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Characteristics of Urinary Tract Infection in 1-17 Years Old Children

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ABSTRACT

Urinary tract infection is a disease that is common in children and is characterized by a significant number of bacteria in the urine. UTI incidence is still high, is the second leading cause of infectious disease morbidity in children after respiratory tract infection. In Indonesia, 200 children were evaluated by 35% in children 1-5 years old and 22% of children aged 6-10 years suffering from a urinary tract infection, or approximately 33% in men and 67% in women. This study aimed to find the characteristics of urinary tract infection in children aged 1-17 years in Wonosari hospital. This study shows the characteristics of urinary tract infection in children aged 1-17 years in Wonosari hospital, Yogyakarta. This study uses a cross-sectional study design obtained from the medical record in the period 2018 to 2019. In this study, 41 pediatric patients with urinary tract infections, 16 (39%) male, 25 (61%) female with an age range most 1-5 years old 20 (48,8%). A total of 41 patients with urinary tract infections, 17 patients (41,5%) with symptoms of nausea and vomiting, 31 (75,6%) with good nutrition. Urinalysis result with positive leucocyte esterase 32 (78%). And 20 patients (41,4%) with penicillin class of antibiotic therapy. Outcome healed 29 (70,7%). Urinary tract infections are the most at the age of 5-12 years. Clinical symptoms, especially nausea and vomiting. Urinalysis results do not exclude the diagnosis of urinary tract infection, so that the child vomits aged 1 to 17 years with no obvious cause of urinary tract infections should be considered.

Keywords: Characteristics, Urinary Tract Infection, Children

ABSTRAK

Infeksi saluran kemih merupakan penyakit yang sering ditemui pada anak dan ditandai dengan jumlah bakteri yang bermakna dalam urin. Insidensi ISK masih tinggi, merupakan penyebab kedua morbiditas penyakit infeksi pada anak setelah infeksi saluran napas. Di Indonesia, dari 200 anak yang dievaluasi sebesar 35% pada anak 1-5 tahun dan 22% anak usia 6-10 tahun menderita infeksi saluran kemih atau sekitar 33% pada laki-laki dan 67% pada perempuan. Tujuan Penelitian ini adalah untuk mengetahui karakteristik infeksi saluran kemih pada anak usia 1-17 tahun di RSUD Wonosari.Penelitian ini menggunakan desain penelitian cross-sectional yang diperoleh dari catatan rekam medis pada periode September 2019 sampai September 2020. Didapatkan 41 pasien anak dengan infeksi saluran kemih, anak laki-laki 16 (39%), anak perempuan 25 (61%) dengan rentang usia terbanyak 1-5 tahun 20 anak (48,8%). Sebanyak 31 pasien (75,6%) dengan status gizi baik. Manifestasi gejala infeksi yang terbanyak adalah mual dan muntah 17 (41,5%). Hasil urinalisis dengan leukosit esterase positif 32 anak (78%). Pilihan terapi antibiotik golongan penisilin (ampicillin dan amoksicilin) 20 anak (41,4%). Luaran pulang sehat ada 29 anak (70,7%). Infeksi saluran kemih pada anak terbanyak usia 1-5 tahun. Gejala klinis terutama mual dan muntah. Hasil urinalisis normal tidak menyingkirkan diagnosis infeksi saluran kemih, sehingga anak usia 1-17 tahun dengan gejala muntah dengan penyebab tidak jelas perlu dipikirkan infeksi saluran kemih.

Kata Kunci: Karakteristik, Infeksi Saluran Kemih, Anak

INTRODUCTION

Urinary tract infection (UTI) is an infection caused by the multiplication of microorganisms in the urinary tract, which normally do not contain bacteria, viruses or other microorganisms in the urine (Sukendar, 2006). Urinary tract infection is a disease that is often found in children and is characterized by a significant amount of bacteria in the urine. The incidence of UTI is still high, it is the second cause of infectious disease morbidity in children after respiratory infections. The prevalence of UTI varies depending on age and gender, which ranges from 3-10% in girls and 1-3% in boys (Subandiyah, 2015). The risk of UTI during the first decade after birth is 1% for male and 3%

for female. At school age, 5% of girls and up to 0.5% of boys experience at least one episode of UTI. The incidence of UTI is different for children aged less than 3 months which is more common in boys (Wahyudi, 2015). The incidence of UTI in children often occurs in patients with anatomical and functional abnormalities of the urinary tract (Hay *et al*, 2011).

