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Bacterial Patterns and Antibiotic Sensitivity of Urinary Tract Infection at Sanjiwani Gianyar Hospital

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Abstract

Background. Urinary tract infection (UTI) is the most common infectious diseases in hospital. *Eschericia coli*, the Gram-negatives bacteria and Gram-positives bacteria are the causative agents. We performed the urinary culture and antibiotic sensitivity tests to identify the causative agents and providing the promt antibiotics therapy in UTI.

Material and Methods. This is a cross-sectional study that consisted of the UTI who underwent culture and antibiotic sensitivity test that fullfilled the inclusion and exclusion criteria in the period of January to June 2022 at Sanjiwani Gianyar Hospital.

Results. We collected 39 samples, the mean age was 60.92 years, 76.9% male, and 97.4% had any of comorbidities. Based on urinary culture, this study obtained Gram-negative bacteria 76.9% dominated by *Escherichia coli* 33.3% followed by Gram-positives bacteria 10.3% which is dominated by *Enterococcus spp*. We also found fungi, 12.8% which dominated by *Candida albicans.* The antibiotics that have high sensitivity to Gram-negative bacteria were meropenem, amikacin, tigesiklin, piperazilin tazobactam and nitrofurantoin. Meanwhile, ampicillin sulbactam, fluoroquinolones, doxycycline, tigecycline, vancomycin, and linezolid have good sensitivity for Gram-positive bacteria and all anti fungals agent still high sensitivitve to candida. This study also identified multi-drug resistant (MDR) bacteria in 35.9%. Prudent antibiotics used, based on bacterial patterns and antibiotic sensitivity because the increasing of MDR cases.

Conclusions. Bacterial pattern of UTIs is dominated by E. Coli, and high sensitive to meropenem, amikacin, tigecycline, piperazine tazobactam and nitrofurantoin.

Keywords: Antibiotic sensitivity, urinary tract infection, urine culture

Introduction

A Urinary tract infection (UTI) is an infection that is caused by uropathogenic bacteria in the urinary tracts and can occur in the community or in hospitals [1, 2]. Uropathogenic bacteria, Escherichia coli (E. coli), are the main Gram-negative causative bacteria [3]. This bacteria was obtained from the study of Kalsoom et al., who identified E. coli as the uropathogenic isolate of bacteria in urinary specimens of UTI rather than Klebsiella pneumoniae, Enterobacter cloacae, or Staphylococcus [4]. In a study conducted in Ethiopia in 2021, Addis et al. discovered that the main uropathogenic bacteria were Gram-negative bacteria, E. coli.[5] Culture and antibiotic sensitivity testing of urinary specimens in patients suspected of UTI infection is a definitive test to determine the causative bacteria and the promt effective antibiotic treatment. The preanalytic process includes aseptic specimen collection, rapid delivery (less than 2 hours) or stored in 4-8 degree Celcius (if suspected more than 2 hours delivery) and the specimens is taken before antibiotic treatment to provide the true cause of UTI [6]. This procedure is supported by a study that concluded that concurrent urine culture with empirical antibiotic therapy was the most cost-effective strategy in the management of patients with UTI [7]. The growing number of multidrug resistant bacteria in hospitals, particularly in UTI patients, justifies performing urinary culture and antibiotic sensitivity testing to determine a definitive therapy.

Urinary tract infection is one of the top 10 most infectious cases at the Sanjiwani Gianyar Hospital, where urine culture testing is the standard for enforcing UTI cases. After blood culture, the most common culture examination is urinary culture. There has been no research conducted on antibiograms for UTI cases, and the bacterial patterns are very important as a reference in treating further empirical therapy in our hospital. Thus, we conducted this study to describe the bacterial pattern and the pattern of antibiotic sensitivity in UTI patients at the Sanjiwani Gianyar Hospital.

