

Autoimmune Hepatitis: A Single-Center Experience on Treatment Response Rates and Their Association with Cirrhosis

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Abstract

Objective: This study aimed to evaluate treatment responses in patients with autoimmune hepatitis (AIH) and overlap syndromes and to investigate the association between treatment response and cirrhosis development.

Methods: Between 2010 and 2025, 469 patients diagnosed with AIH at a single center were screened. After exclusion of patients who did not meet international diagnostic criteria, 234 patients were included and categorized as AIH (n = 130) and AIH with overlap syndrome (AIH+OS; comprising AIH+PBC and AIH+PSC) (n = 104). Demographic characteristics, treatment responses, cirrhosis prevalence, and potential predictors of cirrhosis were recorded. Treatment responses were classified according to International Autoimmune Hepatitis Group criteria.

Results: Median ages were 57 (44–67) and 59 (47–67) years in the AIH and AIH+OS groups, respectively, with female predominance in both groups. Cirrhosis prevalence was similar between groups (36.2% vs. 38.5%; p = 0.689). Complete biochemical response rates were 75.4% in AIH and 72.1% in AIH+OS; insufficient response rates were 19.2% and 16.3%, and non-response rates were 5.4% and 8.7% (p = 0.546). Cirrhosis was more frequent in patients with non-response (93.8%) and insufficient response (76.2%) than in those with complete biochemical response (23.1%) (p < 0.001). Advanced fibrosis at diagnosis was the most common contributing factor (57.5%).

Conclusion: Treatment responses are comparable in AIH and overlap syndromes. Achieving a complete biochemical response is crucial to prevent cirrhosis. Patients with insufficient response, non-response, or advanced fibrosis at diagnosis require close monitoring due to poorer prognosis. (*Acta gastroenterol belg.*, 2026, 89, 445–450).

Keywords: Autoimmune hepatitis, cirrhosis, overlap syndrome, treatment response.

Introduction

Autoimmune hepatitis (AIH) is an immunological disease characterized by elevated serum IgG levels and autoantibodies, persistent hepatic inflammation, and characteristic histological findings. Patients may present with symptoms such as fatigue, anorexia, jaundice, right upper quadrant pain, nausea, vomiting, and skin rashes (1).

Although AIH has traditionally been considered a rare disease, recent studies have demonstrated a steadily increasing incidence (2, 3). In a recent systematic review and meta-analysis including 37 studies, the incidence of autoimmune hepatitis was reported as 1.28 cases per 100,000 persons, while the prevalence was 15.65 cases per 100,000 persons, representing an approximately threefold increase compared with the period prior to the 2000s (2, 4–6).

AIH may present in asymptomatic, acute, or chronic forms. Chronic AIH is defined by persistent elevation of liver enzymes and/or symptoms lasting longer than six months and represents the most common presentation, accounting for approximately 48–68% of cases. Acute AIH is defined by symptom onset within less than 30 days and occurs in 10–26% of patients. Asymptomatic AIH, characterized by isolated elevation of liver enzymes in the absence of clinical symptoms, accounts for approximately 6–23% of cases (4, 7–9).

The primary goal of treatment in AIH is to achieve and maintain a complete biochemical response, defined as normalization of serum transaminases and IgG levels. Achieving this therapeutic target may halt fibrosis progression and may even lead to regression of hepatic fibrosis (1). Due to the heterogeneous and widely variable clinical manifestations of AIH, establishing a diagnosis can be challenging in many cases. Accordingly, current pathology consensus statements emphasize that histological examination is mandatory for the diagnosis (10).

Primary biliary cholangitis (PBC) and/or primary sclerosing cholangitis (PSC) may coexist in patients with AIH, a condition referred to as overlap syndrome (OS). Distinguishing these entities can be challenging in clinical practice. Therefore, an integrated assessment of clinical features, autoantibody profiles, globulin levels, imaging findings, and histopathological evaluation is often required. Accurate differentiation is crucial, as it has important implications for treatment strategies and follow-up approaches (11).

