COMPREHENSIVE ANALYSIS OF URINARY TRACT INFECTIONS: ETIOLOGY, RISK FACTORS, ANTIBIOTIC RESISTANCE TRENDS, AND PREVENTIVE STRATEGIES FOR IMPROVED PATIENT OUTCOMES IN JALALABAD, KYRGYZSTAN

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Abstract

Urinary Tract Infection (UTI) is a common health issue, particularly among women, often leading to significant morbidity if left untreated. It presents a global health challenge, with substantial impacts on the quality of life and healthcare systems. The study aims to analyze the prevalence, risk factors, and clinical outcomes of Urinary tract infection, focusing on resistance and sensitivity of different drugs toward different causative agent.

Methods and methodology: This is a retrospective cross-sectional study using data from hospital records describing the prevalence of Urinary tract infection, it's causative agent and the drugs were sensitive and resistant to in the reported cases of UTI in Jalalabad Regional Clinical Hospital. Data was collected from March 2024 till November 2024.

Objective: The study intends to identify the risk factors, demographic trends, and focusing on resistance and sensitivity of different drugs toward different causative agent in the target population. This topic is vital as Urinary tract infection remains a leading cause of morbidity worldwide, affecting millions annually.

Results: The total of 156 data were collected from Jalalabad Regional Clinical Hospital which shows that the causative agent in most of the cases was found to be Escherichia. Coli, Klebsiella, Candida albicans, Pseudomonas and Staphylococcus aureus. Out of which Escherichia. coli has the highest prevalence rate. It was found that E. coli is resistive to Amoxicillin is the most and is highly sensitive to Meropenem in the patients of Jalalabad Regional Clinical Hospital.

Conclusion

This comprehensive analysis highlights the complexity of urinary tract infections in Jalalabad, Kyrgyzstan. The findings underscore the need for enhanced antibiotic stewardship, improved infection control practices, public awareness campaigns and good hygiene as personal hygiene is crucial in preventing Urinary tract infections, it prevents bacteria from entering the urinary tract, reduces bacterial growth, and minimizes irritation. Implementing preventive strategies and evidence-based guidelines can improve patient outcomes and combat antibiotic resistance. Effective management of UTIs requires a multi-faceted approach. By addressing these challenges, we can promote better health outcomes for the people of Jalalabad.

Keywords: Antibiotic resistance, UTI, antibiotic susceptibility, bacteria

КОМПЛЕКСНЫЙ АНАЛИЗ ИНФЕКЦИЙ МОЧЕВЫВОДЯЩИХ ПУТЕЙ: ЭТИОЛОГИЯ, ФАКТОРЫ РИСКА, ТЕНДЕНЦИИ УСТОЙЧИВОСТИ К АНТИБИОТИКАМ И ПРОФИЛАКТИЧЕСКИЕ СТРАТЕГИИ ДЛЯ УЛУЧШЕНИЯ РЕЗУЛЬТАТОВ ЛЕЧЕНИЯ ПАЦИЕНТОВ В ДЖАЛАЛ-АБАДЕ, КЫРГЫЗСТАН

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Аннотация

Инфекция мочевыводящих путей (ИМП) является распространенной проблемой здравоохранения, особенно среди женщин, часто приводящей к значительной заболеваемости, если ее не лечить. Она представляет собой глобальную проблему здравоохранения, оказывая существенное влияние на качество жизни и системы здравоохранения. Целью исследования является анализ распространенности, факторов риска и клинических результатов инфекции мочевыводящих путей, уделяя особое внимание резистентности и чувствительности различных препаратов к различным возбудителям.

Методы и методология

Это ретроспективное поперечное исследование с использованием данных из больничных записей, описывающих распространенность инфекции мочевыводящих путей, ее возбудителя и препараты, к которым были чувствительны и устойчивы в зарегистрированных случаях ИМП в Джалал-Абадской областной клинической больнице. Данные собирались с марта 2024 года по ноябрь 2024 года.

