# Paediatric Urinary

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## Epidemiology and pathophysiology

The incidence of urinary tract infections (UTIs) is highest during the first year of life, with the majority of infections occurring in males. These rates then fall off in boys, with the risk being 4 to 10 times greater in uncircumcised males, while they remain relatively high in females. A study by Hellstorm et al. (1991) reported a cumulative incidence rate of 7.8% in girls by the age of seven.[1]

The importance of this condition is highlighted by various published papers, including Hoberman et al. (1993), in which it was reported that up to 5% of young children (<2 yrs) presenting with fever at pediatric casualty would have a UTI.[2]

Viruses, fungi and even parasites can all infect the urinary tract. However, most cases of infective pathology of the urinary system, at least in our part of the world, are caused by bacteria.

Common urinary isolates principally from hospitalized patients of all ages in St Luke's hospital include:

- *Escherichia coli* (which is by far the most commonly encountered organism)
- *Proteus mirabilis*
- *Enterococcus faecalis*
- *Pseudomonas aeruginosa*

These last three are isolated as above at more or less equal frequencies, but much less than *E. coli*.

In addition, various other gram positive and negative bacteria are isolated from time to time as being potential infective candidates from a patient's urine, but at a much reduced incidence when compared to the above four agents.

## Laboratory Diagnosis

There are obvious difficulties in taking a history and examining the very young patient. In this case, laboratory diagnosis has an especially important role.

The gold standard for confirming a UTI is still by growing bacteria from a patient's urine. What may appear as a relatively easy procedure is fraught with difficulties, with the taking of a proper specimen especially problematic in a child.

In the very young, the "mid-stream urine" (MSU) technique is not feasible to perform, while the urine bag is considered to give a high rate of false positive cultures. Suprapubic aspiration is very specific but is a somewhat invasive procedure and is said to have a low success rate unless done under ultrasound guidance.

During specimen collection, bacterial contamination is inevitable, even when a proper MSU is obtained. For this reason, a cut off point was established early on in this branch of clinical bacteriology, such that 100 000 colony forming units per ml (cfu/ml) of urine is the established infection

# Tract Infections

| Test done on a urine specimen | % Sensitivity | % Specificity |
|---|---|---|
| Gram stain | 93 (80 – 98) | 95 (87 – 100) |
| Dipstick – Nitrite | 50 (16 – 72) | 98 (95 – 100) |
| Dipstick – L. Esterase | 83 (64 – 89) | 84 (71 – 95) |
| Either Nitrite or Esterase positive | 88 (71 – 100) | 93 (76 – 98) |

Table 1: *A comparison of sensitivity and specificity values for different tests carried out on urine samples*

threshold for adults. Urinary bacterial counts which are lower than this are normally considered to signify the presence of bacterial contaminants, and typically ignored.

It has been suggested that this cutoff point may be too high for young children, with a 10 000 cfu/ml of urine a better cutoff point in these case. In fact, a study by Hoberman *et al.* (1994) showed that 65% of urine specimens taken from febrile children with a bacterial count of 10 000 – 49 000 cfu/ml showed evidence of contamination. If, in the attempt to increase sensitivity, a lower threshold is chosen (i.e. 10 rather than 10 cfu/ml), then one must accept a higher incidence of false positive results.

Another significant drawback of relying on a urine culture for diagnosis is the time delay, with the result not being available for at least 24 hours. Such delays in starting treatment may not be acceptable. In this case, rapid testing, preferably by the patientís bedside, may be useful in helping to confirm a clinical impression. But which tests, and how useful are they in practice?

A meta analysis by Gorelick *et al.* (1999) compared the predictive value of a number of rapid laboratory tests. The results are summarized in Table 1.

If we are to take the gram stain as our 'gold standard' for rapid urine testing, then it is comforting to know that by using a good urine dipstick, we can get excellent sensitivity and specificity, comparable to the gram.

## Treatment of UTI

Below are listed some treatment options:

- Amoxicillin – is a good first line agent, however, a significant proportion of hospital acquired *E. coli* infections are ampicillin resistant. The extent to which this occurs in the community is unclear.
- Co-amoxiclav – some hospital acquired *E. coli* infections will also show intermediate or full resistance to this. Once again, we have no data on resistance rates outside hospital.
- Third generation cephalosporins, such as cefpodixime – are usually active against most strains of *E. coli* and *Proteus mirabilis*, but not *Enterococcus faecalis*.
- Trimethoprim – sulfamethoxazole – mostly effective against *E. coli* and *Proteus mirabilis*.
- Nitrofurantoin – will usually work against *E. coli* and *Enterococcus faecalis*, but not *Proteus mirabilis*.

In practice, all listed antibiotics have strengths and weaknesses. A *Pseudomonas* UTI, especially if confirmed by repeated isolations from the same patient, would require specialized treatment.

While there has been the tendency to try and shorten the duration of antibiotic therapy in adults, in children various studies such as Keren *et al* (2002) have suggested an optimal antibiotic treatment duration of between 7 to 14 days.[6] This is also the recommendation by the American Academy of Pediatrics (1999) for all children between the ages of 2 months to two years with urinary tract infections.[3]

## Epilogue

Repeated infections in childhood require careful investigation to rule out abnormalities of the urinary tract. Sometimes no obvious abnormality will be detected. In this case, one would do well to check on the child's bowel habits. One paper by Newmann (1973) reported a decrease in recurrent UTI by correcting constipation.[7]

A more controversial topic is the existence of a condition sometimes referred to as dysfunctional elimination ñ which is sometimes suggested to be a cause of repeated UTIs in children with an apparently normal urinary tract. It has been described as a disorder of the normal voiding or emptying reflexes, leading to a chronic abnormal pattern of elimination which does not allow the bladder or bowel to empty completely.

## References


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