MEDICAL EDUCATION RESOURCE

DENGUE

Dengue ?

Agent ?

- **Dengue virus**
  - RNA virus
  - Family ? Flaviviridae

Dengue Virus Serotypes ?

- Four serotypes:
  - **DEN-1**
  - **DEN-2**
  - **DEN-3**
  - **DEN-4**

Key Points ?

- Infection with one serotype ? **lifelong immunity to that serotype only**
- Secondary infection with another serotype ?
  - ? risk of **severe dengue (DHF/DSS) ?**

Vector ?

- Transmitted by **Aedes mosquitoes**

Important Species ?

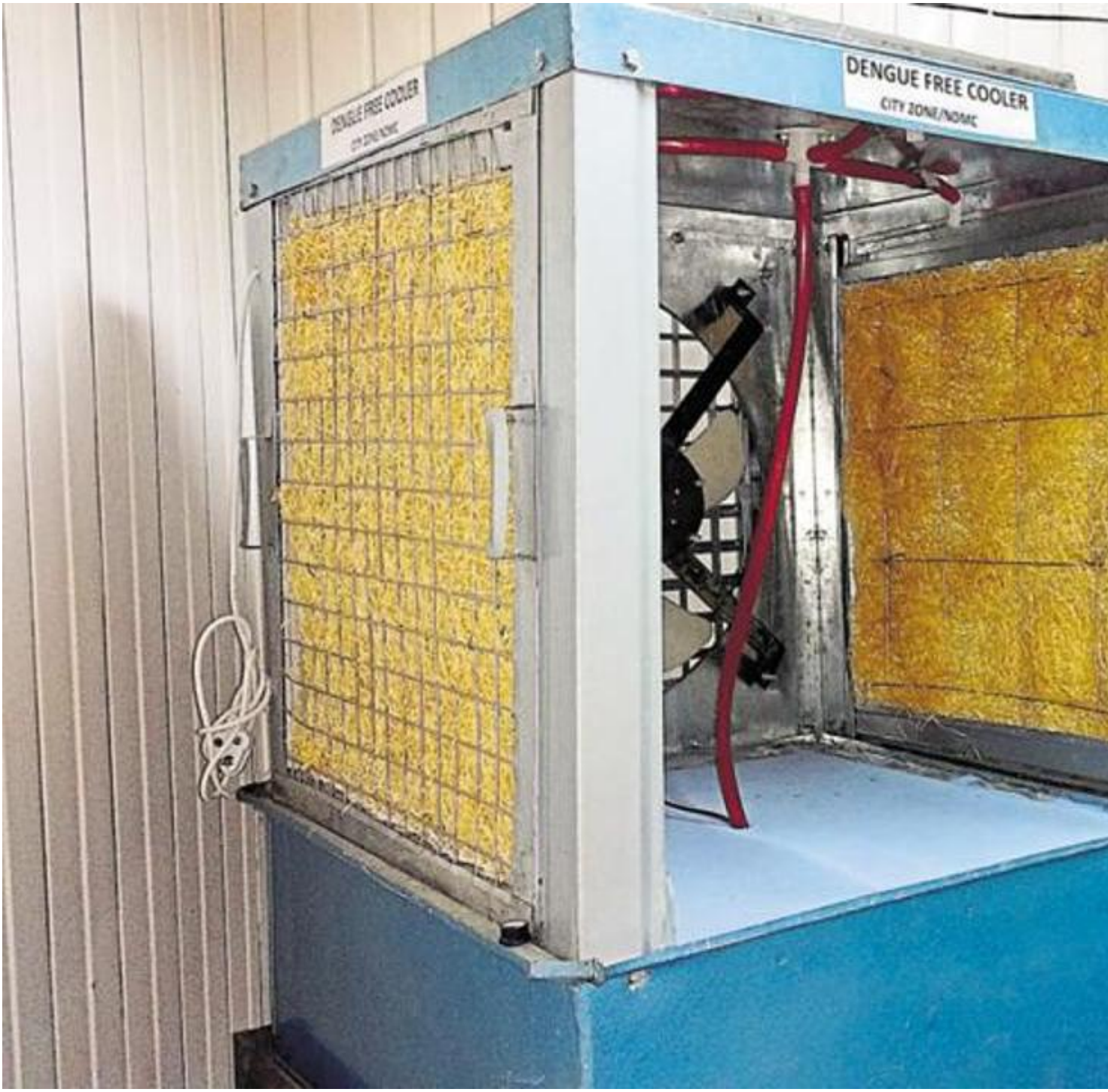
- **Aedes aegypti ?**
  - Principal vector

