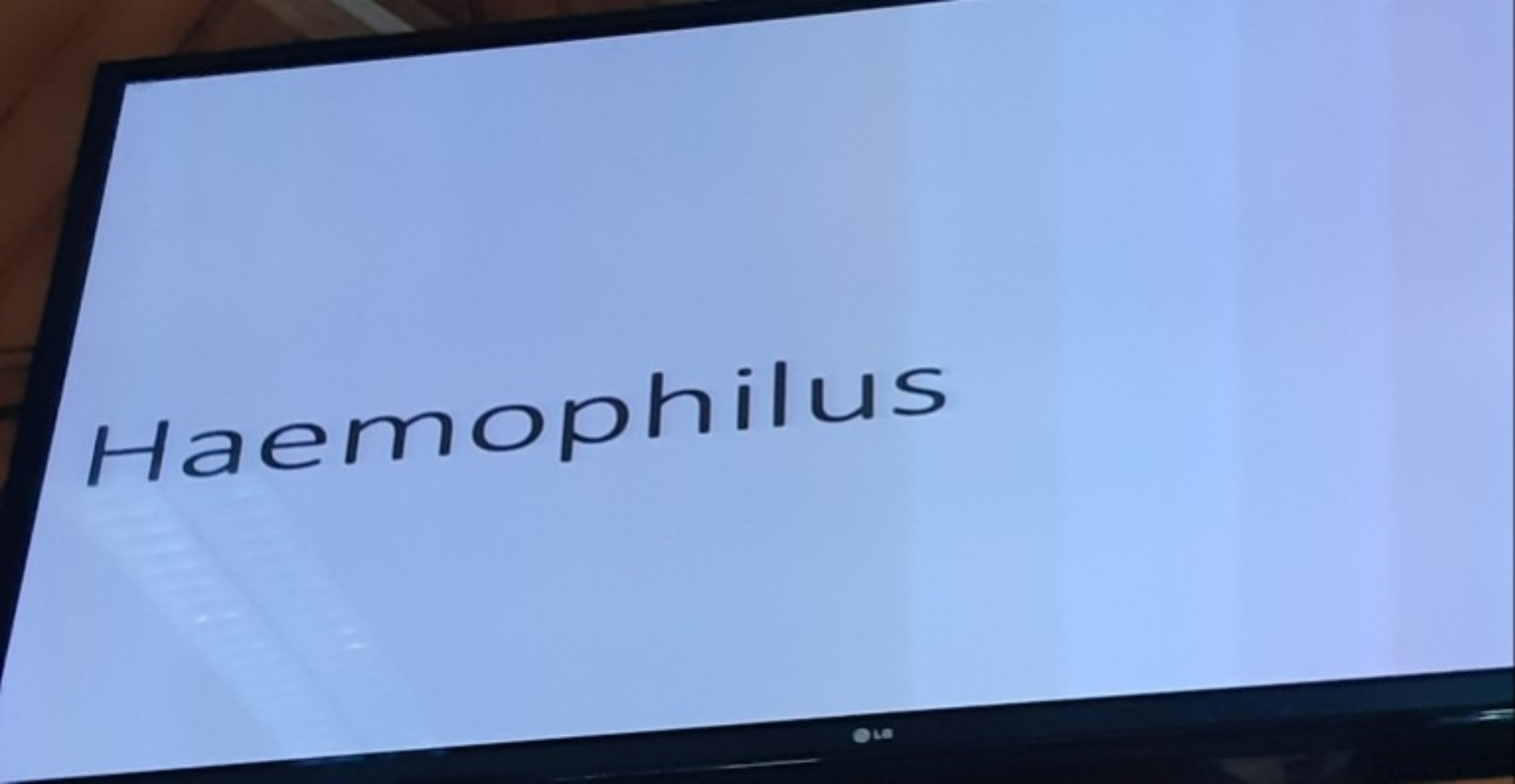

Haemophilus

Classification

Family: Pasteurellaceae

Genera:

- Haemophilus
- Actinobacillus
- Aggregatibacter
- Pasteurella

- Small facultative anaerobic, gram-negative rods

Genus: Haemophilus

Species

- *H. influenzae*
- *H. Parainfluenzae*
- *H. haemolyticus*
- *H.parahaemolyticus*
- *H.ducreyi*

General Characteristics

- Haemophilus= blood loving
- Gram-negative coccobacilli
- Non-motile
- Non-sporing
- Facultative anaerobes
- Oxidase –positive

General characteristics

- Catalase-positive
- Require accessory factors for growth and viability
- Requirements differ among the species

Accessory growth factors

- **"X" factor (haemin)**
  - component of elemental iron-containing part of haemoglobin
  - **heat stable**
  - Required for synthesis of cytochrome and other enzymes e.g. catalase, peroxidase, oxidase

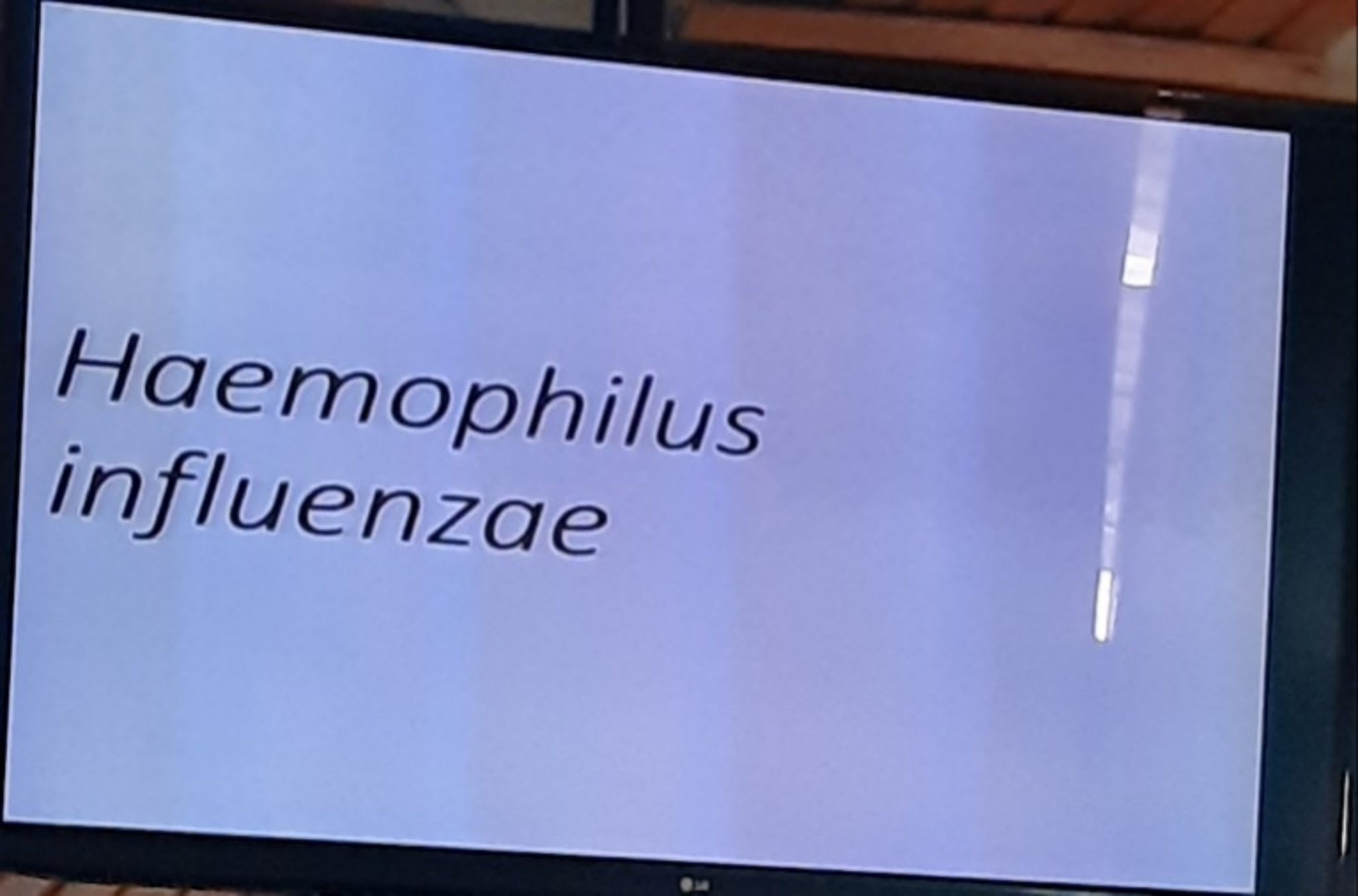
Accessory growth factors

"V" factor (NAD or NADP)

- hydrogen acceptor in cell metabolism
- **heat labile**(destroyed at 120°C)
- present inside RBCs
- synthesised by some fungi and bacteria

Virulence factors

1. Capsule- contains **PRP(polyribosyl-ribitol phosphate)**- avoid phagocytosis and opsonisation
   - Main **virulence** factor
2. Adhesion proteins
3. Outer membrane proteins
4. IgA_1 protease- *H.influenzae*
5. Lipooligosaccharide(LOS)


Haemophilus
influenzae

Haemophilus influenzae

- 1st described in 1892 by Pfeiffer= Pfeiffer's bacilli
- Capsulated and non-encapsulated strains
- 6 capsular types: a-f
- Non-encapsulated= Non-typeable *H.influenzae*(NTHi)
- Both capsulated and non-encapsulated further subdivided into 8 biotypes
  - on the basis of urease, ornithine decarboxylase activities and indole production(I-VIII)

Epidemiology

- Mucosal organism
- Present in 30-50% of healthy persons
- Spread by airborne droplets and contact with secretions
- *H. influenzae* infections seen frequently in children aged from six months to four years of age
- In adults:
  - 2° complications of severe 1° illnesses
  - Immune compromise

Clinical implications

- *Haemophilus influenzae* serotype b(Hib) responsible for majority of invasive disease
- Carrier rate for capsulated b strains is about 2-4%
- Type b capsule-deficient mutant(b^-)

Clinical implications cont

NTHi

- Form part of the normal microbial flora of the URT
- Usually involved in respiratory tract infections and otitis media but may also cause invasive disease.
- Post-Hib vaccine era, responsible for majority of invasive diseases

Pathogenesis

- Mucociliary interactions
- Attachment to respiratory mucosa
  - Adhesins
  - Pili
- Evasion of mucosal immunity
  - Proteases
  - Microcolony formation
  - Phase variation/antigenic shift
  - Intracellular survival/invasion of local tissue.

Infections

1. Invasive(bacteraemic) infections-
   - Meningitis
   - Bacteraemic pneumonia
   - Epiglottitis
   - septic arthritis
   - Septicaemia
   - Cellulitis
   - osteomyelitis
2. Localised infections-
   - Otitis media
   - Sinusitis
   - Bronchitis

Laboratory Investigations

- **Specimen**:
  - CSF
  - Blood
  - Pus swabs
  - Sputum
  - Nasopharyngeal specimen

H.Influenzae **does not retain viability for long. Specimen must be cultured as soon as possible and not refrigerated**

Laboratory investigations

- Direct gram stain
- Culture for isolation and identification

  CBA in 5-10% CO_2 at 35°C-37°C for 18–24h

  - Colonial morphology
    - variation in size and appearance; translucent to mucoid
- Gram-negative coccobacilli or short rod
- Long thread-like and pleomorphic forms may be seen in CSF or following culture

Laboratory investigations

Demonstration of growth factor requirements

1. Satellitism test

aureus produces factor V in excess of its own needs. It is cultured n BA with H. influenzae, the factor V and the haemin released by aphylococcal haemolysins help the growth of H. influenzae.