Цель

Исследование направлено на выявление факторов риска, демографических тенденций и сосредоточение внимания на резистентности и чувствительности различных препаратов к различным возбудителям в целевой популяции. Эта тема имеет важное значение, поскольку инфекция мочевыводящих путей остается основной причиной заболеваемости во всем мире, ежегодно поражая миллионы людей.

Результаты

Всего было собрано 156 данных из Джалал-Абадской областной клинической больницы, которые показывают, что возбудителем в большинстве случаев были Escherichia. Coli, Klebsiella, Candida albicans, Pseudomonas и Staphylococcus aureus. Из которых Escherichia. coli имеет самый высокий показатель распространенности. Было обнаружено, что E. coli, устойчивая к амоксициллину, является наиболее и высокочувствительной к меропенему у пациентов Джалал-Абадской областной клинической больницы.

Заключение

Этот комплексный анализ подчеркивает сложность инфекций мочевыводящих путей в Джалал-Абаде, Кыргызстан. Результаты подчеркивают необходимость усиления контроля антибиотиков, улучшения методов контроля инфекций, кампаний по информированию общественности и хорошей гигиены, поскольку личная гигиена имеет решающее значение для профилактики инфекций мочевыводящих путей, она предотвращает попадание бактерий в мочевыводящие пути, снижает рост бактерий и минимизирует раздражение. Внедрение профилактических стратегий и основанных на фактических данных рекомендаций может улучшить результаты лечения пациентов и бороться с устойчивостью к антибиотикам. Эффективное лечение ИМП требует

многогранного подхода. Решая эти проблемы, мы можем способствовать улучшению результатов лечения для жителей Джалал-Абада.

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Introduction

Urinary tract infection (UTI) is an infection that affects any part of the urinary system, which includes the kidneys, ureters, bladder, and urethra. Most UTIs involve the lower urinary tract, particularly the bladder and urethra. [1]

UTIs are primarily caused by bacteria, particularly Escherichia coli (E. coli), which normally live in the intestines but can enter the urinary system. Common organisms that cause UTI are Staphylococcus aureus, Klebsiella pneumoniae, Streptococcus pneumoniae, Acinetobacter baumannii, and Pseudomonas aeruginosa. Other microorganisms like viruses or fungi can also cause UTI.

Urinary tract infection (occasionally called UTI infection) is a collective term given to various bacterial infections that occur in the urinary tract. One of the most commonly occurring diseases on the planet, the UTI causing organisms have the potential to invade adjacent tissues and/ or result in kidney complications. As such, the most common manifestation of UTI infection is acute cystitis, which is far more prevalent among women than men [2].

The symptoms of recurrent UTI include pain or burning during urination, fever and chills, nausea, vomiting, frequent urination, cloudy urine, strong-smelling urine, hematuria, pelvic and abdominal pain. Risk factors for recurrent UTI include diabetes, kidney stones, multiple sex partners, urinary catheterization, urinary retention, pregnancy, poor hygiene, dehydration, menopause, weaken immune system, urinary tract abnormalities, use of certain medications or chemotherapy treatments and having an enlarged prostate gland.

According to the research done in Mumbai, India: The overall prevalence of UTI was 33.54% of which 66.78% were females and 33.22% were from males. High prevalence was observed in females as compared to males (2:1). Though the overall prevalence was high in old aged (>45 years) patients, in female high prevalence was seen among middle-aged (31 to 45 years) patients and in male high prevalence was seen among old age (>45 years) patients [3].

Urinary tract infections (UTIs) are prevalent in Pakistan, with studies reporting varying rates. A systematic review covering the past decade found that UTIs constitute 16.1% of all clinical diagnoses in the country [4].

Methods and methodology

This is a retrospective cross-sectional study using data from hospital records describing the prevalence of Urinary tract infection, it's causative agent and the drugs that they are sensitive and resistant to, in the reported cases of Urinary tract infection in Jalalabad Regional Clinical Hospital. Data was collected from March 2024 till November 2024.

