RENAL DISORDERS

DR ANJUM

LEARNING OBJECTIVES

- Define terms…… **Nephrotic syndrome, Nephritic syndrome and Azotemia.**
- Causes and types of **Renal stones**
- Causes of **Urinary tract infection** .
- **Pathogenesis** of **Urinary tract infections**.

NEPHROTIC SYNDROME

Nephrotic syndrome, caused by loss of protein through the kidneys leading to low protein levels in the blood.

Nephrotic syndrome is characterized by:

1. **Massive proteinuria….. > 3.5 gm / day**
2. **Hypoalbuminaemia….. < 3 gm / dl**
3. **Generalized edema**
4. **Hyperlipidemia……. Increased cholesterol and triglycerides**
5. **Lipiduria…… lipid casts in urine**

NEPHRITIC SYNDROME

- **Complex clinical condition…. Usually of acute onset**
- **Characterized by 5 criteria :**

1. **Hematuria ….. With diagnostic red cell casts**
2. **Oliguria and impairment of renal functions**
3. **Hypertension**
4. **mild proteinuria**
5. **Mild Edema (localized to face)**

Differentiation Between Nephrotic Syndrome and Nephritic Syndrome		
Typical Features	**Nephrotic**	**Nephritic**
Onset	Insidious	Abrupt
Edema	++++	++
Blood pressure	Normal	Raised
Jugular venous pressure	Normal/low	Raised
Proteinuria	++++	++
Hematuria	May/may not occur	+++
Red blood cell casts	Absent	Present
Serum albumin	Low	Normal/slightly reduced

AZOTEMIA

- Characterized by…….containing abnormally high levels of nitrogen containing compounds…..such as **UREA , CREATININE** and others nitrogen rich compounds in the blood

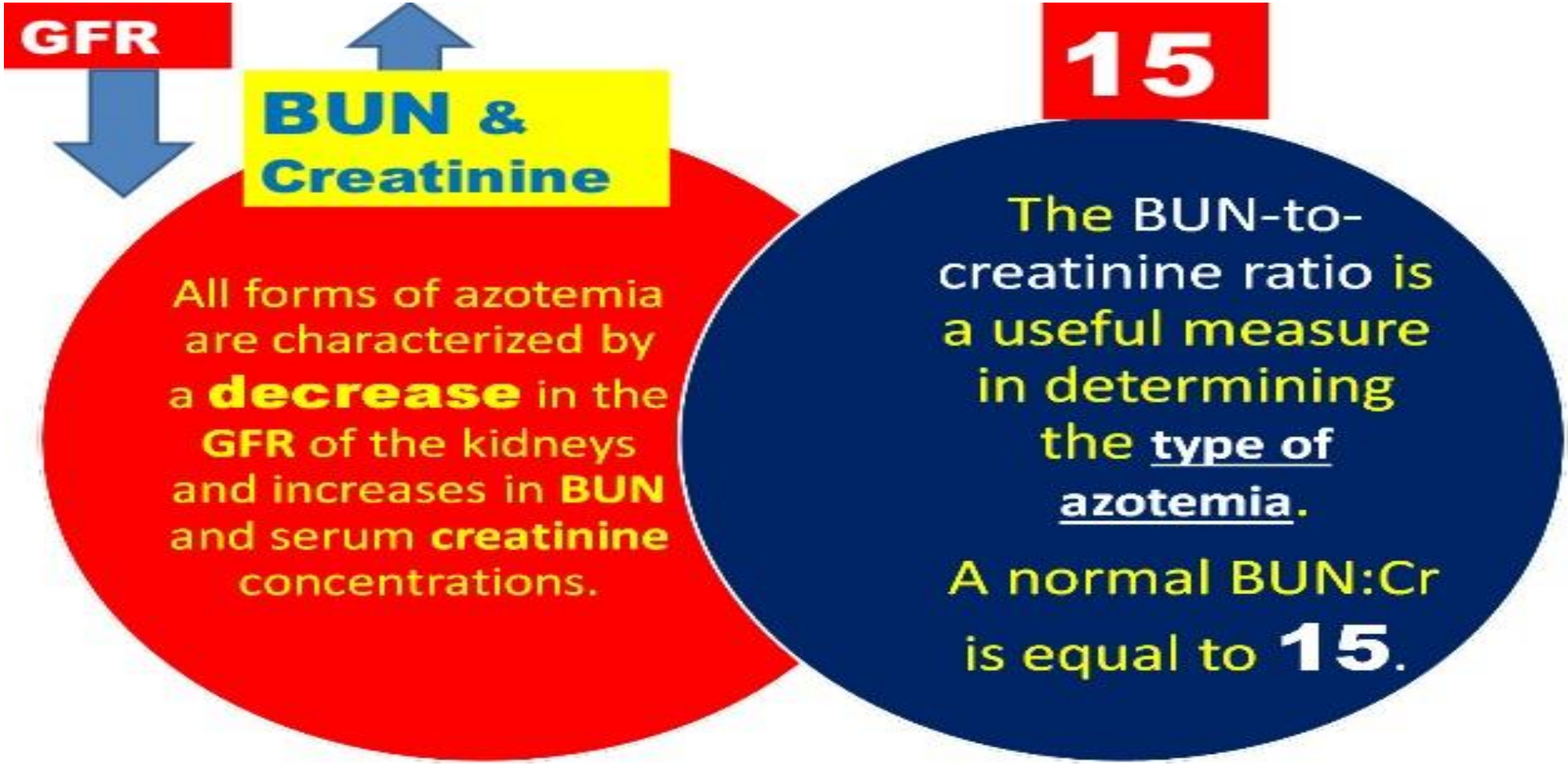
NOTE: Its largely related to insufficient filtering of blood by the kidneys

AZOTEMIA

- **Azotemia** ----biochemical abnormality----- **decreased glomerular filtration rate (GFR)**

  (without S/S)--- - ⬆ **BUN + Creatinine**

- **Azotemia** is produced by many renal disorders, but it also arises from extra-renal disorders.


GFR
BUN &
Creatinine
All forms of azotemia are characterized by a decrease in the GFR of the kidneys and increases in BUN and serum creatinine concentrations.
15
The BUN-to-creatinine ratio is a useful measure in determining the type of azotemia.
A normal BUN:Cr is equal to 15.

KIDNEY STONES (NEPHROLITHIASIS)

RENAL STONES….. INTRODUCTION

- **Kidney stones …..**(also called **renal calculi, nephrolithiasis or urolithiasis**).
- These are **hard deposits** made of minerals and salts that form inside your kidneys.
- Diet, excess body weight, some medical conditions, and certain supplements and medications are among the many causes of kidney stones.