Material And Methods

This study is a cross-sectional descriptive study that was conducted in the Clinical Microbiology Laboratory at Sanjiwani Gianyar Hospital for three months (September to December 2022). From January to June 2022, baseline data were obtained from electronic medical records, as well as the results of urine culture examinations of patients with suspected UTI and antibiotic sensitivity tests performed on the Vitek 2 compact machine. The antibiotic sensitivity was determined using the Clinical Laboratory Standard Institute (CLSI) 2022 standard, which was carried out using a combination method, namely the Kirby Bauer diffusion method, for the antibiotics cefoferazon sulbactam, levofloxacin, fosfomycin, and cefuroxime. Meanwhile, other antibiotic sensitivity tests were carried out automatically by the dilution method using a Vitek 2 compact machine. Sampling is carried out consecutively on samples that meet the inclusion and exclusion criteria. The inclusion criteria were adults with suspected UTI who underwent urine culture examination at the Sanjiwani Gianyar Hospital between January and June 2022, with bacterial identification having a probability level of 90% and antibiotic sensitivity test results being consistent (AES, Advanced Expert System: consysten).The exclusion criteria were that urine culture results did not show the growth of bacteria or showed the growth of three or more types of bacteria (regional normal flora), and the results of antibiotic sensitivity tests could not be displayed by Vitek 2 compact (TRM/terminated) [8]. Data analysis was performed by univariate analysis using SPSS 23 for Windows. This study has been approved by the ethical commission in our hospital with the following number: 57/PEPK/VII/2022

Results

This study collected 39 samples that fulfilled the eligibility criteria. Samples were obtained from patients with suspected UTI, which consist of 76.9% males, and 38 people (97.4%) had any comorbidities, of which 65.8% had multiple comorbidities as described in the following table. The mean age was 60.92±12,56 years and 64.1% of the subjects were elderly (more than 60 years). Some of the subjects have multiple comorbidities, as shown in the table 1.

Table 1 : Baseline characteristics of UTI

Characteristics	Persentage (N=39)
Ages	
• Mean	60,92 ± 12.558 tahun
• Adult (18-59 years)	35,9 (14)
• Elderly (>59 years)	64,1 (25)
Sex	
• Male	76,9 (30)

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• Female	23,1 (9)
Comorbidities	
• None	2,6 (1)
• Comorbidities	97,4 (38)
○ Multiple comorbidities (>1)	65,8 (25)
○ Single comorbidity	34,2 (13)
Type of comorbidities	
▪ Kidney diseases	82,1 (32)
▪ Diabetes Mellitus	20,5 (8)
▪ Cardiac diseases	20,5 (8)
▪ Lung diseases	17,9 (7)
▪ Malignancies	7,7 (3)
▪ Urinary stones	23,1 (9)
▪ Others (BPH, Stroke, Trauma)	12,8 (5)

N= total amount of UTI specimen

Microorganisms that were identified from urinary specimens included gram positive bacteria, gram negative bacteria, and fungi. 1. Gram negative bacteria were found in 76.9% (30 isolates), which were dominated by Enterobacteriales sp. (66.7%, 20 isolates) 2. Fungi were found in 12.8% (5 isolates), with Candida albicans accounting for 80.0% (4 isolates) of the total. 3. In third place were Gram-positive bacteria in 10.3% (4) of isolates, which were dominated by Enterococcus (75.0%) (3). The most isolated bacteria in urine cultures from patients with urinary tract infections were Escherichia coli, Pseudomonas spp., and Candida albicans, at 10.3% (4), 7.7% (3), and 33.3% (13) respectively (table 2).

Table 2 : Patterns of Microorganism of UTI

Species of microorganism	Persentage (N=39)
• *E.coli*	33,3 (13)
• *Pseudomonas spp*	10,3 (4)
• *C.albicans*	10,3 (4)
• *Burkholderia cepacia*	7,7 (3)
• *Enterococcus faecalis*	7,7 (3)
• *Acinetobacter spp*	7,7 (3)
• *Enterobacter cloacae complex*	5,1 (2)
• *K.pneumoniae*	2,6 (1)
• *Staphylococcus aureus*	2,6 (1)
• *Proteus mirabilis*	2,6 (1)
• *Salmonella.spp*	2,6 (1)
	2,6 (1)

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• *Pantoea sp* • *Achromobacter denitrificans* • *C.tropicalis*	2,6 (1) 2,6 (1)

In this study, multidrug-resistant bacteria (MDRO) were found in 35.9% of the isolates. These bacteria produced extended-spectrum beta-lactamases (ESBL), especially E. coli and K. pneumoniae. Other multidrug-resistant (MDR) bacteria such as Pseudomonas, Acinetobacter, Burkholderia, and Enterobacter.

