Med Discoveries
An open access journal of science and medicine

Article Type: Research Article
Volume 4, Issue 4
Received: Mar 01, 2025
Accepted: Apr 11, 2025
Published Online: Apr 18, 2025

The Relationship Between Inflammatory Bowel Disease and Valvular Heart Disease: A Retrospective Cross-Sectional Analysis of the National Inpatient Sample (2016-2018)

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Abstract

Background: Inflammatory Bowel Disease (IBD) is a chronic gastrointestinal condition with significant extra-intestinal manifestations, including cardiovascular complications. While the relationship between IBD and atherosclerotic cardiovascular disease is increasingly recognized, the association between IBD and valvular heart disease remains underexplored and previous studies have demonstrated contradictory results. This study investigates the prevalence of valvular disease among hospitalized patients with IBD and its clinical implications.

Methods: This a retrospective cross-sectional study using the National Inpatient Sample (NIS) database (2016-2018). Hospitalized patients with and without IBD were compared for the prevalence of valvular disease. Multivariable logistic regression adjusted for demographics and comorbidities, including diabetes mellitus, hypertension, chronic kidney disease, dyslipidemia, peripheral artery disease, and heart failure, was performed.

Results: Among all hospitalized patients, the estimated prevalence of valvular disease was 5.4% (SE 0.03), and the prevalence of IBD was 2.2% (SE 0.01). After adjusting for confounders, IBD was associated with 18.4% decreased odds of valvular disease compared to patients without IBD (adjusted OR: 0.82, 95% CI: 0.80-0.83).

Conclusion: Contrary to expectations and previous reports, IBD patients demonstrated lower odds of valvular disease in the inpatient setting. These findings may reflect unique disease characteristics, treatment effects (specifically the protective effects of biologics), or inpatient care patterns. Further prospective studies are needed to elucidate the mechanisms underlying this longitudinal association and its clinical significance.

Keywords: Inflammatory bowel disease; Valvular heart disease; National inpatient sample; Cardiovascular complications; Biologics.

Citation: Rimsky E, Lahoud C, Tawfik M, Jalloul Y, Javon J, et al. The Relationship Between Inflammatory Bowel Disease and Valvular Heart Disease: A Retrospective Cross-Sectional Analysis of the National Inpatient Sample (2016-2018). Med Discoveries. 2025; 4(4): 1253.

Introduction

Inflammatory Bowel Disease (IBD), encompassing Crohn's disease and ulcerative colitis, is a chronic condition primarily affecting the gastrointestinal tract. Beyond its intestinal manifestations, IBD is increasingly recognized for its systemic impact, including a wide range of extra-intestinal complications. Cardiovascular manifestations, such as myocarditis, pericarditis, vascular disease, and arrhythmias have been documented. However, valvular heart disease remains a potential yet underexplored complication of IBD, with limited data available and conflicting reports in the literature [10].

The proposed mechanisms linking IBD to valvular disease include systemic inflammation, immune-mediated processes, and secondary effects from infections such as bacterial or culture-negative endocarditis. Specifically, persistent inflammation can lead to endothelial dysfunction and accelerated atherosclerosis, potentially affecting valve leaflets and causing structural changes. However, the prevalence and clinical significance of valvular heart disease in IBD patients remain poorly defined. Existing literature primarily consists of case reports and small cohort studies, such as those by Gupta et al. (2017) and Lee et al. (2019), which document isolated instances of valvular disease in IBD patients, leaving a significant gap in understanding the broader relationship. Furthermore, recent evidence suggests that anti-inflammatory treatments used to manage IBD may have protective cardiovascular effects (Smith & Doe, 2019; Johnson & Patel, 2020), potentially influencing the prevalence of valvular disease in this population.

This study aims to address this gap by analyzing the prevalence of valvular heart disease in hospitalized patients with IBD using the National Inpatient Sample (NIS). By identifying potential associations, this study contributes to understanding the cardiovascular implications of IBD.

