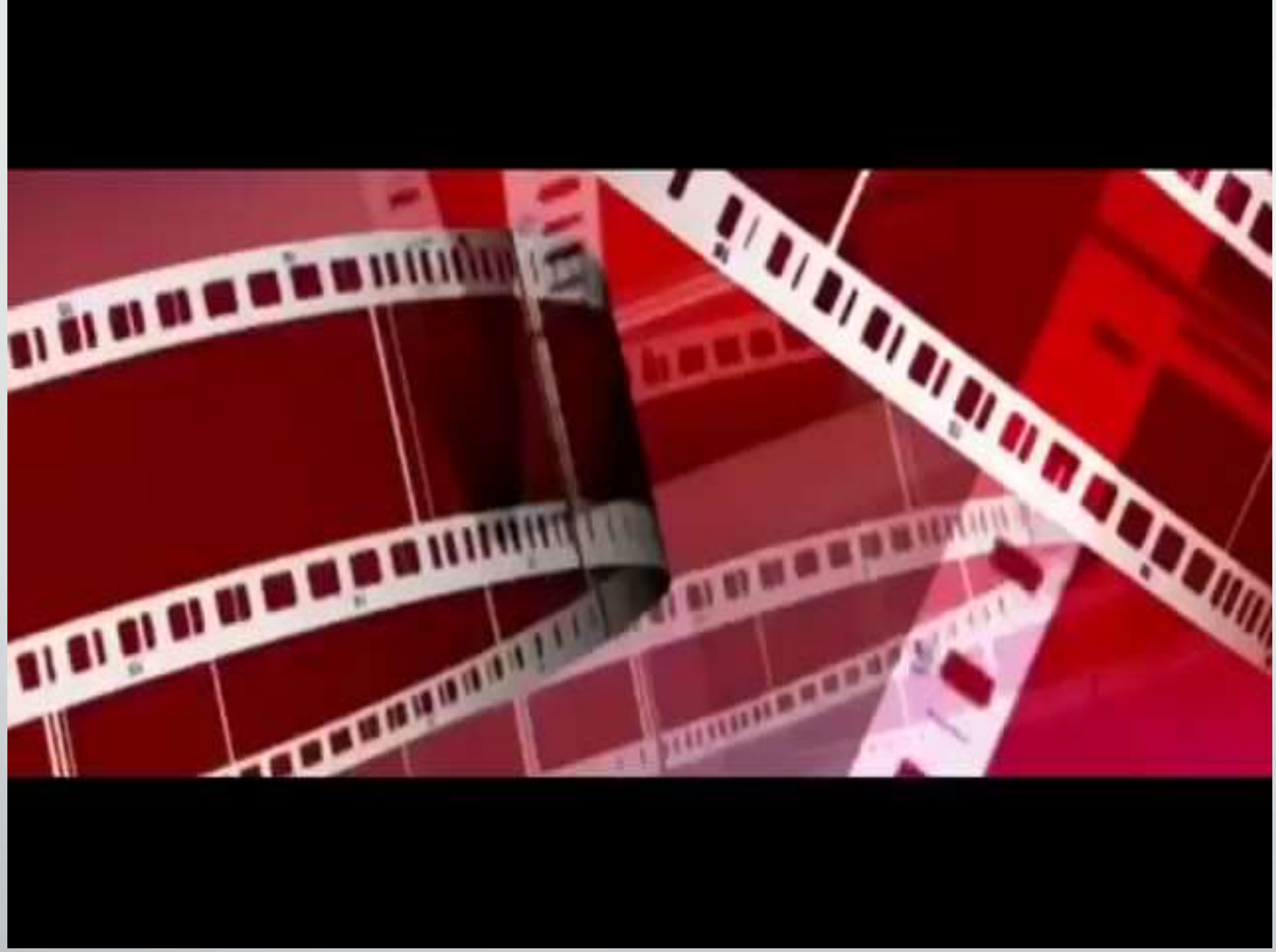


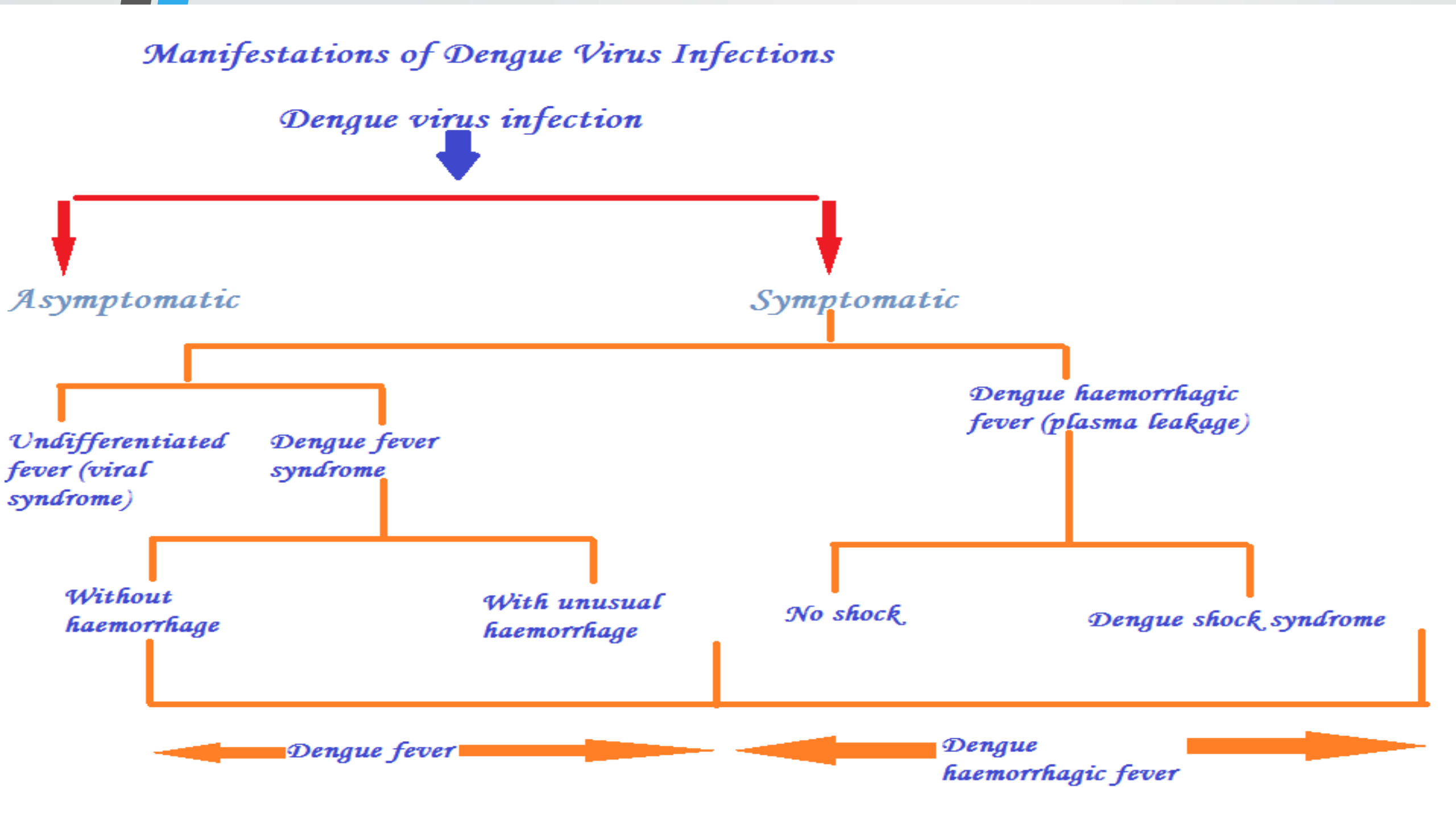
How to do a Tourniquet test

- The tourniquet test is performed by inflating a blood pressure cuff to a point mid-way between the systolic and diastolic pressures for five minutes. A test is considered positive when 10 or more petechiae per 2.5 cm2 (1 inch) are observed. In DHF, the test usually gives a definite positive result (i.e. >20 petechiae). The test may be negative or mildly positive during the phase of profound shock.



