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Prevalence of Urinary Tract Infection in Infants and Young Children and Sensitivity Testing of The Bacterial Isolates in Pediatric Hospital - Benghazi City - Libya

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Abstract— ***Infections of the urinary tract are prevalent in children. In contrast to the benign course of urinary tract infection (UTI) in adults, UTI in children is well-known as a source of acute morbidity and chronic medical disorders such as hypertension and renal insufficiency in adults. This cross-sectional study was conducted on a group of 299 infants and children (103 male, 177 females) in the age range of 15 days to 5 years old in Children hospital Benghazi. The aim of this study was to estimate the prevalence of UTI among these children, to find the major causative organisms behind UTI in this population and to study the antibiotic susceptibility of isolated bacteria. The uncentrifuged urine was evaluated by dipstick culture, microscopy and antibiotic sensitivity test. The overall prevalence of UTI in children was 15.3 %, according to the findings of this study. There was a significant difference (p=0.03) between the frequency of UTI and gender, but no significant difference (P=0.08) was discovered between the frequency of UTI and age. There was a difference in the frequency of UTI among children of various ages. Gram-negative bacteria were identified at a rate of 75 percent, while Gram-positive bacteria made up 25 percent of the total isolates. E. coli was the most often isolated uropathogen among gram negative bacterial isolates (50 percent), followed by Pseudomonas spp. (30%), Klebsiella spp. (16.7%) and the least frequent isolate was Enterobacter spp. (3.3%). The most common Gram-positive bacteria isloated were Streptococcus spp. (50%) followed by Staphylococcus spp. (30%) and Enterococcus spp.(20%). Overall, the sensitivity of Gram-negative bacteria was high to Ciprofloxacin (66.7%), Norfloxacin (66.7%) and Ceftriaxone (56.6%). Gram-negative bacteria have a high level of resistance to Ampicillin (80%), Nitrofurantoin (66.7%), and other antibiotics: Ceftazidime (66.7%) and Amoxicillin/clavulanate (60%). E. coli, Ampicillin (100%) and Nitrofurantoin (100%) resistance was found in the most frequently isolated microorganisms (78.6 percent). Overall, the percentage sensitivity of Gram-positive bacterial isolates was relatively high to Ciprofloxacin (100%), Erythromycin (70%) and Oxacillin (60%). The overall resistance was high to Ampicillin (80%), Pencillin G (70%), Cotrimoxazole (70%), and Nitrofurantoin (60%). All of the isolates tested positive for multiple antibiotic resistance. Ampicillin, Penicillin, and Cotrimoxazole resistance was found in the majority of the Staphylococcus spp. identified.***

***Keywords*- Antibiotics sensitivity, Antimicrobial resistance, Urinary tract infection, Pediatrics.**

I. INTRODUCTION

Infections of the urinary tract are prevalent in the pediatric population. Unlike the relatively benign course of urinary tract infection (UTI) in adults, UTI in children is well established as a cause of acute morbidity and chronic medical disorders in adulthood, such as hypertension and renal insufficiency. As a result, a thorough understanding of its pathophysiology, risk factors, diagnostic test indications, and the proper use of antimicrobial medicines in the treatment of children with UTI is critical. (Steven *et al*., 2009).

A. Definition and classification of UTI:

A urinary tract infection (UTI) is a term that encompasses a wide range of clinical disorders, from asymptomatic to severe. Each year, around 150 million people worldwide are diagnosed with a urinary tract infection (UTI). (Weichhart *et al*., 2008). A urinary tract infection (UTI) is characterized as a pathogen colonizing the kidney, ureter, bladder, or urethra. UTIs have traditionally been categorised based on the place of infection (e.g., pyelonephritis [kidney], cystitis [bladder], urethritis [urethritis]) and severity (e.g., pyelonephritis [kidney], cystitis [bladder], urethritis [urethritis]) (ie,

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complicated versus uncomplicated). Infections in the urinary tract with structural or functional abnormalities or the presence of foreign items, such as an indwelling urethral catheter, are referred to as complex UTIs. This approach, however, does not always represent clinical management. In youngsters, categorizing UTI as a first infection vs recurrent infection is a simpler and more realistic method. There are three types of recurrent infections: (1) unresolved bacteriuria, (2) bacterial persistence, and (3) reinfection. (Steven *et al*., 2009).

B. Back ground:

Urinary tract infection (UTI) is a common and serious clinical condition in children, as recurrent UTIs can cause kidney scarring, hypertension, and end-stage renal failure later in life. Annually, UTIs account for 0.7 percent of physician office visits and 5–14 percent of children's emergency room visits. Younger children may have difficulty being diagnosed, while older children frequently complain of urine symptoms consistent with UTI, such as dysuria, frequency, and urgency, and may have suprapubic discomfort on examination. (Freedman, 2005). According to population-based studies, 3–7% of girls and 1–2% of boys had had at least one UTI by the age of six. (Mahant *et al*., 2002).

Because childhood UTI is the most significant factor affecting adult health, children should be treated with antibiotics as soon as possible. (Zincir *et al*., 2012). Urinary tract infection (UTI) is the second most common cause of morbidity in children in developed countries, after upper respiratory tract infections (Cataldi *et al*., 2006). Although hematogenous spread may be more likely in the first 12 weeks of life, ascending infections cause the majority of UTIs in children. Most UTIs in children are monomicrobial (Martinel *et al*., 1995). Colonic bacteria are the primary cause of UTI. *Escherichia coli* (*E.coli*) caused 75-90 percent of infections in females, followed by Klebsiella spp. and Proteus. Some studies claim that Proteus is as frequent as *E. coli* in males, while others claim that gram-positive organisms predominate. *Staphylococcus saprophyticus* is a known pathogen that affects both men and women. Though UTI is a common problem, microbial isolates and their sensitivity patterns must be analyzed at regular intervals around the world to track changing microbial flora patterns and the development of drug resistance, which may aid physicians in better treating UTI and preventing further complications (Malla *et al*., 2003). The UTI could be restricted to the bladder, involve one or both kidneys, or affect both sites. Those that affect only the bladder (cystitis) are usually not considered severe bacterial infections, despite the fact that they cause major morbidity. On the other hand, urinary infections involving the kidneys, such as acute pyelonephritis (APN), can result in immediate renal morbidity and scarring, as well as hypertension and chronic renal disease. (Cataldi *et al*., 2006). In adulthood, all neonates and infants with APN are at an increased risk of suffering UTI recurrences with cystitis episodes. Females with renal scarring, in particular, continue to have a high rate of pyelonephritic recurrences after ten years of age, signaling that they are at risk of developing progressive renal disease and should be constantly monitored into adulthood. (Martinell *et al*., 1995).

C. Signs and symptoms

In almost half of the instances, infection symptoms are nonspecific throughout the first month of birth, with low or no temperature. APN causes no localized symptoms in the urinary system in newborns and infants aged 0–2 months. They have vague signs including fever, poor feeding, failure to thrive, persistent jaundice, and severe systemic illness, hence UTI is usually diagnosed as part of a neonatal sepsis evaluation. A significant infection might be indicated by a subnormal or very slightly increased body temperature, as well as symptoms such as lethargy, anorexia, grey hue, and body soreness. The use of clinical and laboratory markers to diagnose APN in children, particularly those under the age of two, is problematic. This may increase the risk of kidney impairment in young children because the lack of localizing symptoms, combined with inadequate intrinsic immune defenses, causes antimicrobial treatment to be delayed. (Wald, 2004).

