E. coli

- **Most strains** belong to the resident intestinal microflora and are extraintestinal pathogens
  - Some of these strains carry extra virulence factors promoting extraintestinal infections
- **Some strains** have acquired genetic elements coding for intestinal virulence

Virulence factors in extraintestinal *E. coli* infections

- capsule
- fimbria
- flagella
- siderophor (aerobactin, enterobactin)
- endotoxin

Extraintestinal *E. coli* infections

- Urinary tract infections (cystitis, pyelonephritis)
  - virulence factors: P-fimbriae, alpha-hemolysine, aerobactin
- Wound infections, abscesses, sepsis
- Neonatal meningitis
  - virulence factors: K1, K5 capsular antigens

E. coli

10^9 CFU/mg in the stool

Resident strains: the role is the inhibition of colonisation of pathogenic bacteria

Transient strains: pick up by food

Intestinal *E. coli* infections

- EPEC – enteropathogenic *E.coli* (O55, O111)
- ETEC – enterotoxigenic *E.coli*
- EIEC – enteroinvasive *E.coli* (O124)
- EHEC – enterohemorrhagic *E.coli* (O157)
- EAEC – enteroaggregative *E.coli*

Further pathogenic groups are being identified.

Intestinal *E. coli* infections

are due to virulence factors mediating enhaced attachment to or invasion into the intestinal mucosa

E. coli	Disease	virulence factor
EPEC	infanthood diarrhea (enteritis)	pili (EAF, BFP), intimin Attaching-effacing
ETEC	travellers' diarrhea, *cholera like*, watery diarrhea (enteritis)	CFA, toxins (LT, ST)
EIEC	*dysentery like* diarrhea (colitis, purulent, bloody stool)	invasion plasmid shared with shigellae
EHEC	hemorrhagic colitis (haemolytic-uraemic syndr.)	Verotoxins (Shiga-like toxins)
EAEC	acute and chronic diarrhea (enteritis)	aggregative adhesion fimbriae (AAF)

EPEC

Dyspepsia coli: < 1 year old babies

- watery diarrhea
- effacement
- bundle-forming pili
- intimin (*eae* gene)
- O26:K60, O55:K59, O86: K61, O111:K58

Laboratory diagnosis

- culture
- biochemical reactions
- detection of O and K antigens by agglutination
- adhesion onto Hep-2 cells
- detection of *eae* genes by PCR

Treatment

- replacement of water and electrolites

ETEC

Enterotoxigenic *E. coli*: traveller's disease

- watery diarrhea
- localisation to small intestine
- transmission by food and water

Virulence factors

- CFA (colonisation factor antigen) I. II. III.
- afimbrial adhesins
- heat lable (LT) enterotoxin: cAMP
- heat stable (ST) enterotoxin: cGMP

EIEC

Enteroinvasive *E. coli:* dysenteriform (shigella)

- ulcers in the large intestine
- bloody, mucoid stool
- sorce of infection: contaminated water or food

Virulence factors

- invasive factor (plasmid, 220 kb)

Laboratory diagnosis

- culture, biochemical reactions
- invasivity tests:
  - Serény-test
  - HeLa cell invasion test
- detection of invasion plasmid by PCR or ELISA
- serotyping (O124, O143, O28ac, O164)

Treatment

- replacement of water and electrolites
- ampicillin, 3. generation cephalosporins, fluoroquinolons

EHEC

Enterohaemorrhagic *E.coli:* bloody diarrhea

- food, meat (hamburger), milk (zoonotic)
- GI (colon)
- 10 % HUS (haemolytic uraemic syndrome)
- 1 % TTP (thrombotic thrombocytopaenic purpura)

Virulence factors

- fimbria
- *eae* gene (attaching-effacing factor)
- citotoxins (VERO toxin, SLT I. and SLT II.: Shiga-like toxin)

Laboratory diagnosis

- culture, biochemical reactions
- demonstration of toxin on VERO cells, or detection by ELISA, PCR
- serotyping (O157:H7)

Treatment

- replacement of water and electrolites
- antibiotics not recommended

EAEC

Enteroaggregative *E. coli*

- *in vitro* aggregation on epithelial cells
- chronic watery diarrhea
- bundle forming pili (BFP) plasmid,
- enterotoxins

Extraintestinal infections
UTI

- 80 %
- ascending (stool)
- predisposing factors (stone, tumour, diabetes, pregnancy)

Virulence factors

- endotoxin
- O antigen (antiphagocytic)
- capsule (K1, K5)
- P fimbria
- alfa-hemolizin (citotoxic)
- siderophor (aerobactin)

Laboratory diagnosis

- urine sample (native or „dip slide")
- significant bacteriuria

Treatment

Non complicated cases:

- Sumetrolim or fluoroquinolon for 3 days

Complicated cases:

- fluoroquinolon, Augmentin, cephalosporin for 2 weeks

Asymptomatic bacteriuria:

- according to the sensitivity pattern

Klebsiella genus

- *K. pneumoniae*
- *K. oxytoca*
- *K. oezenae*
- *K. rhinoscleromatis*

Pathogenesis

in hospitalised patients

- pneumonia
- sinusitis, otitis media
- gallbladder inflammation
- nosocomial UTI
- wound infections
- sepsis, meningitis

Treatment

- genetic resistance against ampicillin, carbenicillin, ureidopenicillin
- according to the sensitivity pattern
- ESBL producers (carbapenems)

Control of ESBL

•good antibiotic policy (restrict 3. gen. cephalosporines)
•hand washing
•isolation of ESBL positive patient

Enterobacter genus

- *E. cloacae*
- *E. aerogenes*
- *E. gergoviae*
- *E. sakazakii*
- *E. asburiae*

Diseases

Nosocomial infections

- UTI
- pneumonia
- wound
- sepsis

Proteus genus

- *Poretus mirabilis*
- *Proteus vulgaris*
- *Proteus morganii*

Diseases

- UTI
- nosocomial infections:
  UTI, sepsis, wound infections