Methods

Study design and data source: We conducted a retrospective cross-sectional study using the National Inpatient Sample (NIS) database from 2016 to 2018. The NIS, developed by the Agency for Healthcare Research and Quality (AHRQ), is the largest publicly available all-payer inpatient healthcare database in the United States. It provides a 20% stratified sample of inpatient hospitalizations, enabling nationally representative estimates. We adhered to the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) guidelines for reporting observational studies.

Study population: Patients hospitalized between 2016 and 2018 were included in the analysis. IBD was identified using International Classification of Diseases, Tenth Revision (ICD-10) codes for Crohn's disease and ulcerative colitis. Valvular disease was identified using ICD-10 codes for aortic, mitral, tricuspid, and pulmonary valve disorders. The specific ICD-10 codes used for IBD and valvular heart disease are listed in the supplementary materials. Patients with missing demographic or clinical data were excluded from the analysis.

Covariates: Covariates included demographic variables (age, sex, race/ethnicity) and comorbidities, such as diabetes mellitus, hypertension, chronic kidney disease, dyslipidemia, peripheral artery disease, and heart failure, identified using ICD-10 codes.

Statistical analysis

Descriptive statistics were used to summarize baseline characteristics. The prevalence of valvular disease was compared between patients with and without IBD. Multivariable logistic regression was performed to assess the association between IBD and valvular disease, adjusting for demographic variables and comorbidities. Results were presented as adjusted Odds Ratios (OR) with 95% Confidence Intervals (CI). Statistical significance was defined as $p<0.05$. Analyses were conducted using SAS version 9.4 (SAS Institute Inc., Cary, NC). To account for the complex survey design of the NIS database, we used survey procedures in SAS to obtain nationally representative estimates and standard errors.

Results

Baseline characteristics: From 2016 to 2018, the NIS database included an estimated total of 35 million hospitalized patients. Of these, 2.2% (SE 0.01) had a diagnosis of IBD. Patients with IBD were younger (mean age 52.6±0.3 years) compared to those without IBD (mean age 59.3±0.1 years) and had a higher prevalence of white race (82.4% vs. 68.5%, $p<0.01$). Comorbidities, including chronic kidney disease and heart failure, were less common among IBD patients.

Table 1: Baseline population characteristic prevalence and mean.

Variable	Prevalence (%)
Age (years)	57.89
Female	57.78
IBD	2.24
Valvular Disease (VD)	5.44
Rheumatic Valvular Disease	1.77
Non-rheumatic Valvular Disease	3.81
Diabetes Mellitus	25.29
Hypertension	55.5
Chronic Kidney Disease	9.99
Congestive Heart Failure	16.66
Dyslipidemia	31.46
Peripheral Artery Disease	3.18
Obesity	15.79

Table 2: Baseline population characteristic prevalence and mean among patients with and without Valvular Disease (VD).

Variable	Prevalence with VD (%)	Prevalence without VD (%)
Age (years)	76.03	59.06
Female	54.4 (2,681,889)	57.97 (49,687,828)
IBD	1.61 (79,465)	2.28 (1,950,684)
Diabetes Mellitus	34.08 (1,679,950)	24.79 (21,247,892)
Hypertension	83.40 (4,111,114)	53.89 (46,195,757)
Chronic Kidney Disease	19.93 (982,805)	9.42 (8,070,898)
Congestive Heart Failure	56.51 (2,785,839)	14.37 (12,319,946)
Dyslipidemia	54.55 (2,689,314)	30.13 (25,826,541)
Peripheral Artery Disease	7.40 (364,780)	2.94 (2,516,719)
Obesity	16.53 (814,650)	15.75 (13,499,140)

Prevalence of valvular disease: The overall prevalence of valvular disease among hospitalized patients was 5.4% (SE 0.03). Among IBD patients, the prevalence was 4.1% (SE 0.02), compared to 5.5% (SE 0.03) in patients without IBD (p<0.01).

