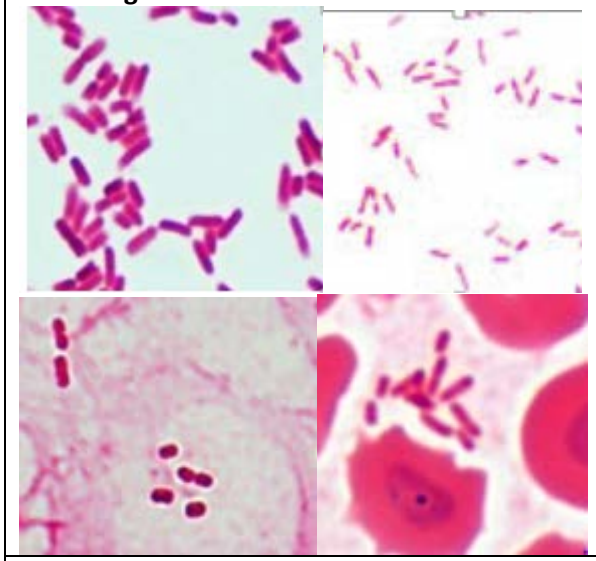
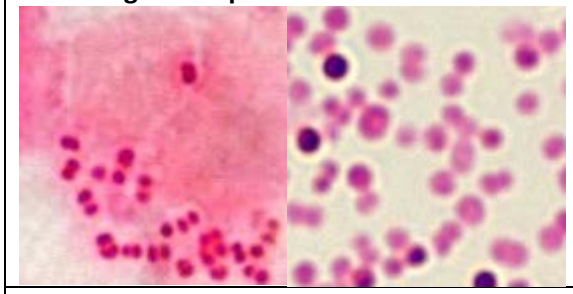
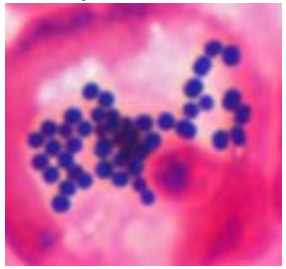
| Gram stain appearance | Microbiological implication | Clinical implications of blood isolate |
|---|---|---|
| **Gram negative rods**<br>  | Enteric (*Enterobacterales* family) or so-called 'coliform' species – *E. coli, Klebsiella. Salmonella* species etc (left)<br><br>*Pseudomonas aeruginosa* and related species (morphology – thinner rods) – will generally only grow in the aerobic bottle) (right)<br><br>*Acinetobacter* species and related species (morphology short rods or coccobacilli) (bottom L)<br>*Haemophilus influenzae* similar (not shown)<br><br>*Burkholderia pseudomallei* (GNR with bipolar staining)<br><br>Anaerobic GNR – *Bacteroides* and related species- will generally only grow in anaerobic bottle (bottom R). Currently no anaerobic plate cultures performed at PMGH and so these organisms cannot be cultured. | In general, Gram negative sepsis is rapidly fatal if untreated and requires early empirical treatment with a rapidly acting antibiotic – an aminoglycoside is used in combination with a broad spectrum beta lactam (usually a cephalosporin like ceftriaxone).<br><br>**Community onset infections** associated with Gram negative sepsis include UTI, biliary sepsis (often with obstruction), GIT infection (e.g. typhoid), intra-abdominal infection and less frequently pneumonia (*Acinetobacter, Haemophilus, Klebsiella*).<br><br>**Hospital onset infections** include UTI, post abdominal surgery, central line infections, ventilator-associated pneumonia.<br><br>These species are almost never contaminants when isolated from blood. |
| **Gram negative diplococci**<br>  | *Neisseria meningitidis* (left)<br><br>*Neisseria gonorrhoeae*<br><br>*Moraxella catarrhalis* and related species (right) | **Meningococcal disease** usually presents from the community as severe sepsis or acute meningitis or on occasions both conditions. Skin changes may take 12 hours to appear after onset of symptoms.<br><br>Gonococcus - rarely associated with bacteraemia in patients with acute septic polyarthritis.<br><br>*Moraxella* is almost always a contaminant. |
| **Gram positive coccus (resembling *Staph.*)**<br>  | *Staphylococcus aureus* – signified by a positive tube coagulase performed from the positive blood culture broth. **Accurate determination of whether it is MRSA or methicillin-susceptible Sa (MSSA) is critical.**<br><br>Coagulase Negative *Staphylococcal* species (CoNS)- e.g. *S. epidermidis, S. capitis* etc<br><br>*Micrococcus* species | *Staphylococcus aureus* (coagulase positive Staph.) is a major pathogen associated with a wide range of both community and hospital infections. Infections without an apparent focus may occur.<br><br>CoNS and *Micrococcus* are contaminants usually. Patients with central iv lines (ICU) may develop infections. The best confirmation is provided by more than one positive culture from separately collected blood samples. |