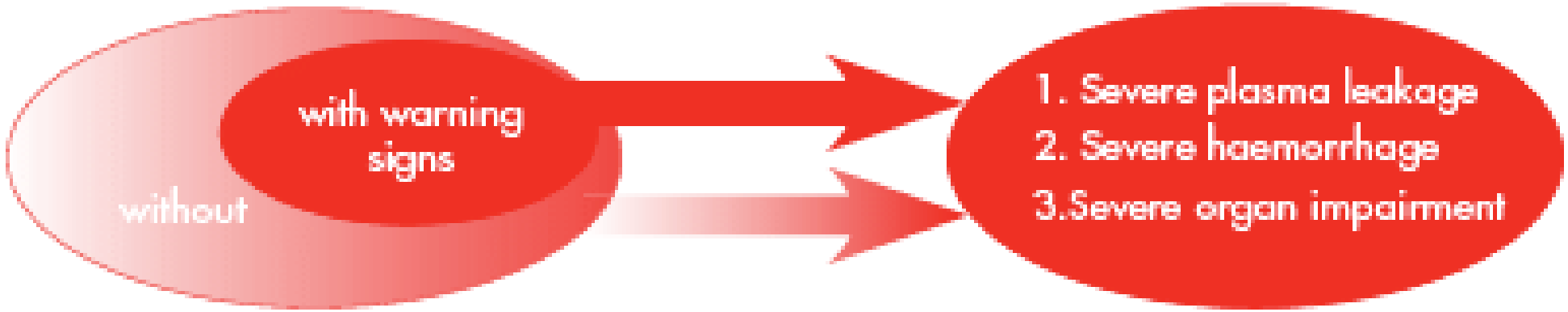





Manifestations of Dengue Virus Infections
Dengue virus infection
Asymptomatic
Symptomatic
Undifferentiated fever (viral syndrome)
Dengue fever syndrome
Dengue haemorrhagic fever (plasma leakage)
Without haemorrhage
With unusual haemorrhage
No shock
Dengue shock syndrome
Dengue fever
Dengue haemorrhagic fever

DENGUE ± WARNING SIGNS

SEVERE DENGUE



CRITERIA FOR DENGUE ± WARNING SIGNS

Probable dengue

live in /travel to dengue endemic area.

