Original Article

Evaluation of Hepatotoxicity in Patients on Antiretroviral Treatment for >6 Months Attending ART Center of Bhavanagar: A Cross-Sectional Study

Piyushkumar Dahyabhai Patel[1], Panna K Kamdar[2], Mohammedjunaid M. Sheikh[3], Ajaykumar H. Patel[3], Sandipkumar R. Parmar[4]

[1]Senior Resident, Department of General Medicine, GMERS Medical College, Panchmahal Godhra, Gujarat, India. [2]Associate Professor, Department of General Medicine, Government Medical College, Bhavnagar, Gujarat, India. [3]Senior Resident, Department of General Medicine, GMERS Medical College, Vadnagar, Gujarat, India. [4]M.D. Medicine, Ruxmaniben Government General Hospital, Khokhra, Ahmedabad, Gujarat, India

Abstract

Background: Drug-induced hepatotoxicity is a recognized complication of long-term antiretroviral therapy (ART) in people living with HIV/AIDS (PLHA). Monitoring liver function is essential to prevent progression to severe hepatic injury. This study aimed to evaluate the prevalence and risk factors of hepatotoxicity in patients on ART for more than six months at the ART Center of Sir T Hospital, Bhavnagar. **Material and Methods:** A cross-sectional observational study was conducted over six months at the ART center. PLHA aged ≥18 years receiving ART for at least six months were included, while patients with pre-existing liver disease or on antitubercular therapy were excluded. Demographic data, ART regimens, presenting complaints, laboratory parameters, hepatotoxicity grading, and Model for End-Stage Liver Disease (MELD) scores were collected from medical records using a pre-validated Case Record Form. Data were analyzed using descriptive statistics. **Results:** Among 112 patients, males predominated (74%), and most were aged 41–60 (57%). Abdominal pain (22%) and jaundice (17%) were the most common presenting complaints. TLD was the most frequently prescribed regimen (68%). Laboratory evaluation revealed a mean hemoglobin of 10.58 ± 1.80 g/dL, AST 141.25 ± 248.60 IU/L, and ALT 113.66 ± 180.23 IU/L. Hepatotoxicity grading showed that 78 (69.64%) patients had normal or mild enzyme elevations (Grade 0), while 25 (22.3%) had moderate to severe elevations (Grade 2–4). MELD scores indicated low mortality risk in 55 (49%) patients and high to very high risk in 15 (13%). **Conclusion:** The incidence of clinically significant hepatotoxicity among patients on long-term ART was relatively low. However, a minority exhibited moderate to severe liver enzyme elevations and high MELD scores, highlighting the importance of regular liver function monitoring and early intervention to prevent progression of hepatic injury.

Keywords: HIV, AIDS, antiretroviral therapy, hepatotoxicity, TLD regimen, MELD score.

Received: 20 July 2025 **Revised: 22 August 2025** **Accepted: 23 September 2025** **Published: 11 October 2025**

Introduction

Hepatotoxicity remains a significant concern among individuals receiving antiretroviral therapy (ART) for HIV/AIDS. While ART has transformed HIV from a fatal disease into a manageable chronic condition, long-term use is associated with various adverse effects, including liver dysfunction. The prevalence of hepatotoxicity in patients on highly active antiretroviral therapy (HAART) varies widely, with studies reporting rates ranging from 1% to 54%.[1,2]

The liver is the primary site for the metabolism of most antiretroviral drugs, making it particularly susceptible to drug-induced toxicity. Hepatotoxicity can manifest as elevated liver enzymes, jaundice, or more severe conditions such as liver failure. Factors influencing the risk of hepatotoxicity include the specific ART regimen, co-infection with hepatitis B or C, and individual patient characteristics such as age, gender, and pre-existing liver conditions.[3,4]

In India, where the burden of HIV is substantial, understanding the prevalence and determinants of ART-induced hepatotoxicity is crucial for optimizing patient care. However, data on this topic remain limited, particularly in patients receiving HAART for extended periods. This study aims to evaluate the extent of hepatotoxicity in patients attending the ART center of Sir T Hospital, Bhavnagar, who have been on HAART for more than six months.[5-7]

This research seeks to provide valuable insights into the hepatic safety of long-term HAART by assessing liver function parameters and correlating them with demographic and clinical variables. The findings could inform clinical practices and contribute to the development of guidelines for monitoring and managing hepatotoxicity in HIV-infected individuals undergoing ART.