The prevalence of urinary tract infections can be grouped based on age, gender, and circumcision status. Based on the results of an evaluation conducted on 200 children in Indonesia, 35% of children aged 1 to 5 years and 22% of children aged 6 to 10 years suffer from UTIs. Based on gender, the incidence of UTI was more common in women (67%) than men (33%). In addition, the highest prevalence of UTI also occurs in male infants less than 3 months old who have not been circumcised and female infants under 1 year old (Tusino A., Widyaningsih, N., 2017). In Indonesia, out of 200 children who were evaluated, 35% of children aged 1 to 5 years and 22% of children aged 6 to 10 years suffered from urinary tract infections or around 33% in boys and 67% in girls. These data indicate that urinary tract infection is an infection with a fairly high incidence rate (Hidayah N. *et al*, 2011).

Common pathogenic sources are enteric Gram-negative bacteria. Escherichia coli is responsible for 75% of UTI episodes. Gram-positive bacteria (especially enterococci and staphylococci) represent 5-7% of cases. Hospital-acquired infections show a more broadly aggressive bacterial pattern, such as Klebsiella, Serratia and Pseudomonas sp. Group A and B Streptococci are common in newborns. There is an increase in S. saprophyticus in UTIs in children, although the role of this bacterium is still being debated (Wahyudi, 2015).

UTI manifestations vary widely and depend on age, starting with asymptomatic to severe symptoms such as a severely unwell child with a high temperature and sometimes secondary bacteremia. So, UTIs are often not detected by either medical personnel or parents. The diagnosis and management of UTIs in children remains challenging. Errors in making a diagnosis will be very detrimental, which can cause kidney damage because it is not treated or the child undergoes unnecessary examinations and treatment (Pardede Sudung O. *et al*, 2011; Tullus and Shaikh, 2020; Simões e Silva, Oliveira, and Mak, 2020).

Seeing the large incidence of urinary tract infections in children and the variation of manifestasions of UTI, it is necessary to have data to determine the characteristics of urinary tract infections in children aged 1-17 years. Therefore, researchers wanted to know the characteristics of UTI in children at the Wonosari Hospital in Yogyakarta, which is one of the Teaching Hospitals of the Faculty of Medicine at the Islamic University of Indonesia.

METHOD

Participant characteristics and research design

This research was a descriptive research. The design of this study was cross-sectional, to determine the characteristics of urinary tract infections in children aged 1-17 years at RSUD Wonosari Yogyakarta. The study population was all pediatric patients aged 1-17 years with a diagnosis of urinary tract infection at Wonosari Yogyakarta Hospital from January 2019 to December 2020.

The inclusion criteria was all pediatric inpatients and outpatients who were 1-17 years old with a primary diagnosis or an additional diagnosis of urinary tract infection at Wonosari Hospital, Yogyakarta. The exclusion criteria was pediatric patients who were diagnosed with urinary tract infection but did not have a urinalysis examination.

Sampling procedures

Sampling was carried out on all pediatric patients aged 1-17 years who were diagnosed with urinary tract infections from January 2019 to December 2020 at Wonosari Yogyakarta Hospital and met the study inclusion criteria.

Sample size, power, and precision

The minimum research sample was set at 34 subjects, using the formula below:

$$N = \frac{Z\alpha^2 x P x Q}{d^2}$$
$$= \frac{(1,96)^2 x 0,0996 x 0,9004}{(0,1)^2}$$
$$= 34$$

Measures and covariates

The variables seen in this study were the characteristics of urinary tract infections including gender, age, anthropometric status, symptoms and signs, laboratory results, administration of antibiotics and other drugs, comorbidity, and patient's outcome, and also the incidence of urinary tract infections.