RENAL STONES

- **Kidney stones…..** Can affect any part of your urinary tract — from your kidneys to your bladder.
- Often, **stones form when the urine becomes concentrated, allowing minerals to crystallize and stick together.**
- If stones become lodged in the urinary tract, are associated with a urinary infection or cause complications — surgery may be needed.

CAUSES OF RENAL STONES

- **Kidney stones…..** often have no definite, single cause, although several factors may increase your risk.
- **Kidney stones…..** Form **when your urine contains more crystal-forming substances — such as calcium, oxalate and uric acid — than the fluid in your urine can dilute.**
- Urine may **lack substances that prevent crystals** from sticking together, creating an ideal environment for kidney stones to form.

CONDITIONS CAUSING KIDNEY STONE FORMATION

- High concentration of metabolic products in glomerular filtrate.
- Changes in urine pH.
- Urinary stagnation .
- Deficiency of stone – forming inhibitors in urine… (citrate, pyrophosphate…. Inhibit calcium phosphate and oxalate stone formation)

TYPES OF KIDNEY STONES

- **Calcium stones**. Most kidney stones are calcium stones, usually in the form of calcium oxalate. ...
- **Struvite stones**. Struvite stones form in response to a urinary tract infection. ...
- **Uric acid stones**. ...
- **Cystine stones**.

TYPES OF KIDNEY STONES

Calcium stones.

- Most kidney stones are **calcium stones,** usually in the form of calcium oxalate.
- **Oxalate** is a substance made daily by your liver or absorbed from your diet.
- Certain fruits and vegetables, as well as nuts and chocolate, have high oxalate content.

CALCIUM STONES.

- Dietary factors, **high doses of vitamin D**, intestinal bypass surgery and several metabolic disorders can increase the concentration of calcium or oxalate in urine.
- **Calcium stones…..** may also occur in the form of **calcium phosphate**.
- This type of stone is **more common in metabolic conditions, such as renal tubular acidosis.**
- It may also be associated with **certain medications** used to treat **migraines or seizures, such as topiramate**

TYPES OF KIDNEY STONES

- **Struvite stones…..** form in response to a urinary tract infection.
- These stones **can grow quickly** and **become quite large**, sometimes with few symptoms or little warning.
- **Uric acid stones.** …..can form in people who **lose too much fluid because of chronic diarrhea or malabsorption.**
- Those who eat a h**igh-protein diet**, and those with **diabetes or metabolic syndrome.**
- Certain **genetic factors** also may increase your risk of uric acid stones.

TYPES OF KIDNEY STONES

Cystine stones.

- These stones form in people with a hereditary disorder called **cystinuria .**
- That causes t**he kidneys to excrete too much of a specific amino acid.**

RISK FACTORS

- **Family or personal history.** Family history of kidney stones, you're more likely to develop stones, too.
- If you've already had one or more kidney stones.....increased risk of developing another.
- **Dehydration.** Not drinking enough water each day can increase your risk of kidney stones.
- People who live in warm, dry climates and those who sweat a lot may be at higher risk than others.

RISK FACTORS

- **Certain diets…..** **High in protein, sodium (salt) and sugar** may increase your risk of some types of kidney stones.
- **Too much salt in your diet increases the amount of calcium** your kidneys must filter and significantly increases your risk of kidney stones.
- **Obesity……..High body mass index (BMI),** large waist size and weight gain have been linked to an increased risk of kidney stones.

RISK FACTORS

Digestive diseases and surgery.

- Gastric bypass surgery, inflammatory bowel disease or chronic diarrhea can cause changes in the digestive process that affect your absorption of calcium and water, increasing the amounts of stone-forming substances in your urine.
- **Other medical conditions……** such as renal tubular acidosis, cystinuria, hyperparathyroidism and repeated urinary tract infections also can increase your risk of kidney stones.

RISK FACTORS

Certain supplements and medications

- Such as vitamin C, dietary supplements, laxatives (when used excessively), calcium-based antacids, and certain medications used to treat migraines or depression, can increase your risk of kidney stones.

Genetics

Obesity

Diet

Some medications

Not enough fluids

Calcium Kidney Stones

80 %

Risk Factors:

Calcium or vitamin D dietary supplement

Foods – very high in Oxalates

Avocados, Dates, Grapefruit, Kiwi, Orange, Raspberries, Spinach and Tomato Sauce.

Struvite Stone

10 %

Composed of magnesium, ammonium and phosphate

Risk Factors:

Urinary tract infections: Proteus mirabilis, Klebsiella pneumonia, Enterobacter, and Pseudomonas aeruginosa.

Uric Acid Stone

9 %

Risk Factors:

Diarrhea and Gout

Cystine stones

1 %

Risk Factors:

Rare disorder called "Cystinuria"

Types of Kidney Stones

- Cystine Stones
- Calcium Stones
- Uric Acid Stones
- Struvite Stones




Calcium stones are formed due to an excess of a mineral called oxalate – commonly found in some fruit, vegetables, nuts and chocolate.

A struvite stone is less common and caused by infection in the urinary tract. It can grow quickly and become quite large.

