Tetanus, Botulism and Diphtheria

Tetanus
Mortality 50% untreated, 45% worldwide, 10% treated
Average duration of paralysis 21/7
Pneumonia most common cause of death

Pathophysiology
Clostridium tetani – anaerobic G+ive, spore forming rod; in faeces and soil
Toxin travels along nerve fibres and inhibits inhibitory NT release in CNS (inc SNS) → sustained muscle spasm, SNS overactivity, incr circulating E+NE levels

Risk factors
IVDU, >65yrs (50-70% don't have protective ab levels); prox wounds; puncture wounds (50%), penetrating, infected wounds, compound #, crush, burns, FB, ischaemia, unsterile OT (2/3 occur after trivial wounds); male > female; neonatal tetanus from umbilicus; 10% have no wound identified

Assessment
Incubation <24hrs – 15/52 (80% within 2/52; if <3/7, almost 100% mortality)
Generalised (80%): altered sensation at wound site, stiff jaw and neck; Sx appear 1st in facial muscles (trismus, difficulty swallowing, risus sardonicus) → descending spread → opisthotonus, convulsions, tetany (lasting up to 3-4/52), avulsion of muscle attachments, normal LOC; progresses over 3/7, stabilise for 10/7, resolution with no sequelae; autonomic instability in 90% (occurs in 2nd week; incr/decr HR, arrhythmia, incr/decr BP, mild fever, profuse sweating);
Cephalic: CN (esp 7th) tetanus with head and neck wounds, OM (very high mortality)
Local: may progress to generalised; 1% mortality
Neonatal: weak, irritable, inability to suck; occurs in wk2

Complications
Rhabdo, long bone #, complications of prolonged hospitalisation, aspiration pneumonia

Differential diagnosis
Dystonic reaction (phenothiazines, maxalon), strychnine poisoning, hypoCa, NMS, SS, SAH, rabies, stiff man syndrome, peritonsillar abscess, meningitis

Investigations
Wound swab (C tetani in 30%; limited value), incr WBC (in 30%), incr CK

Management
Supportive; sedation, paralysis, ventilation, benzos (use midaz, to avoid metabolic acidosis from propylene glycol in loraz/diaz prep), minimal stimulation; debridement of devitalised tissue and FB; metronidazole to eradicated MO; MgSO4 may decr ANS Sx and muscle spasm; labetalol (joint alpha and beta activities) for ANS; morphine helps with ANS also
Tetanus Ig: neutralises toxin not yet entered CNS; decreases mortality; give before wound debridement
Tetanus toxoid: give at presentation, 6/52 and 6/12 as disease does not confer immunity
Intrathecal baclofen: avoids complications and high dose benzos
Immunisation

**Tetanus toxoid immunisation:** given at 2/4/6/18 months, 5/15yrs, every 10yrs; almost 100% effective

**Tetanus Ig:** passive immunisation; 250iu (500iu if >24hrs, severe contamination, burns)

**Immune:** at least 3 doses and UTD

**Immune but out of date:** no indication for Ig
- if <5yrs – no trt
- If 5-10yrs and clean wound (<6hrs old, non-penetrating) – no trt
- If >5 and dirty wound – booster
- If >10yrs – booster; may need further doses if <5 doses of ADT previously

**Partially immune (1-2 doses) / non-immune (no doses) / unsure**
- give booster for all wounds + tetanus Ig if dirty à ADT at 1/12 and 6/12

Botulism

Caused by toxins from obligate anaerobic bacteria Clostridium botulinum, C. baratii and C. butyricum.

Common in soil & can survive in spore form.

**Food-borne botulism**
Home-tinned/canned foodstuff (as not irradiated like commercial canning) or fermented uncooked dishes

**Intestinal botulism**
Infant botulism uncommon, and occurs after a baby ingests spores (classically untreated honey) which germinate in less acidic (compared to adults) gastric juices → release toxin. Adult botulism very rare

**Wound botulism**
The organisms get into an open wound and reproduce in an anaerobic environment.

Biological terrorism potential: the toxin is regarded as one of the most lethal bioweapons

**Presentation**
Occur 2h-8d post-exposure, depending on dose/toxin. May be delayed onset in infant botulism
- Acute symmetrical, descending, flaccid paralysis, usually begins with blurred vision, ptosis
- Difficulty swallowing and speaking, D & V or constipation & retention.
- Patient remains alert
- Acute onset of bilateral cranial nerve involvement
- Failure of accommodation, pupils fixed in mid position or dilated

**Investigations**
Detection of toxin in serum, urine, stool, vomit or gastric fluid.
CSF protein normal.
Spirometry, pulse oximetry, arterial blood gases

**Management**
Respiratory support: Recovery time typically ranges 30-100 days. Tracheostomy may be req Decontamination, Enhanced elimination: Activated charcoal, lavage, catharsis, Antitoxin: Trivalent antitoxin (A, B, E) or polyvalent antitoxin (A to F) also available
Clinical improvement may take weeks to months, but most cases make a recovery. Fatal in 5-10% of cases.
Diphtheria
Notifiable acute upper respiratory tract infection, but sometimes it infects the skin.

Pathogenesis
Corynebacterium diphtheriae - Gram-positive, aerobic, non-motile, rod-shaped bacterium, pathogenic only in humans.
Pharyngeal or cutaneous diphtheria caused by toxigenic strains of C. diphtheriae
A fibrinous pseudomembrane is produced usually on the respiratory mucosa.

Epidemiology
Rare in developed countries where majority vaccinated
Mortality 10%
Mainly affects children <15y

Risk factors
Transmission is by droplet, milk, food handlers, fomites, or contact with skin lesions.
Once recovered some patients become carriers for weeks, months or even a lifetime.
Poor living conditions and lack of immunisation
Adults lose protection from childhood vaccines unless they have boosters.

Presentation
Incubation period: It is usually 2 to 5 days, but may be up to 10 days.
Early URTI symptoms: nasal discharge - initially watery, then purulent and blood-stained
Pseudomembranous pharyngitis with fever, enlarged anterior cervical lymph nodes and oedema of soft tissues giving a “bull neck” appearance.
Swallowing may be difficult if unilateral or bilateral paralysis of palatal muscles
Cutaneous infection is usually mild, but chronic: vesicles or pustules that form a “punched-out” ulcer

Effects of toxin
Cardiomyopathy and myocarditis, arrhythmias
Neuritis affects motor nerves - paralysis of soft palate, causing dysphagia and nasal regurgitation, then ocular nerves, peripheral nerves and diaphragm with resulting infection and respiratory failure.
Nephritis and proteinuria
Thrombocytopenia

Investigations
Bacterial culture (Loeffler’s medium)
PCR detection
Toxigenicity tests by specialist laboratories

Management
Antitoxin should be given within 48 hours of onset (horse serum, reactions common)
Barrier nursing
Benzylpenicillin IV is followed by oral penicillin V for 10 to 14 days.
Urgent tracheostomy may be required for respiratory obstruction.
Contact testing: Swab close contacts, treat with a single dose IM benzylpenicillin

Prognosis
5 to 10% mortality