The pattern of antibiotic and antifungal sensitivity of microorganisms in this study refers to the 2022 Clinical Laboratory Standard Institute (CLSI) standard. Antimicrobials have high sensitivity if the sensitivity is greater than 75–80%. The antibiotic sensitivity test to Gram-positive bacteria, namely S. aureus, showed that almost all groups of antibiotics, ranging from penicillin, macrolide, tetracycline, trimethoprim-sulfamethoxazole, fluoroquinolones, cephalosporins, nitrofurantoin, vancomycin, and linezolid, were highly sensitive. Likewise, Enterococcus faecalis has good sensitivity to penicillin, nitrofurantoin, tetracycline, vancomycin, and linezolid antibiotics, while the sensitivity to fluoroquinolone antibiotics is quite good, while cephalosporins are intrinsically resistant. The Gram-negative bacteria are still highly sensitive to the restricted antibiotics such as meropenem, amikacin, tigecycline, piperazilin, tazobactam, and nitrofurantoin; likewise, fosfomycin is still highly sensitive, especially for Gram-negative bacteria in the enterobacteriales group. Other antibiotics with sensitivity greater than 60% included gentamicin, cepoferazone sulbactam, ceftazidime, and cepefime. There was a decrease sensitivity of E. coli and K. pneumoniae (< 50%) to the third-generation cephalosporin and fluoroquinolones. Antibiotics that have relatively strong antipseudomonal properties also have high sensitivity, including amikacin, ceftazidime, cepefim, fluoroquinolones, piperazilin, tazobactam, and meropenem. Meanwhile, cefoferazon sulbactam, ceftriaxone, cefepime, piperacillin tazobactam, and meropenem were highly sensitive to Acinetobacter spp. Fungi, both Candida albicans and Candida non-Albicans, were also highly sensitive to all antifungals such as fluconazole, voriconazole, micafungin, and amphotericin B, as presented in the following table 3.

Table 3 : Sensitivity patterns of antimicrobial agents on urinary specimens of UTI cases

MICROORAGNISMS	ANTIMIKROBIAL SENSITIVITY PATTERNS (% S)																	
	Amicasin	Ampicilin	Ampicilin Sulbactam	Amoxicillin	Amoxicilin Clavulanat	Azitromycin	Aztreonam	Benzyl Penicilin	Cefazolin	Cefuroxim	Cefotaxime	Ceftriaxon	Ceftazidim	Cefoferazon Sulbactam	Cefepim	Ciprofloxacin	Clindamycin	Doxicyclin
Staphylococcus aureus	-	-	100,0 (1)	0 (1)	-	100,0 (1)	-	0 (1)	100,0 (1)	100,0 (1)	100,0 (1)	-	-	-	100,0 (1)	100,0 (1)	100,0 (1)	100,0 (1)
Enterococcus faecalis	-	100,0 (3)	100,0 (3)	100,0 (3)	100,0 (3)	-	-	100,0 (3)	-	-	-	-	-	-	-	66,7 (3)	-	100,0 (3)
E.coli	91,7 (11)	8,3 (12)	36,4 (12)	-	-	-	36,4(11)	-	9,1 (11)	18,2 (11)	41,7 (12)	36,4 (11)	58,3 (12)	81,8 (11)	75,0 (12)	25,0 (12)	-	-
Enterobacter cloacae complex	100,0 (2)	0 (2)	0 (2)	-	-	-	0 (1)	-	0 (2)	0 (2)	50,0 (2)	50,0 (2)	50,0 (2)	50,0 (2)	50,0 (2)	50,0 (2)	-	-
K.pneumoniae	100,0 (1)	0 (1)	0 (1)	-	-	-	0 (1)	-	0 (1)	0 (1)	0 (1)	0 (1)	0 (1)	0 (1)	0 (1)	0 (1)	-	-
Proteus mirabilis	100,0 (1)	0 (1)	100,0 (1)	-	-	-	100,0 (1)	-	-	100,0 (1)	100,0 (1)	100,0 (1)	100,0 (1)	100,0 (1)	100,0 (1)	100,0 (1)	-	-
Salmonella.spp	100,0 (1)	100,0 (1)	100,0 (1)	-	-	-	100,0 (1)	-	0 (1)	0 (1)	100,0 (1)	100,0 (1)	100,0 (1)	100,0 (1)	100,0	0 (1)	-	-