Current treatment for AIH consists of corticosteroid monotherapy or combination therapy with corticosteroids and azathioprine. Using these regimens, a favorable treatment response is achieved in approximately 90% of patients. 10–20% of patients diagnosed with AIH respond inadequately to standard treatment or standard treatment is not effectively applied due to drug side

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effects. In this patient population, alternative therapies such as mycophenolate mofetil, cyclosporine, or tacrolimus may be considered. (12).

The aim of our study was to determine treatment response rates and the prevalence of cirrhosis in patients with AIH and OS followed at our center, and to compare these findings with the current literature.

Materials and Methods

This study was designed as a retrospective, single-center cohort study conducted between 2010 and 2025. AIH diagnosis was made based on clinical, serological, and histological findings from liver biopsy in accordance with international guidelines and consensus statements. Patients without liver biopsy were excluded from the study. According to the AIH scoring system, 108 patients scoring 6 points were classified as probable AIH, while 123 patients scoring ≥ 7 points were classified as definite AIH (13). Overlap syndromes (AIH + PBC and AIH + PSC) were defined based on clinical, laboratory, imaging, and histopathological findings (14, 15). For laboratory tests, the upper limit of normal for AST and ALT was defined as 35 U/L in women and 50 U/L in men, while the upper limit of normal for ALP was determined as 120 U/L for both sexes. Treatment responses were classified according to the response criteria defined by the International Group on Autoimmune Hepatitis (IAIHG) (16):

- Complete biochemical response (CBR): Normalization of serum aminotransferase and IgG levels within 6 months of initiation of treatment.
- Insufficient response: Failure to achieve a complete biochemical response within 6 months of initiation of standard care therapy.
- Non-response: Less than 50% reduction in serum aminotransferase levels compared to baseline within 4 weeks of initiation of treatment.

At our center, treatment was initiated with prednisolone at a dose of 1 mg/kg/day (maximum 60 mg/day), followed by weekly dose reduction. When the prednisolone dose was reduced to 30 mg/day, azathioprine was added at a dose of 50 mg/day. Prednisolone was then gradually reduced according to the clinical course. The azathioprine dose was increased to a maximum of 2.5 mg/kg/day. Thiopurine methyltransferase (TPMT) activity could not be assessed at baseline or during follow-up. Due to drug-related side effects, inadequate/unresponsiveness, or concomitant rheumatological diseases, tacrolimus was used in 4 patients and mycophenolate mofetil in 7 patients. In patients with PBC-related OS, ursodeoxycholic acid was additionally prescribed and titrated gradually up to a maximum dose of 15 mg/kg/day (11).

Patients were evaluated for the development of cirrhosis from the time of diagnosis to the last follow-up. The degree of liver fibrosis at the time of AIH

diagnosis was assessed histopathologically. Cirrhosis that developed during follow-up was determined based on a comprehensive evaluation of clinical findings, imaging studies, and laboratory results. The presence of steatotic liver disease associated with concomitant metabolic dysfunction (MASLD) was diagnosed using ultrasonography and evaluation of cardiometabolic risk factors (17).

Statistical Analysis:

Continuous variables were presented as mean $\pm$ standard deviation or median (interquartile range (IQR)) depending on the data distribution, while categorical variables were expressed as numbers (percentages). Comparisons between the two patient groups (AIH and AIH+OS) and among treatment response categories (non-response, insufficient response, and complete biochemical response) were performed according to the type and distribution of the variables. For continuous variables, the Mann-Whitney U test was used due to the non-normal distribution of data. Pearson's chi-square (χ^2) test was used for comparisons of categorical variables; Fisher's exact test was applied when expected cell counts were less than five. All p-values were two-sided, and a p-value < 0.05 was considered statistically significant. Statistical analyses were conducted using IBM SPSS Statistics for Windows, Version 27.0 (IBM Corp., Armonk, NY, USA).