Materials and Methods

The present cross-sectional observational study was carried out at the ART Center of Sir T Hospital, Bhavnagar, to determine the proportion of drug-induced hepatotoxicity among patients

Address for correspondence: Dr. Piyushkumar Dahyabhai Patel, Senior Resident, Department of General Medicine, GMERS Medical College, Panchmahal Godhra, Gujarat, India
E-mail: rowdypiyush61296@gmail.com

DOI:
10.21276/amit.2025.v12.i3.116

How to cite this article: Patel PD, Kamdar PK, Sheikh MM, Patel AH, Parmar SR. Evaluation of Hepatotoxicity in Patients on Antiretroviral Treatment for >6 Months Attending ART Center of Bhavanagar: A Cross-Sectional Study. Acta Med Int. 2025;12(3):460-463.

with HIV/AIDS receiving highly active antiretroviral therapy (HAART) for more than six months. The total study duration was nine months, during which data collection was completed over six months. The study population comprised people living with HIV/AIDS (PLHA) who attended the ART center during the study period. All patients above 18 years of any gender who had been receiving HAART for at least six months were included in the analysis. Patients with a known history of liver disease or those receiving antitubercular therapy were excluded from the study.

The institute's institutional ethics committee obtained prior approval for the study protocol. Since the study involved retrospective data collection from medical records, informed consent was not required, and the ethics committee granted a waiver of consent. The required information was extracted from the ART center records using a predefined and pre-validated Case Record Form (CRF). The CRF included demographic variables such as age, gender, literacy status, and marital status; clinical information, including presenting complaints such as jaundice, abdominal pain, fever, vomiting, and altered sensorium; and the current HAART regimen. Laboratory data, including hemoglobin concentration, total leukocyte and platelet counts, liver function parameters (SGPT, SGOT, alkaline phosphatase, total, direct, and indirect bilirubin), international normalized ratio (INR), and serum creatinine levels, were also recorded. Hepatotoxicity was graded according to aminotransferase elevation criteria, and the Model for End-Stage Liver Disease (MELD) score was calculated for each patient to assess the severity of hepatic dysfunction.

All collected data were entered into Microsoft Excel spreadsheets and subjected to appropriate statistical analysis to derive relevant findings.

Results

A total of 112 patients were enrolled in the study. The sociodemographic profile of the participants is summarized in Table 1. The study population comprised a higher proportion of males than females. Most participants belonged to the 41–60 age group, and the majority were literate and married.

The distribution of presenting complaints among the study participants is detailed in Table 2. Abdominal pain was the most frequent symptom reported, followed by jaundice. Fever and vomiting were observed in a smaller proportion of cases, while a few patients presented with altered sensorium.

Table 3 depicts the various HAART regimens administered to the study participants. The TLD regimen was the most commonly prescribed combination, followed by TLE and ABCLD. A smaller number of patients received TLAtv/r or ZLD regimens.

Table 4 presents the mean values and standard deviations of key laboratory parameters. These findings provide an overview of the participants' hematological and biochemical indices, including liver function tests, renal function, and MELD scores.

Table 5 outlines the grading of hepatotoxicity based on serum AST and ALT levels. Most patients demonstrated enzyme elevations within normal limits or mild hepatotoxicity (Grade 0–1), whereas a smaller subset exhibited moderate to severe hepatic injury (Grade 2–4).

Figure 1 shows an analysis of MELD scores for mortality risk estimation. Nearly half of the study participants fell into the low-risk category, while about one-third exhibited medium risk. According to the MELD score classification, only a small proportion of patients demonstrated high or very high mortality risk.

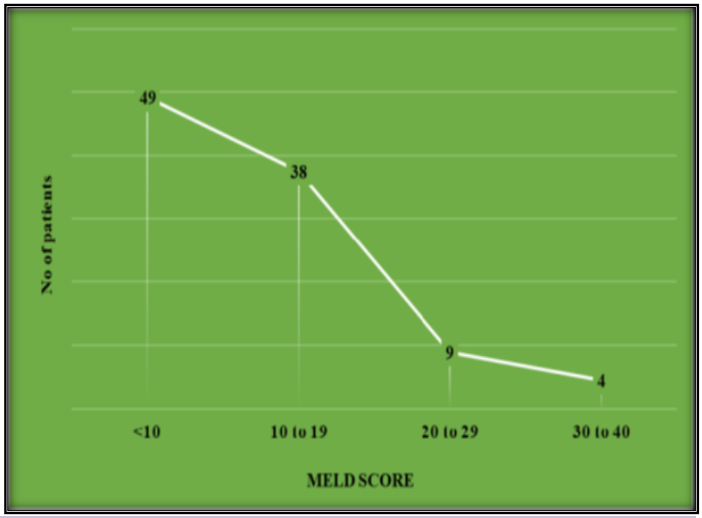

Figure 1: MELD score analysis (%) in the study participants (n=112)

Table 1: Demographic Characteristics of Study Participants

Variable	Number	Percentage (%)
Gender		
Male	83	74
Female	29	26
Age (years)		
20–40	47	42
41–60	64	57
>60	1	1
Literacy status		
Literate	92	82
Illiterate	20	18
Marital status		
Married	88	79
Unmarried	24	21