D. Risk factors

The incidence of UTIs in neonates varies from 0.1 percent to 2.0 percent in all newborns to 20% in the preterm and at-risk neonatal population (low-birth-weight infants) (Cataldi and Fanos,1996, Cataldi *et al*., 1990). UTIs were more common in males than in girls during the first six months of life, mostly without a high temperature; after that, it was more common in girls.(Jakobsson *et al*., 1999). Breastfeeding does not protect against urinary tract infection in the first three months of birth, according to research, and vitamin D supplementation raises the risk by 76%. (Katikaneni *et al*., 2009). In the industrialized world, febrile UTI is the most prevalent dangerous bacterial infection that occurs in infancy and early childhood. Renal scarring occurred in 10–30% of children who had febrile UTIs. In the long run, this is regarded to be a risk factor for hypertension and renal insufficiency. (Bell and Mattoo, 2009). Moreover, the long-term medical consequences (proteinuria, hypertension, and chronic kidney damage) are generally associated with the presence of renal parenchymal damage.

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E. Etiology

Similar to other age groups, *Escherichia coli* is the most prevalent bacterial etiology for newborn UTIs (Wang *et al*., 1994, Zorc *et al*;., 2005, Kanellopoulos *et al*., 2006). However, some studies revealed that the total burden of disease caused by *E. coli* was lower in this age group (approximately 50% of all positive cultures) than in older age groups, when *E. coli* causes up to 80% of UTIs. (Samayam and Ravi Chander, 2012, Lo *et al*., 2013). Male babies with vesicoureteral reflux (VUR) were more likely to have urinary tract infections (UTIs) caused by other bacteria. (Bonadio and Maida, 2014, Kanellopoulos *et al*., 2006). *Klebsiella pneumoniae*, *Klebsiella oxytoca*, *Proteus mirabilis*, *Proteus vulgaris*, *Enterobacter aerogenes*, *Pseudomonas aeruginosa*, and *Morganella morganii* are among the gram-negative pathogens. *(*Bonadio *et al*., 2014). Although cases of *Enterococcus faecalis*, *Staphylococcus aureus*, Group B streptococcus, and *Streptococcus pneumoniae* have been documented in neonates, gram-positive UTI with gram-positive organisms is uncommon (Morley *et al*., 2012, Bitsori *et al*., 2005). The organism was isolated in 14 percent of catheterized urine culture samples from infants with suspected infection and 18 percent concordance with positive blood cultures, suggesting that *coagulase-negative staphylococci* may be a causal agent in preterm newborns. (Downey *et al*., 2013). However, this finding is debatable; one study, which included predominantly premature newborns, found a *coagulase-negative staphylococci* UTI incidence of less than 1%. (Jean-Baptiste *et al.*, 2011). Candida urinary tract infections (UTIs) are more likely in extremely preterm newborns. Candidia spp. were shown to be the source of 42 percent of UTIs in a neonatal intensive care unit, with *Enterobacter cloacae* coming in second. (Phillips and Karlowicz 1997).

II. OBJECTIVE

The aims of the present study were: (i) to evaluate the prevalence of urinary tract infections in infants and young children, (ii) to evaluate the differences in prevalence among males, females, and various age groups, (iii) to find out the major causative organisms for UTI in infants and young children, (iv) to study the antibiotic susceptibility of isolated bacteria.

III. MATERIAL AND METHODS:

The type of study, population and sample size identification, setting, instruments, data collecting, and experimental procedures are all covered in this chapter.

A. Study location and design:

This cross sectional study was conducted in Pediatrics hospital of Benghazi city, in the period of Januaray 2020 to December 2020. The goal of the study was to determine the prevalence of UTI in infants and children aged 14 days to 5 years old.

B. Sample collection:

After instructing the parents or guardians of enrolled children to clean their genitals with soap and water, a freshly voided midstream urine sample (10–20 mL) was collected in a wide mouthed sterile container. The urine samples for babies were collected using a suprapubic aseptic approach. The urine analysis was carried out in the same hospital's microbiological lab. Conventional methods were used to identify urinary isolates from symptomatic UTI cases seen in pediatric departments and those hospitalized to the Pediatrics Hospital of Benghazi's pediatric ward.

C. Sample size:

A total number of 280 samples from both sexes under the age of 5 years were included in the study. Urine samples were collected from different departments of Pediatrics hospital who were suspected to have UTI (children with fever and/or acute voiding symptoms like dysuria, burning micturition, increased frequency, and abdominal pain) were included. The samples were screened by conventional methods such as dipstick, culture and antibiotic sensitivity tests. Children with a history of previous antibiotic usage were excluded.

D. Dipstick screening technique:

Using Medi-Test combi 10®SGL multisticks, urine samples were analyzed for leukocyte esterase and nitrite using the dipstick technique. If leukocyte esterase or nitrites were detected via urine DT, the result was declared positive. Urine generally does not contain nitrates. If bacteria is present, the dipstick will detect nitrites, as bacteria converts nitrates to nitrites. LE (leukocyte esterase) is a neutrophil-produced enzyme. It could indicate pyuria as a result of a urinary tract infection (UTI). WBCs can cause LE anywhere in the genitourinary tract, including the vaginal vault. Before reading the LE test, the dipstick should be left to sit for at least 30 to 60 seconds.

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FIGURE I: Medi-Test combi 10®SGL.

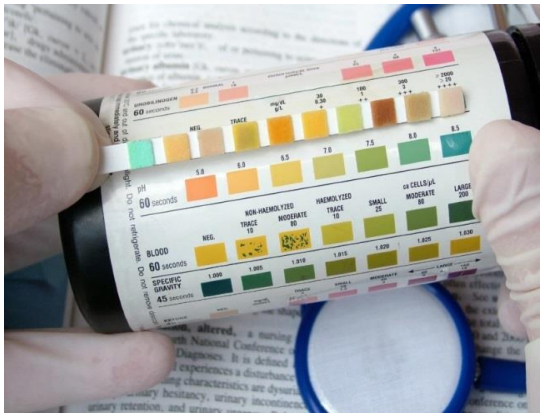

FIGURE II: Detection of nitrite and leucocytes in the urine samples

E. Culturing and identification procedure:

Using a calibrated loop, urine samples from children were infected on blood, MacConkey, and CLED agar (Oxoid, Ltd., Basingstoke, Hampshire, England) (0.001mL). For 24 hours, cultures were incubated at 37°C in an aerobic environment. For midstream urine, a positive urine culture was defined as a colony count of less than 105 CFU/mL. Counting was done with a Stuart scientific colony counter. Gram staining was used to distinguish Gram positives from Gram negatives, and all positive cultures were further characterized by their colony features. Their pattern of biochemical responses and quick identification methods employing normal microbiological protocols provided final confirmation.