- **Aedes albopictus**
    - Secondary vector

Breeding Habits ?

https://www.researchgate.net/publication/371047144/figure/fig3/AS%3A11431281162152768%401685146827479/Identified-Aedes-mosqu

https://www.researchgate.net/publication/322996022/figure/fig2/AS%3A11431281271521615%401723668651692/Different-water-containe



Clean Water Collections ?

- Breeds in:
    - **Clean, stagnant water**

Artificial Containers ?

- Common breeding sites:
    - Water tanks
    - Coolers
    - Flower pots
    - Discarded tyres ?

Domestic / Peridomestic Breeding ?

- Occurs:
    - Inside houses (domestic)
    - Around houses (peridomestic)
- Makes dengue:
    - **Urban disease ?**

High-Yield Points ?

- Dengue virus ? **Flavivirus (RNA)**
- 4 serotypes ? **DEN 1–4**
- Secondary infection ? **severe dengue risk**
- Aedes aegypti ? **main vector**
- Breeding ? **clean water + containers (VERY IMPORTANT)**
- Dengue ? **urban vector-borne disease**

Dengue – Transmission & Pathogenesis ?

Transmission ?

Mode of Transmission

- **Bite of infected Aedes mosquito ?**

Key Features ?

- **Day-biting mosquito ?**
    - Peak biting ? early morning, late afternoon

Transmission Cycle ?

- **Human ? mosquito ? human cycle ?**
- Process:
    - Mosquito bites infected human ? acquires virus
    - Virus multiplies inside mosquito
    - Mosquito becomes infective
    - Transmits virus to another human

Pathogenesis ?

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1. Viraemia ?

- Virus enters bloodstream ? **viraemia develops**
- Responsible for:
    - Early symptoms (fever, malaise)

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2. Increased Vascular Permeability ?

- Key mechanism in severe dengue
- Leads to:
    - Plasma leakage
    - Hemoconcentration
    - Fluid accumulation

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3. Thrombocytopenia ?

- Decreased platelet count
- Causes:
    - Bone marrow suppression
    - Increased destruction
- Leads to:
    - Bleeding manifestations

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4. Shock in Severe Disease ?

- Due to:
  - Plasma leakage
  - Reduced circulating volume
- Results in:
  - **Dengue shock syndrome (DSS) ?**

High-Yield Points ?

- Transmission ? **Aedes (day-biting mosquito)**
- Cycle ? **human–mosquito–human**
- Vascular permeability ? **key in severe dengue**
- Thrombocytopenia ? **causes bleeding**
- Shock ? **due to plasma leakage (DSS)**

Dengue – Clinical Features ?

Classical Dengue Fever ?

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1. Fever ?

- Sudden onset
- High-grade fever
- Often **biphasic (saddle-back fever)**

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2. Headache

- Severe, frontal headache

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3. Retro-orbital Pain ?

- Pain behind eyes

- Increases on eye movement

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4. Myalgia ?

- Severe muscle pain
- Called **“break-bone fever”**

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5. Arthralgia

- Joint pain

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6. Rash ?

- Maculopapular rash
- Appears during illness

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7. Bleeding Manifestations ?

- Due to thrombocytopenia
- Features:
    - Petechiae
    - Gum bleeding
    - Epistaxis
    - Positive tourniquet test

Severe Dengue ?