Results

There was total 156 data which were collected from Jalalabad Regional Clinical Hospital, pediatric department from March 2024 to November 2024 and some of the data was collected from Nephrology Department. The result of the data is as follow:
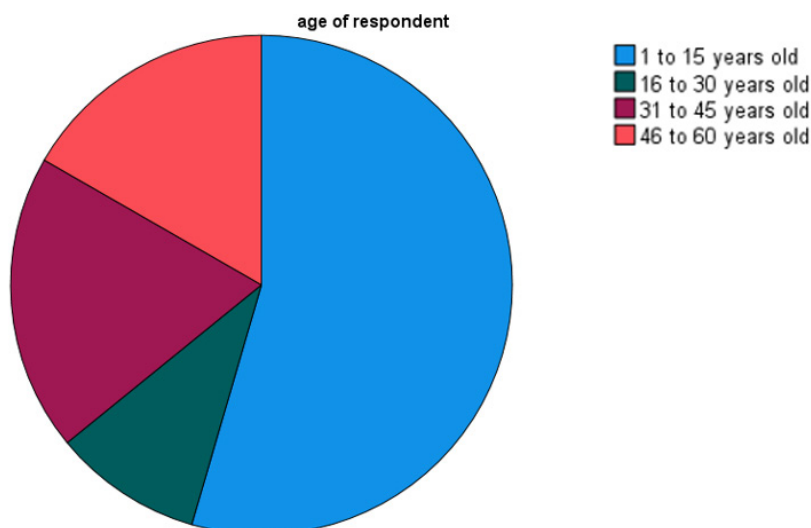

*Figure 1: Showing distribution of respondents according to their age*

This age distribution shows that the majority of respondents (54.5%) are between 1-15 years old, followed by 31-45 years old (19.2%), 46-60 years old (16.7%), and the smallest group being 16-30 years old (9.6%).

• Table 1: Showing gender of respondents

	N	%
Male	54	34.6%
Female	102	65.4%

The gender distribution of respondents shows a significant majority of females (65.4%) compared to males (34.6%). Out of the total respondents, 102 were female and 54 were male, indicating that nearly two-thirds of the respondents were female, while about one-third were male.