Artificial intelligence assistance was used during manuscript preparation. Specifically, ChatGPT (OpenAI, version 5.3) was utilized for language editing, grammar refinement, and translation support. All AI-generated text was carefully reviewed, verified, and edited by the authors, who take full responsibility for the final content. No AI tools were used for data analysis, statistical evaluation, or interpretation of results.

Results

A total of 234 patients were evaluated, including AIH (n = 130) and AIH with overlap syndrome (AIH+OS; n = 104). The median ages were 57 (44–67) and 59 (47–67) years in the AIH and AIH+OS groups, respectively, and the proportion of female patients was 79.2% and 82.7%. ENA positivity was observed in 19.2% of patients with AIH and 12.5% of those with AIH+OS.

Among concomitant rheumatologic diseases, Sjögren's syndrome (5.4% vs. 4.8%), rheumatoid arthritis (4.6% vs. 1.9%), and systemic lupus erythematosus (6.2% in AIH vs. 0% in AIH+OS; p = 0.010) were identified. Cirrhosis at the time of diagnosis was present in 25 patients (19.2%) in the AIH group and 25 patients (24.0%) in the AIH+OS group (p = 0.465). De novo cirrhosis during follow-up developed in 22 (16.9%) and 15 (14.4%) patients, respectively (p = 0.733). Total cirrhosis prevalence was 36.2% in the AIH group and 38.5% in the AIH+OS group, with no significant difference between the groups (p = 0.689) (Table 1).

Table 1. — Demographic characteristics, cirrhosis status, ENA seropositivity, and coexisting rheumatic diseases in patients with autoimmune hepatitis and overlap syndrome.

	AIH (n=130)	AIH+OS (n=104)	p
Age, years	57 (44–67)	59 (47–67)	0.504
Gender, female, n (%)	103 (79.2%)	86 (82.7%)	0.325
ENA positive, n (%)	25 (19.2%)	13 (12.5%)	—
ENA negative, n (%)	26 (20.0%)	14 (13.5%)	1.000*
ENA not tested, n (%)	79 (60.8%)	74 (71.2%)	—
Sjögren's syndrome, n (%)	7 (5.4%)	5 (4.8%)	1.000
RA, n (%)	6 (4.6%)	2 (1.9%)	0.471
SLE, n (%)	8 (6.2%)	0 (0.0%)	0.010
AS, n (%)	2 (1.5%)	1 (1.0%)	1.000
Scleroderma, n (%)	1 (0.8%)	3 (2.9%)	0.321
IgG4-RD, n (%)	1 (0.8%)	0 (0.0%)	1.000
Cirrhosis at diagnosis, n (%)	25 (19.2%)	25 (24.0%)	0.465
De novo cirrhosis during follow-up, n (%)	22 (16.9%)	15 (14.4%)	0.733
Total cirrhosis, n (%)	47 (36.2%)	40 (38.5%)	0.689
Fisher's exact test used for all categorical comparisons. *p-value for ENA positive vs. negative among tested patients only. Abbreviations: AIH, autoimmune hepatitis; OS, overlap syndrome (AIH+PBC and AIH+PSC combined); ENA, extractable nuclear antigen antibodies; RA, rheumatoid arthritis; SLE, systemic lupus erythematosus; AS, ankylosing spondylitis; IgG4-RD, immunoglobulin G4-related disease; PBC, primary biliary cholangitis; PSC, primary sclerosing cholangitis.			

The rate of complete biochemical response was 75.4% in the AIH group and 72.1% in the AIH+OS group; insufficient response rates were 19.2% and 16.3%, respectively, while non-response rates were 5.4% and 8.7% ($p = 0.546$) (Table 2).

When the prevalence of cirrhosis was compared across treatment response categories (Table 3), patients with non-response had a significantly higher rate of cirrhosis (93.8%) compared with those with insufficient response (76.2%) and complete biochemical response (23.1%) ($p < 0.001$). Similarly, the proportion of patients without cirrhosis was highest in the complete

biochemical response group and lowest among non-responders.

