Trends in hospitalisations and inpatient mortality from acute myocardial infarction among patients with psoriatic arthritis: an analysis of nationwide inpatient sample 2004-2014

S. Jatwani[1], K. Jatwani[2], P. Tiwari[3], N. Wadhwa[4], K. Chugh[1]

[1]Albert Einstein Medical Center, Philadelphia, PA, USA; [2]Mount Sinai West - St Luke's Hospital, New York, NY, USA; [3]National Institute of Medical Statistics (Indian Council of Medical Research) AIIMS Campus, New Delhi, India; [4]Shaheed Sukhdev College of Business Studies Rohini, Sector-16, New Delhi, India.

Abstract

Objective

Psoriatic arthritis (PsA) is associated with increased cardiovascular morbidity and mortality. Higher disease activity has been associated with increased rates of mortality in PsA. The objectives of the study were to describe the trends for hospitalisations from acute myocardial infarction (AMI) amongst patients with underlying PsA.

Methods

All adult hospitalisations for AMI with and without PsA from 2004-2014 in the nationwide in-patient sample (NIS) database were captured. A propensity score-matching model was also developed for comparative outcome analysis and reduce the potential of selection bias.

Results

From 2004 to 2014, 4778 unmatched weighted hospitalisations were estimated for AMI with underlying PsA. Mean age for hospitalisations with AMI and PsA was lower (average age in years: 63.1±11.5 vs. 67.5±14.4; p-value <0.05), with a higher percentage being males (62.7% vs. 60.4%, p-value <0.05). When adjusted for confounding factors, overall mortality was found to be significantly lower in hospitalisations with PsA (2.21% vs. 5.8%, p-value <0.05). After propensity matching analyses, in-hospital mortality in PsA cohort continued to be significantly lower when compared to the matched cohort without PsA (1.79% vs. 5.71%, Odds ratio=0.3, p-value 0.002).

Conclusion

The study suggests that overall rates of mortality in AMI with underlying PsA are lower compared to those without PsA. A decrease in cardiovascular mortality from AMI in PsA reflects that even though PsA is associated with an increased prevalence of cardiovascular risk factors, the trends in mortality are similar or even better than those for the general population.

Key words

psoriatic arthritis, acute myocardial infarction, cardiovascular disease, hospitalisations, epidemiology, trends, demographics

Shraddha Jatwani, MD, FACP, FACR, RhMSUS
Karan Jatwani, MD
Preeti Tiwari, MSc
Naman Wadhwa, BBA (FIA)
Karan Chugh, MD

Please address correspondence to:
Shraddha Jatwani,
Albert Einstein Medical Center,
5501 Old York Road,
19141 Philadelphia, PA, USA.
E-mail: shraddha.jatwani@gmail.com

Received on May 10, 2020; accepted in revised form on June 22, 2020.

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Competing interests: none declared.

Introduction

Coronary artery disease (CAD) is the leading cause of cardiovascular death in the United States, with 43.2% of all deaths from CAD, followed by stroke (16.9%). CAD accounted for approximately 13% of total deaths in the U.S. in 2016 (1). A review of the literature suggests that the incidence of acute myocardial infarction (AMI) has declined significantly over time, including over the past decade. National Heart, Lung, and Blood Institute (NHLBI) data suggests that from 2006 to 2016, the annual death rate attributable to CAD declined 31.8%, and the actual number of deaths declined 14.6% (1). Psoriatic arthritis (PsA) is an inflammatory joint and musculoskeletal disease usually associated with skin psoriasis characterised by synovial and entheseal inflammation. (2) There is strong evidence demonstrating higher cardiovascular (CV) risk in several rheumatic diseases (3). As with other rheumatic diseases, PsA is associated with an increased prevalence of CV risk factors, including an increased prevalence of obesity, hypertension, triglyceride level, and angina pectoris (4). A 43% higher risk of developing cardiovascular disease in patients with PsA has been reported compared to the general population. Moreover, the risk of developing an incident CV events has been reported to be 55% higher, with an overall 68% increase in the risk of AMI in patients with PsA (5). However, limited data exist about trends of cardiovascular diseases in PsA.

To understand the epidemiological characteristics, the burden of hospitalisations and cardiovascular disease mortality in PsA patients, it is imperative to assess the trends in its admission and mortality rates. We queried the National Inpatient Sample Database from 2004 to 2014 to address these clinically relevant issues.