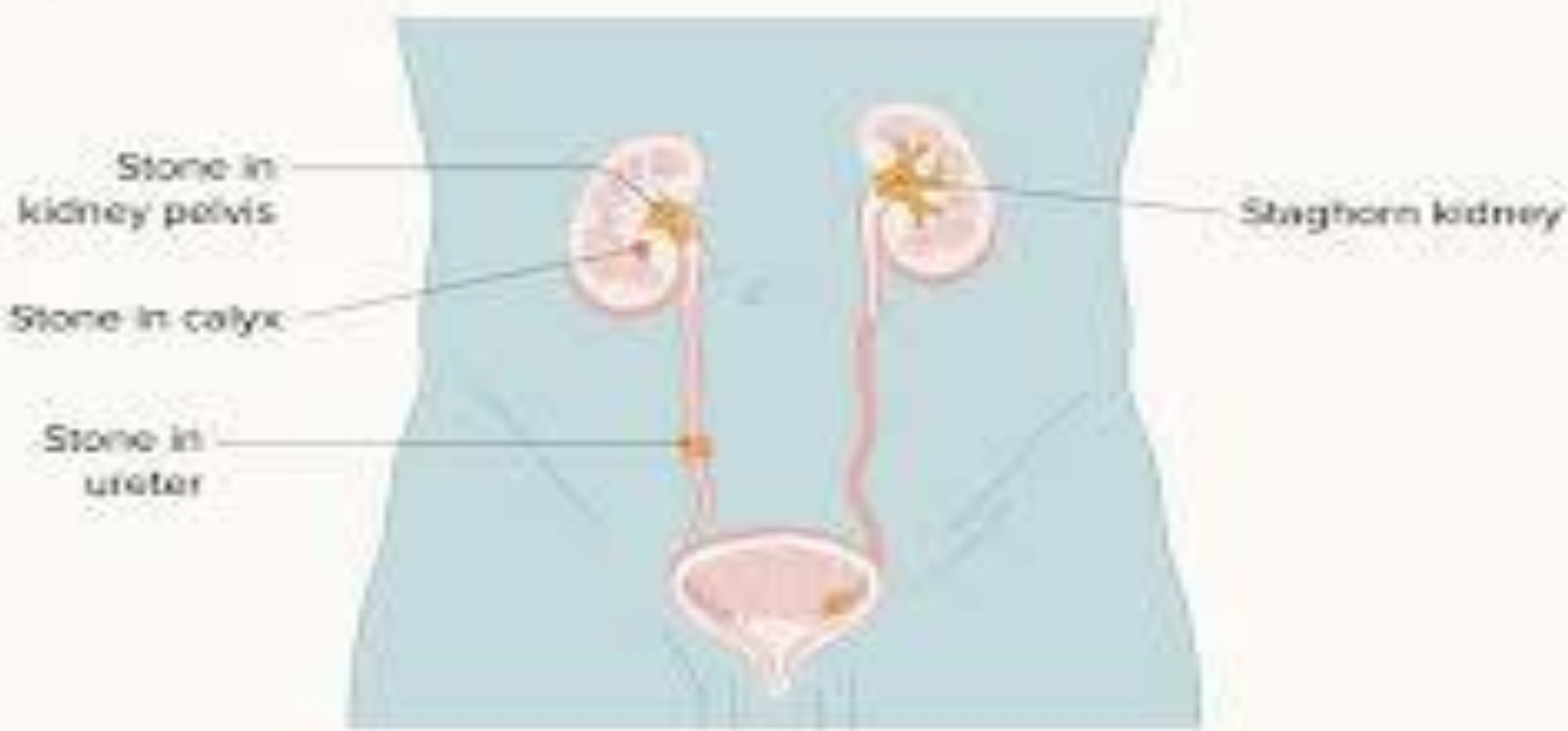
Uric acid stones form due to chronic dehydration. The risk increases in those with gout, a genetic tendency or a diet too high in protein.

Cystine stones form in people with an inherited disorder that causes the kidneys to excrete an excess of certain amino acids.

Xanthine stones are caused by an enzyme deficiency that causes the build-up of xanthine deposits.

Silica stones are rare and caused by certain medications or herbal supplements.

Kidney Stones



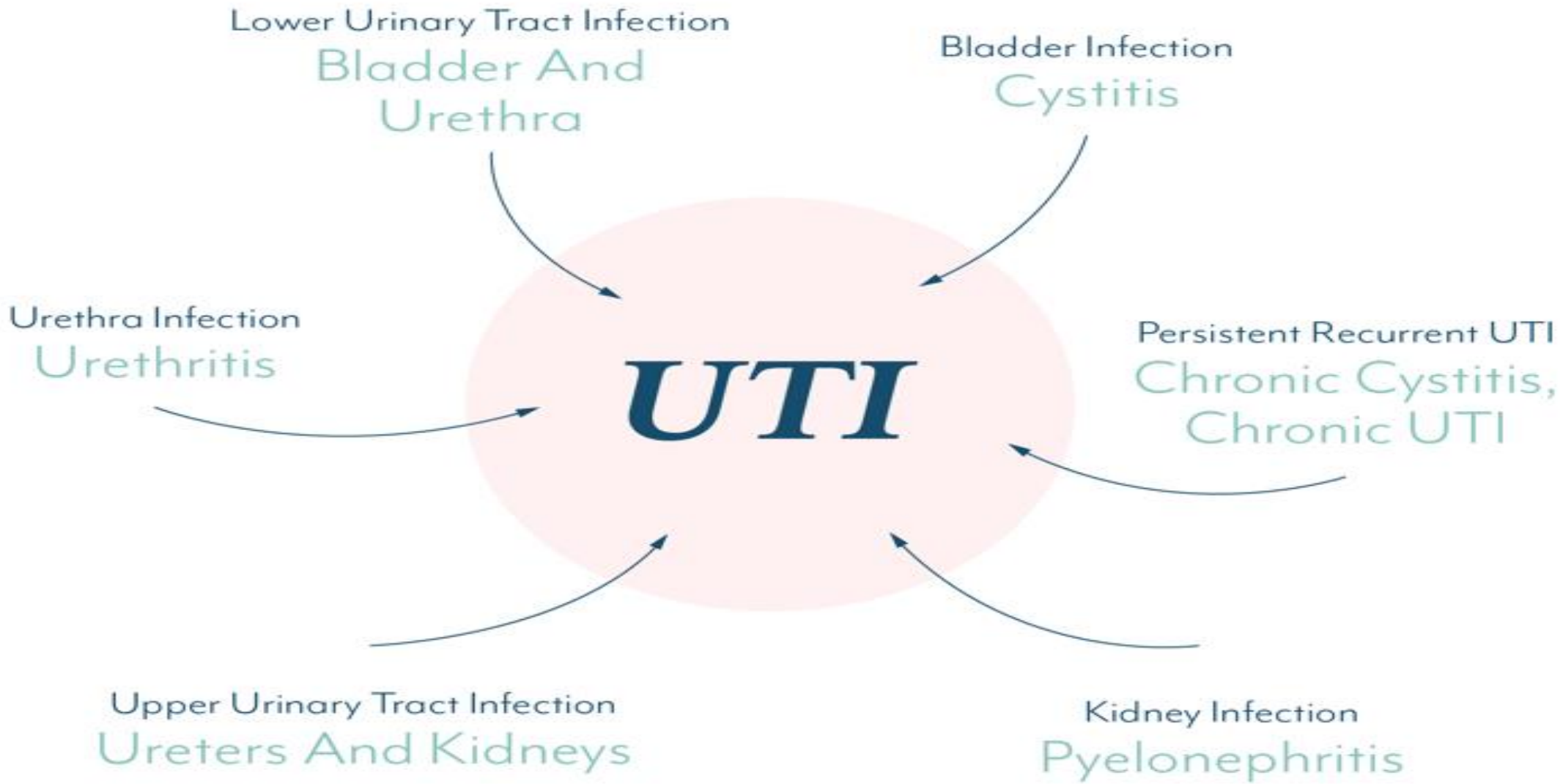
URINARY TRACT INFECTIONS

INTRODUCTION

- **Urinary tract infection (UTI)….** **is an infection that affects part of the urinary tract.**
- The urinary system is made up of the **kidneys, ureters, the urinary bladder, and the urethra.**
- Most UTIs are restricted to infection of the **bladder** (cystitis), though infection may occur in any area of the urinary tract, from the kidney to urethra.
- The presence of bacteria in urine is called **bacteriuria**. It is usually regarded as significant when the urine contains 10^5 organisms or more per ml in pure culture.