2. Commercially prepared factors(X,V,XV) on NA

Biochemical tests

Serology

Slide agglutination

PCR

Antimicrobial susceptibility test

Treatment

- Ampicillin
- Chloramphenicol
- Cephalosporins

Prevention

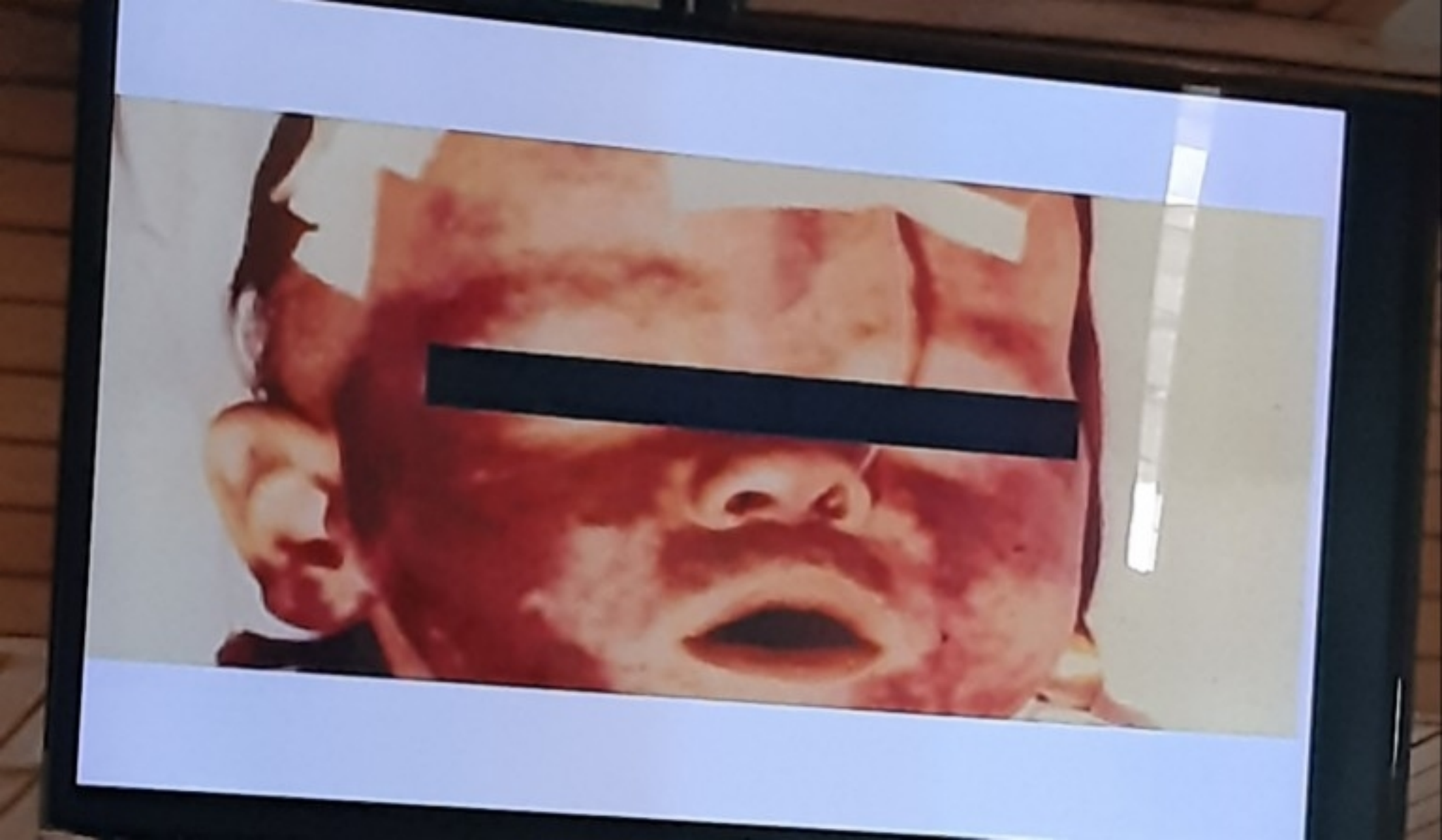
- Vaccination-main method
  - Hib conjugate vaccine