Table 2: Presenting Complaints in the Patients Enrolled in the Study (n=112)

Presenting Complaints	Number	Percentage (%), n=112
Abdominal pain	25	22
Jaundice	19	17
Fever	8	7
Vomiting	8	7
Altered sensorium	4	4

Table 3: HAART Regimens in the Patients Enrolled in the Study (n=112)

HAART Regimen	Number	Percentage (%, n=112)
TLD	76	68
TLE	12	11
ABCLD	11	10
TLAtv/r	8	7
ZLD	5	4

Table 4: Mean ± SD Values of Laboratory Investigations in the Study Patients (n=112)

Laboratory Parameter	Mean Value	SD
Haemoglobin (Hb %)	10.58	1.80
Total leucocyte count (cells/c.mm)	6919.64	2736.00
Platelet count (cells/µL)	297794.64	78259.31
Aspartate aminotransferase (AST/SGPT) (IU/L)	141.25	248.60
Alanine aminotransferase (ALT/SGOT) (IU/L)	113.66	180.23
Alkaline phosphatase (IU/L)	100.21	77.40
Total bilirubin (mg/dl)	2.15	2.34
Direct bilirubin (mg/dl)	0.95	1.19
Indirect bilirubin (mg/dl)	1.20	1.29
International normalized ratio (INR)	1.20	0.40
Serum creatinine (mg/dl)	1.26	1.10
MELD Score	12.17	6.25

Table 5: Hepatotoxicity Analysis in the Study Participants (n=112)

Grade	AST/ALT Above the Normal Range	Number of Patients	Percentage (%, n=112)
Grade 0	<1.25 times	78	69.64
Grade 1	1.25–2.5 times	9	8.03
Grade 2	2.6–5 times	3	2.67
Grade 3	5.1–10.0 times	9	8.03
Grade 4	>10 times	13	11.60

Discussion

This study aimed to evaluate the prevalence of hepatotoxicity and risk factors among patients receiving ART for over six months at the ART Center of Sir T Hospital, Bhavnagar. Our findings indicate a relatively low incidence of clinically significant hepatotoxicity, with most patients exhibiting either mild or no elevations in liver enzymes, suggesting that long-term ART is generally well tolerated in this population. These observations are consistent with previous studies reporting a wide range of hepatotoxicity rates among HIV patients on ART, which vary from 1% to 54% [7-8], reflecting differences in ART regimens, patient demographics, and co-morbid conditions across study populations.

The liver plays a central role in the metabolism and clearance of most antiretroviral drugs, rendering it particularly susceptible to drug-induced toxicity. Several factors have been identified as influencing the risk of hepatotoxicity, including the type and combination of ART drugs used, co-infection with hepatotropic viruses such as hepatitis B or C, and individual patient characteristics such as age, gender, nutritional status, and the presence of pre-existing liver disease.[8] In our cohort, most patients were on the TLD regimen, which has been increasingly preferred due to its efficacy and relatively favorable safety profile. Previous studies have demonstrated that TLD-based regimens are associated with a lower incidence of hepatotoxicity than older regimens such as TLE or regimens containing protease inhibitors.[9-11]

The MELD score is a validated clinical tool used to assess the severity of liver dysfunction and predict short-term mortality. In our study, MELD scores were predominantly in the low-risk range, suggesting that most patients maintained stable liver function despite prolonged exposure to ART. Nonetheless, some participants demonstrated high or very high MELD scores, highlighting the potential for significant hepatic compromise in a vulnerable minority. This finding emphasizes the importance of routine monitoring of liver function, timely identification of at-risk patients, and early intervention to prevent progression to severe liver injury.[12-14]

This study's limitations include its cross-sectional design, which does not allow for the establishment of temporal or causal relationships between ART and hepatotoxicity. Additionally, certain potential confounding factors, such as alcohol intake, herbal medication use, and detailed hepatitis co-infection status, were not fully captured. Future prospective studies with larger sample sizes, longitudinal follow-up, and comprehensive data collection are warranted to understand hepatotoxicity

determinants better and optimize long-term ART safety in diverse patient populations.

