

Gram Positive versus Gram Negative bacteria



In 1884 Christian Gram, a Danish bacteriologist, performed a test that introduced dye to the bacteria, to identify if bacteria had a peptidoglycan wall or a mesh-like layer of amino acids and sugars. This method is called "**Gram staining**" and it is used to distinguish between **Gram positive** and **Gram negative** bacteria. Gram positive bacteria contain a thick peptidoglycan layer (with teichoic acids), that stain **purple** while Gram negative bacteria lack the teichoic acids in their cell wall and therefore, stain **pink /red**.

Commonly encountered **Gram Negative Bacteria**

Commonly Encountered Gram Negative Bacteria*	Common Sites of Infection*	Usual Drug of Choice	Comments *common but not all inclusive
“SPICE” Organisms			
S <i>Serratia</i> spp.	<ul style="list-style-type: none"> respiratory system intra-abdominal urinary system blood wounds surgical sites 	<ul style="list-style-type: none"> Carbapenems (e.g. meropenem) Fluoroquinolones (e.g. ciprofloxacin) Aminoglycosides (e.g. gentamicin) 	Can develop resistance to cephalosporins (e.g. ceftriaxone) while on treatment, therefore not used for serious infections. Nitrofurantoin-cystitis only
P <i>Providencia</i> spp.			
I ndole positive • <i>Proteus vulgaris</i>			
C <i>Citrobacter</i> spp.			
E <i>Enterobacter</i> spp.			
Other Organisms			
<i>Hafnia</i> spp.	respiratory symptom, gastro-intestinal, urinary system, blood	carbapenems, fluoroquinolones, aminoglycosides	
<i>Morganella morganii</i>	urinary system, intra-abdominal, skin, soft tissue, wounds	carbapenems, fluoroquinolones, aminoglycosides	
<i>Proteus mirabilis</i>	urinary system	cefazolin, ceftriaxone, ciprofloxacin, piperacillin/tazobactam,	
<i>Acinetobacter</i> spp.	respiratory system, heart, urinary system, blood, wound	ertapenem, meropenem, ciprofloxacin, moxifloxacin	
<i>Pseudomonas aeruginosa</i>	respiratory tract, blood, urinary tract, wounds, surgical sites	piperacillin-tazobactam, meropenem, ceftazidime, tobramycin, gentamicin, ciprofloxacin	Respiratory: causes VAP Multidrug resistance (MDR): colistin, ceftolozane/tazobactam Tobramycin, gentamicin: not used as first line due to toxicity and penetration reasons

Note: This is only an introduction to the gram negative bacteria. If you have any questions or suggestions please email: Linda.Jorgoni@uhn.ca , or Linda.Dresser@uhn.ca.

References

Bennett, J., Dolin, R., Blaser, M., Mandell, G., Douglas, R.(2015). Douglas, and Bennett's principles and practice of infectious diseases. Philadelphia: Saunders.

Chambers, H. F., Eliopoulos, G. M., Gilbert, D. N., Saag, M., S. (2015). The Sanford Guide to Antimicrobial Therapy, Sperryville, VA: Antimicrobial Therapy.