GLOBAL HEALTH PRESS

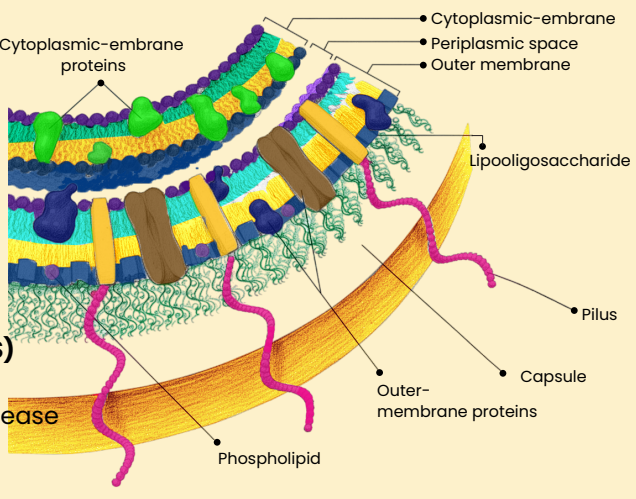
MENINGOCOCCAL DISEASES

What Are Meningococcal Diseases?

Meningococcal diseases include acute and severe infections such as meningitis and sepsis caused by *Neisseria meningitidis*—a Gram-negative diplococcus found in the oro-nasopharynx of approximately 10% of the population. Humans are the only host, and in rare cases, the bacteria can breach the mucosal barrier, enter the bloodstream, and cause a rapid, potentially fatal illness.

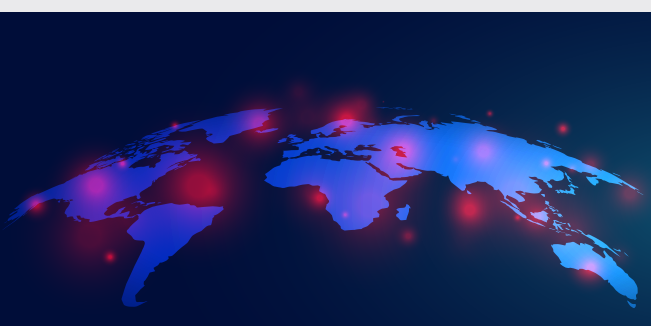
Microbiology & Pathogenesis

- **Gram negative diplococcus**
- **Bacterial membrane** (inside - outward)
  - Inner cell membrane
  - Peptidoglycan
  - Outer cell membrane
  - Capsular polysaccharides (CPS or capsule)
- **Capsular Polysaccharide (CPS)**
  - **13 serogroups**
  - **6 groups** cause almost all disease
  - CPS is major **virulence factor**
  - **"B" CPS** is a self-antigen



Pathogenesis

Local (organ-restricted) meningococcal diseases may result from bacteremia or septicemia and "metastatic seeding." The reasons for invasiveness arise from complex interactions between host factors (such as genetics, viral co-infection, and high infectious pressure due to crowding or kissing), individual conditions (such as smoking and underlying diseases), and bacterial virulence factors.



Epidemiology (2025 Update)

- Epidemiology is dynamic, and local data or surveillance reports should be consulted for up-to-date figures and trend changes.
- Local outbreaks (e.g., in colleges) may occur anywhere and at any time.
- The highest disease burden is seen in infants, adolescents, and the elderly.
- Outbreaks commonly occur in institutional settings and during mass gatherings (e.g., the Hajj)

Transmission & Clinical Disease

- Spread is by respiratory droplets; carriage rates peak in adolescence. New acquisition of a strain is major risk factor for disease

Meningococcal diseases include:

- **Invasive Meningococcal Diseases (IMS)**
  - Bacteremia, septicemia (including Waterhouse-Friederichsen syndrome), both with or without "metastatic seeding":

Septic arthritis | Pericarditis | Others

- **Direct infections**

Pneumonia | Conjunctivitis | Otitis media | Urethritis

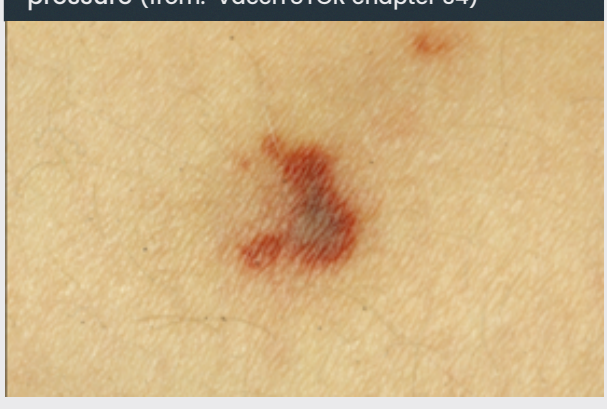
IMD incidences and serogroups by continent

Continent	Incidence (per 100,000)	Predominant serogroups
Africa	10–25 (>500 in epidemics)	A, W, C, X
Europe	0.5–2 (sporadic)	B, C, W, Y
Americas	0.5–1.5 (sporadic)	B, C, Y, W
Asia	<1 (sporadic / outbreaks)	A, C, W
Oceania	<1–2 (sporadic / outbreaks)	B, W

