

MANAGEMENT OF URINARY TRACT INFECTION AND VESICO-URETERIC REFLUX IN CHILDREN

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ABSTRACT

Even though urinary tract infection is common in childhood, its diagnosis and management can be difficult. One must be aware of factors that may interfere with urine culture result.

Besides urinary stasis, renal tract abnormalities and detrusor instability, host factors and certain strains of invading organisms (P-fimbriated E Coli) may be important in the pathogenesis of urinary tract infection.

The choice of antibiotics for treatment of urinary tract infection should be guided by the age of the patient, clinical presentation and urine culture result. The management of vesico-ureteric reflux depends on its grading. Grade I and II can be treated medically by long-term low dose antibiotics because spontaneous resolution is high. For Grade III and IV, the treatment of choice is controversial. Controlled prospective studies showed that surgical reimplantation did not prevent new scar formation, progression of old scars and breakthrough infection.

Endoscopic submureteric injection of Teflon is a new method to correct vesico-ureteric reflux. Despite favourable short-term results, the long-term outcome is unknown.

Keywords: Urinary tract infection, Vesico-ureteric reflux.

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INTRODUCTION

Urinary tract infection (UTI) is common in infants and children. Its incidence is reported to be 1.5 to 2% in children between the ages of 1 to 5 years(1). There is a slight male preponderance in the neonatal period. Thereafter it is more common in girls.

DIAGNOSIS

The diagnosis and management of UTI may not be straightforward at times. The signs and symptoms in young infants may be nonspecific, for example, poor feeding, vomiting, diarrhoea and prolonged jaundice. The diagnosis may be missed unless one is on the lookout for it. Another major difficulty is the problem of getting a proper urine sample for culture. This is crucial as the diagnosis of UTI is based entirely on a quantitative culture of appropriately collected urine specimen. Pyuria does not equate UTI because there are many causes of pyuria. Fifty percent of proven UTI may not have pyuria. Interpretation of urine culture result must also take into account factors like the method of urine collection and

conditions of storage and transportation of the urine sample. A delay in plating the urine sample or improper urine collection may yield false positive result. On the other hand, very dilute or acidic urine, prior antibiotic therapy or urine contaminated with cleansing solution may give false negative result. The suggested criteria for diagnosis of UTI is shown in Table I.

Table I
Criteria for Diagnosis of Urinary Tract Infection

Method of Collection	Colony Count (pure culture)	Probability of Infection (%)
Suprapubic aspiration	Gram-negative bacilli Any number	99
	Gram-positive cocci > 10 ³	99
Catheterisation	> 10 ⁵	95
	10 ⁴ - 10 ⁵	Infection - likely
	10 ³ - 10 ⁴	Suspicious - repeat
	< 10 ³	Infection - unlikely
Clear voided		
Male	> 10 ⁴	Infection - likely
Female	3 x > 10 ⁵	95
	2 x > 10 ⁵	90
	1 x > 10 ⁵	80
	50,000-100,000	Suspicious - repeat

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Once the diagnosis is confirmed, it is important to look out for palpable kidneys or bladder and neurological deficit of the sacral nerve root. Renal tract abnormalities and neurogenic bladder may be the underlying predisposing factors.

PATHOGENESIS OF UTI

The urinary tract mucosa normally has a variety of nonspecific and immunologically specific mechanism that prevent bacterial colonisation. When there are renal tract abnormalities, renal stone or urinary stasis, microbial invasion is facilitated. Other factors may also encourage bacterial growth in the urine for example, virulent factors of the invading organisms and underlying defect of host defense (2,3). Studies done on women who have recurrent UTI have shown that the invading organisms are usually uropathic E Coli which originate from their faecal or vaginal flora. They are resistant to the bactericidal action of normal human serum and can adhere to the mucous membrane of the urinary tract. These bacteria have adhesins on their fimbriae (P Pili) which can adhere to epithelial cell receptor molecule present in the renal tract. Hamley et al reported that 100% of patients with pyelonephritis and 65% of patients with cystitis had P-fimbriated E Coli in their urine. It is believed that the receptivity of genitourinary mucous membrane to a bacterium depends on the binding capacities of the invading organism and the relative distribution and the amount of adhesin receptor on the epithelial cell surfaces.