The diagnostic results show that among Urinary tract infection-related diseases, Glomerulonephritis is the most common, affecting 42.9% of the respondents (67 cases). Pyelonephritis follows closely, accounting for 39.7% of the cases (62 respondents). Nephrotic syndrome and Enuresis are less prevalent, affecting 8.3% (13 cases) and 9.0% (14 cases) of the respondents, respectively.
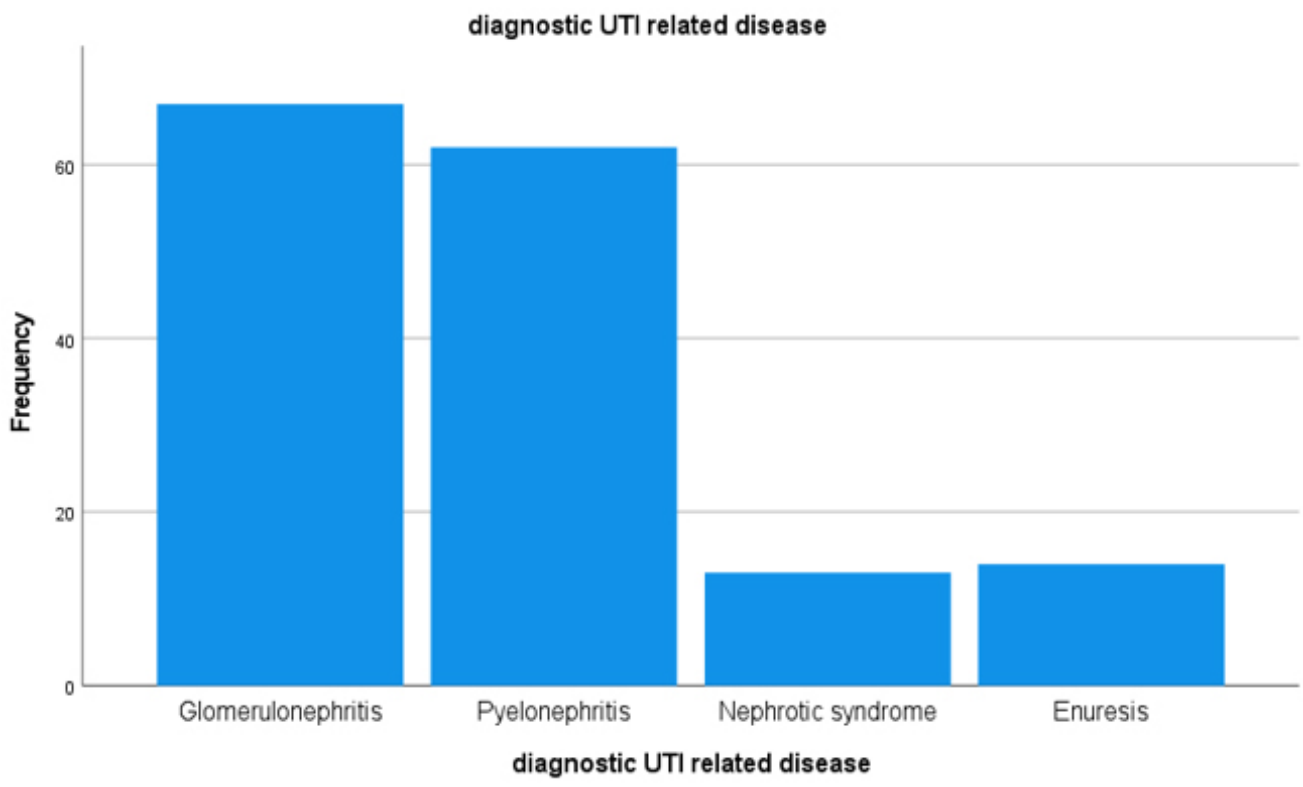
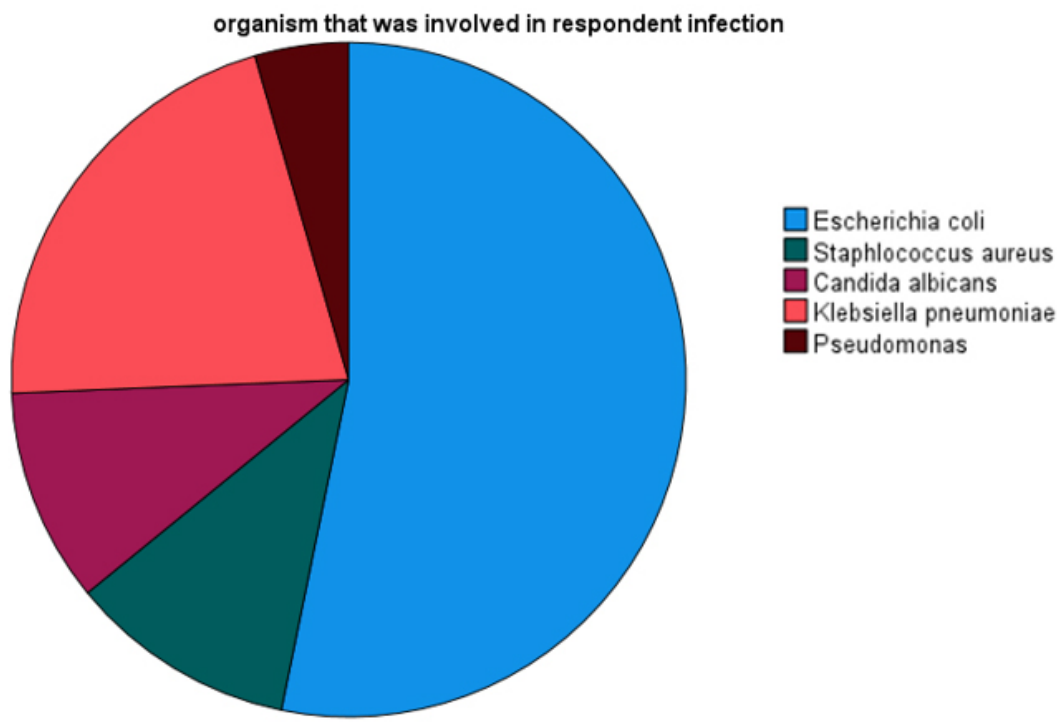*Graph 1: Showing diagnosis of urinary tract infection related disease*

