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, including importance as:
   - A. Source of opportunistic infection.
   - B. Immunostimulation.
   - C. Nutrition: Vitamins production.
   - D. Production of Carcinogens.
   - E. Protection against external invaders.
4. 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.
5. 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

- Fetus is sterile in uterus
- After birth ,exposed to flora of mother's genital tract
- Skin, respiratory tract flora of those handling him
- Organisms in the environment.

Symbiosis

Symbiosis	First symbiont	Second symbiont
Neutralism	No effect	No effect
Commensalism	No effect	Benefit
Mutualism	Benefit	Benefit
Parasitism	Benefit	Harmed

Beneficial effects of normal flora

- 1- Immuno-stimulation (antibodies 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 *Staphylococcus epidermidis, Escherichia 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 :

1. Local defense mechanisms
2. Chemical substances in serum & tissues eg. Complement , antibodies.
3. 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

Sites	Load /gm	*Staphylococcus* aurous (Coagulase +)	Other Staph (Coagulase -) *Staphylococcus* epidermidis	Alph Hemolytic Streptococci (*Streptococci viridians and strept pneumo*	*Enterococcus*	*Neisseria ,Moraxella and Heaomophilus*	*Corynebacteria (diphtheroid)*	*Propionibacterium acnes Lactobacillus*	Gram Negative Bacteria (coliform ie E.coli)	*Pseudomonas*	Anaerobic bacteria (Bactericides, fusobacterium and clostridium)	Candida
Oral Cavity/ Upper Respiratory	10^6	+		+++		+++					+++	
Skin			+++				+++	++				
Eye and eye			+++				+++					
Axilla, Groin and nose		+++	+++				+++					
Stomach	10^2							+				
Small intestines	10^6			++				++	++		++	
Colon	10^{11}			+++	+++			++	+++	+++	+++	++
female Genital								+++				

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

- *Streptococci Viridans*
- Commensal *neisseriae* and *moraxella*
- *Heamophilus inflenzea & Streptococcus pneumoniae* are potential pathogens.
- Corynebacteria
- Bacteroides
- *Fusobacteria , Veillonella, actinomyces, spirochaetes.*
- *Less common: Streptococcus pyogenes ,Neisseria meningitidis*
- Gram negative bacteria in hospitalize patients

Gastrointestinal tract flora

- Saliva contains 10^8 bacteria /ml
- Gingival margin debris and dental plaque continually colonized by bacteria.
- Esophagus flora as pharyngeal flora.
- Empty stomach sterile due to gastric acid.
- Duodenum, jejunum and upper ielum have scanty flora
- Large intestine heavily colonized by bacteria.

Faeces

- 1/3 of faeces wt. is bacteria , mainly dead,
- Living bacteria ~ 10^{11}/gm
- 99% anaerobes
- Anaerobic environment maintained by aerobic bacteria utilizing free O_2.
- *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 .
- 10^8/ml in normal vaginal secretion.
- In both sexes *Mycobactria Smegmatis* (AFB) in secretions which contaminate urine-leads to confusion /misdiagnosis.
- M & F distal urethra:
- ~ Staphylococcus epidermidis

  ~ Corynebacteria

  ~Mycoplasma.

Female Vulva

- *Staphylococcus epidermidis , corynebacteria, E.coli and othe coliforms & enterococcus faecalis.*
- Vagina :
  - Lactobacilli (Doderlein's bacilli)
  - Bacteroides melaninogenicus
  - Enterococcusfaecalis
  - Corynebacteria
  - Mycoplasma
  - Yeasts.

Normal Skin Flora

- Fatty acid , lysozymes by sweat glans
- Skin has rich resident bacterial flora($10^4/cm^2$).
- Exist as microcolonies.
- Ano$_2$ organisms predominate in areas with sebaceous glands.
- Moist skin ,often colonized by coliforms.

Main Skin Flora

- *Staphylococcus epidermidis*
- *Corynebacteria*
- *Propionibacterium acnes*
- *Anaerobic cocci*
- *Staphylococcus aureus* (less common, potential pathogen)
- Coliforms

External auditory meatus

- *Staphylococcus epidermidis*
- *Corynebacteria*
- AFB occasionally in wax.

Conjunctiva and scalar flora

- *Staphylococcus epidrmidis*
- *Corynebacterium xerosis*

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 ☺

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