Fever and 2 of the following criteria:

- Nausea, vomiting
- Rash
- Aches and pains
- Tourniquet test positive
- Leukopenia
- Any warning sign

Laboratory-confirmed dengue

(important when no sign of plasma leakage)

Warning signs*

- Abdominal pain or tenderness
- Persistent vomiting
- Clinical fluid accumulation
- Mucosal bleed
- Lethargy, restlessness
- Liver enlargment >2 cm
- Laboratory: Increase in HCT concurrent with rapid decrease in platelet count

*(requiring strict observation and medical intervention)

CRITERIA FOR SEVERE DENGUE

Severe plasma leakage

leading to:

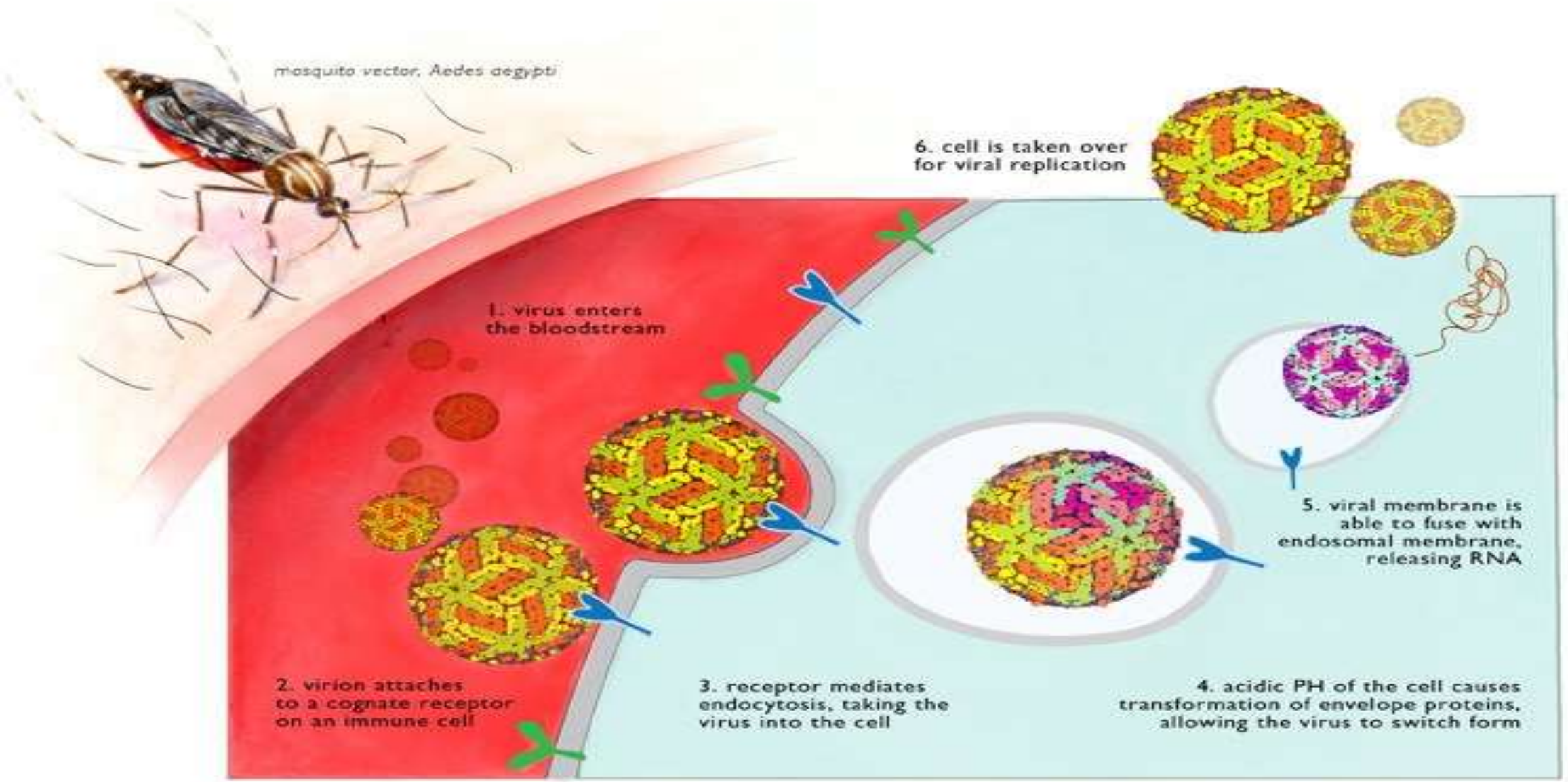
- Shock (DSS)
- Fluid accumulation with respiratory distress

Severe bleeding

as evaluated by clinician

Severe organ involvement

- Liver: AST or ALT >= 1000
- CNS: Impaired consciousness
- Heart and other organs



Primary Infection Pathway of the Dengue Virus

Dengue

Prevention and Treatment

With more than one-third of the world's population living in areas at risk for transmission, dengue infection is a leading cause of illness and death in the tropics and subtropics. Each year, an estimated 100 million cases of dengue fever occur worldwide. Majorities in tropical & subtropical areas of the world, with the greatest risk occurring in the Indian subcontinent, Southeast Asia and Southern China.