Materials and methods

Data source

This study was conducted using the National Inpatient Sample (NIS) files of the Health Care Utilization Project sponsored by the Agency for Healthcare Research and Quality. NIS is a publicly available largest all-payer in-patient care database in the United States, approximating a 20% stratified sample of discharges from U.S. community hospitals. The database contains demographic and clinical data from 12–15 million hospital discharges, structured as annual national cross-sectional data. The NIS database provides information on demographic data, the discharge diagnoses, the hospital procedures, admission, and discharge status. Although there are some limitations, the NIS is one of the most reliable sources of data available on hospital admissions and discharges. (6, 7) Following institutional policy, since this study used publicly available data, it was exempted from the Institutional Review Board.

Patient population

Our study population included all adult hospitalisations (aged ≥18 years) with a primary diagnosis of AMI in the NIS database between 2004 and 2014, with or without PsA. Codes for diagnoses and procedures are based on the International Classification of Diseases-Clinical Modification, 9th Revision (ICD-9-CM). The codes used were ICD-9 CM 410.XX for AMI and 696.0 for PsA. The records were excluded from analysis if they were missing vital status at discharge like age and gender.

Outcomes studied

The primary endpoints in this study were trends in hospitalisations and in-hospital mortality in admissions with a primary diagnosis of AMI and a secondary diagnosis of PsA. We also analysed in-patient mortality in propensity-matched analyses.

Statistical analyses

Data on patient and hospital-level characteristics provided for each hospitalisation in the NIS database was used to describe baseline characteristics. Patient-level factors, including demographics, diagnoses, comorbidities, in-hospital procedures, and disposition, as well as hospital-level factors, including bed size, location, and the total number of hospitalisations, are available via the NIS database. Charlson comorbidity index was used to identify and classify coexisting conditions.

We used survey analysis methods that used hospital-level discharge weights provided by the NIS to estimate the number of AMI hospitalisations on a national level. Descriptive statistics were represented as means/medians for continuous and as frequencies and percentages for categorical variables. We conducted bivariate analyses to compare demographics, clinical characteristics, and hospital characteristics in AMI admissions with or without PsA. In-hospital mortality is available in the NIS data as a categorical variable (yes/no).

Chi-square tests were used for categorical variables, whereas t-test for continuous variables with a normal distribution. A survey-weighted logistic regression model was used to describe in-patient mortality. Binary outcomes were modeled with binomial logistic regressions. The morality trend in PsA was accessed by fitting a Poisson regression model to evaluate for changes in the number of mortalities in PsA per year and adjusting for demographics, comorbidities, and hospital characteristics and keeping the "year" as a continuous variable in the model. Discrete numeric variables were modeled with the generalised linear model regressions.

A propensity score matching model was developed to derive two matched groups for comparative outcome analysis, to account for potential confounding factors and reduce the potential for selection bias (8). A matching protocol using propensity score was used to create a matched cohort between PsA and non-PsA in AMI. All statistical tests were 2-sided, and a p-value of <0.05 was determined a priori to be statistically significant.

Analyses were performed in STATA 15 (StataCorp, College Station, TX) with appropriate statements to account for the complex clustered sampling methods.

Table I. Baseline characteristics of participants of acute myocardial infarction (AMI) with and without psoriatic arthritis (PsA).

	AMI unmatched		AMI matched	
	with PsA	without PsA	with PsA	without PsA
Number of observations (unweighted)	984	1,403,053	385	385
Number of observations (weighted)	4778	6,741,925	1855	1926
Age (in years ± SD)	63.1±11.5	67.5±14.4*	63.5±14.1	63.5±13.9
Sex (%)				
Male	62.7	60.4‡	48.4	48.6
Female	37.3	39.6	51.6	51.4
Race (%)				
Caucasian	89	76.9*	86.9	78.9*
African American	1.9	9.7	2.1	9.6
Hispanic	3.5	7.4	3.6	6.5
Asian/pacific islander	1.9	2.2	2.9	2.1
Native American	0.5	0.57	0.31	0.82
Other	3.1	3.2	4.2	1.9
Charlson Comorbidity Index) (%)				
1	33.1	33.7‡	30.6	33.2‡
2	32.6	27.9	36.7	27.8
3	15.4	16.7	14.1	15.3
4	9.2	9.9	10.2	9.1
5	4.6	6	3.1	6.3
≥6	5.1	5.8	5.3	8.3
Insurance status (%)				
Medicare	49.3	59.2*	53.7	54*
Medicaid	3.5	6.2	2.6	10.4
Private insurance	44.3	28.6	41	27.1
Self-pay	2.9	6.03	2.7	8.5
Median household income for patient's zip code (%)				
0-25th percentile	20.7	28.6	20.8	30.2*
26th to 50th percentile (median)	24.7	27.4	23.3	30.5
51st to 75th percentile	27.7	23.7	29.6	22.2
76th to 100th percentile	26.9	20.3	26.3	17.8
Hospital location (%)				
Rural	8.7	10.5	18.2	17.9
Urban	91.3	89.5	81.8	82
Bed size of hospital (%)				
Small	10.9	10.3	200	20.8
Medium	23.5	24.4	30.4	30.1
Large	65.5	65.2	49.6	49.1
Teaching status of hospital (%)				
Non-teaching	49.8	52.2	51.9	43.4
Teaching	50.2	47.8	48.1	56.6
Geographical region of Hospital (%)				
Northeast	21.8	19.3*	29	28.3
Midwest	23.6	23.2	22.3	22.1
South	32.7	40	24.5	25.2
West	21.9	17.5	24.2	24.4
Length of stay (mean (SD))	4.5(4.8)	4.9(5.7) ‡	4.4(4.9)	4.1(4.3)