Wiswell et al found that 75 to 85% of uncircumcised infants had bacterial colonisation 10 to 20 times more than circumcised infants. But the incidence of UTI in infants is only 1 to 2% (4,5). Periurethral colonisation does not necessarily lead to UTI. It again highlights the importance of virulent characteristics of the uropathogens and the receptivity of uroepithelial cells for these bacteria.

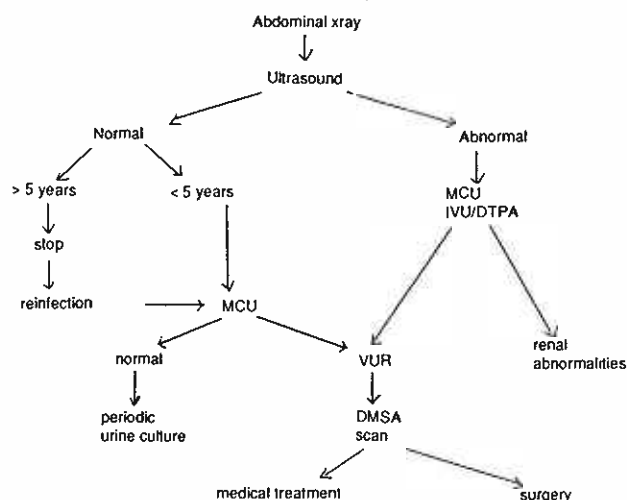
Combined urodynamic studies and rectal manometry confirmed that in some patients, urge incontinence and constipation may predispose to UTI(6,7). These patients, usually girls, have urge incontinence because of detrusor instability. The uninhibited detrusor contraction triggers simultaneous urethral and anal sphincter contraction to prevent wetting. This results in urinary stasis and constipation. The excoriation around vulva from frequent wetting may encourage bacterial colonisation.

INVESTIGATIONS

Besides doing haemogram, renal biochemistry and periodic urine culture once UTI is confirmed, imaging studies of the renal tract should be done a few weeks after the infection has settled. There is a high prevalence of renal tract abnormalities in these patients. The controversy is how far should one investigate as some of the tests are hazardous, invasive or costly. Imaging studies done in many centres have detected structural abnormalities ranging between 25 to 55% and vesico-ureteric reflux (VUR) 8 to 52% (8). Most centres would combine abdominal ultrasound and plain abdominal xray as the initial diagnostic work-up. In the hands of a skilful and experienced ultrasonist, most structural anomalies and obstructive uropathies can be detected. It has replaced intravenous urogram (IVU) in most places because it carries with it a small mortality and morbidity.

In children under 5 years, VUR must be excluded as it is more common in this age group. Unfortunately, micturiting cystogram (MCU) is the only reliable method at present to diagnose it. It has the disadvantage of requiring bladder catheterisation, fluoroscopy and radiation to gonads. Once VUR is confirmed, it is mandatory to do a DMSA static renal scan to look for renal scarring. In some centres, follow up studies on VUR are carried out using direct or indirect radionuclide cystogram in the place of traditional MCU as the radiation is less(9). The systematic approach to investigate patients with UTI is illustrated in Fig 1.