Conclusion

In this cross-sectional study of patients on antiretroviral therapy for over six months, most participants showed no or mild liver enzyme elevations, indicating a low incidence of clinically significant hepatotoxicity. A smaller subset had moderate to severe hepatic injury, emphasizing the need for regular liver function monitoring. MELD score analysis revealed that while most patients had low to medium mortality risk, a minority were at high or very high risk, highlighting the importance of early detection and timely management. These findings underscore the value of routine laboratory surveillance and individualized care to ensure the safety of long-term ART.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Abu-Awwad SA, Abu-Awwad A, Suba MI, Lazureanu VE, Bolovan AD, Rosca O, et al. Evaluating Hepatotoxicity: A Comparative Analysis of New Generation versus Historical Antiretroviral Agents. Infect Dis Rep. 2024 Apr 24;16(3):423-434. doi: 10.3390/idr16030031.
2. Otto AO, Rivera CG, Zeuli JD, Temesgen Z. Hepatotoxicity of Contemporary Antiretroviral Drugs: A Review and Evaluation of Published Clinical Data. Cells. 2021 May 20;10(5):1263. doi: 10.3390/cells10051263.
3. Strauss KE, Phoswa WN, Hanser S, Mokgalaboni K. HIV Infection and Antiretroviral Therapy Impair Liver Function in People Living with HIV: Systematic Review and Meta-Analysis. Pharmaceuticals (Basel). 2025 Jun 25;18(7):955. doi: 10.3390/ph18070955.
4. Qin F, Jiang J, Qin C, Huang Y, Liang B, Xu Y, et al. Liver damage in patients living with HIV on antiretroviral treatment with normal baseline liver function and without HBV/HCV infection: an 11-year retrospective cohort study in Guangxi, China. BMJ Open. 2019 Apr 2;9(4):e023140. Doi: 10.1136/bmjopen-2018-023140.
5. Rukmangathen R, Brahmanapalli VD, Thammisetty DP, Pemmasani D, Gali SD, et al. Study of adverse drug reactions to antiretroviral therapy in Tirupati tertiary care hospital. Perspect Clin Res. 2020 Oct-Dec;11(4):158-163. doi: 10.4103/picr.PICR_133_18.
6. Mukherjee S, Era N, Saha B, Tripathi SK. Adverse drug reaction monitoring in patients on antiretroviral therapy in a tertiary care hospital in Eastern India. Indian J Pharmacol. 2017 May-Jun;49(3):223-228. doi: 10.4103/ijp.IJP_304_16.
7. Kumar R Sr, Jindal A Sr, Garg P, Kaur A, Kumar S, et al. Pharmacovigilance Study of Anticancer Drugs in a Tertiary Care Teaching Hospital in North India: A Retrospective Study. Cureus. 2023 Sep 10;15(9):e44984. Doi: 10.7759/cureus. 44984.
8. Kumarasamy N, Venkatesh KK, Devaleenol B, Poongulali S, Yephthomi T, Pradeep A, et al. Factors associated with mortality among HIV-infected patients in the era of highly active antiretroviral therapy in southern India. Int J Infect Dis. 2010 Feb;14(2):e127-31. Doi: 10.1016/j.ijid.2009.03.034.
9. Gebremicael G, Tola HH, Gebreegzier A, Kassa D. Incidence of Hepatotoxicity and Factors Associated During Highly Active Antiretroviral Therapy in People Living with HIV in Ethiopia: A Prospective Cohort Study. HIV AIDS (Auckland). 2021 Mar 25;13:329-336. Doi: 10.2147/HIV.S283076.
10. Mahajan VK, Wadhwa D, Sharma A, Chauhan S, Vashist S, Kumar P, Chowdhry B. Assessment of liver and renal functions in human immunodeficiency virus-infected persons on highly active antiretroviral therapy: A mixed cohort study. Indian J Dermatol Venereol Leprol. 2020;86:499-507
11. Gali SD, Pemmasani D, Thammi Sett DP. Highly active anti-retroviral therapy-associated hepatotoxicity: case report and discussion. Indian J Pharm Pract. 2019;12(2):126–128. doi:10.5530/ijopp. 12.2.26.
12. Mulu W, Gidey B, Chernet A, Alem G, Abera B. Hepatotoxicity and associated risk factors in HIV-infected patients receiving antiretroviral therapy at Felege Hiwot Referral Hospital, Bahirdar, Ethiopia. Ethiop J Health Sci. 2013 Nov;23(3):217-26. doi: 10.4314/ejhs.v23i3.4.
13. Zhou J, Phanupak P, Kiertiburanakul S, Ditangco R, Kamarulzaman A, Pujary S; TREAT Asia HIV Observational Database. Highly active antiretroviral treatment containing efavirenz or nevirapine and related toxicity in the TREAT Asia HIV Observational Database. J Acquir Immune Defic Syndr. 2006 Dec 1;43(4):501-3. doi: 10.1097/01.qai.0000243109.33759.81
14. Subramanian A, Sulkowski M, Barin B, Stablein D, Curry M, Nissen N, et al. MELD score is an important predictor of pretransplantation mortality in HIV-infected liver transplant candidates. Gastroenterology. 2010 Jan;138(1):159-64. doi: 10.1053/j.gastro.2009.09.053.