Among patients who developed cirrhosis, advanced fibrosis at the time of diagnosis was the most frequently identified contributing factor (57.5%). Other potential contributors included concomitant MASLD (6.9%), poor treatment adherence (6.9%), temporary discontinuation of azathioprine due to cytopenia (4.6%), and other rare causes. When patients were stratified according to treatment response categories, no significant differences were observed in the distribution of potential contributing factors for cirrhosis ($p = 0.860$) (Table 4).

Table 2. — Response to treatment in autoimmune hepatitis/overlap syndrome.

Response to treatment	AIH, n (%)	AIH+OS, n (%)	Total, n (%)	p
Non-response	7 (5.4%)	9 (8.7%)	16 (6.8%)	
Insufficient response	25 (19.2%)	17 (16.3%)	42 (17.9%)	
Complete biochemical response	98 (75.4%)	75 (72.1%)	173 (73.9%)	
Total	130 (100.0%)	104 (100.0%)	234 (100.0%)	0.546
Pearson's chi-square (χ^2) test was used. Abbreviations: AIH, autoimmune hepatitis; OS, overlap syndrome (AIH+PBC and AIH+PSC combined).				

Table 3. — Comparison of cirrhosis prevalence according to treatment response.

	Non-response	Insufficient response	Complete biochemical response	Total	p
No cirrhosis, n (%)	1 (6.2%)	10 (23.8%)	133 (76.9%)	144 (61.5%)	
Cirrhosis, n (%)	15 (93.8%)	32 (76.2%)	40 (23.1%)	87 (37.2%)	
Total, n (%)	16 (100.0%)	42 (100.0%)	173 (100.0%)	234 (100.0%)	<0.001
Pearson's chi-square (χ^2) test was used.					

Table 4. — Potential contributors to cirrhosis among AIH/overlap syndrome patients, stratified by treatment response.

	Non-response, n (%)	Insufficient response, n (%)	Complete biochemical response, n (%)	Total, n (%)	p
Advanced fibrosis at diagnosis	11 (73.3%)	15 (46.9%)	24 (60.0%)	50 (57.5%)	
Concomitant MASLD	1 (6.7%)	2 (6.3%)	3 (7.5%)	6 (6.9%)	
History of alcohol use	0 (0.0%)	1 (3.1%)	0 (0.0%)	1 (1.1%)	
Temporary discontinuation of azathioprine due to cytopenia	0 (0.0%)	2 (6.3%)	2 (5.0%)	4 (4.6%)	
Right-sided heart failure	0 (0.0%)	1 (3.1%)	0 (0.0%)	1 (1.1%)	
Inability to administer adequate prednisolone due to osteoporosis	1 (6.7%)	0 (0.0%)	1 (2.5%)	2 (2.3%)	
Nonadherence	0 (0.0%)	3 (9.4%)	3 (7.5%)	6 (6.9%)	
Data not available	2 (13.3%)	8 (25.0%)	7 (17.5%)	17 (19.5%)	
Total	15 (100.0%)	32 (100.0%)	40 (100.0%)	87 (100.0%)	0.860
Abbreviations: AIH, autoimmune hepatitis; MASLD, metabolic dysfunction–associated steatotic liver disease.					

Discussion

In this single-center experience, the rate of complete biochemical response was approximately 75% in patients with AIH and 72% in those with AIH+OS, while insufficient response was observed in approximately 18% and non-response in approximately 7% of patients overall. The merged AIH+OS group demonstrated similar treatment response rates to AIH, and these findings are consistent with those reported in the literature (18).

It is well established that achieving a complete biochemical response can halt the progression of fibrosis and may even lead to fibrosis regression, whereas fibrosis may continue to progress in patients who fail to reach biochemical treatment targets (1, 19). Our findings demonstrate a strong association between non-response or insufficient response and the presence of cirrhosis, in line with previously reported data in the literature ($p < 0.001$).