INTRODUCTION

- **Urinary tract infections (UTIs) …..**are among the most common conditions requiring medical treatment.
- The **incidence of UTIs** increases with age and **25-50% of females** aged 80 or more have bacteriuria.
- **In infants and children** …… relatively common site of infection
- **UTIs….** occur as a result of interactions between the **uropathogen** and host and their pathogenesis involves several processes


Lower Urinary Tract Infection
Bladder And Urethra
Bladder Infection
Cystitis
Urethra Infection
Urethritis
UTI
Persistent Recurrent UTI
Chronic Cystitis, Chronic UTI
Upper Urinary Tract Infection
Ureters And Kidneys
Kidney Infection
Pyelonephritis

PATHOGENESIS AND PATHOLOGY

- **Most UTIs are ascending infections**.
- The bacteria arise from the fecal flora, colonize the perineum and enter the bladder via the urethra.
- Initially, the uropathogen attaches to the epithelial surface.
- It subsequently colonizes and disseminates throughout the mucosa causing tissue damage.
- After the initial colonization period, pathogens can ascend into the urinary bladder resulting in symptomatic or asymptomatic bacteriuria.
- Further progression, **may lead to pyelonephritis and renal impairment**.

CASE STUDIES

PATHOLOGY

CYSTITIS

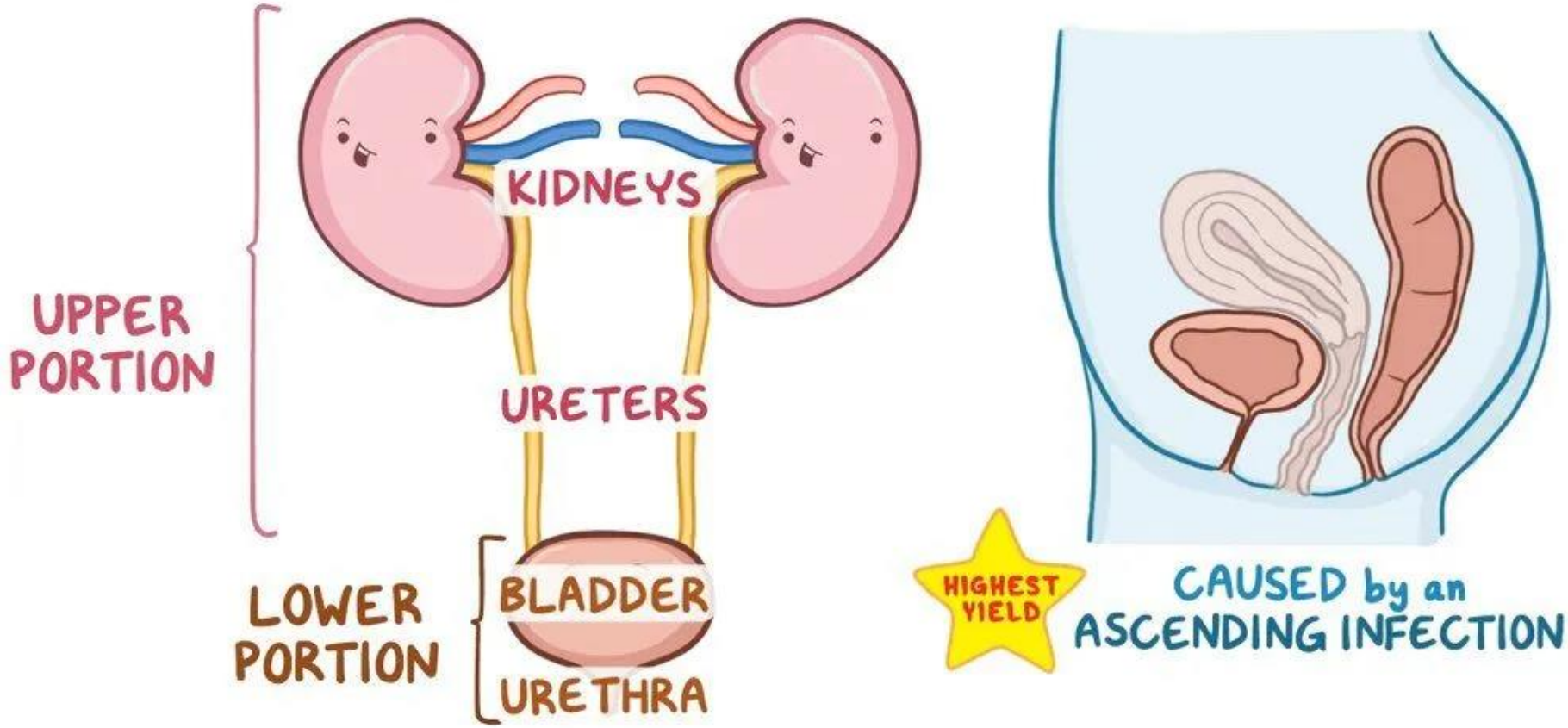
ACUTE PYELONEPHRITIS

CHRONIC PYELONEPHRITIS

REVIEW

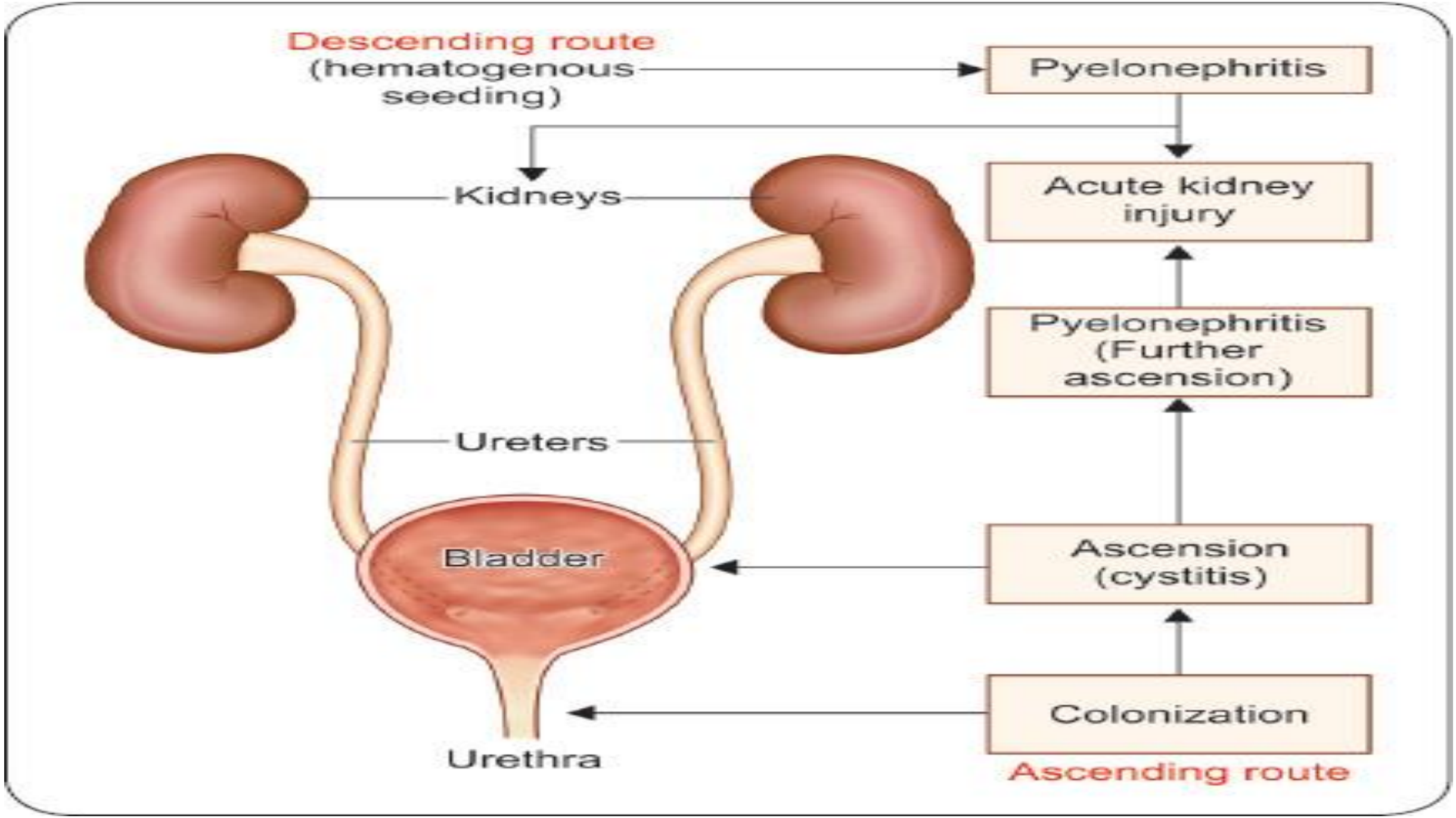
SUMMARY

URINARY TRACT INFECTIONS

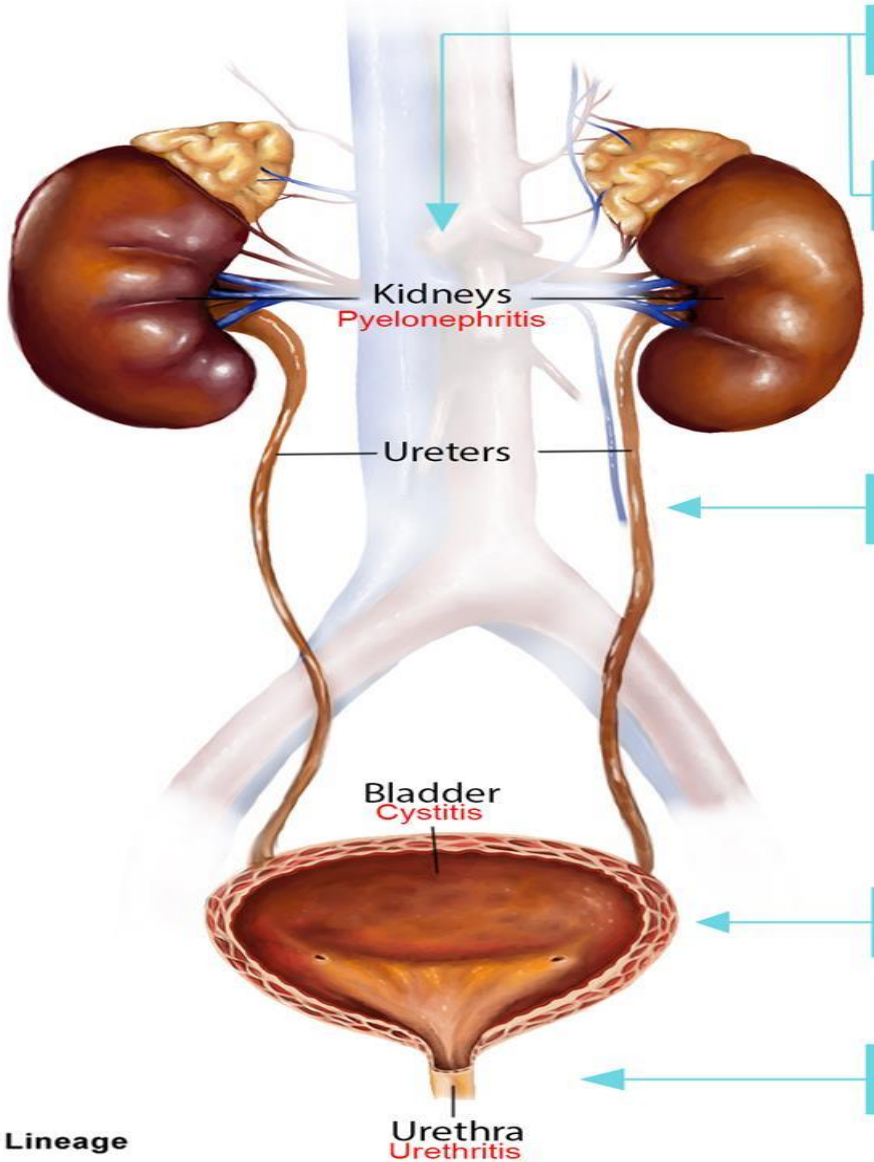


HIGHEST YIELD

CAUSED by an ASCENDING INFECTION


Descending route
(hematogenous seeding)
Pyelonephritis
Kidneys
Acute kidney injury
Pyelonephritis (Further ascension)
Ureters
Bladder
Ascension (cystitis)
Colonization
Urethra
Ascending route