															(1)			
Pantoea sp	0 (1)	0 (1)	100,0 (1)	-	-	-	0 (1)	-		0 (1)	-	0 (1)	0 (1)	0 (1)	0 (1)	-	-	-
Achromobacter denitrificans	0 (1)	-	-	-	-	-	0 (1)	-	0 (1)	-	-	0 (1)	100,0 (1)	100,0 (1)	-	0 (1)	-	-
Burkholderia cepacia	-	-		-	-	-	-	-	-	-	-	-	100,0 (3)	-	-	-	-	-
Acinetobacter sp	50,0 (2)	-	50,0 (2)	-	-	-	-	-	-	-	-	100,0 (2)	50,0 (2)	100,0 (3)	100,0 (2)	50,0 (2)	-	-
Pseudomonas aeruginosa	100,0 (2)	-	-	-	-	-	0 (2)	-	-	-	-	-	100,0 (2)	-	100,0 (2)	100,0 (2)	-	-
Pseudomonas sp	100,0 (2)	-					0 (1)	-	-			50,0 (2)	50,0 (2)	-	100,0 (2)	50,0 (2)		
Candida albicans	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C.tropicalis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL	83,3 (24)	28,6 (21)	52,2 (23)	75,0 (4)	100,0 (3)	100,0 (1)	30,0(20)	75,0 (4)	11,7 (17)	22,2 (18)	50,0 (18)	45,5 (22)	64,3 (28)	76,2 (21)	76,0 (25)	48,1 (27)	100,0 (1)	100,0 (4)

MIKROORGANI	ANTIMIKROBIAL SENSITIVITY PATTERNS (% S)																		
	Eritro	Fosfo	Genta	Levofl	Line	Mer	Moxifl	Nitrofur	Pipera	Quinep	Rifa	Tetrac	Tige	Trimet	Van	Flu	Vor	Mic	Amp

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SMS	mycin	mycin	mycin	oxacin	zolid	openem	oxacin	antoin	zilin Tazobactam	ristin Dalfopirine	mpin	yclin	cyclin	oprim Sulfametoxa-zole	com-ycin	konazol	iconazol	afungin	hotericin B
Staphylococcus aureus	100,0 (1)	-	100,0 (1)	100,0 (1)	100,0 (1)	-	100,0 (1)	100,0 (1)	-	100,0 (1)	100,0 (1)	100,0 (1)	100,0 (1)	100,0 (1)	100,0 (1)	-	-	-	-
Enterococcus faecalis	-	-	-	66,7 (3)	100,0 (3)	-	-	100,0 (3)	-	-	-	100,0 (3)	100,0 (3)	-	100,0 (3)	-	-	-	-
E.coli	-	100,0 (13)	66,7 (12)	25,0 (12)	-	100,0 (12)	-	100,0 (11)	100,0 (11)	-	-	-	100,0 (11)	50,0 (10)	-	-	-	-	-
Enterobacter cloacae complex	-	100,0 (2)	50,0 (2)	50,0 (2)	-	100,0 (2)	-	50,0 (2)	50,0 (2)	-	-	-	100,0 (2)	50,0 (2)	-	-	-	-	-
K.pneumoniae	-	100,0 (1)	100 (1)	0 (1)	-	100,0 (1)	-	0 (1)	100,0 (1)	-	-	-	100,0 (1)	0 (1)	-	-	-	-	-
Proteus mirabilis	-	100,0 (1)	100,0 (1)	100,0 (1)	-	100,0 (1)	-	0 (1)	100,0 (1)	-	-	-	0 (1)	0(1)	-	-	-	-	-
Salmonella.spp	-		0 (1)	100,0 (1)	-	100,0	-	-	100,0 (1)	-	-	-	100,0 (1)	100,0 (1)	-	-	-	-	-

