

### M15 - Urogenital and sexually-transmitted infections

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#### **Learning Objectives**

- Know what significant bacteriuria and pyuria are and the locations and names of different types of UTIs
- Name the common bacteria causing UTI and their likely sources
- Explain the laboratory diagnosis of UTI Know how to collect urine samples properly
- Describe the approach to a patient with an STI List the
  - Etiologic agents
  - Symptoms Methods for diagnosis
- · Appreciate that STIs always infect more than one patient

#### Introduction to the Urogenital Infections

Urinary microbiome Firmicutes and Bacteroidetes account for most of the bacterial representations. A <u>disturbance of bacterial representation [Mostly Enterobacteria]</u> and diversity <u>triggers a transition from health to disease</u>.

#### **Clinical Features of Urogenital Infections** Urethritis - 尿道炎 Location Cystitis - 膀胱炎 Ureteritis - 输尿管炎 Difficulties in urination [Pain] Symptoms **Urinary Tract Infection** Pyelonephritis - 肾炎 25% Untreated Case Bacteriuria [Bacteria in Urine] Pyuria [Pus in Urine] Characteristics

Haematuria

[Blood in Urine]

- ▼ Text Version **Urinary Tract Infection** 
  - 25% of Untreated case → Pyelonephritis
  - Location ○ Urethritis - 尿道炎
  - Cystitis 膀胱炎 ○ Ureteritis - 輸尿管炎
  - Symptoms Difficulties in urination [Pain]
  - Fever
  - Characteristics Bacteriuria Pyuria

Haematuria

**Common Urinary Tract Infection Pathogens** 

Most of the Urinary Tract Infection Pathogens are Enterobacteria Hospital patients Community patients Escherichia coli Escherichia coli 1st Common 2nd Common Staphylococci Klebsiella Enterobacter

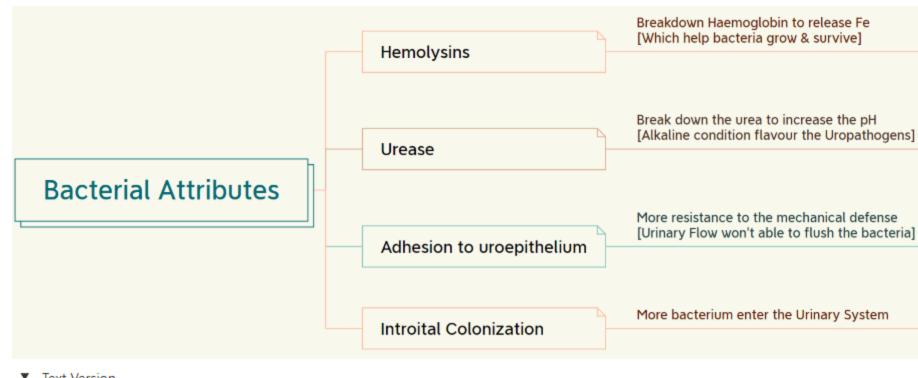
Candida G+ cocci / Proteus 3rd Common **Pathogenesis of Urinary Tract Infection Pathogens** 1. Bladder Epithelial damaged by toxins / protease 2. Uropathogens → + Kidney Upper UTI 3. Damage by bacterial toxins 4. Uropathogen bacteraemia [败血症] Pathogenesis of UTI 1. Contamination of Gut uropathogens 2. Colonization of Urethra → → Bladder Lower UTI

3. Trigger inflammatory response

4. Multiplication & Form Biofilm

Serratia Pseudomonas

- Text Version
  - Upper UTI o 1. Bladder Epithelial damaged by toxins / protease
- 2. Uropathogens → Kidney
- 3. Damage by bacterial toxins ○ 4. Uropathogen bacteraemia [败血症] Lower UTI
- 1. Contamination of Gut uropathogens
- 2. Colonization of Urethra → Bladder 3. Trigger inflammatory response 4. Multiplication & Form Biofilm
- **Bacterial Attributes & Pathogenesis**