Pathogenesis of Urinary Tract Infections



Acute kidney injury
- Continuous inflammatory response results in interstitial edema, interstitial nephritis, and ultimately acute kidney injury (AKI)

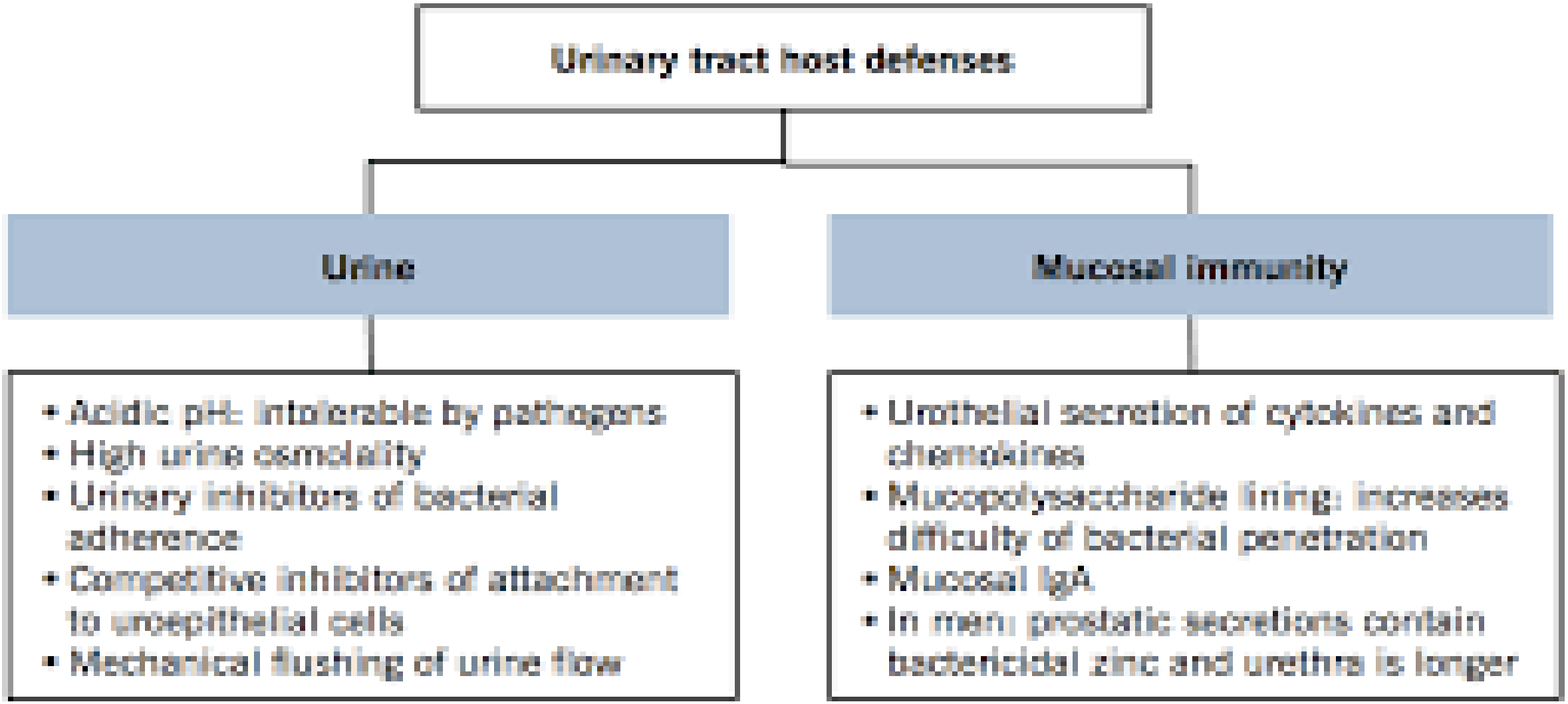
Pyelonephritis
- Bacterial ascension or hematogenous spread infects the renal parenchyma and results in pyelonephritis

Ascension
- Sufficient bacterial colonization can lead to bacterial ascension through the ureters

Uroepithelium penetration
- Bacterial fimbriae allows for attachment and penetration of bladder epithelial cells

Colonization
- Bacterial colonization in the periurethra allows for ascension via the urethra

Urinary tract host defense mechanisms



COMMON CAUSES AND RISK FACTORS

1. Gender…..

- **Women** have much higher risk of UTIs (compared to men).
- Because women have a **shorter urethra**, which allows bacteria to reach and infect the bladder far more easily.
- The opening to the **urethra in women is significantly closer to the rectum**, where UTI-causing bacteria are known to dwell.

COMMON CAUSES AND RISK FACTORS

2. Pregnancy…. increased size and weight of the uterus may prevent the complete drainage of urine from the bladder, which can make pregnant women more UTI-prone

3. Menopause…..greater risk, possibly due to hormonal changes that might affect the beneficial bacteria responsible for fighting off harmful microorganisms in the urinary tract.

COMMON CAUSES AND RISK FACTORS

4. **Health Conditions…..**

- Several **chronic health problems** may increase UTI risk as well, associated with **impaired immune response** (such as diabetes), which can weaken your body's ability to fend off bacteria.

- Age-related issues like Alzheimer's disease_ may also factor into UTI risk, since they may interfere with personal hygiene.

PEOPLE MORE AT RISK

- Those with **spinal cord injuries** or nerve damage around the bladder, which can prohibit complete emptying of the bladder.
- Those with **kidney stones**, **enlarged prostate**, or any other issue that **blocks the normal flow of urine and encourages bacterial growth**
- Those with **Vesicoureteral reflux (VUR)** or other abnormalities of the urinary tract
- Those who have recently used a **urinary catheter**
- Those with **bowel incontinence.**

