



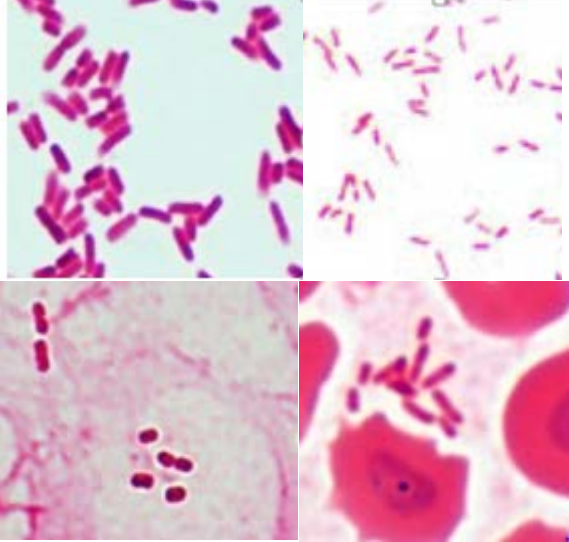
Information Sheet

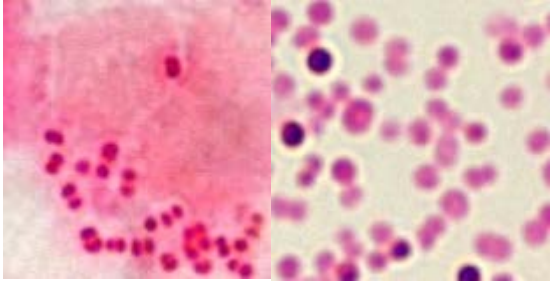

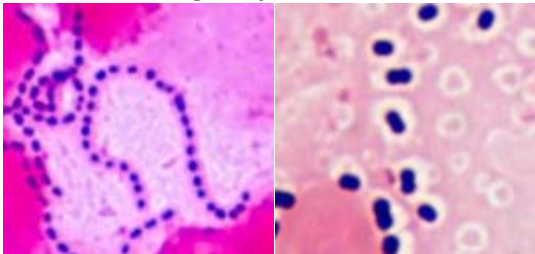


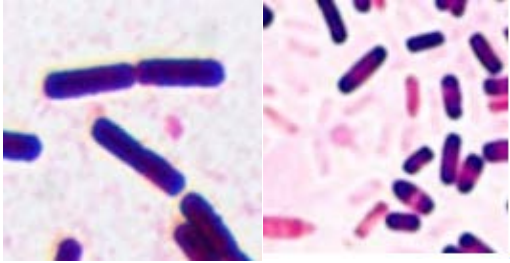
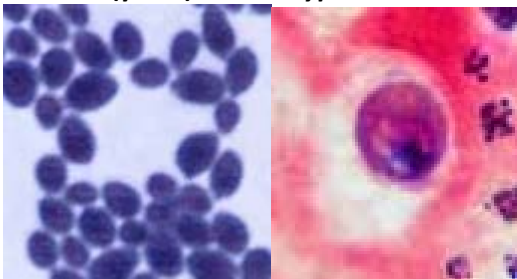
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Common Blood Culture Gram Stain Results and Clinical Implications

Gram stain appearance	Microbiological implication	Clinical implications of blood isolate
<p data-bbox="114 513 712 545">Gram negative rods (GNR)</p> 	<p data-bbox="721 513 1400 625">Enteric (<i>Enterobacterales</i> family) or so-called 'coliform' species – <i>E. coli</i>, <i>Klebsiella</i>, <i>Salmonella</i> species etc (upper left)</p> <p data-bbox="721 667 1400 778"><i>Pseudomonas aeruginosa</i> and related species (morphology – thinner rods) – will generally only grow in the aerobic bottle) (upper right)</p> <p data-bbox="721 820 1400 932"><i>Acinetobacter</i> species and related species (morphology short rods or coccobacilli) (bottom L) <i>Haemophilus influenzae</i> similar (not shown)</p> <p data-bbox="721 973 1400 1053"><i>Burkholderia pseudomallei</i> (GNR with bipolar staining)</p> <p data-bbox="721 1094 1400 1286">Anaerobic GNR – <i>Bacteroides</i> and related species- will generally only grow in anaerobic bottle (bottom R). Currently anaerobic plate cultures are performed in PNG, so these organisms cannot be cultured.</p>	<p data-bbox="1408 513 2123 705">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).</p> <p data-bbox="1408 746 2123 938">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 (<i>Acinetobacter</i>, <i>Haemophilus</i>, <i>Klebsiella</i>).</p> <p data-bbox="1408 979 2123 1091">Hospital onset infections include UTI, post abdominal surgery, central line infections, ventilator-associated pneumonia.</p> <p data-bbox="1408 1133 2123 1212">These species are almost never contaminants when isolated from blood.</p>