Dengue is caused by any one of four related viruses transmitted by the bite of an Aedes mosquitoe. There are no vaccine to prevent infection with dengue virus (DENV) and the most effective protective measures are those that avoid mosquito bites. When infected, early recognition and prompt supportive treatment can substantially lower the risk of developing severe disease.

Dengue fever is a painful, debilitating mosquito-borne disease caused by any one of four closely related dengue viruses. Symptoms appear 3—14 days after the infective bite. Dengue fever is a febrile illness that affects infants, young children and adults.

What is dengue fever?

- Illness caused by- female ***Aedes*** mosquito
- Bites during the day
- Lays its eggs in clean, stagnant water

Symptoms of Dengue Fever

- **Sudden, high fever**
- **Severe headaches**
- **Pain behind the eyes**
- **Severe joint and muscle pain**
- **Nausea**
- **Vomiting**
- **Skin rash, which appears three to four days after the onset of fever**
- **Mild bleeding (such a nose bleed, bleeding gums, or easy bruising)**

It can be fatal

- If Symptoms are severe consult Physician immediately

Prevent *Aedes* from Breeding!

- Remove all sources of stagnant water
- Deny the ***Aedes*** mosquito of any chance to breed

Clean regularly house hold articles

Spread the dengue prevention message to others

Let your family, friends and neighbours know about the dangers of breeding Mozzies!!

Medicines :

Single Herbal Drug :

- Amrita Swaras + Madhu
- Bilwa Churna + Madhu
- Swarasa of Bodhivriksha (pipal) leaf + Madhu
- Swarasa of Papaya leaf + madhu

Rasausdhi :

- Jaimangal Rasa
- Tribhuwankirti Rasa
- Kumarkalyan Rasa
- Mritunjaya Rasa

Kawath :

- Panchtikta Kwath, Phal-trikadi Kwath
- Dasamool Kwath

Vati :

- Mahasudarshana Ghan Vati
- Sanjeevani Vati
- Guduchyadi Ghan Vati

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Website: www.nia.nic.in • E-Mail: nia-rj@nic.in

- **Preparation of Ayurvedic Medicines :**
- The medicines was prepared by the stems of Tinospora cardifolia (Wild) Miers (10 gm) and the plant of Boerhaavia diffusa Linn (10 gm). Both are crushed in pastle and mortar.
- Boil 160 ml of water with crushed mixture of Tinospora cardifolia (Wild) Miers and Boerhaavia diffusa Linn until the quantity remains 20-40 ml.
- Then filter the mixture and add 10 gm of honey in it. This mixture should be taken twice or thrice a day depending upon the condition of patient.
- While consuming these Ayurvedic medicines don't consume common salt. These medicines are given with cow's milk.

Commonly talked about treatment

- Caripill
- Dosage and directions for use Two capsules once (stat) in a day -if platelet count is above 50,000 Two capsules in the morning & two in evening- if platelet count is below 50,000
- Dosage and directions for use Two capsules once (stat) in a day -if platelet count is above 50,000
- Two capsules in the morning & two in evening- if platelet count is below 50,000
- Duration: 5-10 days in Dengue/Malaria/Viral 15-30 days in ITP/Liver Cirrhosis
- Contraindications: Hypersensitivity to any of the ingredients Precautions:
- Pregnancy & Lactation

  Interactions: No drug interaction has been reported so far

- There are no specific antiviral drugs for dengue, however maintaining proper fluid balance is important
- Treatment depends on the symptoms.
- Those who are able to drink, are passing urine, have no "warning signs" and are otherwise healthy can be managed at home with daily follow up and oral rehydration therapy
- "warning signs", or who cannot manage regular follow-up should be cared for in hospital
- Paracetamol(acetaminophen) is used for fever and discomfort while NSAIDs such as ibuprofen and aspirin are avoided as they might aggravate the risk of bleeding

- Blood transfusion is initiated early in people presenting with unstable vital signs in the face of a *decreasing haematocrit*
- Packed red blood cells or whole blood are recommended, while platelets and fresh frozen plasma are usually not

Chikungunya

- “Chikungunya” is derived from the Makonde root verb “Kungunyala” which means “to become contorted” or more specifically to say “which bends up” which reflects the posture of patient suffering from the arthritic symptoms. This disease is almost always self limited and rarely fatal.
- Chikungunya usually starts with sudden onset of fever, chills, headache, nausea, vomiting, joint pain with or without joint swelling and rash which is very similar to that of Dengue fever.
- Unlike dengue there is no haemorrhagic or shock syndrome.