Figure 2: Showing organisms involved in respondent infection

The results show that Escherichia coli (E. coli) was the most common organism responsible for the respondents' infections, accounting for 53.2% of the cases (83 respondents). Klebsiella pneumoniae was the second most prevalent, involved in 21.2% of the cases (33 respondents). Staphylococcus aureus, Candida albicans, and Pseudomonas were less common, responsible for 10.9% (17 cases), 10.3% (16 cases), and 4.5% (7 cases) of the infections, respectively.

The results show that E. coli exhibited resistance to various antibiotics. Amoxicillin had the highest resistance rate, with 23.1% of the cases (36 respondents) showing resistance. Trimethoprim and Ceftazidime followed, with resistance rates of 14.1% (22 cases) and 10.3% (16 cases), respectively. Nitrofurantoin had the lowest resistance rate, at 5.8% (9 cases). Notably, 46.8% of the cases (73 respondents) had missing data on antibiotic resistance.

The results indicate that E. coli showed sensitivity to various antibiotics. Meropenem had the highest sensitivity rate, with 21.2% of the cases (33 respondents) showing sensitivity. Amoxicillin, Amikacin, and Imipenem followed, with sensitivity rates of 12.8% (20 cases), 12.8% (20 cases), and 6.4% (10 cases), respectively. However, a significant proportion of cases (46.8%, 73 respondents) had missing data on antibiotic sensitivity.

• *Table 2: Resistance pattern of E. coli.*

	N	%
Ceftazidime	16	10.3%
Nitrofurantoin	9	5.8%
Amoxicillin	36	23.1%
Trimethoprim	22	14.1%

• *Table 3: Sensitivity pattern of E. coli*

	N	%
Amoxicillin	20	12.8%
Meropenem	33	21.2%
Amikacin	20	12.8%
Imipenem	10	6.4%
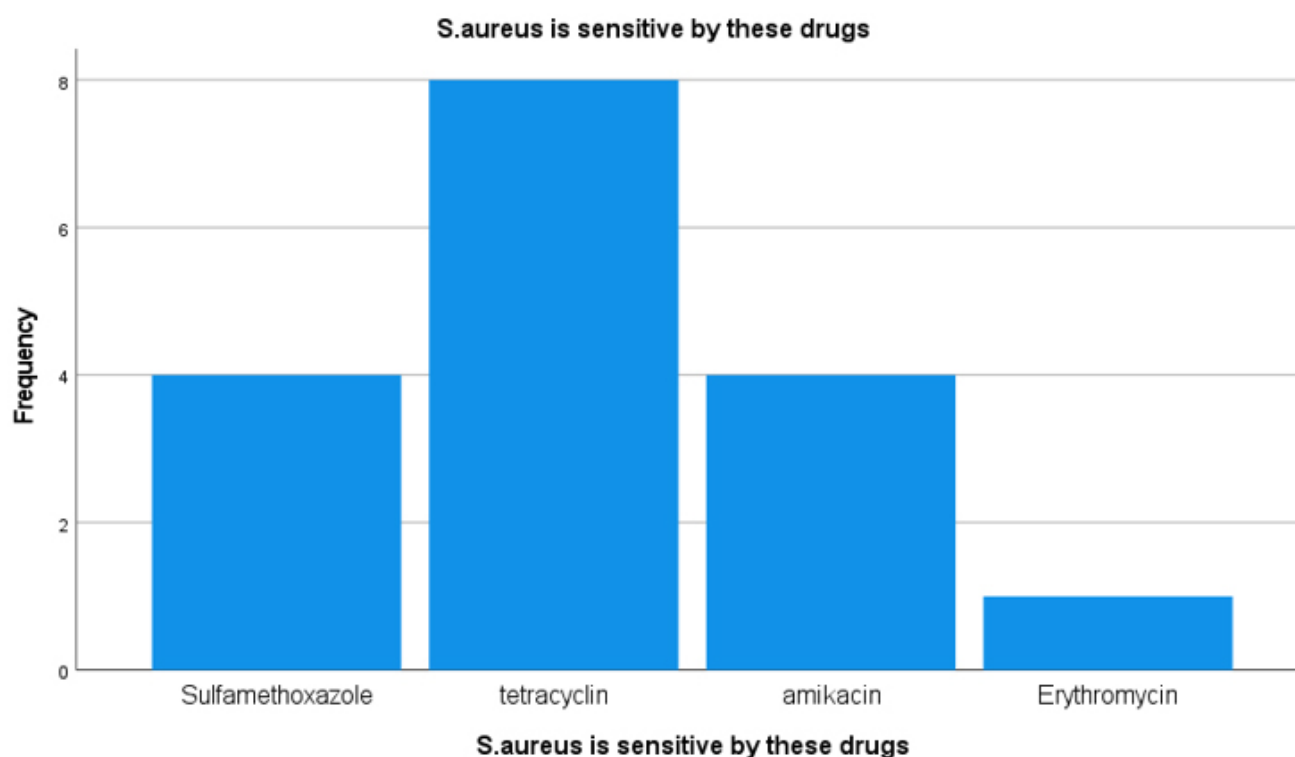
Graph 2: Sensitivity pattern of S. aureus