### ▼ Text Version

- Hemolysins Breakdown Hemoglobin to release Fe
- [Which help bacteria grow & survive] Urease
- Break down the urea to increase the pH [Alkaline condition flavors the Uropathogens]
- Adhesion to uroepithelium More resistance to the mechanical defense
- [Urinary Flow won't able to flush the bacteria] Introital Colonization

More bacterium enter the Urinary System

Introduction to Sexually Transmitted Infections [STI]

 $Accurate\ Diagnosis \rightarrow Compliance \rightarrow Treatment\ on\ epidemiological \rightarrow Follow\ up \rightarrow Screening\ and\ contact\ tracing \rightarrow Education$ Remarks: 精确的诊断→ 遵守治疗 → 基于流行病学的治疗 → 后续随访 → 筛查和接触者追踪 → 教育

# Remarks:

- . Diseases that are transmitted mainly, but NOT EXCLUSIVELY, by sexual contact • STI can be transmitted through Horizontal Transmission & Vertical Transmission
- History Contact is important → Prevent re-infection & Break the chain of transmission → Treat Asymptomatic Infection

### Most common STI Pathogen

Pathogen	Disease	Chinese Translation	Treatment	Remarks
Chlamydia trachomatis (D-K serotypes)	Non-specific UTI	非特异性尿毒症	Doxycycline, azithromycin	
Trichomonas vaginalis (Parasites)	Vaginitis, urethritis	阴道炎、尿道炎	Metronidazole	
Neisseria gonorrhoeae	Gonorrhea	淋病	Common antibiotic	
HIV	AIDS	艾滋病	HAART	
Papillomavirus	Genital warts	生殖器湿疣	Surgical	HPV16, HPV 18 → cervical cancer [子宫颈癌]
Herpesvirus [HSV-2/HSV-1]	Genital herpes	生殖器疱疹	Acyclovir	Latency 潜伏性
Treponema pallidum	Syphilis	梅毒	Penicillin	
C. trachomatis (L1, L2, L3 serotypes)	Lymphogranuloma venereum	性病淋巴结瘤	Doxycycline, erythromycin	Tropical regions
Candida albicans	Vaginal thrush	阴道鹅口疮	Nystatin, fluconazole	Predisposing factors 诱发因素
HBV	Hepatitis	肝炎	Lamivudine	Male homosexual
Hemophilus ducreyi	Chancroid	甲状旁腺疳积	Erythromycin	Mainly tropical

# Female anatomical sites affected by more common STIs

Pathogens	Infected Location	Located Cell Type	
Gonorrhoea	- Cervix - Oral - Rectal	Intermediate endocervical columnar epithelial cells	
Chlamydia	- Cervix - Oral [Rare] - Rectal	Basal endocervical columnar epithelial cells	
Bacterial vaginosis	- Vagina / Internal genitalia	Vaginal Epithelium	
Trichomoniasis	- Vagina / Internal genitalia	Vaginal Epithelium	
HSV	- Vulva / External Genitalia - Oral - Rectal	Epidermal Cell Squamous Epidermal Cell	
HPV	- Vulva / External Genitalia - Oral - Rectal	Epidermal Cell Squamous Epidermal Cell	

- Gonorrhoea and chlamydia typically present as cervicitis 淋病和衣原体通常表现为宫颈炎
  - . Bacterial vaginosis (BV) and trichomoniasis CAN ALSO cause cervicitis, but more commonly manifest as vaginitis. 细菌性阴道病 (BV) 和滴虫病也会引起宫颈炎, 但更常见的表现为阴道炎。 HSV and HPV most typically affect the vulva or external genitalia of women
- HSV 和 HPV 最常影响女性的外阴或外生殖器

### • Gonorrhea · Chlamydia (rare) • HSV • HPV Gonorrhoea Chlamydia Trichomoniasis To the to 例的是可能 Gonorrhea Chlamydia · HSV · HPV Vulva/external genitalia (epidermal cells/squamous) ☐ Vagina/internal genitalia (vaginal epithelium)

Cervix (endocervical columnar epithelial cells)