Data analysis

Data were taken from secondary data from medical record at Wonosari Hospital from January to December 2019. The data collected included risk factors for urinary tract infection in children (age, gender, history of circumcision, history of constipation, anatomic abnormalities, history of previous UTI), clinical symptoms (fever, difficulty urinating, painful urination, decreased appetite, nausea and vomiting), physical examination (body temperature), investigations (peripheral blood, urinalysis, kidney function), and the treatment given. Continuous variable data is presented in mean±standard deviation and categorical variables are presented in amounts and percentages.

RESULTS AND DISCUSSION

Gender

The description of the patients by gender is shown in Table 1. Based on Table 1, it is known that the majority of patients were female (25 patients or 61%) while the rest were male (16 patients or 39%).

Table 1. Description of the patients by gender

Gender	n	%
Male	16	39
Female	25	61
Total	41	100

Gender is a risk factor for the incidence of UTI according to the anatomy and physiology of development. In women, the urethral anatomy is shorter so that colonization and pathomechanism of UTI more easily occurs through the ascending tract to the upper urinary tract. The tissue contact of the urinary bladder and anterior vaginal wall by the fascia acts as a continence regulator (Adelson, *et al*., 2018). The presence of urinary incontinence can be a risk factor for UTI. The distance of the perineum to the external urethral orifice in women is also closer. This causes UTI susceptibility in women who have the habit of washing from back to front. Movement from back to front can cause the normal perineal flora to move to the ureter and increase the incidence of UTI. The physiology of the vagina which has an acidic pH as a protective factor can experience changes in maintaining the number and types of pathogenic or resident microorganisms (Daniel, *et al*., 2013). The existence of vaginal soap that is often circulating in the market is also often used by post-pubertal women so that it contributes to the incidence of UTIs. It has been investigated for the protective effect of estrogen as a urothelial tissue protectant by preventing the activation of lipopolysaccharides. This causes inflammation prevention which can be a metabolic effect of bacteria that cause UTI (Li & Qiu, 2015;

Acevedo-Alvarez, et al., 2018). Women are more at risk of experiencing recurrent UTIs in their lifetime, so the prevalence of UTIs in women is generally higher than men (Anger, et al., 2019).

Men also have higher risk for UTIs due to the structure of the prepuce which makes it easier for bacteria to grow. Thus, circumcision is a protective factor for UTIs by 8 times, especially during childhood (Eisenberg, Galusha, Kenedy, & Cullen, 2018).

Age

The description of the patients by age is shown in Table 2. Based on Table 2 it is known that the majority of patients were in >1-5 years old (20 patients or 48.8%) while the least were in <1 years old (1 patient or 2.4%).

Table 2. Description of the patients by age

Age	n	%
<1 years	1	2.4
>1-5 years	20	48.8
>5-10 years	10	24.4
>10-15 years	4	9.8
>15 years	6	14.6
Total	41	100.0

The incidence of UTI is high in the age range of neonates and infants/children with male gender. This is due to the findings of abnormalities in the development of the urinary tract or so-called congenital anomalies of the kidney and urinary tract (CAKUT). CAKUT conditions have a broad spectrum, associated with abnormalities in gene expression (Stonebrook, Hoff, & Spencer, 2019; Tyagi & Chimurkar, 2021). Some cases of CAKUT are also found in a genetic disorder syndrome. In general, the conditions of CAKUT can be summarized in Figure 1. Any abnormality in morphology will certainly affect the physiology of the urinary tract thereby increasing the risk of infection. Infection can occur due to obstruction of the channel that causes reflux, especially urethrovesical valve abnormalities in VUR / vesicourethral reflux. The earlier the age of onset of UTI, the higher the chance of VUR being detected, with rates of 70% in infants and 5.2% in adolescents. The rate of UTI recurrence was also related to the frequency of kidney damage and increased renal scarring. In addition, the condition of phimosis in boys, which is often encountered, causes urinary retention which increases the incidence of UTI (Miyakita, et al., 2020).