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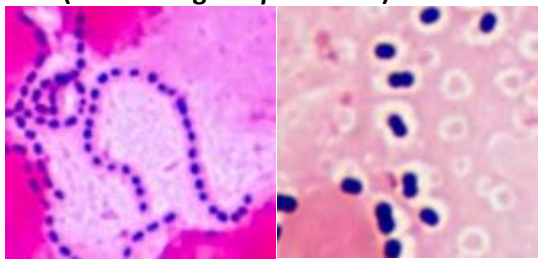
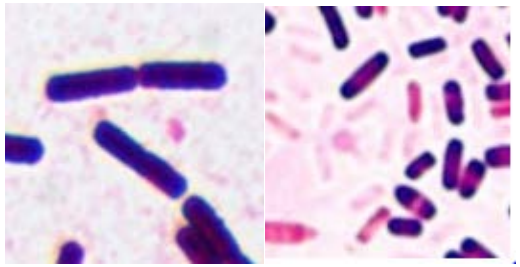
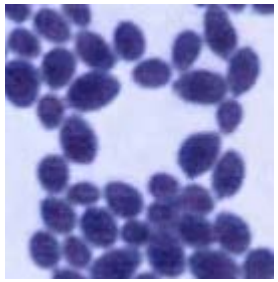
|---|---|---|
| **GPC (resembling *Streptococcus*)**<br>  | Beta-haemolytic *Streptococcal* species (Group A - *Streptococcus pyogenes* and groups B, C or G)<br><br>*Streptococcus pneumoniae* (right) – signified by a positive pneumococcal antigen ICT from broth; halo effect is from polysaccharide capsule<br><br>Other alpha-haemolytic streptococcal species<br><br>*Enterococcus faecalis* and other related species | In large part, these organisms are responsible for community onset rather than hospital infections.<br><br>The BHS species are all susceptible to benzylpenicillin or ampicillin which is the mainstay of treatment, also for pneumococcal pneumonia.<br><br>Other alpha-haem streps are often contaminants, especially if isolated in a single blood sample.<br><br>*Enterococcus* is associated with UTIs, intra-abdominal or biliary infection and sometimes endocarditis. *E. faecalis* is susceptible to penicillin. |
| **GPR**<br>  | *Bacillus cereus* and other species (left)<br><br>*Clostridium* species (right)<br><br>*Cutibacterium (Propionibacterium)* species<br><br>*Corynebacterium* species<br><br>*Listeria monocytogenes* | All with the exception of *Listeria* may be considered contaminants and these positive Gram stain results do not require notification.<br><br>Rare patients with gas gangrene will be bacteraemic with *C. perfringens.*<br>Severe sepsis due to *C. septicum* may occur in association with GIT cancer.<br><br>*Listeria* may cause gastroenteritis, sepsis or meningitis, especially at the extremes of age and in pregnant women. |
| **Yeast**<br>  | *Candida albicans* and related species (morphology- large oval cells staining as Gram positive). Generally 2-3 days required before system detects growth.<br><br>*Cryptococcus neoformans / gattii* (occasionally present in blood) ( morphology visible polysaccharide capsule)<br><br>Filamentous moulds rarely detected. | Fungaemic infections are usually detected in hospitalised patients and are associated with either central venous lines or instrumentation of the urinary tract (including indwelling catheters). Treatment requires remove of any associated device and antifungal therapy – generally fluconazole or amphotericin for 2 weeks. During the second week fundal examination is required to exclude endopthalmitis which may require surgery and prolonged antifungal treatment. |