H.Influenzae biogroup *aegyptius(Hae)*

- Formerly known as Koch-Weeks bacillus; *H.aegyptius*
- A strain of NTHi
- Causes
  - a purulent conjunctivitis- worldwide seasonal epidemics of acute purulent conjunctivitis (*Hae*)
  - Brazilian Purpuric Fever(BPF) (*Hae* BPF)

BPF

- 1st recognised in Brazil in 1984
- Conjuctivitis → overwhelming septicaemia resembling fulminating meningococcal infection
- Characterised by
  - High Fever
  - Haemorrhagic skin lesions
  - Abdominal pain
  - Nausea
  - Vomiting
  - Septic shock
  - Death (Case fatality rate of 40-90%)



Laboratory diagnosis

- **Specimen**:
  - Conjuctival swabs
  - Blood
  - CSF
- **Gram stain**
  - Gram- negative coccobacilli
- **Culture**

Treatment

- Ampicillin
- Amoxicillin/Clavulanic acid
- Cephalosporins
  - Ceftriaxone

Haemophilus ducreyi

- Causative agent of a sexually transmitted ulcer(**chancroid/soft sore**)
- Common cause of **genital ulceration** in tropical countries
- +/- lymphadenitis and bubo formation

Clinical presentation

- Tender erythematous papule-4-7 days after infection
- Pustular stage
- Pustules rupture after 2-3 days
- **Painful** shallow ulcers with granulomatous bases and purulent exudates
- Ulcer
  - Edge is **rugged** and **undermined**

Clinical presentation cont.

- Ulceration can take several weeks or months to resolve in the absence of antimicrobial therapy
- Lesions occur
  - on prepuce and frenulum in men
  - Vulva, cervix and perianal area in women
- In 50% of cases, painful, tender inguinal lymphadenitis
- Buboes may develop
- Lymphadenopathy- usually unilateral, spherical and painful