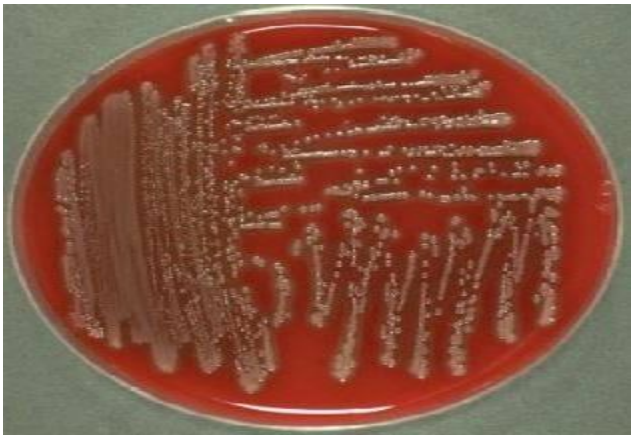

FIGURE III: E. coli growth on blood agar.

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FIGURE IV. Growth of Klebseilla Klebsiella spp.

FIGURE V. Growth of pseudomonas spp.

FIGURE VI. Growth of Enterobacter spp.

FIGURE VII : Growth pattern of staphylococcus spp.

FIGURE VIII: Growth pattern of streptococcus spp.

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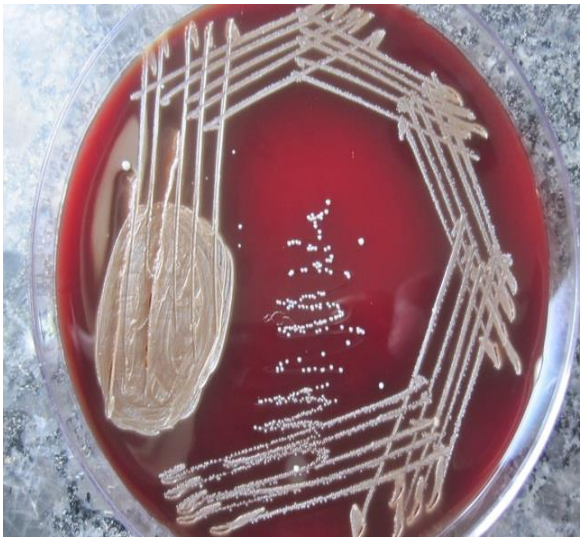

FIGURE IX: Growth pattern of Enterococcus spp.

F. Microscopy:

Isolated colony was inoculated into suitable broth. The inoculate was incubated aerobically for 18-24 hours at room temperature. On a clean microscope slide, one drop of broth culture was inserted and covered with a cover slip. Motility was indicated by individual bacterial cells moving in random directions. The slide was observed at either 400× or under oil immersion.

G. Gram staining:

Gram staining is a method for identifying pathogens in specimens and cultures based on their Gram reaction (Gram positive or Gram negative) and morphology. (Cheesbrough, 2005).

One colony was taken from culture media by a sterile loop, the colony was spread on a clean slide containing a drop of water, then mixed gently and fixed by heat.
The smear was stained with crystal violet for 30–60 seconds before being rinsed quickly.
Lugol's iodine was used to cover the smear for 30–60 seconds.
The smear was quickly decolorized with acetone–alcohol (a few seconds) and wiped with clean water.
The smear was then covered with neutral red stain for 2 minutes.
The stain was then removed with clean water, the back of the slide was cleaned, and the slide was placed in a draining rack to dry.
The smear was inspected microscopically, first with an X40 objective to check the stain and look at the bacterium dispersion, then with an X100 oil immersion objective to determine the bacteria type. (Figure 10).

FIGURE X: Gram staining procedure

H. Biochemical testing:

1) Citrate utilization test:

This is one of numerous strategies used to aid in the identification of enterobacteria on occasion. The test is based on an organism's capacity to use citrate as its only carbon source. (Figure 11).

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In a tube containing citrate medium a small amount of bacteria was inoculated. or streaked into "Simmons citrate tube".
It was incubated at 30-37ºC for 24-48 hours.
A positive test result is growth in citrate medium or growth in Simmon's citrate tube with a blue color change. Negative test result: no growth in citrate medium and no color change in Simmon's citrate tube (still green).

2) Urease test:

This urease enzyme activity assay is critical for distinguishing enterobacteria. Proteus strains are strong urease producers. Salmonella and Shigella do not produce urease (Figure 12).

1. A piece of a well-isolated colony or 1 to 2 drops from an overnight brain-heart infusion broth culture were streaked on the surface of a urea agar slant.
2. The cap was left loose, and the tube was incubated for 48 hours to 7 days at 35°-37°C in ambient air.
3. For up to 7 days, the tubes were checked for the development of pink color.

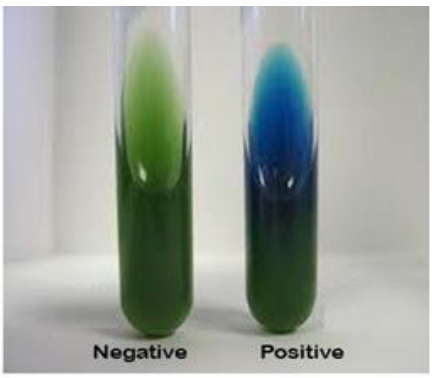

***Figure XI**: Citrate utilization test.*

***Figure XII**: Urease test.*

3) Catalase test:

This test distinguishes bacteria that produce the enzyme catalase, such as staphylococci, from bacteria that do not produce catalase, such as streptococci. (Figure 13).

Using a loop or sterile wooden stick, a little amount of bacterial colony was applied on the surface of a clean, dry glass slide.
A drop of 3% H2O2 was dropped onto the slide and stirred together.
The quick development of oxygen (within 5-10 seconds) as demonstrated by bubbling validated a positive outcome.
When no bubbles or only a few scattered bubbles were observed (no catalase enzyme to hydrolyze the hydrogen peroxide), a negative result was verified.

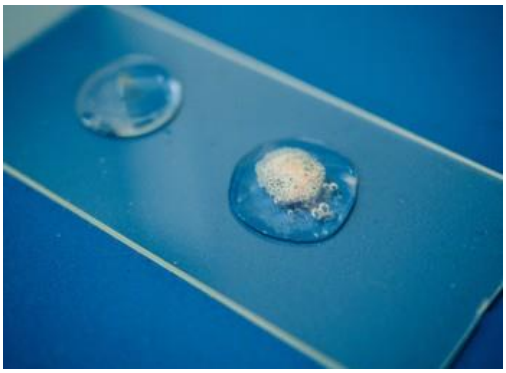

Figure XIII: Catalase test.

4) Indole test:

This test is for indole production and is used in identification of enterobacteria that breaks down amino acid tryptophan and releases indole. Sulphide indole motility (SIM) medium is used for determination of three parameters: sulfur production, indole production and motility (Figure 14).
Inoculate tryptophan broth with broth culture or emulsify a test organism isolated colony in tryptophan broth.
The culture was cultured in ambient air for 24-28 hours at 37°C.
The broth culture was given 0.5 mL of Kovac's reagent.
Positive reaction was indicated by a pink colored ring, Negative reaction showed no color changes.