						(1)													
Pantoea sp	-	100,0 (1)	100,0 (1)		-	0 (1)	-	100,0 (1)	100,0 (1)	-	-	-	100,0 (1)	0 (1)	-	-	-	-	-
Achromobacter denitrificans	-	-	0 (1)	0 (1)	-	100,0 (1)	-	-	-	-	-	-	0 (1)	100,0 (1)	-	-	-	-	-
Burkholderia cepacia	-	-	-	0 (3)	-	0 (1)	-	-	-	-	-	-	0 (3)	-	-	-	-	-	-
Acinetobacter sp	-	-	33,3 (3)	66,7 (3)	-	100,0 (2)	-	-	100,0 (2)	-	-	-	50,0 (2)	50,0 (2)	-	-	-	-	-
Pseudomonas aeruginosa	-	-	100,0 (2)	100,0 (2)	-	100,0 (2)	-	-	100,0 (2)	-	-	-	0 (2)	-	-	-	-	-	-
Pseudomonas sp	-	-	100,0 (2)	100,0 (1)	-	100,0 (2)	-		100,0 (2)	-	-	-	100,0 (2)	-	-	-	-	-	-
Candida albicans	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100,0 (4)	100,0 (4)	100,0 (4)	100,0 (4)
C.tropicalis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100,0 (1)	100,0 (1)	100,0 (1)	100,0 (1)

TOTAL	100,0 (1)	100,0 (18)	66,7 (18)	45,2 (31)	100,0 (4)	92,3 (26)	100,0 (1)	85,0 (20)	95,7 (23)	100,0 (1)	100,0 (1)	100,0 (4)	74,2 (31)	50,0 (20)	100,0 (4)	100,0 (5)	100,0 (5)	100,0 (5)	100,0 (5)

Discussion

Urinary tract infection is an infectious disease that causes hospitalization for mild to severe symptoms [3,9]. It can be a community-acquired or hospital-acquired infection. [1]. Urinary tract infections can affect both men and women at any age [10,11]. Host factors, bacterial virulence, and infection route are all risk factors for UTI [1, 3, 12].This study discovered that the elderly had the highest rate of UTI, with a mean age of 60 years and 76.9% being male.Due to comorbid diseases such as kidney disease, diabetes mellitus, malignancy, urinary stones, and others, the predisposition factors were declining both immune status and physiologic function [13].Similar findings were found in a UTI study at Sanglah Hospital Denpasar in 2020, with a mean age of 55 years [14].Previously, it was stated that UTI can affect people of all ages, but that getting older increases the likelihood of UTI and morbidity [10].In the case distribution by gender, there are different results in this study from studies at Sanglah Hospital, Kariadi Hospital Semarang, and several other studies that stated that the prevalence of UTI is dominant in women [5,14,15]. However, this study was similar to another one conducted at Sanglah Hospital in 2020, which discovered that UTIs were caused by Enterobacteriaceae and that UTIs were more common in men [16].This discrepancy was caused by the fact that the subjects in this study had a complicated UTI with comorbid kidney disorders such as urinary tract stones and prostate hypertrophy, which are dominant in males, and that most of the cases had one or more comorbidities. The presence of stones, especially in the urinary tract, either in the kidneys, ureters, or bladder, or the presence of prostate hypertrophy will cause obstacles in the process of flushing bacteria through the urinary process so that it becomes a good medium for bacterial growth, which will lead to an increase in bacterial colonies [1-3,9]. The use of urinary catheters was a risk factor for UTI because the catheters were a foreign material that would be a place for bacterial colonization, such as E. coli's phyllase and its ability to form biofilms [6,9].