Etiology

- Chikungunya virus (CHIKV) belongs to the family *Togaviridae*, is member of genus *Alphavirus.* The vector of this disease is *Aedes mosquito* (Sps. *aegypti*.), which was the same vector for Dengue and Yellow fever. Recently the Pasteur Institute in Paris claimed that the virus has suffered a mutation that enables it to be transmitted by *Aedes albopictus* (Tiger Mosquito) also.

Clinical Features

- The incubation period of Chikungunya can be 2-12 days, but usually 3-7 days.
- After an incubation period there is a sudden onset of fever (>40° C or 104° F), chills, arthralgia or arthritis, rash, nausea, vomiting, headache, conjunctival suffusion, mild photophobia.
- The joints of the extremities are swollen and tender. Some patients may have incapacitating arthralgia or arthritis, which may last for weeks to months.

- Acute Chikungunya fever lasts for few days to a couple of weeks but as Dengue fever, West Nile fever and other arboviral fevers, some patients may complaint prolonged fatigue which lasts for several weeks.
- In the recent out break in Andhra Pradesh, the fever and crippling joint pain is the prevalent complaint.
- Fever lasted for 2 days but joint pains, intense headache, insomnia and an extreme degree of prostrations lasts for variable period, usually for 5-7 days.

- The symptoms of ***Vata Pitta Jvara*** and ***Vata Kapha Jvara*** are similar to the symptoms of Chikungunya fever to some extent. (Table-3) The description of ***Sandhigata Sannipata Jvara*** mentioned by Bhava Prakkasha (1550AD) can be equated with Chikungunya fever. Sandhigata Sannipata Jvara is characterised by fever, joint pains and swelling, sleeplessness, cough etc., Bhela Samhita (Sutra Sthana, 13) has mentioned Sharada jvara – a seasonal fever that occurs preceeding the rainy season, usually attributable to viral fevers.

- ***Medicines that can be used as per condition***
- Guduchi *Tinospora cordifolia* Willd. Miers, Sunti *Zingiber officinale* Rosc., Bhunimba *Andrographis paniculata* Linn., Patha *Cissampelos pariera* Linn. , Tulasi *Ocimum sanctum* Linn. , Nimba *Azadirachta indica* A.Juss, Haritaki *Terminalia chebula* Retz., Vibhitaki *Terminalia belerica* Roxb., Amalaki *Emblica officinalis* Geartn. Manjishta *Rubia cordifolia* Linn., Musta *Cyperus rotundus* Linn., Katuki *Picrorrhiza Kurroa Royle ex. Benth* , Rasna *Pluchea lanceolata* Oliver&Hiern , Guggulu *Commiphora wightii* (Arn.) , Bhandari , Haridra *Curcuma longa* Linn. , Sallaki *Boswelia serrata* Roxb., Nirgundi *Vitex negundo* Linn.

General health Promoters

- Aswagandha *Witahnica somnifera* Dunal, Amalaki *Emblica offcinalis* Gaertn., Guduchi *Tinospora cordifolia* Willd. Miers , Yastimadhu *Glycyrrhiza glabra* Linn

Vector control measures

Tulasi *Ocimum sanctum* Linn. , Nimba *Azadirachta indica* A. Juss , Aparajita *Clitorea terneta* Linn. , Vacha *Acorus calamus* Linn. , Jatamansi *Nardostachys jatamansi* DC. , Guggulu *Commiophora wightii* (Arn.) Bhandari , Salaparni *Desmodium gangeticum* DC.,Sala *Shorea robusta* Linn.

- **Jvara hara Dhuma churnas described in Bhaishajya Ratnavali**
- **Astanga Dhuma (Bhaishajya Ratnavali, Jvaradhikara, 254).** Guggulu, Nimba Patra, Vacha, Kushta, Haritaki, Yava, Sarsapa and Ghrita all mixed together and burnt.
- **Aparajitha Dhooma Curna (Bhaishajya Ratnavali,Jvaradhikara, 255)**
- Guggulu,Gandha trina, Vacha, Sarja, Nimba, Arka, Agaru, Devadaru mixed together and burnt.

- **Group I:**
- 1. Amrutotharam Kwatha Churna 150 gm. (to prepare kwatha 60 ml. thrice daily)
- 2. Tribhuwanakeerthi rasa - 21 Nos. 1 tablet thrice daily
- 3. Vilwadi gutika- 21 Nos. 1 tablet thrice daily
- 4. Sudarsana - 21 Nos. 1 tablet thrice daily

- **Group II:**
- 1. Rasna Saptakam kwatha Churna- 150 gm. (To prepare kwatha 60 ml. thrice daily)
- 2. Sudarsanam Tab.- 21 Nos. 1 tablet thrice daily
- 3. Vettumaran gutika- 21 Nos. 1 tablet thrice daily
- 4. Arogyavardhini Vati-21 Nos. 1 tablet thrice daily
- 5. Kottamchukkadi lepa Churna-100 gm. for external application, where swelling dwells)