Staphylococcus aureus (S. aureus) demonstrated sensitivity to several antibiotics. Tetracycline was the most effective, with 8 cases (5.1%) showing sensitivity. Sulfamethoxazole and Amikacin were effective in 4 cases each (2.6%), while Erythromycin was effective in only 1 case (0.6%).
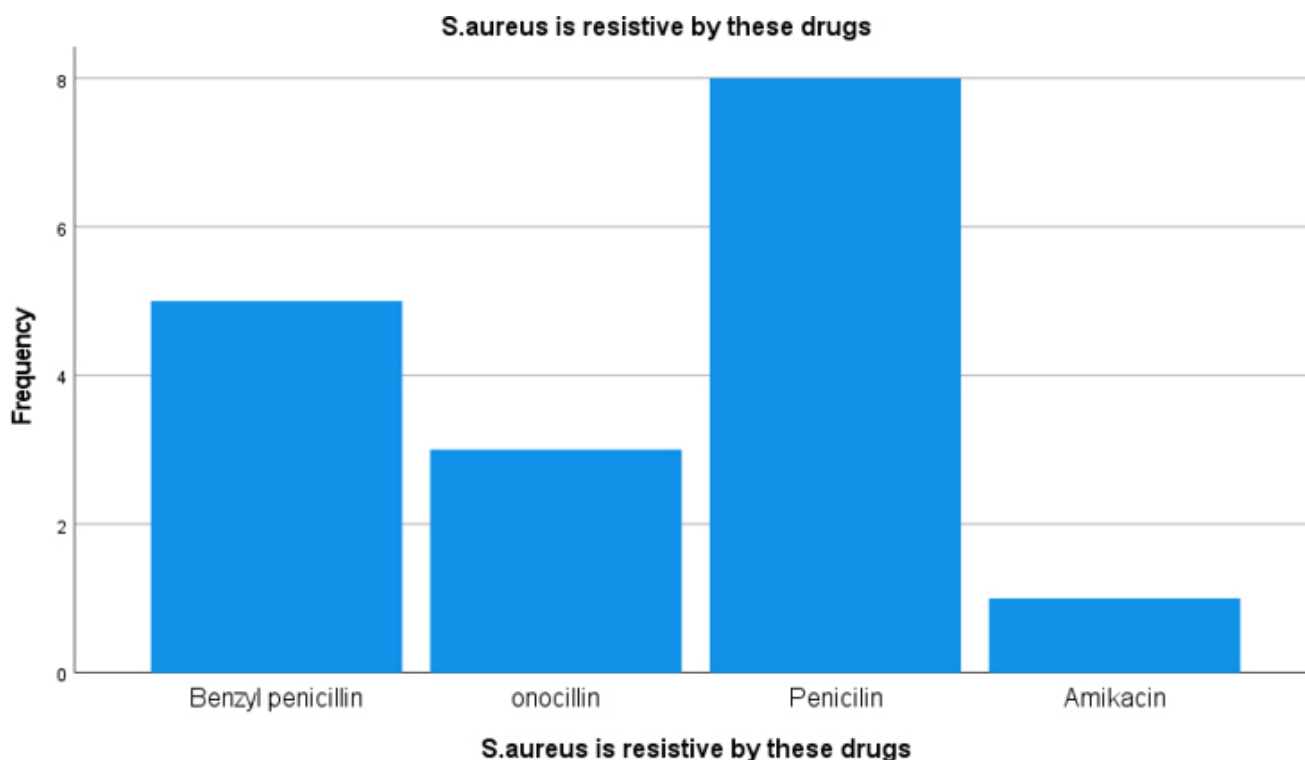
Graph 3: Resistance pattern of S. aureus