Identification of microorganisms on urine cultures of the subjects showed that most isolates were gram-negative bacteria (51%), rather than gram-positive bacteria [5]. Gram-negative bacteria One of the uropathogens that frequently causes UTI is E. coli [6, 9].In this study, E. coli was the most common bacteria found in the urine specimens of the subjects, at 33.3%. The same thing was also found in the study of Girma, et al., 2022, in a southwest Ethiopian hospital, which found that 43% of UTI cases were caused by E. coli infection [17]. Similar results were found by Dabobash et al. (2017), who conducted the study in a hospital in Libya and found that E. coli infection was the main cause of UTI cases with a prevalence of 40% [18]. The study by Bambang, et al, at RS. Kariadi Semarang identified E. coli in 66% of UTI cases, while the study by Kandarini, et al, at Sanglah Hospital isolated 39.7% of the E. coli that was isolated from urine specimens of UTI patients [14,15]. Escherichia coli and other enterobacteriales are flora that colonize in the gastrointestinal tract and cause infection due to transmission or displacement from the gastrointestinal tract to the urinary tract [6,9]. Supporting host factors such as anatomic and physiological abnormalities of the kidneys and urinary tract, diabetes mellitus, malignancy, and immunocompromise were supported by the transmission process (use of urinary catheters for sexual activity) causing colonization of these bacteria in the urinary tract with a number of colonies > 10^5 cfu/ml, which causes colonization of the urinary tract. onset of infection [13].

Coli bacteria as the main cause of UTI cases in this study have many virulence factors that support it as the causative agent of infection, especially in UTI patients. E. coli bacteria have adherent factors (fimbriae and pili), which are useful for moving ascending from the lower urinary tract to the top, especially when using a urinary catheter. The ability of these bacteria, together with Pseudomonas, S. aureus, and Acinetobacter bacteria, to form a glycocalic biofilm causes these bacteria to have the ability to survive external conditions such as antibiotic activity, so that antibiotics are unable to work effectively against bacteria protected by this biofilm [3,13]. E. coli bacteria, especially uropathogenic E. coli (UPEC), naturally also have the ability to avoid the natural immune system, namely Toll Like Receptor 4 (TLR-4), which allows it to be able to replicate in uroepithelial cells, which can then infect urinary tract cells [3]. The ability of enterobacteriales such as E. coli and K. pneumoniae to produce the Extended Spectrum Betalactamase (ESBL) enzyme is another virulence factor that triggers the emergence of E. coli and K. pneumoniae, which are multi-resistant to antibiotics, especially the third-generation cephalosporin antibiotics widely used in hospitals, so this antibiotic has become less sensitive to these bacteria [6,19-20]. In this study, Pseudomonas and Candida were two other microorganisms with a relatively high prevalence in UTI, while the gram-positive bacteria Enterococcus faecalis was the most commonly found gram-positive bacteria aside from S. aureus. Pseudomonas and Enterococcus are also uropathogenic bacteria, besides E. coli and other enterobacteriales [9-10,20]. The study at RSUP yielded nearly identical results [14, 17]. The fungal infections were obtained in high numbers in this study, which may be due to immunocompromised patients and prolonged and repeated use of antibiotics because most patients have chronic comorbidities [6,12].

ESBL, both E. coli and Klebsiella pneumoniae, which led to highly resistant bacteria to the third-generation cephalosporin antibiotics such as cefotaxime, ceftriaxone, and ceftazidime and evenly resistant bacteria to some of the fourth-generation cephalosporins such as cefepime. The emergence of these multi-resistant bacteria in highly concentrated numbers is influenced by host factors, patient care management, and bacterial intrinsic factors. The history of antibiotics used in the previous 90 days, particularly the use of third-generation cephalosporin antibiotics, the status of patients with comorbid chronic diseases that caused patients to be frequently hospitalized, the use of broad-spectrum antibiotics for prophylaxis and long-term use that causes selection pressure, less optimal isolation precautions, bacterial producing biofilms, and the genetic ability of bacteria to produce hydrolysis enzymes such as ESBLs, AmpC, and Carbapnemase enzymes are the triggering factors for the emergence of bacteria that are multi-resistant to antibiotics [6,19-20].

