

# Pre-disposing factors to UTI in children

## Sex and Age:

- UTIs are more frequent in females than males at all ages with the exception of the neonatal period. Excluding neonates, females younger than 11 years have a 3-5% risk; boys of the same age have a 1% risk.
- Uncircumcised males have a higher incidence than circumcised males.
- Uncircumcised male infants have a higher incidence of UTI than female infants.
- Incidence is highest in sexually active adolescent females.
- UTI is the source of infection in up to 6-8% of febrile infants. Conversely, approximately the same number of febrile infants are bacteremic (considering all sources, including UTI).

## Pathophysiology:

The natural defense mechanisms against infection work extremely well –  $10^5$  *E. coli* injected into the bladder are cleared, and  $10^5$  injected IV do not cause pyelonephritis. Essentially the only way to produce pyelonephritis experimentally is direct medullary injection of bacteria (100 bacteria will do – WBC function is paralyzed in the medulla due to high  $H^+$  and  $NH_4^+$  content), or in the presence of obstruction.

Almost all UTIs are due to coliforms and are **ascending** in origin.

UTI due to *staph aureus*, TB, & viruses is usually via the bloodstream.

Disturbance of the normal peri-urethral flora - part of the host defence against colonization by pathogenic bacteria - predisposes to a UTI. Bacteria of the peri-urethral flora inhabit the distal urethra, but urine is normally sterile *within* the urinary tract. In early childhood, enterobacteria and enterococci are part of the normal peri-urethral flora. *E coli* is the dominant gram-negative species in young girls, while *E coli* and *Proteus* species predominate in boys. Pathogens must gain access to the bladder and proliferate if infection is to occur.

Pathogens in the distal urethra may gain access to the bladder because of turbulent urine flow during normal voiding or because of dysfunctional voiding. Successful bladder colonization is unlikely unless bladder defence mechanisms are impaired because normal voiding usually results in an essentially complete washout of contaminating bacteria. Children up to about age 5 years are predisposed to UTIs partly because of peri-urethral colonization by *E coli*, *enterococci*, and *Proteus* species. Usually, these potential pathogens diminish in the first year of life and are rarely found in children older than 5 years. Staphylococcal, especially *S saprophyticus*, infections are common among adolescent females.

Entry of bacteria into the urinary bladder may be the result of turbulent flow during normal voiding, voiding dysfunction, or catheterization. In addition, “sexual intercourse or genital manipulation” may foster the entry of bacteria into the urinary bladder.

Neonatal circumcision decreases the risk of UTI by about 90% in male infants during the first year of life. The risk of UTI in a circumcised infant during the first year is about 1 in 1000, while an uncircumcised infant has a 1 in 100 chance of developing a UTI.

### **Risk factors for the development of a urinary tract infection:**

- An anatomically abnormal urinary tract - almost any abnormality
- Vesicoureteric reflux
- Residual urine in the bladder after micturition - bladder outflow obstruction caused by, neurological lesion, urethral valves, or other cause
  - Prolonged incubation of bacteria in the urine due to incomplete bladder emptying or infrequent voiding may compromise an important bladder defence against infection. Symptoms such as urgency, frequency, hesitancy, dribbling, or incontinence may occur in the absence of infection or local irritation because of uninhibited detrusor contractions. When incontinence is prevented by obstruction of the urethra, milking back of bacteria-laden urine may occur from the distal urethra into the urinary bladder. This mode of bacterial access is a common predisposing factor to UTI in children
  - Voiding dysfunction is usually not encountered until a child is in the process of achieving daytime urinary control. Children with voiding dysfunction may attempt to prevent incontinence using various posturing manoeuvres. Constipation, with the rectum chronically dilated by feces, is another important cause of voiding dysfunction. Finally, neurogenic or anatomical abnormalities for voiding dysfunction can exist.
- Urine that favours bacterial growth – *esp diabetes mellitus*
- Stones (renal, staghorn, ureteric, bladder)
- Sexual intercourse in girls
- Pregnancy
- Instrumentation of the urinary tract
  - Indwelling catheter or other foreign body within the urinary tract (eg ureteric stent) 3% of all admissions “acquire” UTI, usually due to urethral instrumentation in the form of a catheter. For all practical purposes, anyone with a catheter will be infected by the second week, the infection remains until it is taken out. At this point, most infections clear spontaneously; some require treatment. Always use a closed drainage system, never open it, always hang the bag below the patient, and get the catheter out ASAP.
- Patients who receive broad-spectrum antibiotics (eg, amoxicillin, cephalexin), which are likely to alter GI and periurethral flora, are at increased risk because of disturbance of the natural defense against colonization by pathogenic bacteria.