Laboratory diagnosis

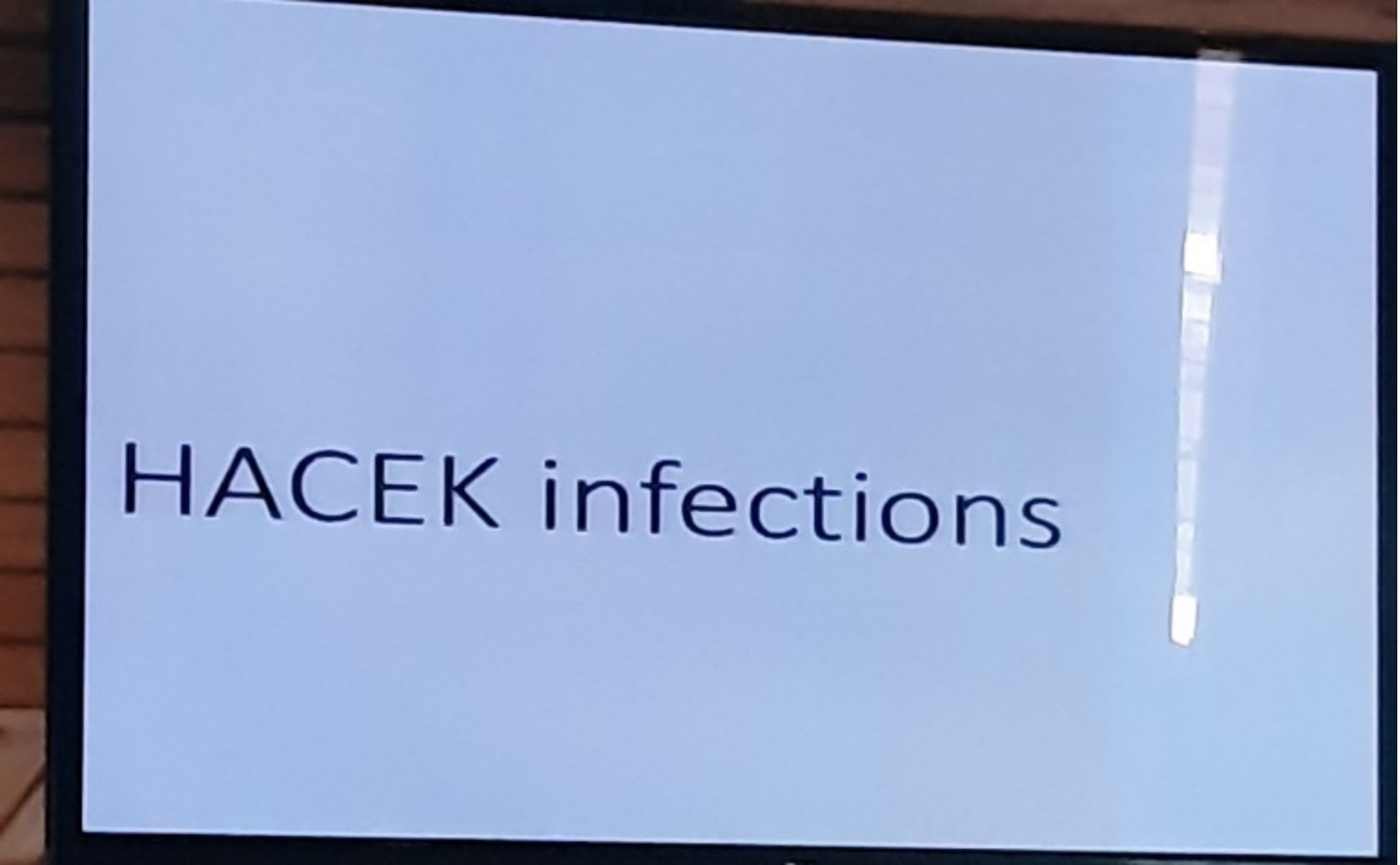
*Clinical history

Specimen- swab

- Culture
  - Fastidious, difficult to isolate
  - Requires factor X but not factor V
  - CBA with 1% Isovitalex and vancomycin
  - CO_2 32-35^{o} C
- Biochemical tests
  - Slowly oxidase positive
  - Catalase, urease, indole negative
- PCR

Treatment

- Erythromycin
- Azithromycin
- Ceftriaxone
- Ciprofloxacin
- Spectinomycin


HACEK infections

HACEK Organisms

- Group of fastidious, slow-growing, gram-negative bacteria
  - **Haemophilus spp.**
    - *H.parainfluenzae*
  - **Aggregatibacter**
    - *A.actinomycetemcomitans*
    - *A.segnis*
    - *A.aphrophilus*

HACEK Organisms

- **Cardiobacterium**
  - *C.hominis*
  - *C.valvarum*
- ***Eikenella*** *corrodens*
- **Kingella** spp
  - *K.kingae*

HACEK Organisms

- **Normal flora in the oral cavity**
- Associated with local infections in the mouth
- Cause severe systemic infections- **bacterial endocarditis**, which can develop on either native or prosthetic valves
- Responsible for 3% of cases of **Infective Endocarditis**
- Often a cause of **culture-negative endocarditis**

HACEK Organisms: other infections

- Periodontal infections,
- Bacteremia
- Abscesses
- Peritonitis
- Otitis media
- Conjuctivitis
- Pneumonia
- Septic arthritis
- Osteomyelitis
- Urinary tract infections
- Wound infections
- Brain abscesses

Laboratory diagnosis and Treatment

Diagnosis

- Specimen: blood culture
- *H.parainfluenzae*- requires only factor V

Treatment

- Penicillins
- Aminopenicillins
- Ceftriaxone
- Fluoroquinolones