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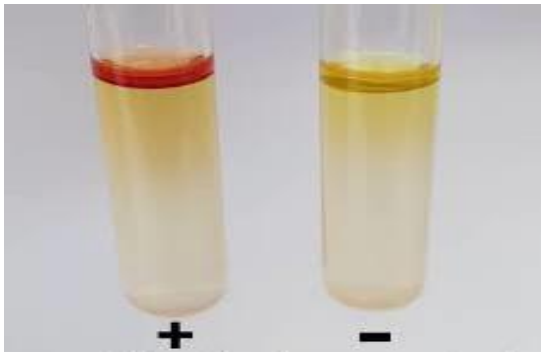

Figure XIX: Indol test.

5) Oxidase test:

This test is used to help identify Pseudomonas and Neisseria species, both of which generate the cytochrome oxidase enzyme (Figure 15).

A filter paper soaked with the substrate tetramethyl-p-phenylenediamine dihydrochloride was moistened with a sterile distilled water.

The colony to be examined was smeared on the filter paper using a wooden or platinum loop.

Within 10-30 seconds, the infected region of paper was inspected for a color change to deep blue or purple.

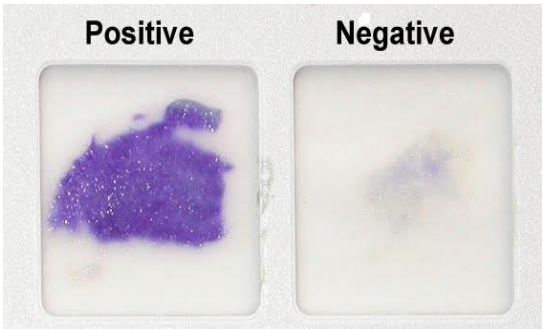

Figure XV: Oxidase test.

6) ***Coagulase test:***

This test is used to identify *S. aureus*, a bacteria that generates the coagulase enzyme. (Cheesbrough, 2005). (Figure 16).

1. Prepare a 1-in-6 dilution of lyophilized rabbit coagulase plasma in saline (0.85 percent NaCl), and deposit 1 ml quantities of the diluted plasma in tiny tubes.
2. A milky suspension was made by emulsifying several isolated colonies of the test organism in 1 ml of diluted rabbit plasma.
3. For 4 hours, the tube was held at 35°C in the air or in a water bath.
4. The tube was tilted to 90° at 1, 2, and 4 hours to check for clot development. (It's possible that clots will liquefy after they've formed.)
5. Negative tubes were re-examined after being maintained at room temperature overnight. Some strains of *S. aureus*, particularly *MRSA*, require this step because they develop a delayed clot that is rapidly dissolved at 37°C by the organism's staphylokinase.

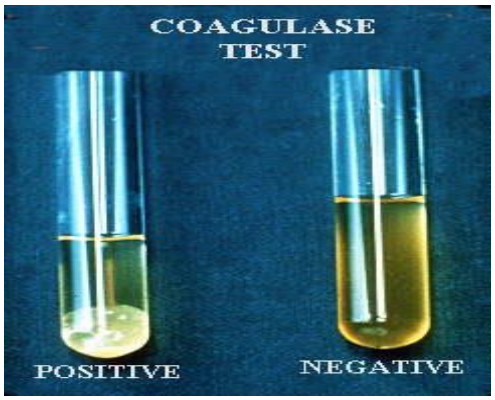

Figure XVI: Coagulase test.

7) DNAse test:

It's utilized to tell the difference between *S. aureus*, which makes the enzyme DNAse, and other Staphylococci, which don't. (Figure 17).

Several colonies from an 18-24 hour culture were chosen and inoculated on the surface of DNase agar plate using a sterile loop.

The plate was incubated at 35-37°C for 24 hours.

The surface of agar was flooded with 1N HCL solution and the excess acid was tipped off.

The reagent was allowed to absorb into the plate and the clear zone around the colonies was observed within 5 minutes.

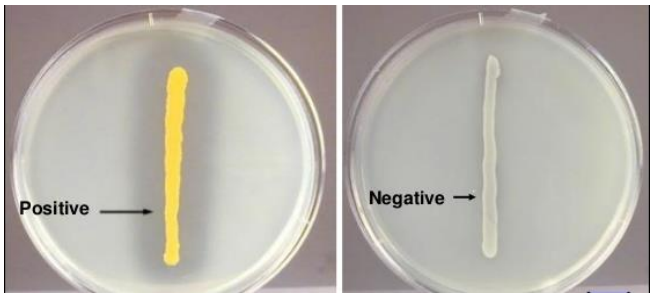

Figure XVII: DNAse test.

8) Triple sugar iron (TSI) Test:

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This is a microbiological test used to determine a microorganism's capacity to ferment carbohydrates and create hydrogen sulfide. (Figure 18).
A well isolated colony was picked with a sterile straight wire.
The TSI slant was infected by stabbing through the medium's center to the tube's bottom, and then streaking the slant's surface.
The cap was left loose, and the tube was incubated for 18 to 24 hours at 35°C in ambient air.
Lactose and sucrose non fermenter bacteria were identified by their red surfaces and bottoms. Only glucose fermentation was revealed by the red surface and yellow bottom. Glucose, lactose, and/or sucrose fermenters have yellow surfaces and bottoms. H2S generation was indicated by a dark precipitate in the butt. The creation of CO2 or H2 by the glucose and sucrose, glucose and lactose, or glucose, sucrose, and lactose fermenter was shown by bubbles or cracks in the tube.

Figure XVIII*:* TSI test.

9) Antimicrobial sensitivity:

All isolates were tested for antimicrobial susceptibility using the Kirby-Bauer disk diffusion method (Msaki *et al*., 2012) with commercial disks (Oxoid). A loopful of bacteria from a colony was removed and transferred to a tube containing 5mL of normal saline, where it was gently stirred until it produced a homogeneous solution. A sterile cotton swab was dipped into the suspension, then gently rotated against the tube's surface to remove the excess. The swab was then used to equally disperse the germs around the Mueller-Hinton agar surface (Oxoid). The inoculated plates were allowed to dry for 3–5 minutes at room temperature. The following antibiotic concentration was obtained using sterile forceps. Ampicillin (10µg), Amoxicillin clavulanic acid (30µg), Ciprofloxacin (5µg), Gentamicin (10µg), Ceftriaxone (30µg), Nalidixic acid (30µg), Nitrofurantoin (300µg), Cefoxitin (1µg), Trimethoprim-sulfamethoxazole (25µg) and Ceftazidime (30µg) were placed on the surface of Mueller-Hinton agar (Oxoid).

10) Statistical analysis:

The Statistical Package for Social Sciences SPSS software was used to tabulate and analyze the data. The information was presented as a frequency chart. Findings on the comparison of positive UTI cases according to individual characteristics were one way Anova was applied. The tests were carried out using a 95% confidence level, and statistical significance was defined as P 0.05.

IV. RESULTS:

This cross-sectional study was done on a group of 299 infants and children in the age group between 15 days to 5 years old in departments of Pediatrics hospital of Benghazi city, from January 2020 to December 2020. Nineteen urine samples were removed from the analysis because they were collected from children who were taking antibiotics at the time of the test.

