

Lecture Title:

NORMAL FLORA

(Foundation Block, Microbiology)

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Lecture Objectives..

By the end of this lecture the student is expected to be able to:

1. Define the terms: *Normal Flora*, *Resident flora*, *Transient flora* and carrier state
2. Know the origin of normal flora.
3. Know the importance of normal flora with examples Know areas of the body with normal flora (GIT, Urogenital tract, and skin) and most common types of organism in these areas and relation to pathogenicity of these organism.
4. Know sites of the body with no normal flora e.g. sterile body sites and the importance of this fact in relation to interpretation of culture results.

Definition

- Normal flora are microorganisms that are frequently found in a particular site in normal healthy individual.
- Some are found in association with humans / animals only. **The Majority are bacteria.**
- **Symbiotic relationship with the host.**
- Subject to constant changes.
- Altered by antimicrobial agents.

Types of Normal Flora

- *Commensals*: natural relationship with host. (No harm to the host)
- *Residents* : present for invariable period . (months~years)
- *Transients* : establish itself briefly , excluded by host defense or competition from residents. (days~weeks)
- *Carrier state* : potentially pathogenic , eg. *S.pneumoniae*, *N. meningetidis* in throat of healthy individual.

Origin of Normal Flora

- Newborn sterile in utero
- After birth ,exposed to flora of mother's genital tract , skin, respiratory tract flora of Those handling him ,and organisms in the environment.

Beneficial effects of normal flora

- 1~ **Immunostimulation** (antibody development)
- 2~ **Exclusionary effect** (vacuum effect) and protection from external invaders..
- 3~ **Production of essential nutrients** (Vit. **K & B**) by some normal intestinal flora eg. *E.coli*.

Other facts regarding normal flora

- **May be a source of opportunistic infections.**
eg . In patients with impaired defense mechanisms. eg *S.epidermidis*, *E.coli*.
- **Some may cross react with normal tissue components,** eg, antibodies to various ABO group arise because of cross reaction between intestinal flora and the antigens of A & B blood substances.

Continue:

- **Production of carcinogens:**
- Some normal flora may modify through their enzymes chemicals in our diets into carcinogens. eg. artificial sweeteners may be enzymatically modified into bladder carcinogens.

Distribution of normal flora

- **Internal organs** (except alimentary tract) are sterile at health.
- Sterility maintained by :
 - ~ local defense mechanisms
 - ~ chemical substances in serum & tissues eg. Complement , antibodies.
 - ~phagocytic activity of PMN

Areas of the body with normal flora

- Skin
- Upper Respiratory Tract
- GIT: mouth & large colon
- Urogenital Tract: vagina & distal 1/3 of the urethra

DISTRIBUTION AND FREQUENCY OF BACTERIA IN THE INTESTINE

density	frequency of occurrence in population	
oesophagus stomach	lactobacilli	
small bowel duodenum jejunum ileum	lactobacilli streptococci Enterobacteria Bacteroides spp.	
large bowel	Bacteroides spp. Fusobacterium spp. E. faecalis Escherichia coli	Enterobacteria Klebsiella spp. Eubacteria Bifidobacteria
faecal material	Lactobacillus Staph. aureus Clostridium spp	Streptococci Pseudomonas Salmonella
	Bacteroides spp. Bifidobacteria Eubacteria	Coliforms E. faecalis

Distribution of Intestinal Flora

Predominant organisms	Concentration (per gram)
Obligate anaerobes Streptococci Staphylococci Neisseria	$>10^6$
None	10^2
Lactobacilli Streptococci	$<10^4$
Anaerobes Bacteroides	10^6
Coliforms E. coli	10^9
Streptococci Candida Protozoa	10^{11}



Summary

	Staphylococcus aureus (Coagulase +)	Other Staph(Coagulase -)	Alph Hemolytic Streptococci (viridians Streptococci and strept pneumo	Enterococcus	Neisseria ,Moraxella and Heaomophilus	Corynebacteria (diphtheroid) Popionibacterium acnes	Lactobacillus	Gram Negative Bacteria (coliform ie E.coli) Pseudomonas	Anaerobic bacteria (Bactericides, fusobacterium and clostridium)
Oral Cavity			+++		+++				+++
Skin		+++				+++			
Eye and eye		+++				+++			
Axilla, Groin and nose	+++	+++				+++			
GIT			+++	+++			+++	+++	+++
female Genital							+++		

Normal Skin Flora

- Fatty acid , lysozymes by sweat glands
- Skin has rich resident bacterial flora($10^4/cm^2$).
- Exist as microcolonies.
- Anaerobic organisms predominate in areas with sebaceous glands.
- Moist skin ,often colonized by coliforms.

Main Skin Flora

- *Staph. epidermidis*
- *Corynebacteria*
- *Propionibacterium acnes*
- *Staph. aureus* (less common, potential pathogen)
- Coliforms

Ear and Eye

- **External auditory meatus:**
 - Staph. epidermidis
 - Corynebacteria
 - AFB occasionally in wax.
- **Conjunctival sac flora:**
 - Corynebacterium xerosis
 - Staph. epidermidis

Normal flora of the respiratory tract

- Upper resp.tract colonizes by flora as in mouth & nasopharynx
- Lower respiratory tract is sterile
- NOSE:
 - *Staph. Aureus* 30%
 - *Staph. epidermidis*
 - *Corynebacteria*

Oropharynx flora

- Viridance streptococci
- Corynebacteria
- Commensal neisseriae and moraxella
- Hemophilus influenzae & Pneumococcus are potential pathogens.
- Bacteroides, Fusobacteria, Veillonella, actinomyces, spirochaetes.
- Less common: *S.pyogenes*, *N.meningitidis*
- Gram negative bacteria in hospitalized patients

Gastrointestinal tract flora

- Saliva contains 10^8 bact/ml
- Gingival margin debris & dent. Plaque continually colonized by bacteria.
- Oesophagus flora as pharyngeal flora.
- Empty stomach sterile due to gastric acid.
- Duodenum, jejunum & upper ileum have scanty flora
- Large intestine heavily colonized by bacteria.

Faeces

- 1/3 of faeces wt. is bacteria , mainly dead,
- Living bacteria $\sim 10^{10}$ /gm
- 99% anaerobes
- Anaerobic environment maintained by aerobic bacteria utilizing free O₂.
- Bacteroides fragilis group the dominant anaerobes, bifidobact. Lactobacilli...etc.
- Less common: E.coli ,Proteus,...etc.

Genitourinary tract flora

- Kidney, bladder and fallopian tube are sterile
- Female genital tract heavily colonized , why ?
- 10^8 /ml in normal vaginal secretion.
- In both sexes *Mycob. Smegmatis* (AFB) in secretions which contaminate urine~leads to confusion / misdiagnosis.
- M & F distal urethra: ~ *S.epidermidis*
~ *Corynebacteria*
~ *Mycoplasma*.

Female Genital

Vulva

- S. epidermidis
- Corynebacteria
- E.coli and other coliforms
- Enterococcus faecalis.

Vagina

- lactobacilli
- Bacteroides melaninogenicus
- Enterococcus faecalis
- Corynebacteria
- Mycoplasma
- Yeasts.

Reference book and the relevant page numbers..

- SHERRIS MEDICAL MICROBIOLOGY, AN INTRODUCTION TO INFECTIOUS DISEASES. KENNETH RYAN /GEORGE RAY. LATEST EDITION. PUBLISHER MC GRW HILL.
- CHAPTER 9,PAGE 141~148

Thank You 😊

(Foundation Block, Microbiology)

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