Information Sheet

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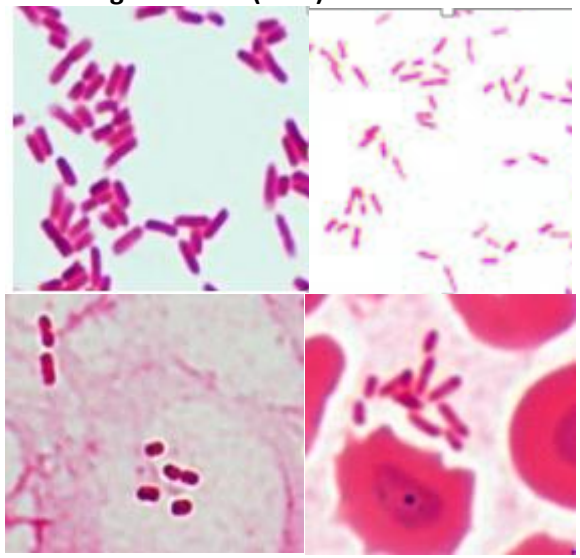
Common Positive Blood Culture Gram Stain Appearances and Implications

Gram stain appearance	Microbiological implication	Clinical implications of blood isolate
Gram negative rods (GNR) 	Enteric (*Enterobacterales* family) or so-called 'coliform' bacterial species – e.g. *E. coli, Klebsiella, Salmonella* species etc (upper left image) *Pseudomonas aeruginosa* and related species (morphology – thinner rods) – will generally only grow in the aerobic bottle) (upper right) *Acinetobacter* species and related species (short rods or coccobacilli) (bottom left); *Haemophilus influenzae* has similar appearance (not shown) *Burkholderia pseudomallei* (Melioidosis agent - GNR with bipolar staining) (not shown) Anaerobic Gram negatives – *Bacteroides* and related species- will generally only grow in anaerobic bottle (bottom right image). Currently anaerobic plate cultures are not performed in PNG, 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). **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*). **Hospital onset infections** include UTI, post abdominal surgery, central line infections, ventilator-associated pneumonia. **These species are almost never contaminants when isolated from blood.**

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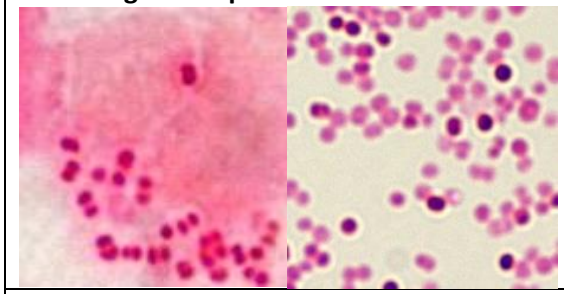
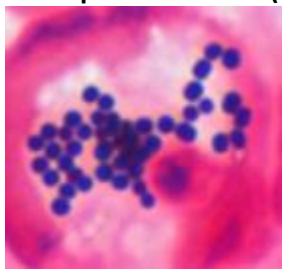
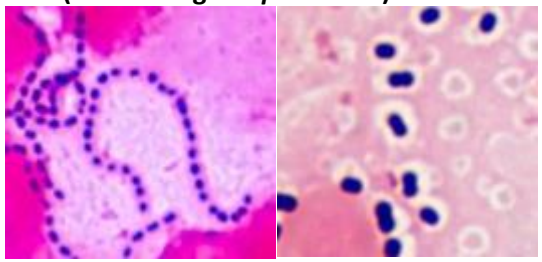
Gram negative diplococci 	*Neisseria meningitidis* (left image) *Neisseria gonorrhoeae* (not shown) *Moraxella catarrhalis* and related species (right)	**Meningococcal disease** usually presents from the community as severe sepsis or acute meningitis or on occasions both conditions. Skin changes may take 12 hours to appear after onset of symptoms. Gonococcus - rarely associated with bacteraemia in patients with acute septic polyarthritis. *Moraxella* is almost always a contaminant.
Gram positive coccus (resembling *Staph.*) 	*Staphylococcus aureus* – signified by a positive tube coagulase performed from the positive blood culture broth or from agar subculture. **Accurate determination of whether it is methicillin-resistant (MRSA) or methicillin-susceptible (MSSA) is critical.** Coagulase Negative *Staphylococcal* species (CoNS)- e.g. *Staph. epidermidis, S. capitis* etc *Micrococcus* species	*Staphylococcus aureus* (coagulase positive Staph.) is a major pathogen associated with a wide range of both community and hospital infections (frequently associated with an intravascular or other device). Infections without an apparent focus may occur. CoNS and *Micrococcus* are usually contaminants. Patients with central iv lines may develop infection. Confirm by repeat detection in a separately collected sample. If in doubt, remove/replace the line.
GPC (resembling *Streptococcus*) 	Group A strep=*Streptococcus pyogenes,* other beta-haemolytic strep. (BHS) species (groups B, C or G) *Streptococcus pneumoniae* (right image) – halo effect may be seen, caused by a polysaccharide capsule (not all isolates Other alpha-haemolytic streptococcal species ("Viridans" streptococci) *Enterococcus faecalis* and other related species	In large part, these organisms are responsible for community onset rather than hospital infections. The BHS species are all susceptible to benzylpenicillin or ampicillin which is the mainstay of treatment, also for pneumococcal pneumonia. Viridans streps are often contaminants, especially if isolated in a single blood sample. NB. Endocarditis possibility. *Enterococcus* is associated with UTIs, intra-abdominal or biliary infection and sometimes endocarditis. *E. faecalis* is susceptible to penicillin.