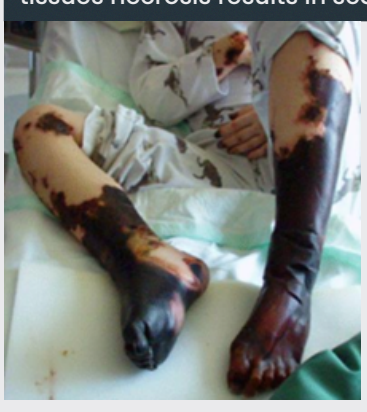
Clinical presentations local (organ) diseases are not different from other causes of these local infections; clinical **presentation of IMD:**

- **Early symptoms:** fever, headache, malaise, neck stiffness, photophobia, vomiting, diarrhea, and a non-blanching petechial rash.
- **Complications:** tissue necrosis, neurological damage, hearing loss, amputation, and death (case fatality rate ~5–16%).
- **Management:** rapid disease progression requires immediate hospital admission for blood and CSF cultures, followed by prompt intravenous antibiotic therapy (third-generation cephalosporins). Penicillin and chloramphenicol are alternatives.

Picture 1: Always a medical emergency: Petechiae, lesion does not disappear upon pressure (from: VacciTUTOR chapter 34)



Picture 2 and 3. Complications of meningococcal diseases: blood clotting results in closure of vessels with lack of blood supply; tissues necrosis results in scarring and necessitates amputation



Prevention

- Antibiotic prophylaxis for close contacts is recommended
- Vaccination is the primary preventive measure, with vaccine type selection based on circulating serogroups, age, and risk profile
- Immunization programs have dramatically reduced incidence (e.g., serogroup A and C disease)

Meningococcal Vaccines

Broadly, there are three types of meningococcal vaccines:

- Pure polysaccharide vaccines
- Polysaccharide-conjugate vaccines
- Vaccines not based on capsular polysaccharides (see Table 1–3)

Consult your local public health office for specific vaccination recommendations. The unpredictability of outbreaks and the rapid progression of disease—often evolving from the first symptoms to death or severe complications within a few hours—form the basis for vaccination programmes in many countries.

Tables: Global meningococcal vaccines

1. Pure Polysaccharide Vaccines:
No T-cell-immunity, no memory, short-term (3-5 years) protection; no herd protection, not effective before age 2 years.

Brand Name	Manufacturer	Antigens (Serogroups)	Efficacy/Effectiveness
Menomune	Sanofi Pasteur	A, C, W, Y	High short-term efficacy; wanes within 3–5 yrs; no herd protection
VA-MENGOC-ACYW	Finlay Institute (Cuba)	A, C, W, Y	Effective for outbreak control; limited immunogenicity in young children
Group A, C Chinese VAC	Lanzhou Institute (China)	A, C	Used for epidemics in Asia; limitations as above
Various brands	India, Africa, Latam	A, C, W, Y	Used mainly during epidemics or mass gatherings

2. Polysaccharide-Conjugate Vaccines:
T-cell dependent, boostable (memory), long-term protection, herd protection

Brand Name	Manufacturer	Serogroups (Polysaccharide)	Conjugate Protein	Efficacy/Effectiveness
MenAfriVac (PsA-TT)	Serum Institute of India	A	Tetanus toxoid	>90% efficacy, effective in <2y, herd protection
Menactra®	Sanofi Pasteur	A, C, W, Y	Diphtheria toxoid	Long-lasting, prevents carriage, herd protection
Menveo®	GSK	A, C, W, Y	CRM197	Effective, induces immune memory, licensed globally
Nimenrix®	Pfizer	A, C, W, Y	Tetanus toxoid	High immunogenicity including infants
Conjugate MenC (various)	Pfizer, GSK	C	CRM197/ Tetanus toxoid	~90–99% disease reduction, strong herd protection
Pentavalent conjugates (in dev.)	Multiple	A, C, W, Y, X	Various	Pan-serogroup protection, trials ongoing in Africa
Others (China)	Various	A, C	Various	Used in East Asia; strong disease controlmenimg

"Other" Vaccines (Protein/OMV and Combination)

Brand Name	Manufacturer	Type	Composition (Antigen)	Efficacy/Effectiveness
Bexsero®	GSK	Recombinant protein/OMV	fHbp, NadA, NHBA, OMV	60–90% MenB strain protection; used in EU/US
Trumenba®	Pfizer	Recombinant protein	Two fHbp variants	Broad MenB coverage, licensed as of 10 years (USA: up to 25 years)
VA-MENGOC-BC	Finlay Institute (Cuba)	OMV B+C	OMV, polysaccharide B+C	Used in Cuba/Latin America; epidemic control
OMV/NZ	New Zealand	OMV (PorA P1.4)	Strain-specific OMV	Controlled local MenB outbreaks
Multicomponent penta/MenABCWY	Pfizer, GSK	Combination conjugate & protein	A, B, C, W, Y + fHbp/NadA/NHBA	Pan-serogroup protection—trials & early use

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