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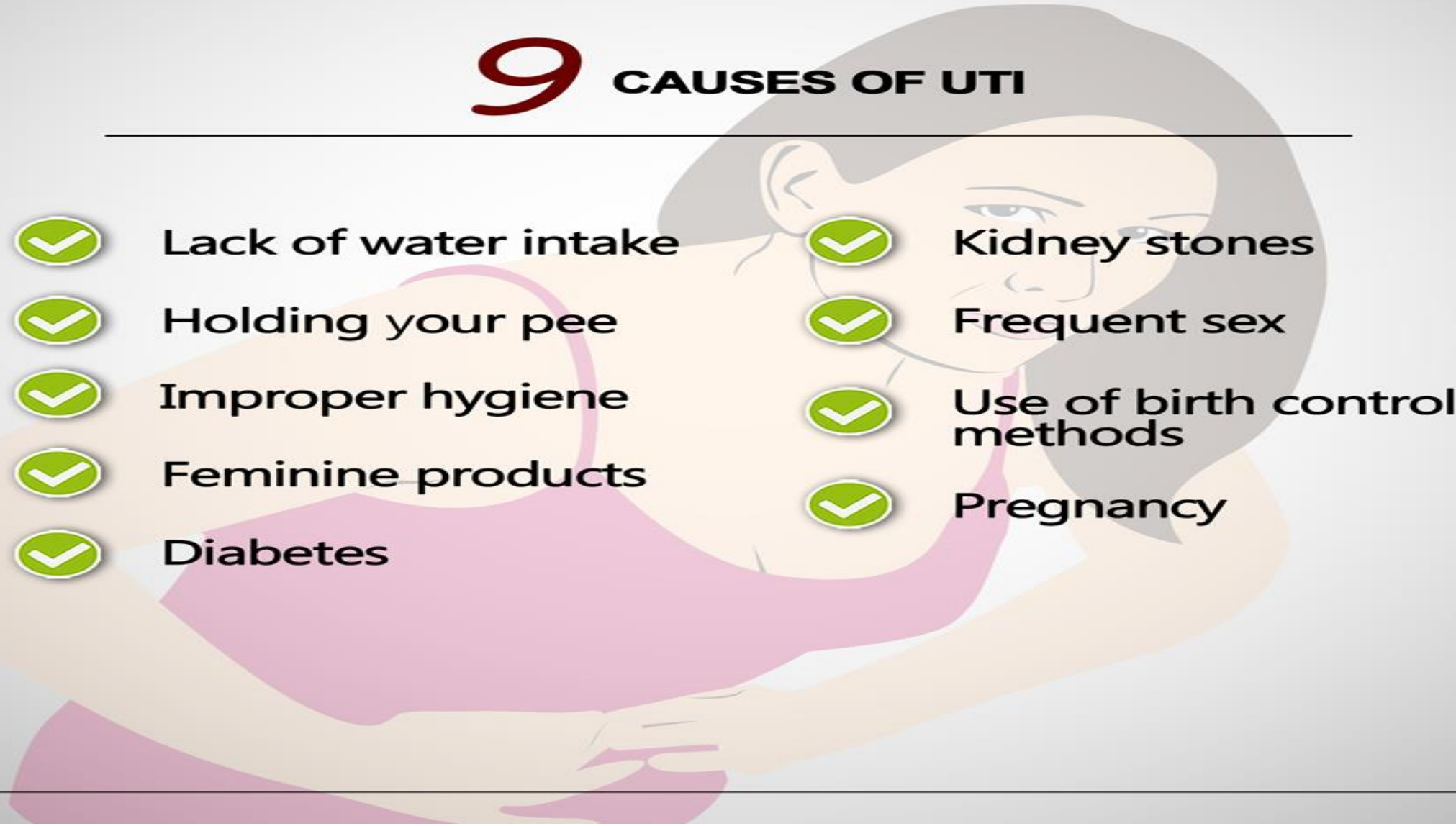
9 CAUSES OF UTI

- Lack of water intake
- Holding your pee
- Improper hygiene
- Feminine products
- Diabetes
- Kidney stones
- Frequent sex
- Use of birth control methods
- Pregnancy



UTI Risk Factors

pregnancy

menopause

chronic health conditions

sexual activity

birth control

personal hygiene

verywell

ROUTES OF INFECTION

1. **ASCENDING ROUTE**….. uropathogens originate from rectal flora and enter the urinary tract via the urethra into the bladder.

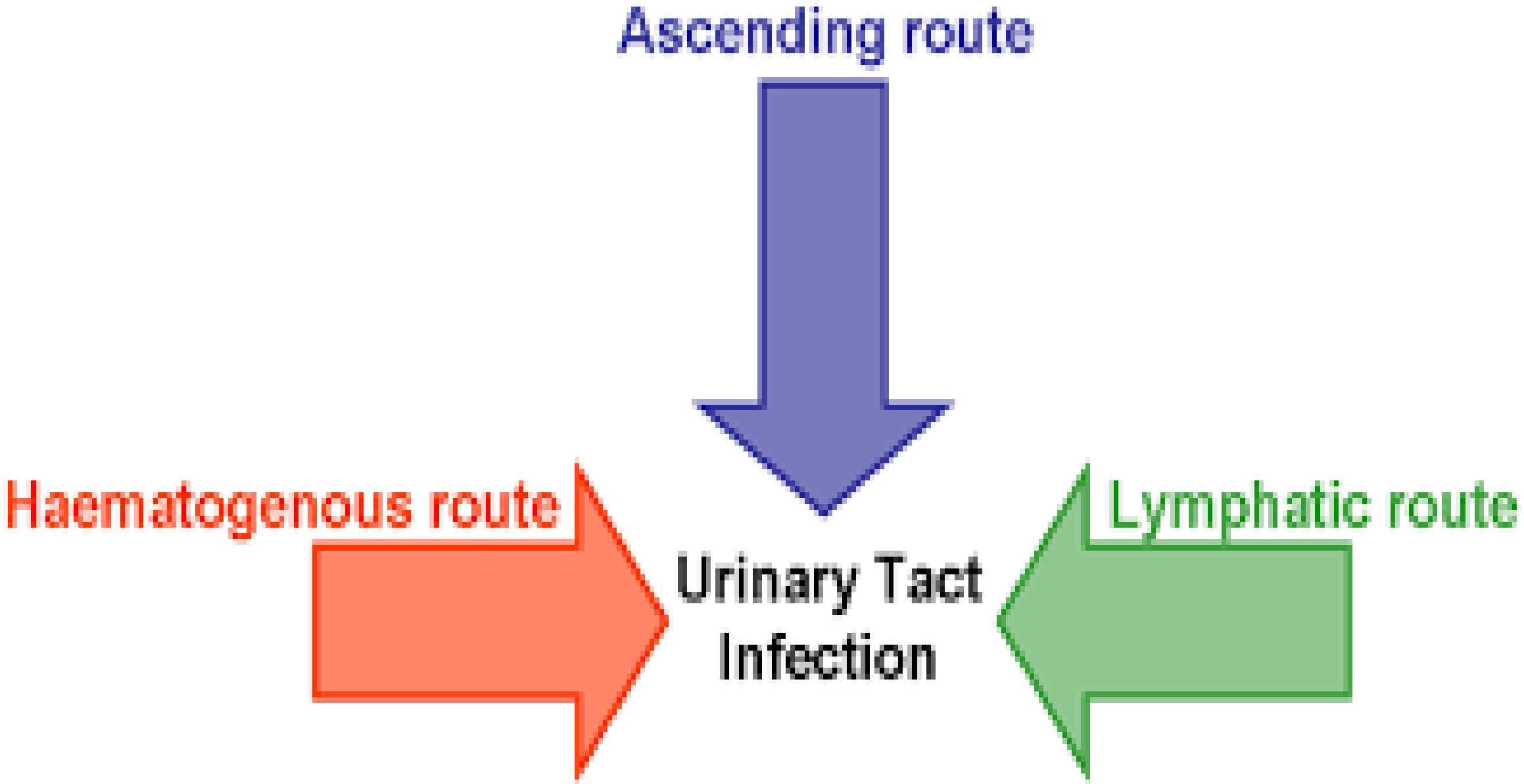
- This route is exacerbated in patients with soiling around the perineum, in patients with urinary cath.
- **Bacterial ascent** is aided by conditions such as pregnancy and ureteral obstruction, as these conditions inhibit ureteral peristalsis