Staphylococcus aureus (S. aureus) exhibited resistance to several antibiotics. Penicillin had the highest resistance rate, with 8 cases (5.1%) showing resistance. Benzyl penicillin followed, with 5 cases (3.2%) resistant. Oxacillin had a resistance rate of 1.9% (3 cases), while Amikacin had the lowest resistance rate, at 0.6% (1 case).

Klebsiella pneumoniae demonstrated sensitivity to various antibiotics. Meropenem was the most effective, with 12 cases (7.7%) showing sensitivity. Nitrofurantoin followed, with 6 cases (3.8%) sensitive. Cefuroxime and Imipenem had lower sensitivity rates, with 3 cases (1.9%) and 2 cases (1.3%) showing sensitivity, respectively

Klebsiella pneumoniae exhibited resistance to several antibiotics. Amoxicillin had the highest resistance rate, with 11 cases (7.1%) showing resistance. Levofloxacin followed, with 7 cases (4.5%) resistant. Cefuroxime and Aztreonam had lower resistance rates, with 3 cases (1.9%) each showing resistance.

• *Table 4: Sensitivity pattern of Klebsiella pneumoniae*

	N	%
Nitrofurantoin	6	3.8%
Meropenem	12	7.7%
Cefuroxime	3	1.9%
Imipenem	2	1.3%

• *Table 5: Resistance pattern of K. pneumoniae*

	N	%
Amoxicillin	11	7.1%
Levofloxacin	7	4.5%
Cefuroxime	3	1.9%
Aztreonam	3	1.9%

Discussion

Urinary tract infections (UTIs) are common bacterial infections, primarily caused by Escherichia coli, that affect the bladder, urethra, or kidneys, with women being at higher risk due to anatomical factors. Symptoms include painful urination, frequent urges to urinate, and cloudy or foul-smelling urine. The latest data on Urinary Tract Infections (UTIs) from the World Health Organization (WHO) [1] reveals some alarming trends. According to the Global Burden of Disease Study 2019, there were approximately 404.61 million cases of UTIs worldwide in 2019, resulting in 236,790 deaths.

Retrospective cross-sectional study done in Jalalabad study Regional Clinical Hospital done from March 2024 to November 2024 describing the prevalence of UTI, it's causative agent and the drugs sensitivity and resistivity shows that out of total 156 data we collected cases majority 54.5% of the patients were from age group 1 - 15 years followed by 9.6% of them were in age group 16 to 30 years. Remaining 19.2 % and 16.7 % were in between age group 31 to 45 years and 46 to 60 years respectively. But according to results of study done in Korea, Taiwan and Japan collectively shows that the risk of UTI during the first decade of life is 1% in males and 3% in females [5]. Another cross-sectional study done in morogora Tanzania shows: The prevalence of UTIs was 41% (141/344) and elders (>=60 years) had five times higher odds of having UTI as compared to adolescents (p < 0.001) [6].

