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Original Research Article

Comparative Efficacy and Safety of Doxycycline Versus Azithromycin in Infectious Diseases

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Abstract: ***Background***: Doxycycline and azithromycin are widely used broad-spectrum antibiotics for the treatment of various bacterial infectious diseases. Although both agents are commonly prescribed, comparative data on their efficacy and safety in routine clinical practice remain limited. ***Objective:*** To compare the clinical efficacy and safety of doxycycline versus azithromycin in patients with infectious diseases. ***Materials and Methods***: A prospective, comparative, observational study was conducted over a period of six months (April 2025 to September 2025) in the Department of Pharmacology, Noida International Institute of Medical Sciences. A total of 120 patients diagnosed with bacterial infections were enrolled and divided equally into two groups: Group A received doxycycline and Group B received azithromycin. Clinical efficacy was assessed by resolution of symptoms, while safety was evaluated based on the incidence of adverse drug reactions. Treatment compliance was also recorded. ***Results:*** Clinical cure was achieved in 88.3% of patients in the doxycycline group and 85.0% in the azithromycin group. Adverse drug reactions were more frequent with doxycycline (20.0%) compared to azithromycin (11.7%), with gastrointestinal disturbances being the most common. Treatment compliance was higher in the azithromycin group (93.3%) than in the doxycycline group (86.7%). Conclusion: Both doxycycline and azithromycin were found to be effective and safe in the treatment of infectious diseases. Doxycycline showed marginally higher efficacy, whereas azithromycin demonstrated better tolerability and patient compliance. Antibiotic selection should be individualized based on infection type, patient profile, and safety considerations.

Keywords: Doxycycline, Azithromycin, Infectious diseases, Antibiotics, Comparative study, Safety

INTRODUCTION

Infectious diseases remain one of the leading causes of morbidity and mortality worldwide, particularly in low- and middle-income countries where access to timely diagnosis and appropriate antimicrobial therapy may be limited [1]. The increasing burden of bacterial infections, coupled with the growing challenge of antimicrobial resistance, has emphasized the need for rational selection and optimal use of antibiotics in clinical practice [2].

Among the commonly prescribed broad-spectrum antibiotics, doxycycline and azithromycin occupy an important place due to their proven efficacy against a wide range of pathogens and favorable pharmacokinetic properties. Doxycycline, a semisynthetic tetracycline antibiotic, exerts its antimicrobial action by inhibiting bacterial protein synthesis through reversible binding to the 30S ribosomal subunit. It is effective against gram-positive and gram-negative bacteria, atypical organisms such as *Chlamydia*, *Mycoplasma*, *Rickettsia*, and certain protozoa, making it useful in respiratory tract infections, sexually transmitted infections, skin and soft tissue infections, and zoonotic diseases [3].

Azithromycin, a second-generation macrolide antibiotic, also inhibits bacterial protein synthesis by binding to the 50S ribosomal subunit. It is widely used in the treatment of respiratory tract infections, enteric infections, and sexually transmitted diseases. Azithromycin is distinguished by its long elimination

half-life, extensive tissue penetration, and post-antibiotic effect, allowing for shorter treatment durations and improved patient compliance [4].

Despite their extensive clinical use, both antibiotics differ significantly in terms of spectrum of activity, dosing schedules, drug interactions, and adverse effect profiles. Doxycycline is commonly associated with gastrointestinal disturbances, photosensitivity, and esophageal irritation, while azithromycin is generally better tolerated but has been linked to cardiac arrhythmias in susceptible individuals and potential drug-drug interactions [5,6]. These differences can influence clinical decision-making, particularly in patients with comorbidities or those requiring long-term therapy.

Comparative studies evaluating the efficacy and safety of doxycycline versus azithromycin in real-world clinical settings are limited, especially in the Indian healthcare context. Most available data are derived from randomized controlled trials focusing on specific infections, which may not fully reflect routine prescribing practices [7]. Therefore, systematic evaluation of these antibiotics in diverse infectious conditions is essential to guide rational antibiotic use and optimize patient outcomes.

The present study was undertaken to compare the clinical efficacy and safety of doxycycline and azithromycin in patients with infectious diseases over a six-month period at a tertiary care teaching hospital. The findings aim to provide evidence-based guidance for clinicians in selecting appropriate antibiotic therapy while balancing effectiveness, safety, and patient compliance.

MATERIAL AND METHODS

Study Design

A prospective, comparative, observational study.

Study Duration

Six months (April 2025 – September 2025).

Study Setting

Department of Pharmacology, Noida International Institute of Medical Sciences.

Study Population

Patients attending outpatient and inpatient departments diagnosed with bacterial infectious diseases and prescribed either doxycycline or azithromycin.