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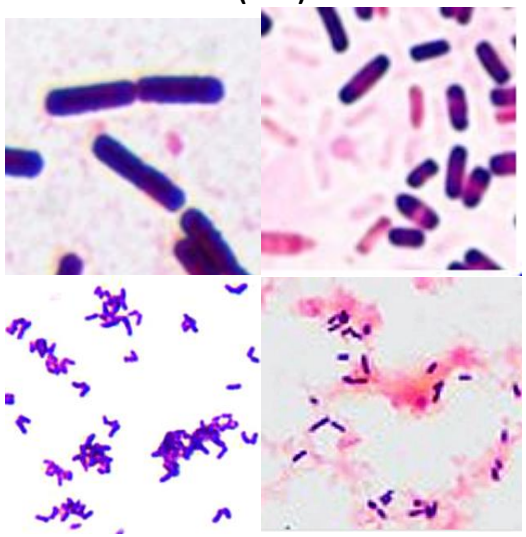
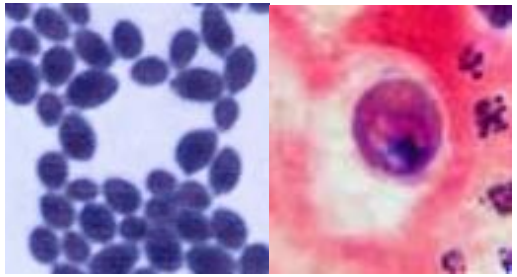
Gram Positive Rod (GPR) 	*Bacillus cereus* and other species (left upper image – large +/- spores) *Clostridium* species (right upper- large +/- spores) *Corynebacterium* species (left lower; 'chinese' characters) *Listeria monocytogenes* (right lower – small GPR) *Cutibacterium (Propionibacterium)* sp. (not shown)	GPR with the exception of *Listeria* are usually considered contaminants. These positive Gram stain results from blood culture do not require immediate notification. Rare patients with gas gangrene will be bacteraemic with *Clostridium perfringens.* Severe sepsis due to *Clostridium septicum* may occur in association with gastrointestinal cancer. *Listeria* infection is rare – patients may present with gastroenteritis, sepsis or meningitis, especially at the extremes of age and in pregnant women.
Candida* (yeast)** ***Cryptococcus 	*Candida albicans* and related species (morphology- large oval cells staining as Gram positive). Generally 2-3 days required before system detects growth. *Cryptococcus neoformans / gattii* (occasionally present in blood) (morphology - visible polysaccharide capsule creates a halo effect) Filamentous moulds (e.g. *Aspergillus* species) are rarely detected in blood cultures (not shown).	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 of candidaemia requires remove of any associated device and antifungal therapy – generally fluconazole or amphotericin for 2 weeks. Treatment of cryptococcal infection is complex – see guidelines.