Regarding the gender 34.6% (54) of respondents were males and 65.4 % (102) were females. The diagnostic UTI related diseases which were mainly Glomerulonephritis, pyelonephritis, nephrotic syndrome and enuresis their percentage was 42.9%, 39.7%, 8.3% and 9.0% respectively.

Urinary tract infections (UTIs) are a severe public health problem and are caused by a range of pathogens, but most commonly by Escherichia coli, Klebsiella pneumoniae, Proteus mirabilia [7] as per study done in Jalalabad Regional Clinical Hospital the organisms involved in respondent infection the most likely organism to cause infection was E. Coli with percentage of 53.2% and least infection causing organism was Pseudomonas (4.5 %). Similarly, according to a research conducted in Europe The six most commonly isolated micro-organisms were, in decreasing order: Escherichia coli (35.6%), Enterococci (15.8%), Candida (9.4%), Klebsiella (8.3%), Proteus (7.9%) and Pseudomonas aeruginosa (6.9%). Pseudomonas was isolated more frequently in non-EU countries [8].

Antibiotics with high percentages of resistance were trimethoprim sulfamethoxazole (50%), followed by third-generation quinolones with similar percentages, ciprofloxacin (38.2%), levofloxacin (36.7%) and norfloxacin 36.5%. The most resistant antibiotic in this study was amoxicillin plus clavulanic acid (33.9%). According to the sensitivity profiles, the most effective antibiotics were fosfomycin (68.9%), amikacin (68.4%), nitrofurantoin (62.5%), gentamicin (60.5%) and ceftriaxone (50.1) [9]. Regarding the drugs sensitivity and resistivity according to the data collected from Jalalabad Regional Clinical Hospital, E. Coli was most resistive by Ceftazidime (10.3%) and sensitive by amoxicillin (12.8%). Similarly, S. aureus was sensitive by sulfamethoxazole (2.6%) and resistive by benzyl penicillin (3.2%). Candida albicans was sensitive by sulfamethoxazole (1.3%) and resistive by benzyl penicillin (1.3%). Klebsiella was most sensitive by nitrofurantoin (3.8%) and resistive by amoxicillin (7.1%). As per cross-sectional study done in Iran, it is shown that the most common pathogen causing UTIs is Escherichia coli with 62%. The resistance among the isolates of E. coli was as follows: ampicillin (86%), amoxicillin (76%), tetracycline (71%), trimethoprim-sulfamethoxazole (64%), cephalexin (61%), and cefalothin (60%). The highest sensitivity among isolates of E.

coli was as follows: Imipenem (86%), nitrofurantoin (82%), amikacin (79%), chloramphenicol (72%), and ciprofloxacin (72%) [9].

Recommendations

To mitigate the incidence of Urinary Tract Infections (UTIs) and the emergence of antibiotic-resistant strains, a multifaceted approach is warranted. Firstly, adherence to proper hygiene practices, including correct wiping techniques and genital area cleansing, is essential. Additionally, promoting adequate hydration through evidence-based guidelines can facilitate the flushing of bacteria from the urinary tract. Implementation of antibiotic stewardship programs, incorporating judicious prescribing practices and regular surveillance of resistance patterns, is crucial to curtail the development of antibiotic-resistant bacteria. Furthermore, development and periodic updating of Urinary tract infection management guidelines, informed by local epidemiological data and susceptibility profiles, can optimize treatment outcomes. Lastly, patient education initiatives emphasizing preventive measures, such as avoidance of irritant foods and stress management techniques, can empower individuals to reduce their risk of Urinary tract infections. By adopting these evidence-based recommendations, healthcare providers can contribute to a reduction in the incidence of Urinary tract infections and the emergence of antibiotic-resistant strains.

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