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1. Plasma Leakage ?

- Increased vascular permeability
- Leads to:
    - Hemoconcentration
    - Pleural effusion / ascites

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2. Shock ?

- Due to plasma leakage
- Leads to:

- **Dengue Shock Syndrome (DSS)**

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3. Severe Bleeding ?

- Gastrointestinal bleeding
- Massive hemorrhage

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4. Organ Involvement ?

- Liver ? hepatitis
- Brain ? encephalopathy
- Kidney ? renal failure

High-Yield Points ?

- Classic triad ? **fever + myalgia + rash**
- Retro-orbital pain ? **characteristic feature**
- Dengue = **“break-bone fever”**
- Severe dengue ? **plasma leakage + shock + bleeding**
- Thrombocytopenia ? **key cause of bleeding**

Dengue – Diagnosis ?

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1. NS1 Antigen ?

- Detects **dengue viral antigen**
- Positive in **early phase (day 1–5 of illness) ?**
- Advantages:
  - Early diagnosis
  - Useful before antibody formation

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2. Serology ?

- Detects antibodies:
    - **IgM**
        - Appears after **5 days**
        - Indicates recent infection
    - **IgG**
        - Appears later
        - Indicates past infection or secondary infection

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3. CBC Changes ?

- **Leukopenia** (low WBC count)
- Progressive fall in platelets

Platelet Count ?

- **Thrombocytopenia (<1 lakh/mm³) ?**
- Severity correlates with:
    - Risk of bleeding

Hematocrit ?

- **Increased hematocrit ?**
    - Due to plasma leakage
- Important indicator of:
    - Disease severity
    - Fluid loss

WHO Classification of Dengue ?

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1. Dengue (Without Warning Signs)

- Fever + 2 of the following:
    - Nausea/vomiting
    - Rash

- Aches and pains
- Leukopenia

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2. Dengue with Warning Signs ?

- Presence of any of the following:
  - **Abdominal pain ?**
  - Persistent vomiting
  - Clinical fluid accumulation
  - Mucosal bleeding
  - Lethargy/restlessness
  - Liver enlargement
  - Rising hematocrit with falling platelets ?

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3. Severe Dengue ?

- Any of the following:
  - **Severe plasma leakage ? shock (DSS) ?**
  - Severe bleeding
  - Severe organ involvement

High-Yield Points ?

- NS1 ? **early diagnosis (day 1–5)**
- IgM ? **after 5 days**
- Platelet ? + hematocrit ? ? **warning sign ?**
- Leukopenia ? **common finding**
- Severe dengue ? **shock + bleeding + organ failure**

Dengue – Prevention and Control ?

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1. Source Reduction ?

- Most important strategy
- Elimination of breeding sites:
    - Removal of **stagnant clean water**
    - Emptying containers regularly
    - Proper disposal of:
        - Tyres
        - Plastic containers
        - Water storage vessels
- Weekly “dry day” concept ?

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2. Anti-larval Measures ?

- Target mosquito larvae
- Methods:
    - Chemical:
        - Larvicides (e.g., temephos)
    - Biological:
        - Larvivorous fish
- Aim:
    - Prevent development of adult mosquitoes

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3. Community Participation ?

- Essential for dengue control
- Activities:
    - Awareness campaigns
    - Household-level source reduction
    - Community clean-up drives

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4. Personal Protection ?

- Prevent mosquito bites
- Measures:

    - Mosquito repellents
    - Protective clothing
    - Window screens
- Important because:
    - **Aedes is day-biting ?**

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5. Outbreak Control ?

- Early detection of cases
- Measures:
    - Rapid surveillance
    - Vector control (fogging, insecticides)
    - Public awareness
- Goal:
    - Prevent spread of infection

High-Yield Points ?

- Dengue control ? **source reduction is key**
- Aedes ? **container breeder + day-biting**
- Anti-larval ? **prevents adult mosquito formation**
- Community participation ? **most important pillar**
- Fogging ? **used during outbreaks only**

Table: Dengue Fever vs Chikungunya ?