An antimicrobial sensitivity test was performed on bacterial isolates grown on culture media. Antimicrobial sensitivity testing was carried out using the disc diffusion and dilution method with isolates that had been standardized by 0.5 MacFarland. In this study, the restricted antibiotics retained high sensitivity to all good gram-positive bacteria, including vancomycin and linezolid, as well as gram-negative bacteria antibiotics such as meropenem, amikacin, piperacillin-tazobactam, tigecycline, nitrofurantoin, and fosfomycin. As for antifungals, all antifungals, both restricted and non-restricted, showed high sensitivity. The use of restrictive antibiotics in hospitals needs to be limited based on medical indications, especially for severe and life-threatening cases that do not respond to first-line empirical antibiotic therapy or definitively for the treatment of cases of UTI caused by bacteria that are multi-resistant due to restriction group antibiotics [21]. Resistance to restriction group antibiotics will make it difficult to treat infectious diseases that can increase mortality and patient costs. Antibiotic stewardship (including the use of empiric antibiotics in the hospital based on local germ patterns or antibiograms, performing urine cultures on UTI patients to obtain sensitive antibiotic options based on the causative microorganism, short-term use of antibiotics for cystitis and non-recurrent UTI cases, not screening and administering antibiotics in asymptomatic cases except in pregnant women, and preparing for urological surgery, and if possible, avoiding the use of antibiotics in patients with non-complicated recurrent UTIs) becomes a necessity in the management of UTI patients in an effort to reduce the incidence of infection by multi-resistant bacteria and improve hospital service quality, especially for patients with UTI [22].

This study has several limitations because it is a descriptive study that only provides a general description of suspected microorganisms that cause urinary tract infections in adults at Sanjiwani Gianyar Hospital during the study period. The relationship between demographic factors and the pattern of microorganisms was not analyzed in this study. The number of isolates of each identified microorganism species is not sufficient for the minimum number (ideally 30 per isolate) for optimal analysis, especially regarding the pattern of antimicrobial sensitivity, so that the interpretation of the results of this antimicrobial sensitivity pattern requires caution and its use as a reference in the selection of therapy. Empirical studies or the preparation of guidelines for the use of antibiotics (PPAB) in hospitals require additional studies using national or international guidelines/guidance/clinical practice guidelines to be used as a reference in the preparation of guidelines for the use of antibiotics (PPAB) for UTI cases, which will later be used as a basis for the selection of appropriate empirical therapy in UTI.

Conclusions

Most of the patients with UTI were found in the elderly age group, were male, and had multiple comorbidities. Based on the results of urine cultures of UTI patients, gram-negative, gram-positive, and Candida bacteria were identified. The most common bacteria that are the causative agents of UTI patients treated at the Sanjiwani Hospital are E. coli bacteria. Penicillin, tetracycline, fluoroquinolones, nitrofurantoin, vancomycin, and linezolid antibiotics still have high sensitivity for Gram-positive bacteria. For Gram-negative bacteria, antibiotics that have high sensitivity include ceftazidime, cefoferazone sulbactam, cepefim, fosfomycin, and all antibiotics in the reserve group, namely meropenem, piperacillin, tazobactam, tigecycline, amikacin, and nitrofurantoin. As for fungi, all types of antifungals, including the azole, echinocandin, and polymyxin groups, still have high sensitivity.