The ratio of UTI cases in men and women increases to 1:10 when approaching the age of five (under five years) (Purba, Ardhani, Patria, & Sadjimin, 2015). In general, toddlers are at particular risk due to the use of diapers/baby diapers and unhygienic toilet training. The low frequency of changing diapers in infants and children is related to the significant incidence of childhood UTIs. This is because the bacteria that cause UTIs come from the digestive tract and are obtained from the feces of toddlers who use diapers. The use of diapers facilitates continuous contact between the feces and the urinary tract so that an ascending infection process occurs. In addition, the process of urinating on a diapered baby puts the pelvic floor and sphincter muscles in a relaxed position. In effect, there is an accumulation of residual urine which can create reflux and infection. Materials from diapers that easily absorb fluids can also help bacterial colonies grow properly thereby increasing the possibility of infection (Daulay, *et al*., 2013; Lestari, Ardanikusuma, & Prawirohartono, 2014; Tusino & Widyaningsih, 2017).

The habit of holding micturition can arise during the toilet training process which leads to voiding dysfunction. The recommended age to start toilet training should start closer to the age of 18-24 months. This is because the child already has the ability to communicate verbally well so that he can express his desire to urinate without affecting the control function of the bladder. The process of toilet training can pose a risk of dysfunction in the process of urination due to prolonged use of diapers (Li, *et al*., 2020). This reduces the perception of continence so that children tend to wet the bed

frequently which leads to dysfunction of the urinary process. If left unchecked, this can be a risk factor for UTI (Sivaraj, *et al*., 2015; Meena, Mathew, Hari, Sinha, & Bagga, 2020).

As age increases, the risk factors for UTIs are also increasing. This is closely related to gender, such as men having circumcision as a protective factor and women related to hygiene during menstruation. The process of occurrence of UTI due to the use of unhygienic sanitary napkins is the same as the occurrence of UTI in children due to the use of diapers. The use of sanitary napkins that are not disposable can increase the incidence of UTI (Das, *et al*., 2015; Torondel, *et al*., 2018). In addition, women who experience menstruation may live in an environment with poor access to toilets, thereby reducing hygiene in changing and bathing during menstruation which increases the incidence of UTI (Sommer, Kjellén, & Pensulo, 2013).

Anthropometric status

The description of the patients based on their anthropometric status is shown in Table 3. Based on Table 7, it is known that the majority of patients have good nutritional status (31 patients or 75.6%), with an average weight of 24.5 ± 19.8 kg and an average height of 110.6 ± 34.6.

Table 3. Description of the patients based on anthropometric status

Anthropometric status	Results
Weight (mean, SD)	24.5 ± 19.8
Height (mean, SD)	110.6 ± 34.6
Nutritional status	
Overweight (n,%)	1 (2.4)
Healthy Weight (n,%)	31 (75.6)
Underweight (n,%)	9 (22)

In general, the anthropometric status is strongly influenced by the type of diet consumed by an individual. Some foods can contribute to the occurrence of excess nutrition and are associated with the risk of UTI. Carbonated drinks, coffee and excessive consumption of red meat have been studied to increase the risk of UTI (Salem, Ali, Al Bllady, & Albeshri, 2019). The condition of hyperlipidemia in excess nutrition and the habit of consuming alcohol are also related to increasing cases of UTI. Conversely, foods and drinks that contain high probiotics can be protective against UTIs, especially in cases of recurrent UTIs that are receiving antibiotic treatment (Bazzaz, Fork, Ahmadi, & Khameneh, 2021). A vegetarian or high-fiber diet is also associated with a protective factor against the incidence of UTI, especially in the female population.

Good nutritional status plays a strong role in preventing the occurrence of UTI because an individual's immune regulation tends to work optimally. However, nutritional status can be a cause or a result of UTI conditions (Triasta, Setiabudi, & Rachmadi, 2016). Malnutrition in children causes decreased function of the immune system, including innate, adaptive, and mucosal defense capabilities (Uwaezuoke, 2016). This can facilitate the growth of bacteria that cause infection, which in turn can trigger UTIs. Overnutrition is also a risk factor for UTIs in children, particularly in cases of acute cystitis and pyelonephritis. This is due to alterations in the production of immune system mediators and changes in immune system tissue due to fat accumulation. In addition, obesity conditions also support infections to become more severe and cause acute disease with high tissue damage rates (Hsu & Chen, 2018; Yim, Han, Kim, & Yoo, 2021; Grier, Kratimenos, Singh, Guaghan, & Koutroulis, 2016).