**Classification of Urinary Tract Infections** 

Uncomplicated UTI

Low risk

Uncomplicated UTIs

Complicated UTIs

Recurrent UTIs

Urosepsis

尿路败血症

Catheter-associated UTIs

**Risk Factors** 

▼ Text Version

Renal calculi

Ureteral tumors

Ureteral strictures

输尿管狭窄

· Short urethra in women

Prostatic hypertrophy

Neurologic Problems

Incomplete bladder emptying

Large volume of residual urine

**Laboratory Diagnosis of Urinary Tract Infection** 

Significant Pyuria

Significant Bacteriuria

False Negatives

Mixed bacteria

Skin Flora

≤ 10<sup>5</sup>

False Positive

o Loss of sphincter control

**Laboratory Diagnosis of** 

Urinary Tract Infection

▼ Text Version

CFU/ml

HIV

Hepatitis B

Herpes

Dengue

Ebola

Marburg

Mumps

Chikungunya

Epstein-Barr

Chickenpox

Zika

Significant Pyuria

Def.: White blood cell in pus

Leukocyte esterase dip stick test

Microscopy ≥ 10WBC mm³ (μL)

[ ≥100WBC in 1 Loop of Urine]

≥ 10⁵

Number of Type Usually one

True Positive

Typical Uropathogens

27 Sexually Transmitted Infectious Virus - Male Semens

Adj. Tumors

Catheterization

Ureteric reflux

输尿管反流

前列腺肥大

神经系统问题

肾结石

**Risk Factors & Urinary Tract Infection** 

Cystitis

**Pyelonephritis** 

Recurrent UTI

Catheter-associated UTI

**UTI** in men

Urosepsis

- Limited to non-pregnant women with no known abnormalities.

女, 其尿路内没有已知的相关解剖和功能异常或异常。

病因宿主对来自泌尿道和/或男性生殖器官感染的反应失调。

Decreased urinary outflow from upper urinary tract obstruction

Adj. Tumors

Catheterization

Ureteric reflux 输尿管反流

前列腺肥大

神经系统问题

Decreased urinary outflow from upper urinary tract obstruction

Short urethra in women

Prostatic hypertrophy

Neurologic Problems

- Increased chance of a complicated course

急性、散发性或目前的下尿路感染 (无复杂性膀胱炎) 和/或上尿路感染, 仅限于未怀孕的妇

Urinary tract is currently catheterized or has had a catheter in place within the past 48 hours.

By Dysregulated host response to infection originating from the urinary tract / genital organs.

Renal calculi 肾结石

Ureteral tumors

Ureteral strictures 输尿管狭窄

Incomplete bladder emptying

Large volume of residual urine

Def.: White blood cell in pus

Leukocyte esterase dip stick test

Microscopy ≥ 10WBC mm³ (µL) [ ≥100WBC in 1 Loop of Urine]

≥ 105 Colony-Forming-Unit/ml

Usually isolate 1 uropathogens

≤ 10<sup>5</sup> Colony-Forming-Unit/ml

Poor Collection

Delay in transportation

Typical Uropathogens

Skin Flora

Mixed bacteria

Loss of sphincter control

- Cause: Indwelling urinary catheters, renal diseases, immunocompromising diseases

极大机会出现复杂的医疗情况;原因:导尿管堵塞、肾脏疾病、免疫功能低下疾病

A frequency of at least three UTIs per year or two UTIs in the last six months.

- Acute, sporadic

- Uncomplicated cystitis, and/or

- Uncomplicated pyelonephritis

- All Apart from uncomplicated.

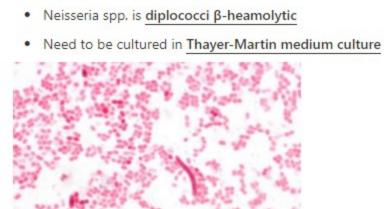
Complicated UTI

High risk

# More About Sexually Transmitted Infections

# Neisseria Gonorrhoeae





Gonorrhoea Male Patients **Female Patients** Painful urination Initial: Asymptomatic Later: Spread to the fallopian tubes [ Salpingitis ] Discharge of pus 扩散到输卵管[输卵管炎] Blockage of the urethra Important reservoirs → Multiple sexual partners Sterility