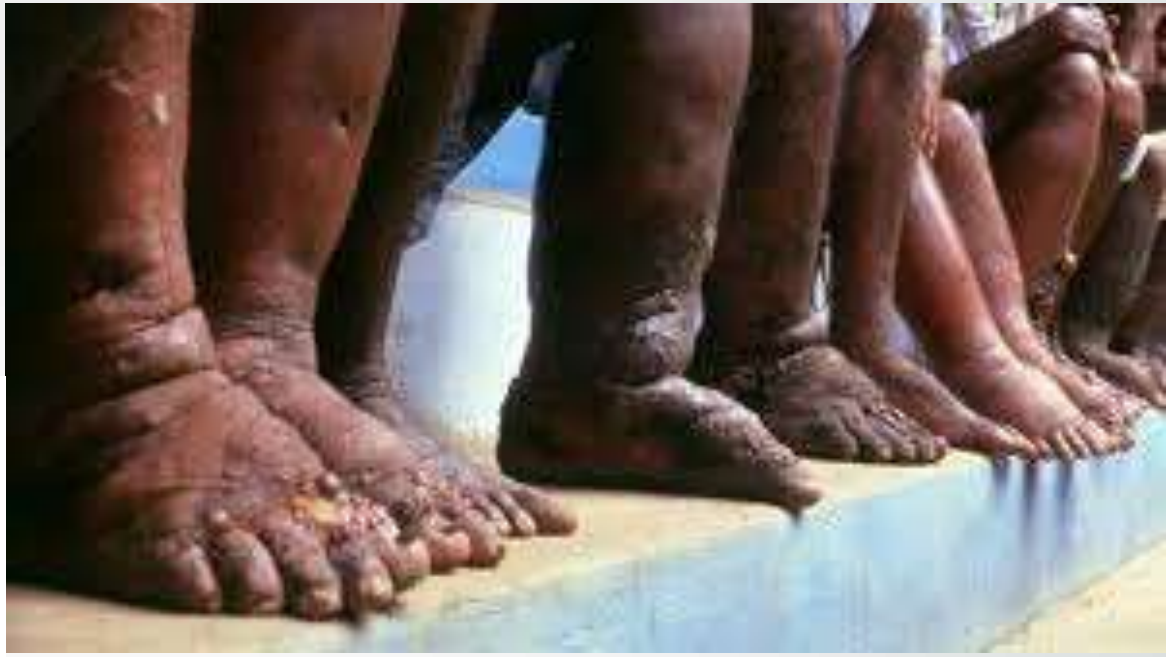
Preventive camps

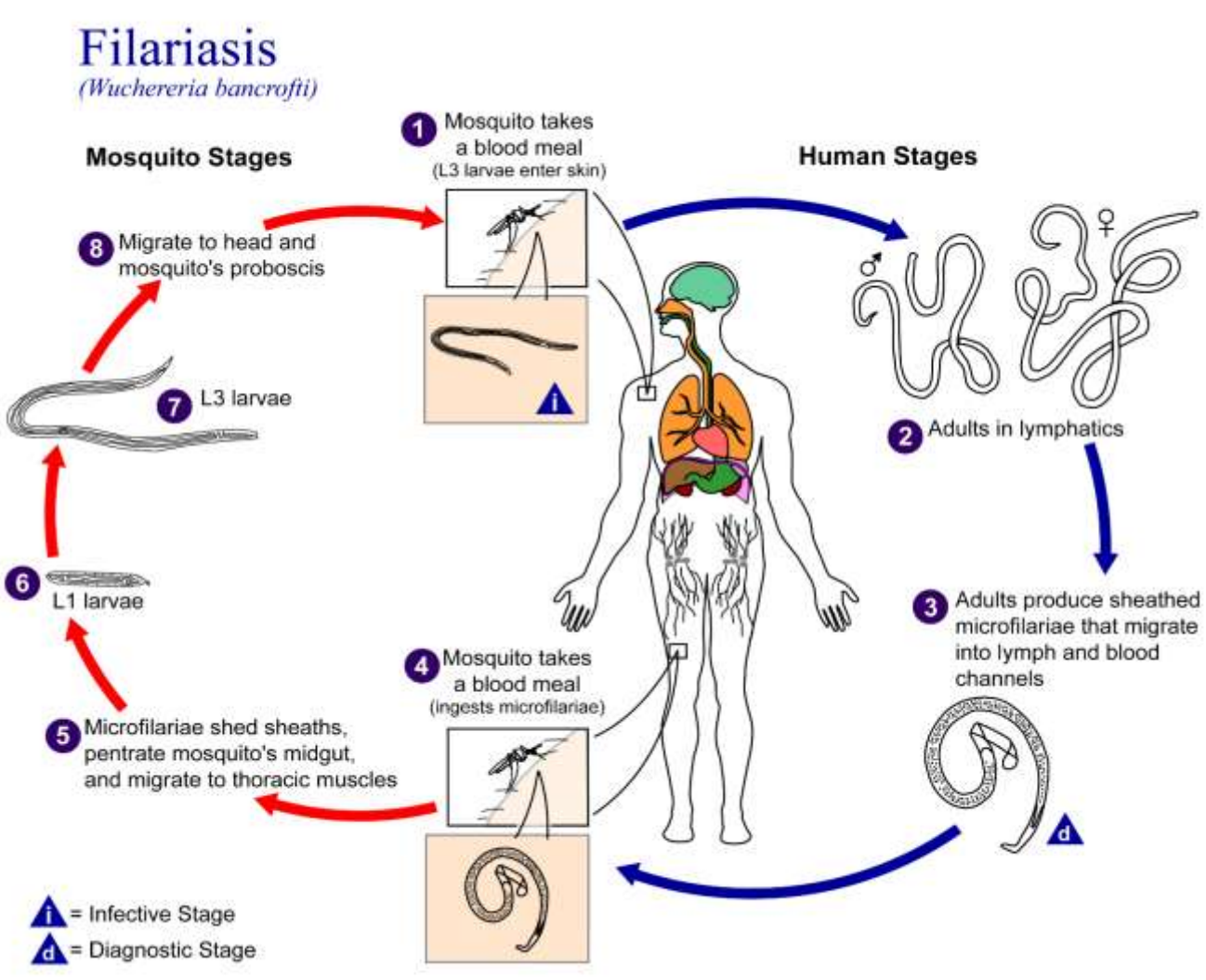
- During, this patients were advised "***Swasthya Raksha Amruta Peya***" prepared by using the decoction of ***Guduchi*** (*Tinospora cordifolia*), ***Nadod*** (*Vitex negundo*) **Nimba** (*Azadirachta indica*), ***Tulasi*** (*Ocimum sanctum*), ***Sunthi*** (*Zingiber officinale*), ***Kariyatu*** (*Andrographis paniculata*), ***Nagarmoth*** (*Cyperus rotundus*), ***Pathyadhi Kvatha***, ***Guduchyadi Kvatha*** and ***Maha Sudarshana Curna***. The dose of the *Swasthya Raksha Amrut Peya* is 50 ml twice daily for 7 days.