*p-value <0.01; ‡ p-value <0.05.

Results

We identified 6,746,703 weighted hospitalisations for AMI, of which 4778 weighted hospitalisations were with PsA from 2004 to 2014. The mean age for hospitalisations with AMI and history of PsA was significantly lower compared to those without PsA (average age in years: 63.1±11.5 *vs*. 67.5±14.4; p-value <0.05). Overall amongst unmatched weighted admissions, PsA hospitalisations were more likely to be Caucasian and had private insurances (Table I).

The estimated total number of hospitalisations for AMI fluctuated year to year, whereas the hospitalisations for AMI with PSA had an increasing trend over the years (Fig. 1).

In-hospital mortality was noted to be decreasing with time for hospitalisations both for AMI and AMI with PsA. When adjusted for confounding factors including age, gender, race, patient and hospital characteristics, overall mortal-

ity was lower in AMI with PsA compared to the AMI in the general population as well (odds ratio=0.94, 95% CI 0.84–1.05). When comparing trends over the years, in-patient mortality continued to be lower for admissions with AMI & PsA compared to admissions for AMI. The length of stay for AMI with PsA was also lower over the years, except in 2014 (Table II).

After propensity-matching, a total of 1855 weighted AMI hospitalisations with PsA were matched for age, gender as well as hospital region, hospital location, and bed size with non-PsA AMI hospitalisations (385 unweighted hospitalisations each). An increasing number of admissions for AMI with PsA were found in both matched and unmatched over the years (2004-2014). In the matched group, hospitalisations for AMI & PsA were more likely to have private insurances and a higher Charlson comorbidity index similar to the unmatched group (Table I). The average length of stay (4.4 days *vs*. 4.1 days, p=0.44) was comparable between PsA and non-PsA admissions. In-hospital mortality in PsA group was estimated lower (1.79% *vs*. 5.71%, OR 0.30, CI 0.14–0.64, p-value 0.002). However, trends in mortality among AMI with PsA did not show any distinct pattern throughout the period (2004-2014) for the matched or unmatched group.

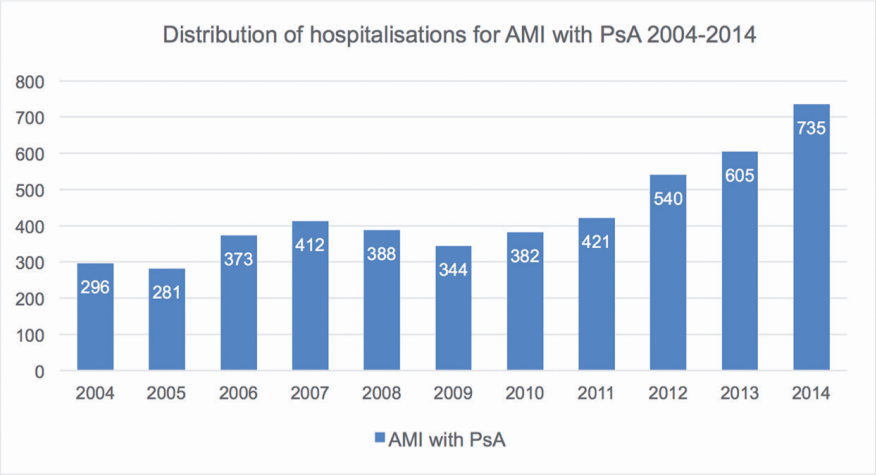

Fig. 1. Hospitalisations for acute myocardial infarction (AMI) with psoriatic arthritis (PsA) from 2004 to 2014 (unmatched, weighted).

Table II. Clinical outcomes studied in admissions for acute myocardial infarction (AMI) with and without psoriatic arthritis (PsA) (unmatched, weighted).