### Nongonococcal Urethritis (NGU) NGU is any inflammation of the urethra NOT CAUSED by N. gonorrhoeae.

Pathogens	- Chlamydia trachomatis (L1, L2, L3 serotyps) - Ureaplasma urealyticum	
	- Mycoplasma hominis	
Symptoms	- Milder than Gonorrhoea	
	- Urethral discharge - Dysuria	
Complications	- Salpingitis	
	- Sterility	

# Treponema pallidum / Spirochete - Syphilis

Cannot be cultured in vitro 1. Fluorescent treponemal antibody-absorption test 2. VDRL test - By using Patient's serum

- Initial Infection
- o Multiplication of treponemes at site of infection Primary syphilis
- o Proliferation of treponemes in regional lymph nodes Multiplication and production of lesions in lymph nodes, liver, muscle, skin and mucous membrane
- o Treponemes dormant in liver and spleen Tertiary Syphilis

Transmission Method	Direct contact of intact mucous membrane
	Direct contact of breaks in skin with lesions
Primary	Lesion: Chancre [A firm, painless ulcer]
	Chancre can heals spontaneously, without treatmen
	Invade the blood & lymphatic system
	Enlarged inguinal lymph nodes
Secondary	Flu-like illness
	Generalized Mucocutaneous rash on skin
	Myalgia - 肌肉痛
	Headache, Fever
Tertiary	Neurosyphilis

Cardiovascular syphilis

Progressive destructive disease





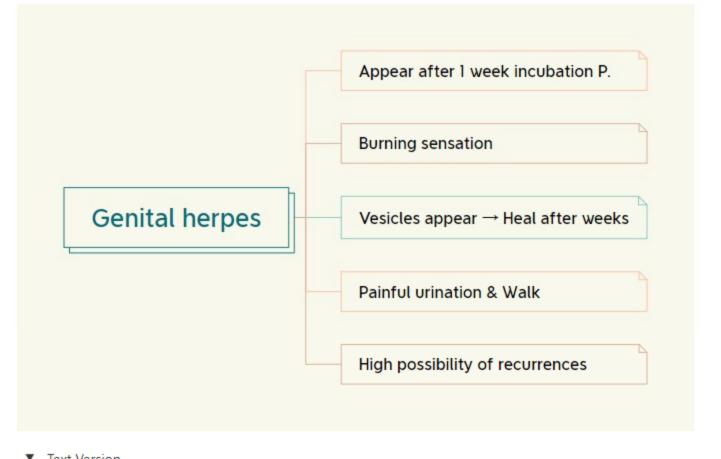
Generalized Mucocutaneous rash on skin

▼ Remarks: Not to be confused with chancroid, which is typically very, very painful and is caused by Haemophilus ducreyi.

▼ Text version

# **Viral Sexually Transmitted Infections**

### Herpesvirus - Genital herpes HSV-2 is more common than HSV-1





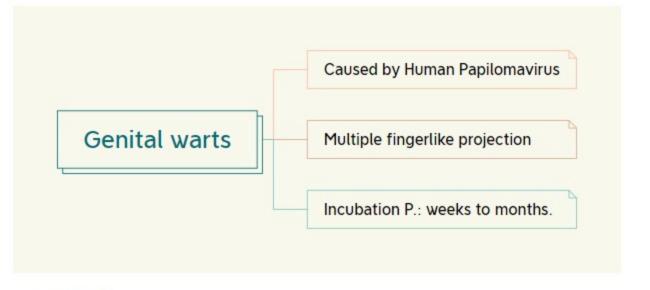
# **Human Papillomavirus - Genital warts**

Genital warts are caused by papillomaviruses.

· Warts are multiple fingerlike projections

. The incubation time is weeks to months.

Leads to cervical cancer





- ▼ Text Version
  - Lesions appear after an incubation period of about 1 week and cause a burning sensation. Vesicles appear. · Painful urination and discomfort while walking.
  - Vesicles usually heal in a couple of weeks.
  - About 88% of HSV-2 patients and 50% of HSV-1 patients will have recurrences in 3-6 month intervals.