A. Socio-demographic data:

1) Gender:

Among 280 children investigated, 103 (63.2%) were males and 177 (36.8%) were females as shown in table 1 & figure 19.

TABLE (I): Distribution of gender included in the study:

Gender	Number	Percentage %
Male	103	36.8%
Female	177	63.2%

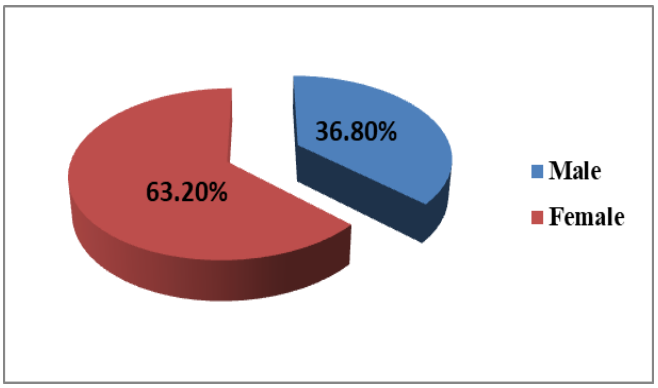

Figure XIX: Distribution of gender included in the study.

2) Age group:

The study subjects aged 15 days to 5 years were divided into 3 age groups as shown in table 2 & figure 20 .

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TABLE (II): Distribution of children into age groups:

Age	Number	Percentage %
<1 year	32	11.43
1-3 years	143	51.07
3-5 years	105	37.5

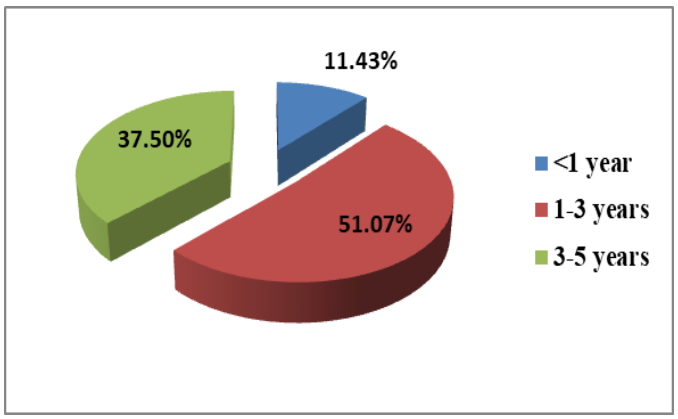

Figure XX: Distribution of children into age groups.

3) Dipstick results:

The dipstick approach revealed that 90 (32.14 percent) of urine samples were positive for leukocytes, nitrites, or both after lab tests. As indicated in table 3 and figure 21, 7 samples were positive for both leukocytes and nitrites, 25 samples were positive for leukocytes only, and 8 samples were positive for nitrites only.

TABLE (III): Dipstick test results for nitrate and leukocytes:

Positive	No of samples	Percentage %
Both nitrite and leukocytes	25	27.8%
Leukocytes	29	32.2%
Nitrites	36	40%

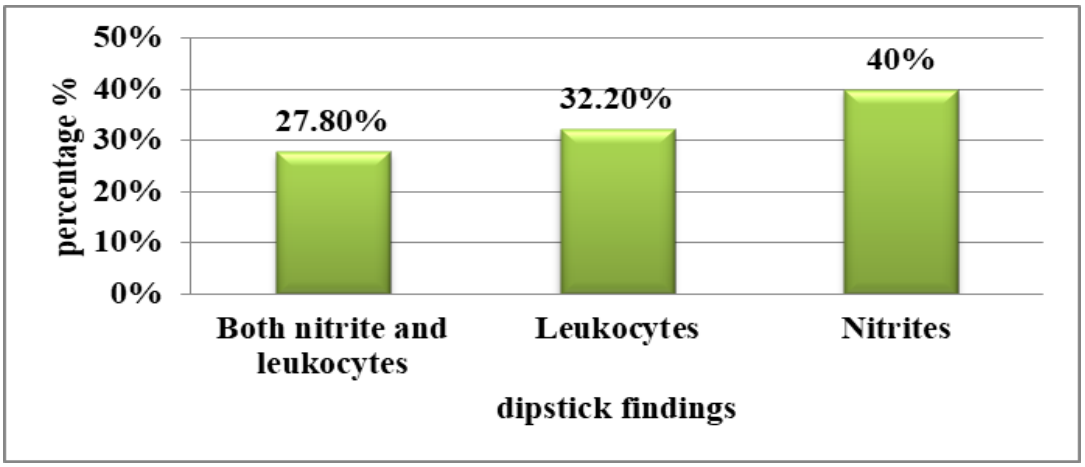

Figure (XXI): *Dipstick test results for nitrate and leukocytes*

4) Microscopy and culture results:

Microscopic examination for WBCs, gram staining and bacterial culture of the 90 samples that were positive to dipstick test, found that 22 (24.4%) cases had no growth upon culture, 28 (31.2%) cases had insignificant growth (less than 100,000 cfu/ml), and, 40 (44.4%) cases had significant growth (more than 100,000 cfu/ml) as is demonstrated table 4 & figure 22.

TABLE (IV): Microscopy and culture results:

Growth pattern	Number	Percentage %

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No growth	22	24.4%
Insignificant growth (< 100,000 cfu/ml)	28	31.2%
Significant growth (> 100,000 cfu/ml)	40	44.4

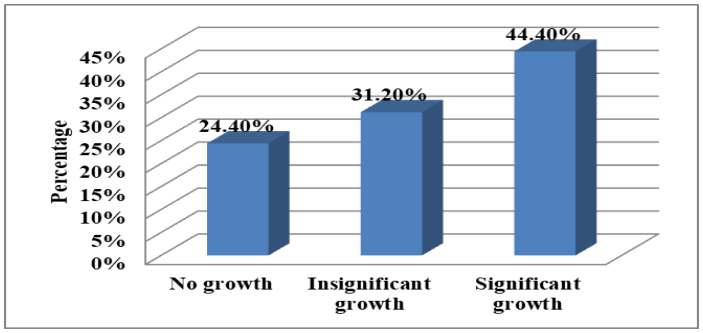

Figure XXII: Microscopy and culture results.

B. Prevalence:

Significant bacteriuria was observed in 40 of 280 (15.3%) urine samples cultured. Gram-positive bacteria accounted for ten percent (25 percent), while Gram-negative bacteria accounted for thirty percent (75 percent). There were 9 (30%) males and 31 (70%) females among the total positives (P=0.03), and the difference in prevalence between males and females was statistically significant. 18 (45%) children with significant bacteriuria were between 1 and 2.5 years, 12 (30%) were between 2.5 and 5 years, and only 10 (25%) were from 15 days to 1 year with no significant difference based on one way anova test (P=0.08) as shown in table 5.