Inclusion Criteria

- Patients aged ≥18 years
- Diagnosed with bacterial infections
- Prescribed doxycycline or azithromycin
- Provided informed consent

Exclusion Criteria

- Pregnant and lactating women
- Patients with known hypersensitivity to study drugs
- Patients with severe hepatic or renal impairment

Study Groups

- **Group A:** Patients receiving doxycycline
- **Group B:** Patients receiving azithromycin

Outcome Measures

- Clinical efficacy (resolution of symptoms)
- Microbiological cure (where applicable)
- Incidence and severity of adverse drug reactions

Statistical Analysis

Data were analyzed using descriptive statistics. Results were expressed as percentages and mean values. Comparative analysis was performed using appropriate statistical tests, with $p < 0.05$ considered statistically significant.

RESULTS

A total of 120 patients diagnosed with bacterial infectious diseases were included in the study over the six-month period. Patients were equally distributed into two groups: Group A (Doxycycline) and Group B (Azithromycin), with 60 patients in each group. The results were analyzed with respect to demographic characteristics, clinical efficacy, safety profile, and treatment compliance.

Demographic Characteristics

The majority of patients belonged to the age group of 18–45 years. Both groups were comparable with respect to age and gender distribution, indicating homogeneity of the study population.

Table 1: Demographic Characteristics of Study Participants

Parameter	Doxycycline (n=60)	Azithromycin (n=60)
Mean age (years)	36.4 ± 12.2	35.8 ± 11.9
Male	34 (56.7%)	32 (53.3%)
Female	26 (43.3%)	28 (46.7%)

Distribution of Infectious Diseases

Respiratory tract infections were the most common indication for antibiotic therapy in both groups, followed by skin and soft tissue infections and gastrointestinal infections

Table 2: Distribution of Infectious Conditions

Type of Infection	Doxycycline (n=60)	Azithromycin (n=60)
Respiratory tract infections	26 (43.3%)	28 (46.7%)
Skin and soft tissue infections	18 (30.0%)	16 (26.7%)
Gastrointestinal infections	10 (16.7%)	9 (15.0%)
Others	6 (10.0%)	7 (11.6%)

Clinical Efficacy

Clinical efficacy was assessed based on resolution of signs and symptoms at the end of therapy. Doxycycline showed a slightly higher clinical cure rate compared to azithromycin, although the difference was not statistically significant.

Table 3: Clinical Efficacy Outcomes

Outcome	Doxycycline (n=60)	Azithromycin (n=60)
Clinical cure	53 (88.3%)	51 (85.0%)
Partial improvement	5 (8.3%)	6 (10.0%)
Treatment failure	2 (3.4%)	3 (5.0%)

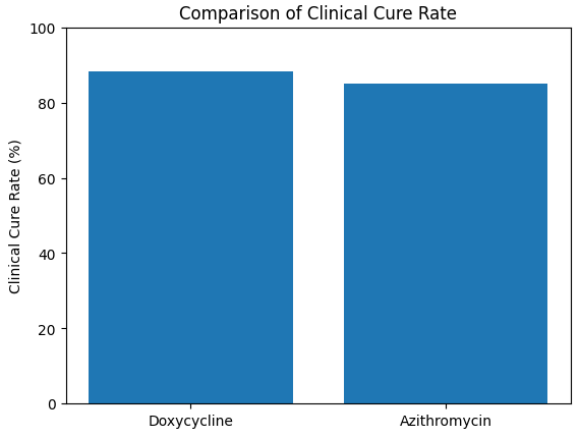

Figure 1: Comparison of Clinical Cure Rate (%); This bar graph compares the overall clinical cure rates between patients treated with doxycycline and azithromycin. Doxycycline showed a marginally higher cure rate (88.3%) compared to azithromycin (85.0%), indicating comparable efficacy between the two antibiotics.

Safety and Adverse Drug Reactions

Adverse drug reactions (ADRs) were monitored throughout the treatment period. A higher incidence of ADRs was observed in the doxycycline group, predominantly gastrointestinal in nature. Most adverse effects were mild to moderate and did not require discontinuation of therapy.

Table 4: Adverse Drug Reactions Observed

Adverse Effect	Doxycycline (n=60)	Azithromycin (n=60)
Gastrointestinal upset	9 (15.0%)	4 (6.7%)
Nausea	2 (3.3%)	2 (3.3%)
Headache	1 (1.7%)	1 (1.7%)
Total ADRs	12 (20.0%)	7 (11.7%)

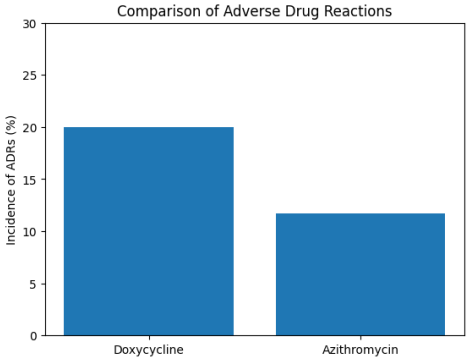

Figure 2: Incidence of Adverse Drug Reactions (%); This graph illustrates the incidence of adverse drug reactions in both treatment groups. The doxycycline group exhibited a higher frequency of adverse events (20.0%) compared

to the azithromycin group (11.7%), with gastrointestinal disturbances being the most common.