	Inpatient Mortality (%)		Length of stay (in days, mean±SD)	
	AMI without PsA	AMI with PsA	AMI without PsA	AMI with PsA
2004	7.2	1.5	5.3±6.3	4.4±3.6
2005	6.8	1.8	5.2±6.1	4.1±2.8
2006	6.2	1.2	5.1±6.1	4.0±2.9
2007	6.1	2.1	5.0±6.2	5.8±5.0
2008	6	5	5.0±5.7	4.7±4.4
2009	5.6	3.2	4.9±6.2	3.7±3.3
2010	5.3	2.7	4.7±5.2	3.1±2.5
2011	5.3	2.8	4.6±5.4	3.7±2.6
2012	5.2	3.7	4.6±5.2	4.8±6.4
2013	5	0	4.6±5.3	4.4±4.3
2014	5	1.4	4.5±5.2	5.6±6.9

Discussion

Atherosclerosis is strongly linked with chronic low-grade vascular inflammation that results from an interaction between immune mechanisms and metabolic abnormalities within the vessel wall (9, 10). The studies have shown that patients with PsA have abnormalities in several stages of atherogenesis, including endothelial dysfunction, arterial wall stiffness, plaque formation, and, ultimately, clinical cardiovascular events (11-13). An association of psoriasis with cardiovascular diseases has been well established (14-16), but few studies have assessed the risk of prevalent and incident cardiovascular diseases in patients with PsA (5, 17).

Our goal was to assess the healthcare burden of cardiovascular events associated with PsA. We found that admissions with AMI and PsA were significantly younger. The average age of onset for PsA has been described between 30–50 years (18), and younger age at admissions for AMI in this population suggests a cumulative effect of inflammation. A study in the general population reported a 2-fold higher risk of cardiovascular disease in men than women after adjustment for CV risk factors. (18). The demographic trends in previous studies have shown that the overall gender distribution of PsA is 1:1(19, 20). The study suggests the number of hospitalisations was higher for males with AMI and PsA, due to gender predisposition of CV risk. A higher number of hospitalisations for Caucasians were noticed in PsA, both in matched and unmatched groups, as seen with the epidemiology of PsA in previous studies (21). Based on NIS data from 2004 to 2014, we noted that the in-hospital mortality was lower in AMI with PsA, when compared to admissions without PsA. Trend analysis from our study suggested that the average number of hospitalisations for AMI and history of PsA has not changed significantly over the decade.

Buckley *et al*. had shown that the risk of developing incident MI in patients with PsA was 55% higher than that in the general population, but studies have also suggested that overall mortality in patients with PsA has declined over time (22-24). Mortality and rates of hospitalisations from AMI are decreasing nationally in the general population (1). Our study suggests similar changes in trends of mortality in admissions for AMI with PsA. These findings reflect increased awareness of the association between autoimmune disease and cardiovascular disease. Furthermore, this

could be attributed to timely screening of CV risk factors, early identification and improved management of AMI with prompt revascularisation, utilisation of newer antiplatelets and anticoagulants, use of high-intensity statin therapy, control of risk factors, and adoption of quality measures in population, at risk for AMI. With the introduction of new treatment options for PsA, the disease activity burden has reduced as well (25). Even though our study does not provide any data on disease activity or medications of the patients, a lower disease activity with the use of newer treatments may relate to lower rates of mortality.

NIS provides a large, diverse sample of hospitalisations, with respect to age, gender, and race or ethnic group, and is representative of the U.S. population, suggesting that the results truly reflect the trends in AMI and provide statistically high power to the study. There are some limitations to this study, which should be considered. This study is subject to the bias of retrospective studies but does provide insight into rare conditions like PsA. Because of the observational nature of the study, the change in trends may represent an association, but not causation, because several other variables could not be evaluated in this study. NIS is a sampling of hospitalisations rather than individual patients, which may contribute more than one hospitalisation due to readmissions. This is a general limitation of NIS, which, unfortunately, could not be adjusted for because patients are de-identified in the database. The data is based on administrative coding, which may be influenced by coding practices in hospitals. This database does not generate data on medications or laboratory results, to assess disease activity and a possible role in the type of treatments in alteration of CV risks.

Conclusion

In conclusion, in-hospital outcomes of AMI in PsA are similar or even lower to the general population. PsA is associated with an increased risk of CV risk factors and CV events but does not seem to affect mortality associated with AMI, according to our study.

Acknowledgements

We would like to acknowledge Jean G. Ford from the Albert Einstein Medical Center, Philadelphia.

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