Curative camps

- During Curative camps, the probable cases of Chikungunya patients were advised ***Mahasudarsana Ghana Vati, Samshamani Vati, AYU - 64, Kanchanara Guggulu*** **and** ***Pathyadi Guggulu*** for 7 days with *Swasthya Raksha Amruta Peya.*

FILARIASIS




Filariasis
(Wuchereria bancrofti)
Mosquito Stages
Human Stages
1 Mosquito takes a blood meal (L3 larvae enter skin)
2 Adults in lymphatics
3 Adults produce sheathed microfilariae that migrate into lymph and blood channels
4 Mosquito takes a blood meal (ingests microfilariae)
5 Microfilariae shed sheaths, pentrate mosquito's midgut, and migrate to thoracic muscles
6 L1 larvae
7 L3 larvae
8 Migrate to head and mosquito's proboscis
i = Infective Stage
d = Diagnostic Stage

- Lymphatic filariasis caused by the mosquitoborne, lymphatic-dwelling nematodes *Wuchereria bancrofti and Brigia malayi* is still a common tropical parasitic disease.
- Of the estimated 120 million people affected by this disease in the world, one-third live in India. W. bancrofti accounts for ~90% of the disease burden while B. malayi contributes the remaining ~10%.
- Next to psychiatric illness, this is the leading cause for permanent and long-term disability.
- Several recent advances have helped not only in better understanding of the pathogenesis of this disease, but also in the diagnosis, management and in planning effective strategies for its global prevention.

Asymptomatic microfilaraemia

- In an endemic area the largest group of affected individuals in the otherwise healthy young adults and children who in-spite of being clinically asymptomatic, harbour microfilaria in their peripheral blood.
- It is important to know that even at this stage of the disease abnormalities of the lymphatic vessels like dilatation appears to be irreversible even after treatment.

Acute Adeno-Lymphangitis (ADL)

- Attacks of fever and chills due to ADL are the commonest acute manifestations, which occur in the affected limbs or sometimes involve the genitalia.
- These episodes may be seen both in the early and late stages of the disease.
- The affected area is painful, tender, warm, red and swollen.
- The lymph nodes in the groin and axilla, are frequently inflamed.
- These acute ADL attacks recur many times a year in patients with filarial swelling, their incidence increasing with the degree of lymphedema.

- Secondary infections due to bacteria like streptococci are responsible for these acute episodes
- In the affected limbs, lesions which favour entry of these infecting agents can be frequently demonstrated, either in the form of fungal infection in the webs of the toes, minor injuries, eczema, insect bites or infections.
- These ADL attacks are responsible for the persistence and progression of the swelling leading on to elephantiasis not only of the limbs but also of the external genitalia and breasts.

Acute Filarial Lymphangitis

- Acute manifestations directly caused by adult worms are usually rare.
- They are seen when the adult worms are destroyed in the lymphatics either spontaneously or by drugs like diethylcarbamazine.
- Small tender nodules form at the location of adult worm death either in the scrotum or along the lymphatics.
- Lymph nodes may become tender. Inflamed large lymphatics may stand out as long tender cords underneath the skin, usually along the sides of chest or the upper arm and axilla associated with restriction of movement of affected limb.
- Though transient oedema may occur sometimes, these episodes are not associated with fever, toxemia or evidence of secondary bacterial infections.