Fig 1
Investigations for urinary tract infection



TREATMENT

Treatment of symptomatic UTI should be guided by the clinical presentation and antibiotics susceptibility of the bacteria isolated in the urine culture. Young infants and children with severe systemic manifestations should be hospitalised for intravenous fluid and parenteral antibiotics. The antibiotics of choice are ampicillin with or without aminoglycoside or one of the third generation cephalosporins. Older children with less severe symptoms can be managed as outpatients. Oral drugs like co-trimoxazole, trimethoprim, amoxycillin, nitrofurantoin or second generation cephalosporin are suitable. The duration of therapy varies depending on the severity of the infection and age of the patient. Young infants may require up to two weeks of therapy whereas in older children, a seven day course may be sufficient. Shorter duration of antibiotics is not universally acceptable. A repeat urine culture should be done 2 to 4 days after initiating treatment. Persistent bacteriuria means that the antibiotic used is ineffective and a different one should be substituted.

Because of high recurrence in patients with UTI, urine culture should be monitored every 3 months for at least 2 years. Further management depends on what the repeat urine cultures and investigations show. Long-term low dose antibiotic prophylaxis is indicated in children with recurrent symptomatic bacteriuria, VUR and those who are for surgical relief of obstructive uropathy. The two most useful drugs are trimethoprim and nitrofurantoin. Both can be given as a single nightly dose of 1-2mg/kg/day.

The management of VUR depends on the age and severity of the reflux. The International Classification of

reflux divides into 5 grades (Table II). Grade I and II are usually managed conservatively because the chance of spontaneous cessation of reflux is about 90% over a period of time. Conservative management requires the patient to be on low dose antibiotic prophylaxis until the reflux stops. Urine culture, renal growth and reflux are monitored regularly. Grade V reflux often requires surgical correction because the chance of spontaneous resolution of reflux is very slim. For Grade III and IV, the appropriate mode of treatment is still controversial. Controlled studies by the Birmingham Study Group and Skoog et al looked into parameters like renal function, scar formation, progression of old scar, renal growth and breakthrough infection in both groups of reflux patients treated either medically or surgically(10-12). They did not find any difference between the two. Based on these reports, most nephrologists would be hesitant to send patients with Grade III and IV for surgical reimplantation unless they are non-compliant with medication or difficult to be monitored and supervised.

Table II

International Classification of Vesico-Ureteric Reflux

Grade I	–	ureter only
Grade II	–	no dilatation of ureter, pelvis, calices normal calical fornices
Grade III	–	mild to moderate dilatation of ureters and pelvis slight or no blunting of calical fornices
Grade IV	–	moderate dilatation of ureter, pelvis complete obliteration of sharp angle of fornices
Grade V	–	gross dilatation of ureter, pelvis and calices papillary impressions no longer visible in most calices

In 1984, O'Donnel & Puri(13) described an endoscopic procedure called subureteric injection of Teflon (sting) which can be done as outpatient to correct moderate VUR. The procedure entails an injection of a small amount of Teflon, an inert substance, into the Waldeyer's space at the ureteric orifice. He claimed more than 80% cure rate for reflux. This is still a new procedure with unknown long-term effect. There have been reports of migration of Teflon to regional lymph nodes and distant organs and growing granuloma at the site of injection. It may have a place where reimplantation is needed but difficult to perform, for example, neurogenic bladder with trabeculated bladder wall.

PROGNOSIS

The prognosis for the majority of patients who have no obstructive uropathy or vesico-ureteric reflux is good. In these patients, repeated urinary infection will rarely cause renal damage but reinvestigations may be necessary. For patients with obstructive uropathy the prognosis depends on how much functioning renal tissue remains before obstruction is relieved. Thus it is crucial to relieve the obstruction early. Children with coarse renal scarring must be monitored closely for life. Five to 30% of them will develop hypertension in adult life. Fortunately with proper management, very few of them should end up in chronic renal failure subsequently.

CONCLUSION

The above discussion emphasises the importance of making the correct diagnosis of urinary tract infection. Overdiagnosis leads to unnecessary investigations, some of which can be costly and unpleasant. On the other hand, underdiagnosis may miss out important conditions like obstructive uropathy, vesico-ureteric reflux or renal abnormalities. Some these are surgically correctable and some need long-term periodic close surveillance and supervision. Failure to diagnose these conditions early would have detrimental consequences.

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