Treatment Compliance

Treatment compliance was assessed based on completion of prescribed therapy. Compliance was higher in the azithromycin group, likely due to shorter duration of treatment and better tolerability.

Table 5: Treatment Compliance

Compliance Status	Doxycycline (n=60)	Azithromycin (n=60)
Completed therapy	52 (86.7%)	56 (93.3%)
Did not complete therapy	8 (13.3%)	4 (6.7%)

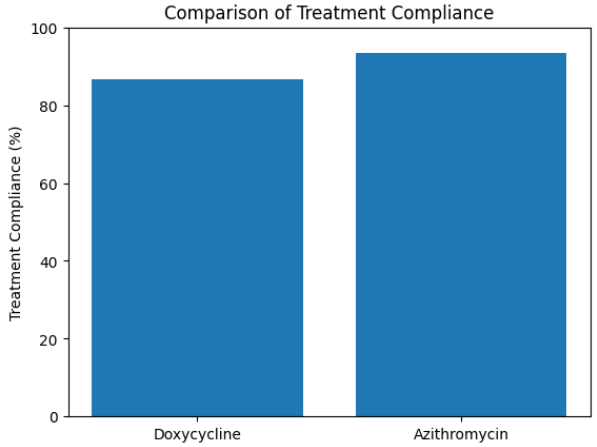

Figure 3: Treatment Compliance (%); The compliance rate was higher in patients receiving azithromycin (93.3%) than in those receiving doxycycline (86.7%). This may be attributed to the shorter treatment duration and better tolerability of azithromycin.

Overall, both doxycycline and azithromycin demonstrated high clinical efficacy in the treatment of infectious diseases. While doxycycline showed marginally better cure rates, azithromycin was associated with fewer adverse drug reactions and higher patient compliance. These findings highlight the importance of balancing efficacy with safety and tolerability when selecting antibiotic therapy.

DISCUSSION

The present study evaluated and compared the efficacy and safety of doxycycline and azithromycin in the treatment of infectious diseases over a six-month period. The findings demonstrate that both antibiotics are highly effective, with comparable clinical cure rates, while exhibiting differences in safety profile and treatment compliance. These observations highlight the importance of individualized antibiotic selection to optimize therapeutic outcomes and minimize adverse effects [9].

In the current study, doxycycline demonstrated a marginally higher clinical cure rate compared to azithromycin. This finding may be attributed to its broad spectrum of antimicrobial activity against gram-positive, gram-negative, and atypical pathogens, as well as its established role in the treatment of respiratory tract and skin infections [10]. Previous studies have similarly reported high efficacy of doxycycline in community-acquired infections, particularly in regions where macrolide resistance is prevalent [11]. However, the difference in clinical cure rates observed in the present study was not statistically significant, indicating that both antibiotics remain effective therapeutic options.

Azithromycin exhibited a more favorable safety profile, with a lower incidence of adverse drug reactions compared to doxycycline. Gastrointestinal disturbances were the most frequently reported adverse effects in both treatment groups but were more common among patients receiving doxycycline. These findings are consistent with earlier reports documenting gastrointestinal intolerance and photosensitivity associated with doxycycline therapy [12]. In contrast, azithromycin is generally well tolerated, owing to its pharmacokinetic properties and simplified dosing regimen [13].

Treatment compliance was notably higher in the azithromycin group. The shorter duration of therapy and once-daily dosing schedule associated with azithromycin likely contributed to improved adherence among patients. Enhanced compliance with azithromycin therapy has been widely reported and is considered an important factor in achieving successful treatment outcomes and reducing the risk of antimicrobial resistance [14].

The clinical implications of these findings are significant. In situations where patient adherence and tolerability are primary concerns, azithromycin may be the preferred agent. Conversely, doxycycline may be more appropriate in infections requiring broader antimicrobial coverage or in settings where macrolide resistance is suspected, as recommended by national treatment guidelines [15]. Therefore, antibiotic selection should be guided by infection type, patient characteristics, safety profile, and prevailing resistance patterns.

Despite the valuable insights provided by this study, certain limitations must be acknowledged. The relatively small sample size and short follow-up period may limit the generalizability of the findings. Additionally, microbiological confirmation of infection was not performed in all cases, which may have influenced the assessment of bacteriological cure. These limitations underscore the need for larger, randomized studies with comprehensive microbiological evaluation to further substantiate the comparative effectiveness of these antibiotics [16].

In inference, the study supports the use of both doxycycline and azithromycin as effective and safe treatment options for infectious diseases. While doxycycline demonstrated slightly higher efficacy in certain infections, azithromycin offered advantages in terms of tolerability and patient compliance. These findings emphasize the importance of rational and patient-centered antibiotic prescribing practices.

CONCLUSION

The present study concludes that both doxycycline and azithromycin are effective and safe antibiotics for the management of infectious diseases. While doxycycline demonstrated marginally higher clinical efficacy in certain infections, azithromycin showed better tolerability and higher patient compliance. Therefore, the choice of antibiotic should be individualized based on the type of infection, patient profile, safety considerations, and local antimicrobial resistance patterns.

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