  They generally subside without any treatment

Lymphoedema and Elephantiasis

- The commonest chronic manifestation of lymphatic filariasis is lymphoedema, which on progression leads on to elephantiasis.
- Even though lower limbs are commonly affected, upper limbs and male genitalia are frequently involved.
- In females, rarely the breasts and the external genitalia may also become elephantoid.
- Repeated ADL episodes responsible for the progression of lymphoedema continue to occur with greater frequency in higher grades of oedema.

- This is due to the fact that the presence of moisture in the web spaces of the closely apposed swollen toes promotes fungal infections damaging the skin, which in turn favour of infecting organisms.
- For this reason the frequency of ADL episodes is shown to increase in the rainy season, when people have to wade through water in the lanes
- In brugian filariasis the lymphoedema involves only the legs below the knee and upper limbs below the elbow.
- Acute ADL episodes are common in affected limbs like in bancroftian filariasis. But genitourinary lesions are not seen.

Genito-urinary lesions

- Hydrocoele is common chronic manifestation of bancroftian filariasis in the males.
- Chylocoele, chyluria and chylous ascites rarely occur.
- Apart from the lymphoedema of the scrotum and penis, sometimes the skin of the scrotum may be covered with vesicles distended with lymph, that may leak presenting as 'lymph scrotum'.
- Microscopic and rarely macroscopic haematuria is known to occur in people with asymptomatic microfilaraemia.
- Tropical pulmonary eosinophilia associated with high eosinophil counts in the blood is an occult manifestation of both W. bancrofti and B. malayi filariasis.

- Diethylcarbamazine (DEC)
- The earlier recommended dose of this drug was 6 mg/kg given daily for 12 days. Recent studies have shown that single dose of DEC 6mg/kg is as effective as the above standard dose given for 12 days.
- The adverse effects produced by the drug are seen mostly in patients who have microfilaria in their blood and are due to their rapid destruction which is characterized by fever, headache, myalgia, sore throat or cough lasting for 24 to 48 hours. They are usually mild and self-limiting requiring only symptomatic treatment

- ***Ivermectin***
- This drug acts directly on the microfilaria and in single doses of 200 to 400ugm/ kg keeps the blood microfilaria counts at very low levels even at the end of one year, like DEC.
- The adverse effects are similar to DEC and are mild due to the slower clearance of the parasitaemia.
- ***Albendazole***
- Destroy the adult filarial worms in doses of 400mg twice daily for two weeks. The death of the adult worm induces severe scrotal reactions in bancroftian filariasis since this is the common site where they are lodged.
- Albendazole has no direct action against the microfilaria and does not immediately lower the microfilaria counts. But when given in single dose of 400 mg in combination with DEC or ivermectin, the destruction of microfilaria by these drugs becomes more pronounced.
- Albendazole combined with DEC or invermectin is recommended in the global filariasis elimination programme.
- The strategy most suitable for elimination of filariasis in India with administration of single annual dose of albendazole 400mg along with DEC 6 mg/kg body weight.

- During the time of fever
- Shringa Bhasma, Sanjivani, Hinguleshwar- 100mg of each of these should be taken three times a day with warm water
- Medicines after fever subsides
- Pippali Churna, Nityananda Rasa, Shripadagajakeshari- One dose of 100mg should be given at night
- Apart from the above mentioned ayurvedic medicines, Kanchnaar-Guggulu, Triphala-Guggulu, Punarnavadi-Guggulu, Arogya-Vardhini should be given which helps in reducing swelling and thick skin.

Prevention

- **To prevent mosquito bites:** Use mosquito repellents containing DEET on exposed skin When indoors, stay in well-screened areas.
- Use bed nets if sleeping in areas that are not screened or air-conditioned.
- When working outdoors during day times, wear long-sleeved shirts and long pants to avoid mosquito bite.
- **(b). To Prevent Mosquito breeding**
- The prevention of mosquito breeding can be done by three methods such as Source reduction, use of larvicide and biological controls.

- 1). Source reduction can be done by elimination of all potential vector breeding places near the domestic or peri-domestic areas.
- Not allowing the storage of water for more than a week. Straining of the stored water by using a clean cloth once a week to remove the mosquito larvae from the water and the water can be reused.
- The sieved cloth should be dried in the sun to kill immature stages of mosquitoes.
- 2). Pyrethrum extract (0.1% ready-to-use emulsion) can be sprayed in rooms (not outside) to kill the adult mosquitoes hiding in the house.

- Temephos can be used at the dose of 1ppm/ once a week in place where water cannot be removed such as water for cattles and other purposes.
- 3). Biological controls such as introduction of larvivorous fish, namely *Gambusia* and Guppy in water tanks and other water sources.

- DDT, malathion, fenitrothion, propoxur, bendiocarb, alphacypermethrin,
- permethrin, deltamethrin, lambda-cyhalothrin, cyfluthrin and etofenprox.

THANK YOU