FEATURE	DENGUE	CHIKUNGUNYA
Agent	Dengue virus (Flavivirus)	Chikungunya virus (Alphavirus)

FEATURE	DENGUE	CHIKUNGUNYA
Vector	Aedes mosquito	Aedes mosquito
Fever	High, acute	High, acute
Joint pain	Mild/moderate	**Severe, debilitating ?**
Rash	Common	Common
Bleeding	Common (severe dengue) ?	Rare
Shock	Possible (DSS) ?	Rare
Platelet count	Markedly decreased ?	Mild decrease
Chronic symptoms	Rare	Persistent joint pain ?

Table: Dengue Warning Signs ?

WARNING SIGN	SIGNIFICANCE
Abdominal pain ?	Early indicator of severe dengue
Persistent vomiting	Indicates worsening disease
Clinical fluid accumulation	Plasma leakage
Mucosal bleeding ?	Risk of severe hemorrhage
Lethargy / restlessness	CNS involvement
Liver enlargement	Hepatic involvement
Rising hematocrit with falling platelets ?	**Most important warning sign**

Table: Dengue vs Malaria ?

FEATURE	DENGUE	MALARIA
Agent	Virus	Protozoa (Plasmodium)
Vector	Aedes (day-biting) ?	Anopheles (night-biting) ?
Fever pattern	Continuous / biphasic	Periodic (tertian/quartan) ?
Chills & rigors	Less prominent	Prominent ?
Rash	Common ?	Rare
Splenomegaly	Rare	Common ?
Platelets	??? (thrombocytopenia) ?	Mild ?
Hematocrit	? (plasma leakage) ?	Normal / ?

Table: Aedes Mosquito Characteristics ?

FEATURE	AEDES MOSQUITO
Biting habit	**Day-biting ?**
Appearance	Black with white stripes (tiger mosquito)
Breeding place	Clean stagnant water ?
Habitat	Domestic / peridomestic
Diseases transmitted	Dengue, Chikungunya

Table: Household Breeding Sites of Aedes ?

SITE	EXAMPLES
Water storage containers	Buckets, tanks, drums
Domestic items	Flower pots, coolers
Discarded items ?	Tyres, plastic containers
Household surroundings	Roof gutters, construction sites
Miscellaneous	Coconut shells, broken bottles

High-Yield Points ?

- Dengue vs chikungunya ? **joint pain severe in chikungunya**
- Warning sign ? **hematocrit ? + platelets ? (VERY IMPORTANT)**
- Dengue vs malaria ? **vector + fever pattern difference**
- Aedes ? **day-biting + container breeder ?**
- Household breeding ? **key for prevention (source reduction)**

Flowchart: Dengue Transmission Cycle ?

```
Infected human (viraemia)
        ?
Aedes mosquito bites human
        ?
Virus enters mosquito
        ?
Multiplication inside mosquito
        ?
Mosquito becomes infective
```

```
        ?
Infective            mosquito            bites            healthy            human
        ?
Virus                                enters                                bloodstream
        ?
Viraemia                                                                   develops
        ?
Further            transmission            (human–mosquito–human            cycle)
```

Flowchart: Pathogenesis of Severe Dengue ?

```
Dengue                                virus                                infection
        ?
Viraemia
        ?
Immune                                response                             activation
        ?
Cytokine                                                                   release
        ?
Increased                  vascular                  permeability                  ?
        ?
Plasma                                                                     leakage
        ?
Hemoconcentration                  (?                  hematocrit)
        ?
Thrombocytopenia
        ?
Bleeding                                                                manifestations
        ?
Severe                                    plasma                                loss
        ?
Shock              (Dengue              Shock              Syndrome)              ?
        ?
Organ            dysfunction            (liver,            brain,            kidney)
```

Figure: Aedes Breeding Containers ?

Image

Image

Image

Image

Flowchart: Approach to Suspected Dengue ?