UTI in childhood can also affect growth or nutritional status. UTI can induce systemic reactions that can reduce food intake and digestion and cause nutrients and calories to be produced decreased. Infectious conditions also increase the rate of metabolism to fight pathogenic germs so that energy requirements increase. As the result, there is a conversion of body components such as fat and muscle reserves. In the short term this can lead to weight loss. The long-term impact can lead to failure of the growth process which can affect stature as a teenager. Therefore, it is important to treat

infections in children immediately so as not to interfere with the growth process (Bishwokarma, et al., 2022; Ulfa, Wibowo, Rusmawatiningtyas, & Hermawan, 2021; Nendra, et al., 2021).

Symptoms and signs

The description of the patients based on symptoms and signs is shown in Table 4. Based on Table 4, it is known that most patients come with nausea and vomiting (41.5%), accompanied by dysuria (31.7%), polyuria/urgency (22%), and lower abdominal pain/suprapubic pain (22%). About 12 patients experienced various symptoms, such as weakness, decreased appetite, coughing, bloating, dizziness, or pus coming out of the genitals.

Table 1. Description of the patients based on symptoms and signs

Symptoms and signs	n	%
Nausea/vomiting	17	41.5
Dysuria	13	31.7
Polyuria/urgency	9	22
Lower abdominal pain/suprapubic pain	9	22
Fever	4	9.8
Convulsion	3	7.3
Others	12	29.3

Based on general guidelines, UTI symptoms in toddlers are often difficult to diagnose. The main symptom is fever, especially in children who are not used to urinate in the toilet. In children who are used to it, the triad of urinary tract infections often appears (IDAI, 2011). In infants, the common symptoms that can be found are fever, agitation, dehydration, and weakness. Gastrointestinal symptoms such as diarrhea and constipation may also be present but not always. Symptoms that are often encountered are nausea and vomiting associated with other complaints such as dizziness. This is due to changes in cytokines that induce autonomic responses when sick. The irritation of the urinary tract mucosa can also spread to the nerves that regulate the digestive process so that it can cause a sensation of nausea and vomiting. In children who have started to walk, there is pain when walking and changes in urinary patterns, urine appearance and enuresis can also occur (Triasta, Setiabudi, & Rachmadi, 2016).

The main complaint can also be a typical symptom of the location of the UTI. In the case of a lower UTI, the complaint that generally appears is when urinating. In cases of upper UTI such as cystitis, the fever is generally not too high but there are complaints of suprapubic pain and incontinence. In pyelonephritis, you can find symptoms of high fever accompanied by low back pain (Triasta, Setiabudi, & Rachmadi, 2016; Bono, Leslie, & Reygaert, 2023).

Some symptoms can be a sign of danger or an emergency. Fever with high temperature due to infection in children aged less than 1 year can cause simple febrile seizures and complex seizures. Secretions in the form of pus can be a symptom that must be considered because it is not common. Pus is a combination of fluid, leukocytes, tissue, and bacteria that accumulates during the infection. In cases of UTI, the infectious process is generally isolated in the body. It is necessary to ensure that the source of pus that comes out of the genitalia is from the reproductive tract or urinary tract. The condition of pyuria can occur due to sexually transmitted diseases which often occur together with UTIs. Therefore, it is necessary to carry out further examination regarding the origin of the pus (Triasta, Setiabudi, & Rachmadi, 2016).

Seizures can be a complication of the fever caused during a UTI. Febrile seizures generally occur in UTI patients aged 6 months to 6 years. This is due to an increase in excitatory neurotransmitters, causing tonic and clonic muscle contractions. Seizures can also be caused by electrolyte and fluid dysregulation in cases of dehydration due to UTI. In some cases, UTI in infants can cause meningitis which can cause seizures (Arshad & Seed, 2015). Patients who present with seizures should receive emergency care and it is important to identify the cause and duration of the

seizures. The impact of seizures in children is associated with the progression of seizures to epilepsy which can affect cognitive development (Mahyar, et al., 2018; Abadi, Moghtaderi, & Ashrafi, 2017).

Laboratory results

The description of patients based on laboratory results is shown in Table 5. Based on Table 9, it is known that patients came to the emergency room with varying laboratory results. From the results of urinalysis, esterase leukocytes (+) were found in 32 patients (78%) and urine bacteria (+) in 10 patients (24.4%).