Conflict Of Interests

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References

1. Flores-Mireles AL, Walker JN, Caparon M, Hultgren SJ. Urinary tract infections: Epidemiology, mechanisms of infection and treatment options. Nature Reviews Microbiology. 2015;13: 269–84.
2. Lee DS, Lee SJ, Choe HS. Community-acquired urinary tract infection by Escherichia Coli in the era of antibiotic resistance. BioMed Research International. 2018; 1-14.
3. Klein, R. D. and Hultgren, S. J. Urinary tract infections: microbial pathogenesis, host–pathogen interactions and new treatment strategies. Nature Reviews Microbiology. 2020; 18: 211–26.
4. Banoi K, Khani J, Rifati, Begum H, Munir S, Akbar N, et al. Patterns of antibioticsensitivity of bacterial pathogens among urinary tract infections (UTI) patients in a Pakistani population. African Journal of Microbiology Research. 2012; 6(2): 414-20.
5. Addis T, Mekonnen Y, Ayenew Z, Fentaw S, Biazin H. Bacterial uropathogens and burden of antimicrobial resistance pattern in urine specimens referred to Ethiopian Public Health Institute. PLOS ONE. 2021; 16(11): 1-14.
6. Mahon CR, Lehman DC. Text Book Of Diagnostic Microbiology. 6th ed. Elseiver Saunder. 2019.
7. Wang R, LaSala C. Role of antibiotic resistance in urinary tract infection management: a cost-effectiveness analysis. Am J Obstet Gynecol.2021; 225:550.e1-10.
8. Biomerieux. 'No Title', 'Vitek 2 TM Technology Product Information. 2013. Lyon France.
9. Foxman, B. The epidemiology of urinary tract infection. Nature Reviews Urology. 2010. 7, 653–60.
10. Kalal BS, Nagaraj S. Urinary tract infections: a retrospective, descriptive study of causative organisms and antimicrobial pattern of samples received for culture, from a tertiary care setting. GERMS. 2016; 6(4).132-8.
11. Oli AN, Akabueze VB, Ezeudu CE, Eleje GU, Ejiofor OS, Ezebialu IU, et al. Bacteriology and antibiogram of urinary tract infection among female patients in a tertiary health facility in

south eastern Nigeria. Open Microbiol J. 2017;11:292-300.

12. Kasper, DL. *et al.* Harrison's principles of internal medicine.2015
13. Melekos MD, Naber KG. Review Complicated urinary tract infections. International Journal of Antimicrobial Agents. 2000. 4. 247–56.
14. Kandarini Y, Mahadita W, Marciyasa PA. Profil kuman pada infeksi saluran kemih di Rumah Sakit Umum Pusat Sanglah Bali tahun 2019-2020. Udayana Journal of Internal Medicine.2020; 4(2): 45-52.
15. Karjono BJ, Susilaningsih D, Purnawati RD. Microbiology pattern of urinary tract infection in Dr Kariadi General Hospital Semarang. Jurnal Kedokteran Yarsi.2009; 17 (2) : 119-24.
16. Janasuta PBR, Sukrama DM, Dwija IBNP. Pola kepekaan bakteri enterobacter sp yang diisolasi dari spesimen urin di RSUP Sanglah. Jurnal Medika Udayana. 2020; 9(1): 247-56.
17. Girma A, Aemiro A. The bacterial profile and antimicrobial susceptibility patterns of urinary tract infection patients at Pawe General Hospital, Northwest Ethiopia. Scientifica (Cairo). 2022. 15(4):247-56.
18. Dabobash MD, Attla MF, Elgarba M, Menshawy AS, Antibiogram sensitivity in urinary tract infections (UTI) at el batnan medical center-tobruk - libya', Urol Nephrol Open Access J. 2017*;* 4(3):89–95.
19. Brooks GF, Jawetz, Melnick & Adelberg's Medical Microbiology, 26th Edition, 2013. *Journal of Chemical Information and Modeling*. 2013.doi: 10.1017/CBO9781107415324.004.
20. Tille PM. Bailey & Scott's diagnostic microbiology. 13th. Ed. 2014 Mosby, Inc., an affiliate of Elsevier Inc. p 12-15; 53-67.
21. Antibiotic Expert Groups. Therapeutic guideline:antibiotic.Version 15. 2014. Melbourne : Therapeutic Guideline Limited.p 1-12
22. Waller. *et al*.(2018) 'Urinary Tract Infection Antibiotic Resistence In The United States', Prim Care Clin Office Pract.