TABLE (V): Prevalence according to demographic data:

Category	Positive results	Percentage	P- value
Gender			
Male	9	30%	0.03
Female	31	70%	
Age groups			
<1 years	10	25%	0.08
1-2.5 years	18	45%	
2.5-5 years	12	30%	

1) Bacterial Etiologies:

There were a total of 40 uropathogens found. Gram-positive bacteria accounted for ten percent of the total, whereas Gram-negative bacteria accounted for thirty percent. The most common uropathogen identified was *E. coli* 15 (50%), which was followed by Pseudomonas spp. 9 (30%) and Klebsiella spp. 5 (16.7%), with Enterobacter spp. 1 being the least common (3.3 percent). Streptococcus 5 (50 percent) was the most often identified Gram-positive bacteria, followed by *S. aureus* 3 (30 percent), and Enterococcus spp.2 (20 percent), as indicated in Figures 23 and 24.

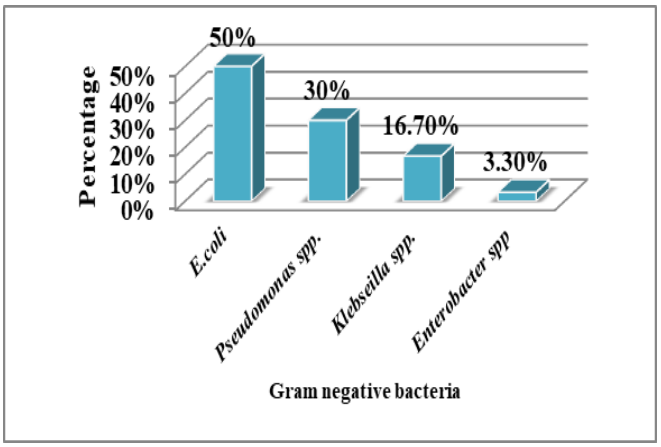

Figure (XXIII): Distribution of gram negative bacteria.

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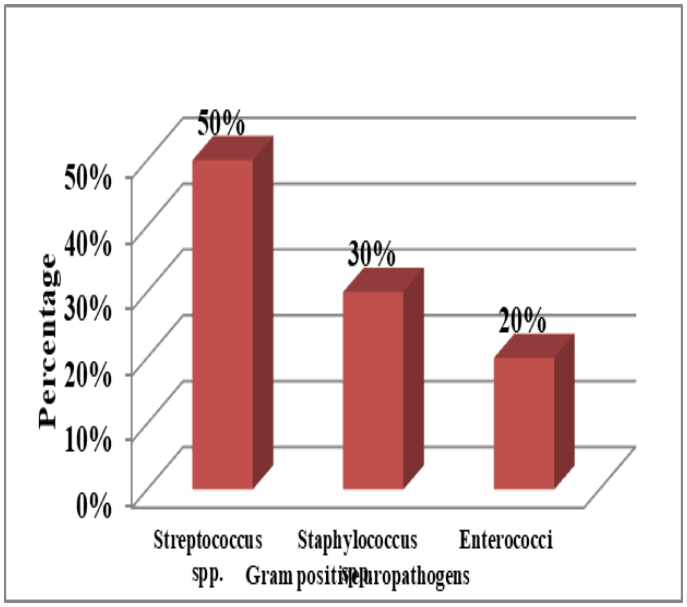

Figure (XXIV): Distribution of positive bacteria.

high level of resistance (60 percent). As demonstrated in table 6 and figure 25, *E. coli*, the most often isolated bacteria, was extremely resistant to Ampicillin (100 percent).

2) Antimicrobial Susceptibility Testing:

All urine culture positive samples were subjected to an antimicrobial susceptibility test. Gram-negative bacteria were tested against 10 antibiotics through disk diffusion, while Gram-positive bacteria were tested against 7 antibiotics.

Overall, Ciprofloxacin (66.7 percent), Norfloxacin (66.7 percent), and Ceftriaxone (56.6 percent) had a high percentage of sensitivity for Gram-negative bacteria, whereas Ampicillin (80 percent), Nitrofurantoin (66.7 percent), Ceftazidime (66.7 percent), and Amoxicillin/clavulanate (66.7 percent) had a

Table (VI): Antimicrobial Susceptibility Pattern Of Gram-Negative Bacteria:

Antibiotic	*E.coli* (15 isolates)		*Pseudomonas spp.* (9 isolates)		*Klebsiella spp.* 5 isolates		*Enterobacter spp* 1 isolate		Total	
	S	R	S	R	S	R	S	R	S	R
AMP	0	15 (100%)	6 (66.7%)	3 (33.3%)	0	5 (100%)	0	1 (100%)	6 20%	24 80%
CIP	10 (66.7%)	5 (33.3%)	7 (77.7%)	2 (22.3%)	3 (60%)	2 (40%)	0	1 (100%)	20 66.7%	10 33.3%
CRO	8 (53.3%)	7 (46.7%)	5 (55.6%)	4 (44.4%)	4 (80%)	1 (20%)	0	1 (100%)	17 56.7%	13 34.3%
AMC	6 (40%)	9 (60%)	5 (55.6%)	4 (44.4%)	0	5 (100%)	1 (100%)	0	12 40%	18 60%

CN	7 (46.7%)	8 (53.3%)	7 (77.7%)	2 (22.3%)	1 (20%)	4 (80%)	1 (100%)	0	16 53.3%	14 46.7%
F	4 (26.7%)	11 (73.3%)	5 (55.6%)	4 (44.4%)	1 (20%)	4 (80%)	0	1 (100%)	10 33.3%	20 66.7%
SXT	7 (46.7%)	8 (53.3%)	2 (22.3%)	7 (77.7%)	2 (40%)	3 (60%)	0	1 (100%)	11 36.7%	19 63.3%
NOR	11 (73.3%)	4 (26.7%)	6 (66.7%)	3 (33.3%)	3 (60%)	2 (40%)	0	1(100%)	20 66.7%	10 33.3%
NA	7 (46.7%)	8 (53.3%)	-	-	5 (100%)	0	0	1 (100%)	12 57.2%	9 42.8%
CAZ	-	-	3 (33.3%)	6 (66.7%)	-	-	-	-	3 33.3%	6 66.7%