Table 5. Description of patients based on laboratory results

Laboratory parameter	Results
Hemoglobin (Mean, SD)	12.1 ± 1.2
Hematocrit (Mean, SD)	34.1 ± 3.8
Leucocyte (Mean, SD)	12,238 ± 9,849
Platelet (Mean, SD)	200,047 ± 103,381
Netrophil (Mean, SD)	64.2 ± 14.5
Lymphocyte (Mean, SD)	29.9 ± 12.7
Urinalysis	
Erythrocyte (+) (n,%)	5 (12.2)
Leukocyte esterase (+) (n,%)	32 (78)
Bacteriuria (+) (n,%)	10 (24.4)
Protein (+) (n,%)	3 (7.3)
Calsium oxalate (+) (n,%)	2 (4.9)

The UTI consensus guidebook in children states that the recommended laboratory examinations are urinalysis, complete blood count, and urine culture (IDAI, 2011). However, the definite diagnosis is established by examination of urine culture. Blood test results tend to describe the condition of the infection in general. What can be found is leukocytosis (Triasta, Setiabudi, & Rachmadi, 2016). The leukocyte component that can be increased is neutrophils, especially in the acute phase and lymphocytosis in the continuation phase. However, in conditions of sepsis lymphocytes can decrease due to apoptosis induction. This leads to a worse prognosis in cases of sepsis in children (Luisa, et al., 2021).

Blood tests that can be recommended are the sedimentation rate (ESR), which usually increases >30 mm/hour. Besides that, checking for C-Reactive Protein is also an indicator of inflammation, although it is quite expensive. Increased procalcitonin can be a strong marker of pyelonephritis as a product of kidney scarring (Triasta, Setiabudi, & Rachmadi, 2016).

Urinalysis examination is used for the diagnosis of UTI to initiate initial therapy empirically. The finding of erythrocytes in the urine is abnormal if the value is >4 red blood cells/high power field. This can indicate extensive kidney damage so that it cannot selectively filter erythrocyte components (IDAI, 2011). In addition, minor bleeding may also occur in the lower urinary tract causing hematuria. Another condition that can be found is a positive leukocyte esterase test result. Leukocyte esterase is an enzyme present in neutrophils which indicates leukoria on the dipstick test in urinalysis (Triasta, Setiabudi, & Rachmadi, 2016).

The presence of bacteria in the urine is a marker of UTI. Incorrect sampling may affect the test results. It is recommended to do a nitrite test (Triasta, Setiabudi, & Rachmadi, 2016). Nitrite is a byproduct of the bacterial metabolism of nitrate compounds. Therefore, the use of a nitrite test to confirm bacteriuria is more accurate (IDAI, 2011).

The size of protein and calcium oxalate is larger than the glomerular filtration component in the kidney so it should not be excreted in the urine. A positive protein urinalysis result indicates a failure in the filtration process or a side effect of the metabolism of pathogens, especially bacteria, in the infection process. Calcium oxalate is one of the most common types of crystals found in cases of

nephrolithiasis. In general, urinary tract stones can be excreted through peristalsis of the urinary tract muscles so that they can be identified through urine (Nojaba & Guzman, 2023). Normal conditions can also affect test results. Consuming high-protein foods such as meat and several types of vegetables (beans, asparagus, potatoes, and others) in high quantities can increase the amount of protein excreted in the urine (Ko, Rhee, Kalantar-Zadeh, & Joshi, 2020). Calcium oxalate is a derivative of the calcium minerals, oxalate, cysteine, and phosphate. So, consumption of food or drink containing these components can affect urine composition (Bargagli, Tio, Waikar, & Ferraro, 2020).

Administration of antibiotics and other drugs

A description of the administration of antibiotics and other drugs given to patients is shown in Table 6. Based on Table 10, it is known that the antibiotics most frequently used were amoxicillin (39%) and cefixime (31.7%). Other antibiotics include levofloxacin, cefadroxil, clindamycin, and cefotaxime. Paracetamol was used quite frequently, that is used in 19 patients (46.3%). There are other medicines that are also given to patients, which are betahistine, prednisone, furosemide, and captopril.

