Normal Flora

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Objectives

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.

Objectives, cont,.

4. Know areas of the body with normal flora (GIT, urogenital tract, and skin) and most common types of organism and relation to pathogenicity.
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.

Introduction

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

Types of Normal Flora

- **Commensals:** have natural relationship with the host.
- **Residents** : present for invariable period .
- **Transients** : establish itself briefly , excluded by host defense or competition from residents.
- **Carrier state** : **potentially pathogenic** , eg. *Streptococcus pneumoniae, Neisseria meningetidis* in throat of healthy individual.

Origin of Normal Flora

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

Beneficial Effects of Normal Flora

1- **Immuno-stimulation** (antibody production)

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*.

Facts About Normal Flora

- May be a **source of opportunistic infections** in patients with impaired defense mechanisms. Eg. *Staphylococcus 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.

Facts About Normal Flora-cont.,

- 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

- Normal flora found on external body sites
- **Internal organs (*except alimentary tract*) are sterile at health.**
- **Sterility of internal organs maintained by :**

~ Local defense mechanisms

~ Chemical substances in serum & tissues eg. Complement , antibodies.

~Phagocytic activity of Polymorphnuclear Monocytes.

Body Sites With Normal Flora

All external body sites contain normal flora:

- GIT: mouth & large colon
- Urogenital tract: vagina & distal 1/3 of the urethra.
- Skin (including external ear & conjunctiva)

DISTRIBUTION AND FREQUENCY OF BACTERIA IN THE INTESTINE

density	frequency of occurrence in population
oesophagus **stomach**	lactobacilli
small bowel duodenum	lactobacilli streptococci
jejunum ileum	Enterobacteria *Bacteroides* spp.
large bowel	*Bacteroides* spp. *Fusobacterium* spp. *E. faecalis* *Escherichia coli* Enterobacteria *Klebsiella* spp. Eubacteria Bifidobacteria
	Lactobacillus *Staph. aureus* *Clostridium* spp Streptococci *Pseudomonas* *Salmonella*
faecal material	*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* Streptococci	10^9
Candida Protozoa	10^{11}

Normal Flora Of The Respiratory Tract

- Upper respiratory tract colonized by normal flora as in mouth & nasopharynx
- Lower respiratory tract is sterile
- Nose Flora : ~ *Staph. epidermidis*
  ~ *Staph. aureus*
  ~*Corynebacteria*

Normal Flora Of The Oropharynx

- Viridance streptococci
- Commensal neisseriae
- Corynebacteria
- Bacteroides
- Fusobacteria , Veillonella, Actinomyces, Spirochaetes.
- *Heamophilus inflenzea & Pneumcoccus* are potential pathogens.
- Less common potential pathogens : *S.pyogenes , N.meningitidis*

Normal Flora Of The GIT

- Saliva contains 10^8 bacteria/ml
- Gingival margin debris & dental Plaque continually colonized by bacteria.
- Oesophagus has normal flora similar to pharyngeal flora.
- **Empty stomach sterile due to gastric acid.**
- **Duodenum, jejunum& upper ielium have scanty flora**
- **Large intestine heavily colonized by bacteria.**

Feces (Stool)

- 1/3 of feces weight is bacteria , mainly dead.
- Living bacteria about 10^{10}/gm
- **99% anaerobes**
- Anaerobic environment maintained by aerobic bacteria utilizing free O2.
- ***Bacteroides fragilis*** group is the dominant anaerobes, bifidobacteria , Lactobacilli…etc.
- **Less common aerobics: *E.coli* ,*Proteus*,….etc.**

Normal Flora Of The Genital Tract

- Female genital tract heavily colonized , why ?
- 10^8/ml flora in normal vaginal secretion.
- **In both sexes *Mycobacterium smegmatis* in secretions which contaminate urine and leads to confusion /misdiagnosis.**
- Male & Female distal urethra: ~ *S.epidermidis*
  ~ *Corynebacteria*
  ~*Mycoplasma* species

Normal Flora Of The Female Genital Tract

- **Vulva** : *S. epidermidis , Corynebacteria, E.coli* and other coliforms & *E. faecalis.*
- **Vagina :**

~Lactobacillus (Doderlein's bacilli)

~ *Bacteroides melaninogenicus*

~*E.faecalis*

~ Corynebacteria

~*Mycoplasma*

~ Yeasts.

Normal Flora Of The Skin

- 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:

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

Normal Flora Of The External Auditory Meatus

External ear has the following normal flora:

- *S. epidermidis*
- Corynebacteria
- Acid fast bacilli (AFB) (occasionally in wax).

Middle and inner ear are sterile.

Normal Flora Of The Conjunctival Sac

Conjunctiva has normal flora eg.

- *Corynebacterium xerosis*
- *Staphylococcus epidrmidis*

Internal eye is sterile.

Reference Book

- *SHERRIS* MEDICAL MICROBIOLOGY, AN INTRODUCTION TO INFECTIOUS DISEASES. KENNETH RYAN /GEORGE RAY. LATEST EDITION. PUBLISHER MC GRW HILL.

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