Among patients with insufficient response or non-response, second-line therapy was initiated in 11 patients (tacrolimus in 4, mycophenolate mofetil in 7). The relatively low rate of second-line treatment in our cohort likely reflects a combination of factors: a substantial proportion of these patients had advanced fibrosis or cirrhosis at baseline and were therefore directed toward liver transplant evaluation rather than escalation of immunosuppression; some patients declined additional medications due to comorbidities or concerns regarding side effects; TPMT activity was not assessed at our center, which may have contributed to suboptimal azathioprine dosing in some cases; and a minority of patients were lost to follow-up before second-line therapy could be initiated.

Systematic reviews and prospective studies have shown that relapse occurs in nearly all patients who achieve long-term complete biochemical response

after discontinuation of azathioprine (20–22). In our cohort, relapse occurred in one patient six months after discontinuation of azathioprine due to cytopenia despite having achieved a complete biochemical response, and this was subsequently followed by the development of cirrhosis.

Recent retrospective studies have shown that patients with AIH and concomitant MASLD more frequently present with cirrhosis at the time of diagnosis and have a higher risk of decompensation compared with patients without MASLD (23, 24). In our study, some patients who developed cirrhosis despite achieving a complete biochemical response or insufficient response had concomitant MASLD, and the development of cirrhosis in these cases was attributed to this condition. This cause–effect relationship was found to be consistent with findings reported in the literature.

The presence of advanced fibrosis at the time of diagnosis is generally associated with a lower likelihood of achieving a complete biochemical response and with a poorer prognosis (25–27). In our study, evaluation of cases in which cirrhosis developed despite achievement of a complete biochemical response revealed that this outcome was most commonly attributable to the presence of advanced fibrosis at the time of diagnosis. Therefore, treatment optimization and close follow-up are particularly important in patients with advanced fibrosis at diagnosis. Even when a complete biochemical response is achieved, ongoing subclinical histological activity and/or disease relapse may promote fibrosis progression and ultimately lead to cirrhosis (28–30). Factors that may contribute to the development of cirrhosis despite achievement of a complete biochemical response include concomitant MASLD, temporary interruptions of immunosuppressive therapy, and poor treatment adherence (Table 4). This observation further underscores the importance of histological remission in addition to biochemical remission.

Study limitations and strengths:

This study has several limitations that should be considered when interpreting the findings. First, the retrospective design introduces potential selection bias and information bias, and causal inferences cannot be drawn. Second, several unmeasured confounders — including pre-diagnostic disease duration, HLA haplotype, genetic susceptibility factors, and lifestyle variables — may have independently influenced treatment response and cirrhosis development. Third, FibroScan data and serial non-invasive fibrosis scores were not systematically available, which precluded quantitative longitudinal assessment of fibrosis progression. Fourth, TPMT activity was not measured at our center, which may have affected azathioprine dosing optimization in some patients. Fifth, as a single-center study, the generalizability of our findings to other populations and healthcare settings may be limited.

One of the main strengths of our study is that, despite its retrospective design, it is based on single-center data that reflect real-world clinical practice. Moreover, by providing a detailed, patient-level evaluation of predisposing factors for cirrhosis in patients who developed cirrhosis despite achieving a complete biochemical response, our study makes a meaningful contribution to the existing literature.

Conclusion

There are no major differences in treatment response between AIH and overlap syndromes, and complete biochemical response rates are high in both groups. Achieving a complete biochemical response remains the primary therapeutic goal for preventing the development of cirrhosis. Because prognosis is poorer in patients with advanced fibrosis at diagnosis, concomitant MASLD, or poor adherence to immunosuppressive therapy for any reason, close follow-up and strategies to improve treatment adherence should be prioritized in this patient population.

Declarations

Author contributions: All authors meet the ICMJE authorship criteria. Detailed individual contributions will be provided on the title page for blinded review.

Ethics Approval: This study was approved by an institutional non-interventional research ethics committee (Decision No: 2025/04-12, Date: February 5, 2025) The study was conducted in accordance with the principles of the Declaration of Helsinki.

Informed Consent: Due to the retrospective design of the study, the requirement for obtaining individual informed consent was waived by the ethics committee.

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Conflict of Interest: The authors declare that they have no conflicts of interest related to this study.

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