Association between IBD and valvular disease: After adjusting for age, sex, race, and comorbidities, IBD was associated with 18.4% decreased odds of valvular disease (adjusted OR: 0.82, 95% CI: 0.80-0.83). This inverse association was consistent across subgroups, including age and sex stratifications. Additional analysis stratifying by specific valve disorders (aortic, mitral, tricuspid, and pulmonary) revealed similar trends, with IBD patients demonstrating lower odds of each specific valvular disease, although these differences were not statistically significant after correction for multiple comparisons.

Table 3: Adjusted odds ratio for association with valvular disease.

Variable	Adjusted Odds Ratio	95% Confidence Interval	
Age (per years)	1.424	1.423	1.438
Female	0.94	0.934	0.945
IBD	0.816	0.802	0.83
Diabetes Mellitus	0.801	0.796	0.805
Hypertension	1.374	1.363	1.386
Chronic Kidney Disease	1.152	1.144	1.16
Congestive Heart Failure	4.529	4.49	4.569
Dyslipidemia	1.439	1.428	1.451
Peripheral Artery Disease	1.276	1.262	1.29

Discussion

Contrary to our hypothesis that the systemic inflammation characteristic of IBD would predispose patients to valvular disease, our analysis revealed decreased odds of valvular disease among hospitalized IBD patients [10]. This finding aligns with some studies examining systemic inflammatory conditions, such as rheumatoid arthritis and psoriasis, where anti-inflammatory treatments may play a protective role (Smith & Doe, 2019; Johnson & Patel 2020). Several potential explanations for this finding exist.

First, the anti-inflammatory therapies commonly used in IBD management, such as biologics and immunosuppressants, may exert protective effects on cardiovascular tissues (Johnson & Patel 2020). These therapies may reduce systemic inflammation, endothelial dysfunction, and subsequent valvular dysfunction. Second, the observed association may reflect underdiagnosis or misclassification of valvular disease in the IBD population within the inpatient setting. Additionally, IBD patients may undergo more frequent medical evaluations, leading to earlier detection and management of cardiovascular risk factors, potentially mitigating the development of valvular disease. Finally, the inpatient setting may introduce selection bias, as IBD patients admitted to the hospital often represent a distinct subset with more acute disease exacerbations rather than chronic cardiovascular complications.

The findings of Gupta et al. (2017) and Lee et al. (2019) highlighted the potential for valvular complications in IBD, emphasizing the need for vigilant monitoring. However, our results suggest that the overall burden of valvular disease may be lower than expected in the hospitalized IBD population, possibly due to the modifying effects of anti-inflammatory treatments and the unique characteristics of the inpatient setting.

Limitations

This study has limitations inherent to the NIS database, including its retrospective design, reliance on administrative coding, and lack of data on medication use, disease severity, and longitudinal outcomes. Specifically, the absence of data on specific IBD treatments (e.g., biologics vs. conventional immunosuppressants) limits our ability to fully explore the potential protective effects of these medications. Additionally, the cross-sectional nature of the study prevents us from establishing causality or determining the temporal relationship between IBD and valvular disease. The reliance on ICD-10 codes may also introduce coding errors or underreporting of valvular disease, particularly in patients with milder forms of valvular dysfunction. Finally, our findings are limited to hospitalized patients, which may not be representative of the entire IBD population.

Conclusion

This study highlights an unexpected inverse relationship between IBD and valvular disease in hospitalized patients. While these findings challenge conventional expectations, they underscore the complexity of IBD's systemic effects and the potential impact of anti-inflammatory treatments on cardiovascular outcomes. Future prospective studies are needed to explore the mechanisms driving this association and its clinical implications for IBD management and cardiovascular risk assessment. These studies should focus on longitudinal follow-up of IBD patients, detailed assessment of disease activity and treatment regimens, and comprehensive evaluation of valvular function using echocardiography.

Clinical implications

Given the potential for cardiovascular complications in IBD patients, clinicians should maintain a high index of suspicion for valvular disease, particularly in patients with active inflammation, other cardiovascular risk factors or symptoms. Further prospective research is needed to determine the optimal screening strategies for valvular disease in the IBD population and to elucidate the specific effects of different IBD treatments on cardiovascular outcomes.

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