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<p data-bbox="125 193 434 220">Gram negative diplococci</p> 	<p data-bbox="730 193 1084 220"><i>Neisseria meningitidis</i> (left)</p> <p data-bbox="730 272 1021 300"><i>Neisseria gonorrhoeae</i></p> <p data-bbox="730 352 1352 379"><i>Moraxella catarrhalis</i> and related species (right)</p>	<p data-bbox="1413 193 2107 341">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.</p> <p data-bbox="1413 394 2085 459">Gonococcus - rarely associated with bacteraemia in patients with acute septic polyarthritis.</p> <p data-bbox="1413 512 1973 539"><i>Moraxella</i> is almost always a contaminant.</p>
<p data-bbox="125 544 629 571">Gram positive coccus (resembling <i>Staph.</i>)</p> 	<p data-bbox="730 544 1386 735"><i>Staphylococcus aureus</i> – 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.</p> <p data-bbox="730 788 1285 853">Coagulase Negative <i>Staphylococcal</i> species (CoNS)- e.g. <i>S. epidermidis</i>, <i>S. capitis</i> etc</p> <p data-bbox="730 906 994 933"><i>Micrococcus</i> species</p>	<p data-bbox="1413 544 2107 692"><i>Staphylococcus aureus</i> (coagulase positive <i>Staph.</i>) is a major pathogen associated with a wide range of both community and hospital infections. Infections without an apparent focus may occur.</p> <p data-bbox="1413 745 2107 933">CoNS and <i>Micrococcus</i> 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.</p>
<p data-bbox="125 940 510 967">GPC (resembling <i>Streptococcus</i>)</p> 	<p data-bbox="730 940 1368 1005">Beta-haemolytic <i>Streptococcal</i> species (Group A - <i>Streptococcus pyogenes</i> and groups B, C or G)</p> <p data-bbox="730 1058 1368 1165"><i>Streptococcus pneumoniae</i> (right) – signified by a positive pneumococcal antigen ICT from broth; halo effect is from polysaccharide capsule</p> <p data-bbox="730 1217 1323 1244">Other alpha-haemolytic streptococcal species</p> <p data-bbox="730 1297 1346 1324"><i>Enterococcus faecalis</i> and other related species</p>	<p data-bbox="1413 940 2058 1005">In large part, these organisms are responsible for community onset rather than hospital infections.</p> <p data-bbox="1413 1058 2107 1165">The BHS species are all susceptible to benzylpenicillin or ampicillin which is the mainstay of treatment, also for pneumococcal pneumonia.</p> <p data-bbox="1413 1217 2107 1401">Other alpha-haem streps are often contaminants, especially if isolated in a single blood sample. <i>Enterococcus</i> is associated with UTIs, intra-abdominal or biliary infection and sometimes endocarditis. <i>E. faecalis</i> is susceptible to penicillin.</p>

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<p data-bbox="125 193 427 220">Gram Positive Rod (GPR)</p> 	<p data-bbox="730 193 1312 225"><i>Bacillus cereus</i> and other species (left image)</p> <p data-bbox="730 352 1155 384"><i>Clostridium</i> species (right image)</p> <p data-bbox="730 544 1283 655"><i>Cutibacterium (Propionibacterium)</i> species <i>Corynebacterium</i> species <i>Listeria monocytogenes</i></p>	<p data-bbox="1413 193 2085 304">All species with the exception of <i>Listeria</i> may be considered contaminants and these positive Gram stain results do not require notification.</p> <p data-bbox="1413 352 2096 496">Rare patients with gas gangrene will be bacteraemic with <i>Clostridium perfringens</i>. Severe sepsis due to <i>Clostridium septicum</i> may occur in association with gastrointestinal cancer.</p> <p data-bbox="1413 624 2085 735"><i>Listeria</i> may cause gastroenteritis, sepsis or meningitis, especially at the extremes of age and in pregnant women.</p>
<p data-bbox="125 740 315 767"><i>Candida</i> (yeast)</p> <p data-bbox="398 740 566 767"><i>Cryptococcus</i></p> 	<p data-bbox="730 740 1330 895"><i>Candida albicans</i> and related species (morphology- large oval cells staining as Gram positive). Generally 2-3 days required before system detects growth.</p> <p data-bbox="730 975 1335 1086"><i>Cryptococcus neoformans / gattii</i> (occasionally present in blood) (morphology - visible polysaccharide capsule)</p> <p data-bbox="730 1134 1364 1206">Filamentous moulds are rarely detected in blood cultures.</p>	<p data-bbox="1413 740 2119 895">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).</p> <p data-bbox="1413 943 2096 1046">Treatment requires remove of any associated device and antifungal therapy – generally fluconazole or amphotericin for 2 weeks.</p> <p data-bbox="1413 1094 2085 1238">During the second week, examination of the retinal fundal is required to exclude endophthalmitis which may require surgery and prolonged antifungal treatment.</p>