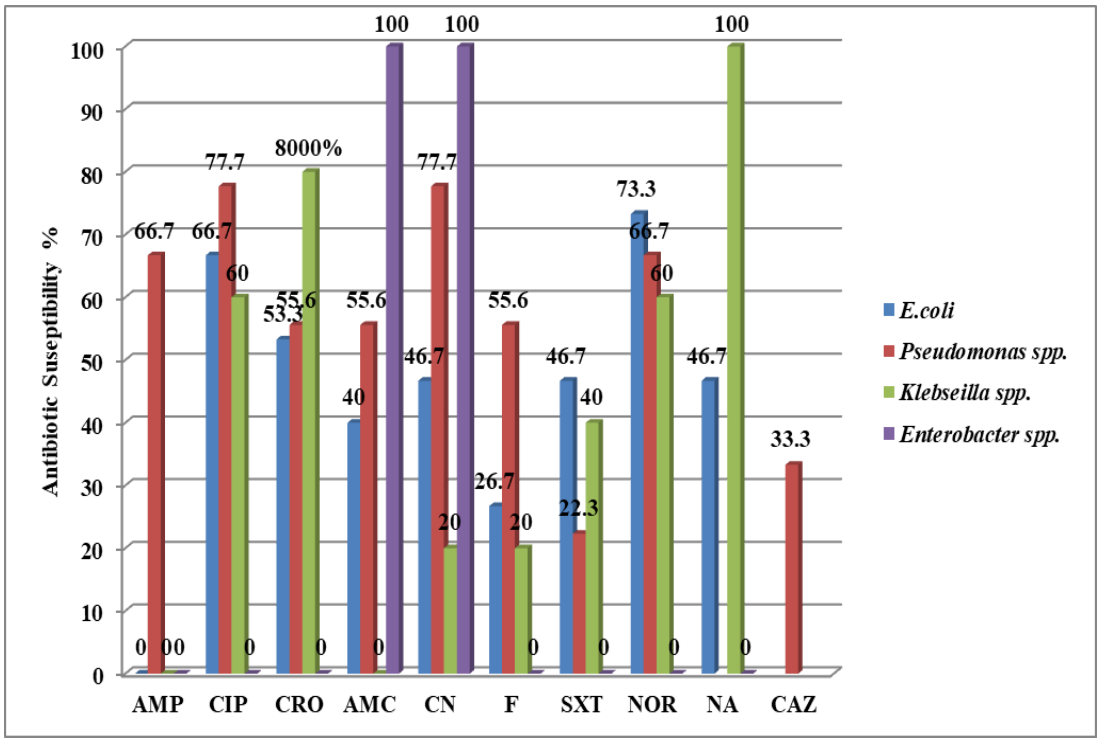

Figure (XXV): Antimicrobial Susceptibility Pattern Of Gram-negative Bacteria.

Ciprofloxacin (100 percent), Oxacillin (60 percent), and Erythromycin had comparatively high percentages of sensitivity for Gram-positive bacterial isolates (70 percent). Ampicillin (80%), Pencillin G (70%), Cotrimoxazole (70%), and Nitrofurantoin (70%) all have high levels of resistance (60 percent). Table 7 and figure 26 reveal that all isolates tested positive for various antibiotic resistances**.**

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TABLE (VII): Antimicrobial Susceptibility Pattern Of Gram-positive Bacteria:

Antibiotics	*Staphylococcus spp.* *3 isolates*		*Streptococcus spp.* *5 isolates*		*Enterococcus spp.* *2 isolates*		Total	
Pattern	**S**	**R**	**S**	**R**	**S**	**R**	**S**	**R**
AMP	0	3 (100%)	1 (20%)	4 (80%)	1 (50%)	1 (50%)	2 20%	8
OX	2 (66.7%)	1 (33.3%)	4 (80%)	1 (20%)	-	-	6	2
F	2 (66.7%)	1 (33.3%)	2 (40%)	3 (60%)	0	2 (100%)	4	6
P	0	3 (100%)	5 (100%)	0	2 (100%)	0	3	7
SXT	0	3 (100%)	5(100%)	0	2 (100%)	0	3	7
CIP	3 (100%)	0	3 (60%)	0	-	-	6	
E	2 (66.7%)	1 (33.3%)	4 (80%)	1 (20%)	1 (50%)	1 (50%)	7	3

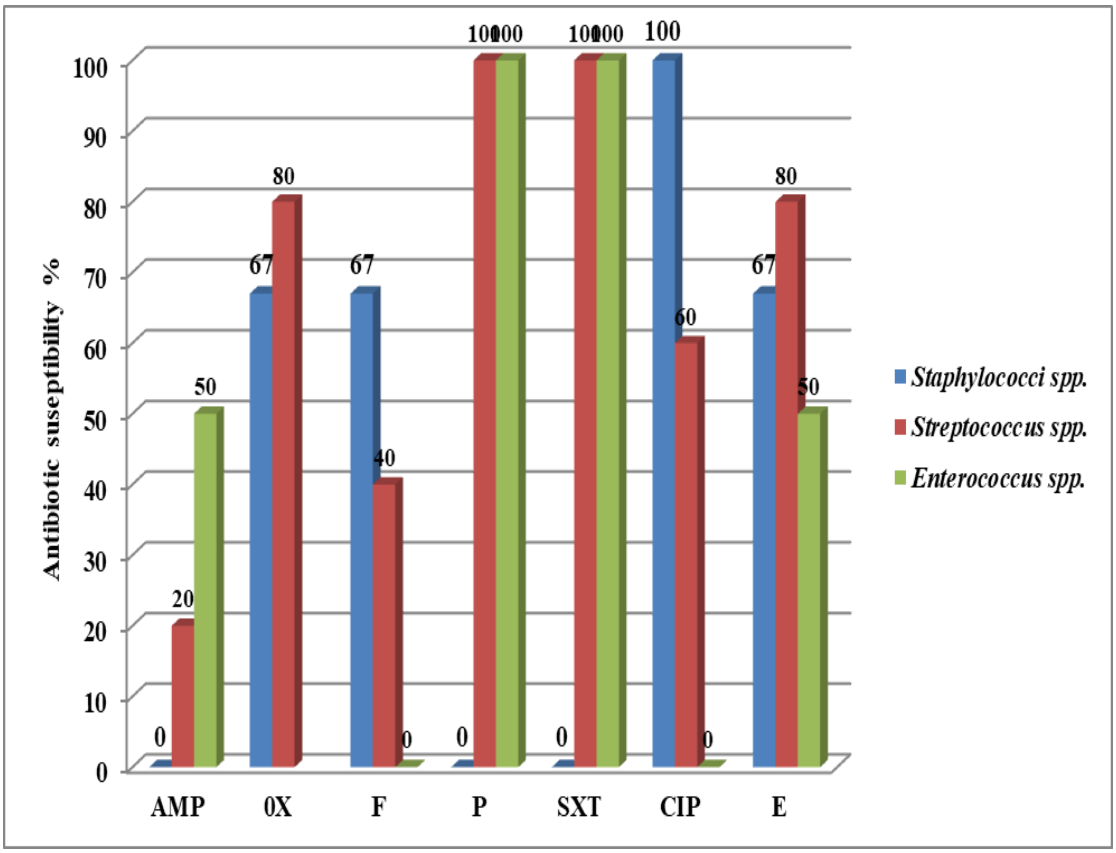

Figure (XXVI): Antimicrobial Susceptibility Pattern Of Gram-positive Bacteria

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V. DISCUSSION:

A. Prevalence of UTI:

The overall prevalence of UTI in children was 15.3 percent, according to the current study. Our findings were remarkably identical to those of a Tanzanian study (20.3%) (Msaki *et al*., 2012), Nigeria 20.5% (Mava *et al*., 2012), Gondar 17.5%, (Yismaw *et al*., 2012) and Ethiopia 15.8% (Belete *et al*., 2019). A lower prevalence was reported from Egypt 7% (Amin *et al*., 2019), Turkey 7.1% (Zincir *et al*., 2012), Nigeria 9% (Musa *et al*., 2013) and India 10.9% (Akram *et al*., 2007). The difference could be attributed to sample size, personal hygiene habits, and literacy level.