Table 6. Description of the administration of antibiotics and other drugs

Drugs	n	%
Antibiotics		
Ampicillin	4	2.4
Ceftriaxone	4	2.4
Cefixim	13	31.7
Amoxicillin	16	39
Others	6	14.6
Paracetamol	19	46.3
Ondansentron	4	9.8
Diazepam	5	12.2
Others	12	29.3

Management of UTI in children consists of causative therapy in the form of antibiotics and supportive therapy. The choice of antibiotics is based on individual factors related to allergies and antibiotic resistance. Selection of oral and parenteral antibiotics in UTI cases is shown in Tables 7 and 8 (IDAI, 2011). Some experts recommend doing a urine culture before using antibiotics, but if this is not possible, adjust it to the location of the UTI (Triasta, Setiabudi, & Rachmadi, 2016).

Table 7. Oral antibiotic choices in cases of UTI (IDAI,2011)

Antibiotics name	**Dosage/day**
Amoxicillin	20-40mg/kg/day
Sulfonamide	
- Trimethoprim (TMP)-sulfametoxazole (SMX)	6-12mg TMP and 30-60mg/kg/day divided into 2 doses
- Sulfisoxazole	120-150mg/kg/day divided into 4 doses
Cephalosphorin	
- Cefixime	8mg/kg/day divided into 2 doses
- Cefpodoxime	10mg/kg/day divided into 2 doses
- Cefprozil	30mg/kg/day divided into 2 doses
- Cephalexine	50-100mg/kg/day divided into 4 doses
- Loracarbef	15-30mg/kg/day divided into 2 doses

Table 8. Parenteral antibiotic choices in UTI (IDAI, 2011)

Antibiotics name	**Dosage/day**

Ceftriaxone	75mg/kg/day
Cefotaxime	150mg/kg/day divided every 6 hours
Ceftazidime	150mg/kg/day divided every 6 hours
Cefaxolin	50mg/kg/day divided every 8 hours
Gentamicin	7.5mg/kg/day divided every 6 hours
Amikacin	15mg/kg/day divided every 12 hours
Tobramycin	5mg/kg/day divided every 8 hours
Ticarcillin	300mg/kg/day divided every 6 hours
Ampicillin	100mg/kg/day divided every 6 hours

Some recommendations for UTI cases in the acute phase are as follows;

- Infants <3 months are recommended to be referred to a pediatrician for parenteral treatment.
- Infants >3 months old can take oral antibiotics for 7-10 days or parenteral for 2-4 days followed by oral medication for 10 days (IDAI, 2011).

Some recommendations for management of cases of lower UTI are as follows;

- Infants <3 months are recommended to be referred to a pediatrician for parenteral treatment.
- Infants >3 months old can take oral medication for 3 days. If the condition does not improve within 24-48 hours, a culture can be done to see antibiotic resistance (IDAI, 2011).

The use of supportive therapy found in patients includes administration of paracetamol which used as an antipyretic and analgesic with a good safety profile. In addition, antiemetics and antinausea can be given such as ondansetron to help reduce patient complaints. Some patients also receive diazepam as an anticonvulsant in cases of febrile seizures (IDAI, 2011).

The use of corticosteroid drugs such as prednisone which is given in cases of nephrotic syndrome can be continued according to the management of nephotic syndrome. And it should be considered for discontinuation if there are no comorbidities with indications for corticosteroid administration. The use of prednisone can increase the risk of infection due to its strong immunosuppressant profile. In addition, long-term use of predinison can result in cases of fungal infections in the genitalia and urinary tract thereby increasing the risk (Bazi, Baghbanian, Ghazaeian, Fallah, & Hendoiee, 2021; Jeong, 2012).