ROUTES OF INFECTION

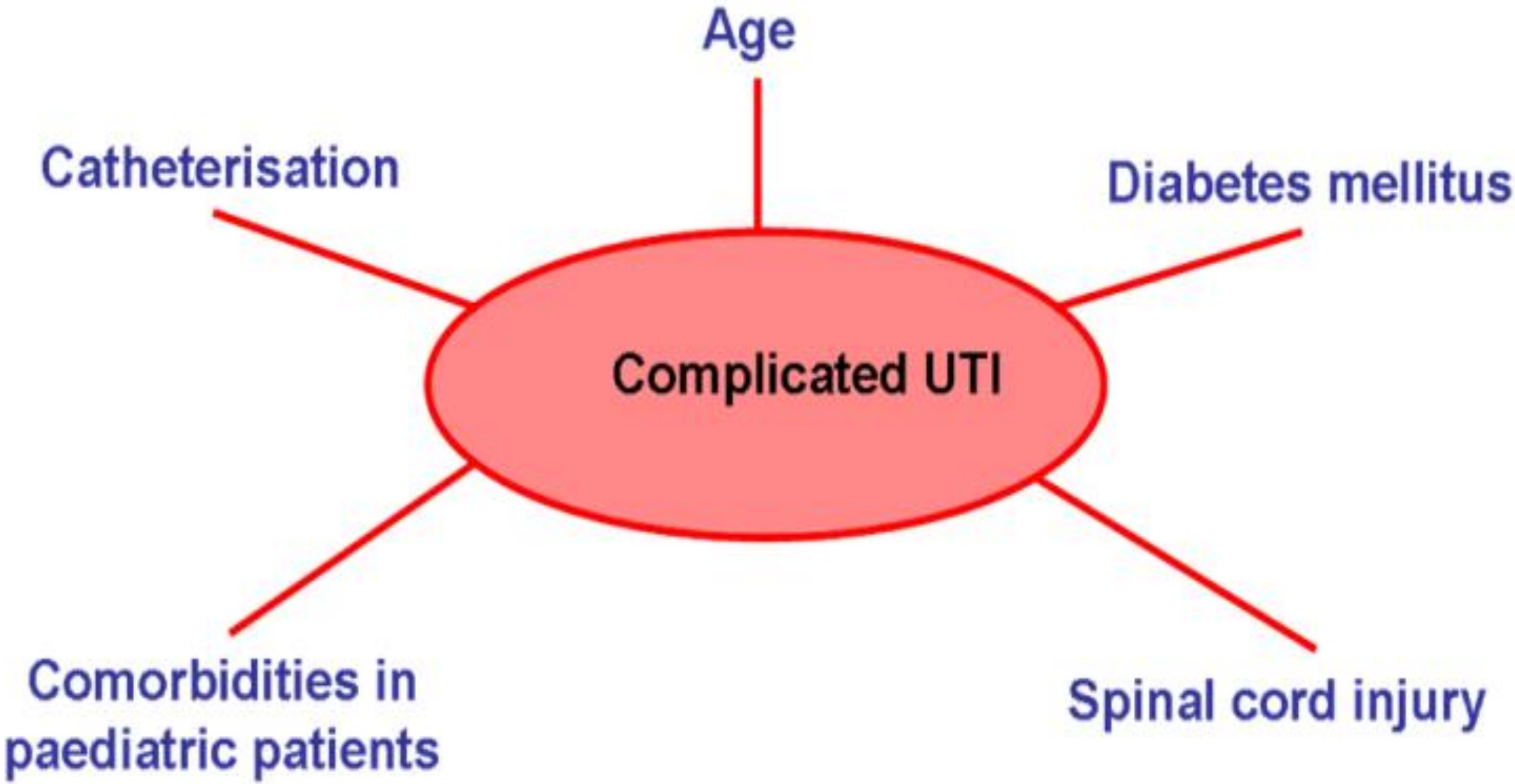
2. HAEMATOGENOUS ROUTE : is uncommon.

- Occasionally, the renal parenchyma may be breeched in patients with **Staphylococcus aureus** bacteremia or **Candida** that originate from oral sources in immunosuppressed patients.

- On rare occasions, bacteria from adjacent organs may penetrate the urinary tract **via the lymphatics**. Conditions associated with the lymphatic route are **retroperitoneal abscesses** and **severe bowel infections**.

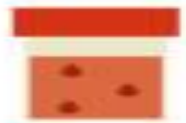

Ascending route
Haematogenous route
Lymphatic route
Urinary Tact Infection

Uncomplicated UTI Pathogens	Complicated UTI Pathogens
Escherichia coli	*Escherichia coli*
Staphylococcus saprophyticus	*Klebsiella* spp.
Klebsiella spp.	*Enterobacter cloacae*
Enterococcus faecalis	*Serratia marcescens*
	Proteus mirabilis
	Pseudomonas aeruginosa
	Enterococcus faecalis
	Group B streptococci


Age
Catheterisation
Diabetes mellitus
Complicated UTI
Comorbidities in paediatric patients
Spinal cord injury

Symptoms of cystitis

Urine that's dark cloudy



Blood in the urine

Pain in your lower tummy

Pain and burning when you pee

Strong smelling urine

Needing to pee often

Pain during sex

Feeling sick and tired

Thank You
For Your Attention