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MORPHOLOGICAL AND PATHOPHYSIOLOGICAL ALTERATIONS IN LIVER AND KIDNEY IN PATIENTS WITH MULTIDRUG-RESISTANT TUBERCULOSIS: A CLINICOPATHOLOGICAL STUDY

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Abstract

Multidrug-resistant tuberculosis (MDR-TB) represents a major global health burden and is frequently associated with systemic complications beyond pulmonary involvement. Among these, liver and kidney damage plays a critical role in treatment outcomes and patient prognosis. This study aimed to investigate morphological and pathophysiological alterations in hepatic and renal tissues in patients with MDR-TB receiving second-line anti-tuberculosis therapy.

A total of 86 patients diagnosed with MDR-TB were included in this clinicopathological study. Histological evaluation was performed using hematoxylin-eosin staining and immunohistochemical analysis. Clinical parameters, biochemical markers, and treatment duration were correlated with morphological findings.

The results demonstrated significant hepatocellular degeneration, macrovesicular steatosis, sinusoidal dilation, and varying degrees of fibrosis in liver tissue. Renal pathology included tubular epithelial degeneration, interstitial inflammation, glomerular hypertrophy, and focal necrosis. The severity of organ damage was strongly associated with prolonged drug exposure and systemic inflammatory response.

These findings highlight the importance of early detection and monitoring of organ dysfunction in MDR-TB patients. The study provides novel clinicopathological insights into drug-induced toxicity and systemic effects of chronic tuberculosis.

Keywords

MDR-TB, liver morphology, kidney pathology, drug toxicity, fibrosis, tubular necrosis

Introduction

Tuberculosis remains one of the leading infectious diseases worldwide, with increasing prevalence of multidrug-resistant forms posing serious therapeutic challenges. According to the World Health Organization, MDR-TB continues to rise, with significant morbidity and mortality rates globally.

Second-line anti-tuberculosis drugs, although essential for MDR-TB management, are associated with considerable toxicity. Hepatotoxicity and nephrotoxicity are among the most severe adverse effects, often leading to treatment interruption or failure.

The liver plays a central role in drug metabolism, making it particularly vulnerable to toxic injury. Similarly, the kidneys are critical for drug excretion and are highly susceptible to damage from prolonged pharmacological exposure.

Despite increasing clinical awareness, the morphological basis of liver and kidney injury in MDR-TB remains insufficiently studied. Understanding these changes is essential for improving therapeutic strategies and patient outcomes.

Aim

To evaluate morphological and pathophysiological alterations in the liver and kidneys of patients with multidrug-resistant tuberculosis and to determine their association with treatment duration and systemic factors.

Materials and Methods

This study was conducted as a clinicopathological observational analysis.

Study population:

- 86 patients diagnosed with MDR-TB
- Age: 25–68 years
- Treatment duration: 6–24 months

Methods:

- Histological analysis (H&E staining)
- Immunohistochemistry (fibrosis and inflammation markers)
- Biochemical analysis (ALT, AST, creatinine, urea)
- Statistical analysis using SPSS ($p < 0.05$ considered significant)

Inclusion criteria:

- Confirmed MDR-TB
- Long-term second-line therapy

Exclusion criteria:

- Pre-existing severe liver/kidney disease
- Viral hepatitis

Results and Discussion

1. Liver Morphological Changes

Histological examination revealed:

- Hepatocellular degeneration (72%)

- Macrovesicular steatosis (64%)
- Sinusoidal dilation (51%)
- Fibrosis (F1–F3) in 47%

These findings indicate progressive liver injury associated with chronic drug exposure.

2. Kidney Morphological Changes

Renal tissue analysis showed:

- Tubular epithelial degeneration (69%)
- Interstitial inflammation (58%)
- Glomerular hypertrophy (42%)
- Focal necrosis (33%)

These changes suggest impaired renal filtration and toxic injury.

3. Correlation with Treatment Duration

- 12 months therapy → significantly higher fibrosis ($p < 0.01$)
- Elevated ALT/AST correlated with hepatocyte damage
- Increased creatinine associated with tubular necrosis

4. Pathophysiological Mechanisms

The observed changes may be explained by:

- Oxidative stress
- Mitochondrial dysfunction
- Drug-induced cytotoxicity
- Chronic systemic inflammation

5. Comparison with International Studies

Our findings are consistent with recent studies published in high-impact journals such as Clinical Infectious Diseases and Journal of Hepatology, which report significant organ toxicity in MDR-TB patients.

However, our study provides more detailed morphological evidence, particularly regarding fibrosis progression and renal structural damage.

Table 1. Liver Morphological Changes in MDR-TB Patients

Parameter	Frequency (%)
Hepatocellular degeneration	72%
Steatosis	64%
Sinusoidal dilation	51%
Fibrosis	47%

Table 2. Kidney Morphological Changes

Parameter	Frequency (%)
Tubular degeneration	69%
Interstitial inflammation	58%
Glomerular hypertrophy	42%
Necrosis	33%

Clinical Implications

To improve outcomes in MDR-TB patients:

1. Regular monitoring of liver enzymes and renal function
2. Early detection of drug toxicity
3. Individualized treatment regimens
4. Use of hepatoprotective and nephroprotective strategies
5. Multidisciplinary clinical approach

Conclusion

Morphological and pathophysiological alterations in the liver and kidneys are highly prevalent in patients with MDR-TB. These changes are strongly associated with prolonged drug exposure and systemic inflammation. Early diagnosis and integrated management are essential to reduce complications and improve treatment outcomes.

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