Comorbidity

All patients were diagnosed with UTI and there were several comorbidities, which are dehydration, simple febrile seizures, complex febrile seizures, anemia, organic mental disorders depressive episodes with psychosis, vertigo, epilepsy, nephrotic syndrome, post-streptococcal acute glomerulonephritis (GNAPS), viral infections, typhoid fever, bronchopneumonia, and sexual violence. Co-morbidities in patients can be a contributing factor to cases of UTI and may require special management. In cases of UTI with dehydration and febrile seizures, adequate fluid management is required. Fluid therapy can help regulate body temperature and restore lost fluids and help the process of urinating which can cause pain and prevent recurrence (Castera & Borhade, 2022; Scott, Clark, Mar, & Glasziou, 2020). In cases of sexual violence, further examination is needed regarding sexually transmitted diseases that can increase the risk of UTI. In addition, sexual violence against women can traumatize the external orifice so that it can cause pain when urinating and become an entry point for pathogenic germs (Krajewski, Wojciechowska, Krefft, Hirnle, & Kołodziej, 2016; Behzadi, Behzadi, & Pawlak-Adamska, 2019).

In cases related to the kidneys, such as nephrotic syndrome and GNAPS, it is recommended to carry out investigations such as imaging to see the condition of the kidneys and confirm the relationship between UTI and nephrotic syndrome or GNPS. Another treatment that can be recommended is to refer the patient to a specialist who is in accordance with the patient's comorbid illnesses to receive comprehensive therapy (Dicu-Andreescu, Penescu, Căpusă, & Verzan, 2022).In cases related to the kidneys, such as nephrotic syndrome and GNAP, it is recommended to carry out investigations such as imaging to see the condition of the kidneys and confirm the relationship between UTI and nephrotic syndrome or GNPS. Another treatment that can be recommended is to

refer the patient to a specialist who is in accordance with the patient's comorbid illnesses to receive comprehensive therapy (Dicu-Andreescu, Penescu, Căpusă, & Verzan, 2022).

Patient's outcomes

The descriptions of patient's outcomes is shown in Table 9. Based on Table 9, it is known that the majority of patients that are healthy discharged (70.7%). A total of 2 patients (4.9%) were forced discharged and 3 patients (7.3%) were referred. The remaining 7 patients (17%) had residual symptoms so they were required to return for control.

Table 9. Description of patient's outcomes

Outcomes	n	%
Healthy discharged	29	70.7
Forced discharged	2	4.9
Reffered	3	7.3
Control/ with sequele	7	17

The prognosis of UTI cases is generally dubia ad bonam. Therapy of UTI must be followed by lifestyle changes such as improving urinary tract hygiene, avoiding the habit of holding urine, and adequate water intake. Criteria for hospitalization in cases of UTI include:

- Neonates <30 days old
- Parenteral use of drugs
- Co-morbidities (anemia, prematurity, respiratory distress, etc.)
- Complications (renal failure, hypertension, sepsis, shock)
- Severe clinical symptoms (pain, high fever, anuria)
- Indication of suprapubic catheterization or puncture
- Suspicion of a resistant pathogen
- Nutrition and care assistance (IDAI, 2011).

Recurrent UTIs can worsen the overall prognosis because of the risk of scarring of the kidneys or strictures of the urinary tract. Periodic evaluation is recommended for cases of atypical, recurrent UTIs and in neonates. Monitoring can include checking nutritional status and vital signs, periodic urine culture and repeated imaging every 6 months to 1 year using ultrasound if necessary(Arshad & Seed, 2015).

CONCLUSIONS AND SUGGESTIONS

The conclusions from this study, with a total of 41 patient cases, include:

1. Urinary tract infections in boys 16 (39%), girls 25 (61%) with the most was 1-5 years old (20 children or 48.8%).
2. The most common symptoms of infection were nausea and vomiting 17 (41.5%).
3. Choice of penicillin class antibiotic therapy (ampicillin and amoxicillin) in 20 children (41.4%).
4. The results of urinalysis with leukocyte esterase were positive for 32 children (78%). So that normal urinalysis results do not rule out a diagnosis of urinary tract infection, so children aged 1-17 years with symptoms of vomiting with unclear causes need to think about urinary tract infections.
5. The output of healthy discharge was 29 children (70.7%)

Suggestions for further research:

1. Need more complete characteristics according to age group.
2. Research related to risk factors for urinary tract infection in children according to age group. Because, if it is under 3 years old the incidence is high, and although it occurs frequently it is not easy to recognize and confirm the diagnosis of this infectious disease.

ETHICAL CONSIDERATIONS

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Conflict of Interest Statement

The authors declare no conflict of interest.

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