In contrary, a higher prevalence was reported in Spain 32.9% (González *et al*., 2019), China 36.5% (Song *et al*., 2012), Nepal 45.5% (Singh *et al*., 2013) and Cameroon 58.3% (Akoachere *et al*., 2012). This disparity could be attributed to differences in study subjects' ages, sample sizes, and the presence of problems.

B. UTI and demographic variables:

The frequency of UTI and gender had a significant difference (p=0.03) in our study. According to the department of urology/university of Wisconsin education module number 7 of Pediatric Urinary Tract Infection, the risk of UTI was 8% for girls and 2% for boys throughout childhood (Heffner and Gorelick, 2008). Because of the shorter female urethra, the prevalence of UTI was greater in females than in males.(Zincir *et al*.,2012) 's study found comparable results, with girls having a higher prevalence than boys.

The incidence of UTI is bimodal, rising throughout childhood and then declining during adolescence (Heffner and Gorelick, 2008).

C. Uropathogens in this study:

Gram-negative bacteria were isolated at a rate of 75% in the current investigation, which is comparable to previous studies in Madagascar (Rasamiravaka *et al*., 2015) and Kenya (Okwara *et al*., 2004), Egypt (Amin *et al*., 2019), and Nigeria (Musa *et al*., 2013), but lower than in reports from India, 92% (Akram *et al*., 2007) and South Africa 87.5% (Jeena *et al*., 1996).

Almost all previous studies conducted over around the world for UTI revealed that, the most uropathogens were Gram-negative bacteria. The frequency with which uropathogens are isolated varies by geographical location. Gram positive bacteria accounted for 25% of the total isolates. Among the gram negative bacterial isolates, *E. coli* (50%) was the most frequently isolated uropathogen in our study. Our findings are consistent with those of other Iranian investigations (Navidinia *et al*., 2012), Germany (Pape *et al*., 2004) Tanzania (Msaki *et al*., 2012), Egypt (Amin *et al*., 2019) and Nigeria (Musa *et al*., 2013). In contrast a study conducted in China demonstrated *Enterococcus* spp. to be the dominant pathogen isolated (Song *et al*., 2012), while in Nairobi the most dominant isolates were *S. aureus* (Adeleke and Asani 2009). *E. coli* is the most commonly isolated uropathogen because it is the most prevalent cause of UTI in children, accounting for 75–90% of UTIs. Its relative frequency, however, varies by region (Esbjörner *et al*., 1997). *E. coli* is the most frequent flora of the gastrointestinal system and intestine, from which it ascends to the urine tract, and it possesses well-known virulence characteristics that enable it to colonize urinary tracts. Pseudomonas spp. was the second most common gram negative bacterial isolate in our study (30%), followed by Klebsiella spp. (16.7%), while Enterobacter spp. was the least common (3.3 percent).

In comparison, *Klebsiella* spp was reported to be the second leading uropathogen in Iran (Navidinia *et al*., 2012), as well as Germany (Pape *et al*., 2004). Bacterial etiologies range throughout geographical regions and even within a population over time.

D. Antibiotic sensitivity:

Overall, the percentage sensitivity of Gram-negative bacteria was high for Ciprofloxacin (66.7%), Norfloxacin (66.7%) and Ceftriaxone (56.6%) among the selected antibiotics. Ciprofloxacin is a widely used fluoroquinolone with significant bacterial activity against uropathogens and a well-established therapeutic efficacy in the treatment of urinary tract infections, according to most studies (Blondeau, 2004).

High level of resistance of Gram-negative bacteria was observed for Ampicillin (80%), Nitrofurantoin (66.7%), Ceftazidime (66.7%), and Amoxicillin/clavulanate (60%). In the current investigation, *E. coli*, the most commonly identified bacteria, was completely resistant to Ampicillin (100 percent). This is in line with the findings of an Indian study (Akram *et al*., 2007), which found a significant level of Ampicillin resistance. In investigations conducted in Jimma, Ethipoia, seventy-five percent (75%) of Gram-negative isolates were sensitive to Nitrofurantoin (Tesfahunegn *et al*., 2009). In different places, the availability and use of certain medications may differ.

The most often isolated bacterium, *E. coli*, was completely resistant to both Ampicillin and Nitrofurantoin (78.6 percent). Similar findings were seen in India (Akram *et al*., 2007), when Nitrofurantoin resistance was found (80 percent). Nitrofurantoin, on the other hand, had the highest activity against *E.coli* in an Iranian investigation (Mortazavi and Shahin, 2009). It's possible that Gram-negative bacteria's strong resistance to ampicillin is attributable to its widespread availability, frequent prescription, and inexpensive cost.

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Ciprofloxacin (100 percent), Oxacillin (60 percent), and Erythromycin had comparatively high percentages of sensitivity for Gram-positive bacterial isolates (70 percent). Ampicillin (80%), Pencillin G (70%), Cotrimoxazole (70%), and Nitrofurantoin (70%) all have high levels of resistance (60 percent). All of the isolates tested positive for several antibiotic resistances. Ampicillin, Penicillin, and Cotrimoxazole resistance was found in the majority of Staphylococcus spp. identified.

VI. CONCLUSIONS :

This cross-sectional study was done on a group of 299 infants and children (103 male, 177 females) in the age group from 15 days to 5 years old in departments of Pediatrics hospital in the period of Januaray 2020 to December 2020. Because these children were taking antibiotics at the time of testing, 19 urine samples were removed from the study calculations. UTI was found to be 15.3% of the time in children.

Out of the total positives, 9 (30%) were males and 31 (70%) were females with a statistically significant difference (p=0.03) between the frequency of UTI and gender.

There were no significant differences in the frequency of UTI among children of different ages (P= 0.08).

Gram-negative bacteria were isolated at a rate of 75%, while gram positive bacteria were isolated at a rate of 25%.

E. coli was the most often isolated uropathogen in our study (50 percent).

The second leading gram negative bacteria was Pseudomonas spp. (30%), followed by Klebsiella spp. (16.7%), and the least frequent was Enterobacter spp. (3.3%).

The most common bacterium among Gram positives was Streptococcus spp. (50%), followed by Staphylococcus spp. (30%), and Enterococcus spp. (20%).

Overall, the percentage sensitivity of Gram-negative bacteria was high for Ciprofloxacin (66.7%), Norfloxacin (66.7%) and Ceftriaxone (56.6%) among the selected antibiotics.

High level of resistance of Gram-negative bacteria was observed for Ampicillin (80%), Nitrofurantoin (66.7%), Ceftazidime (66.7%), and Amoxicillin/clavulanate (60%).

E. coli, was highly resistant to Ampicillin (100%), and Nitrofurantoin (78.6%).

Overall, the percentage sensitivity of Gram-positive bacteria was relatively high for Ciprofloxacin (100%), Oxacillin (60%) and Erythromycin (70%), and overall resistance was high for Ampicillin (80%), Pencillin G (70%), Cotrimoxazole (70%), and Nitrofurantoin (60%). All of the isolates tested positive for multiple antibiotic resistance. Ampicillin, Penicillin, and Cotrimoxazole resistance was found in the majority of the Staphylococcus spp. identified.

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