Incidence, Prevalence and Outcomes of Acute Myocardial Infarction in Hospitalized Patients with Psoriasis: Results from the Nationwide Inpatient Sample Database

Christopher G. Gibson[1,*], Bhakti B. Chavan[2], Ruby S. Gibson[3], Francis Essien[4], Melissa J. Newman[1], Robert L. Zee[1], Stephanie J. Ott[5] and Irving L. Rosenberg[5]

[1]*Department of Internal Medicine, Fairfield Medical Center, Lancaster, Ohio, USA*

[2]*Ohio University Heritage College of Osteopathic Medicine, Dublin, OH, USA*

[3]*Long School of Medicine, University of Texas Health San Antonio, San Antonio, TX, USA*

[4]*Department of Internal Medicine, Keesler Air Force Base, Biloxi, MS, USA*

[5]*Department of Rheumatology at the Fairfield Medical Center, Lancaster, OH, USA*

Abstract: Background: Psoriasis (PsO) is a chronic multisystem inflammatory condition that has been linked with increased cardiovascular mortality most notably in patients with a severe disease burden. This inflammatory process is driven by an increase in several markers including: C-reactive protein (CRP), cytokines, and acute phase reactants which promote the development and progression of atherosclerosis. Endothelial dysfunction is central to the disease pathophysiology and accelerated atherosclerosis results in a higher risk of Acute Myocardial Infarction (AMI), stroke and peripheral vascular disease (PVD). There is a paucity of literature describing the inpatient burden, prevalence, and socioeconomic status of hospitalized psoriasis patients diagnosed with AMI. The purpose of this article is to subsidize the literature by evaluating a nationwide database to compare the incidence, prevalence, and inpatient burden of AMI in patients with and without psoriasis.

Methods and Results: A total of 31,713 patients were diagnosed with PsO in a sample size of 7,135,090. Table **2** shows the distributions of sociodemographic characteristics and selected comorbid medical disorders for patients with psoriasis and patients in the comparison cohort. Patients with psoriasis demonstrated a statistically significant increased risk of AMI in adjusted and unadjusted analyses.

Conclusion: The correlation between atherosclerosis and aggressive therapy suggests that more vigorous therapy might decrease the likelihood and burden of atherosclerosis in patients with PsO and thus a lower incidence of AMI.

Keywords: Psoriasis, Epidemiology, Inflammation, Cardiovascular, Myocardial Infarction.

INTRODUCTION

Psoriasis (PsO) is a common autoimmune disease that has been associated with increased mortality [1, 2]. Recent advances over the past decade have improved our understanding of the immunological etiology of the disease and has elucidated the focus from a single organ to a systemic inflammatory condition [3]. As a result of the systemic complications that can arise from this disease it is pertinent for front-line physicians such as primary care providers (PCPs) to be aware of treatment goals of various comorbidities associated with PsO. This can be psychologically distressing for patients [4, 5] in conjunction with increased burden on the health care system [6]. Therefore a multidisciplinary approach may contribute to reducing patients' mortality and reducing the overall economic burden.

*Address correspondence to this author at the Office of Graduate Medical Education, 401 N Ewing St, Lancaster, OH 43130, USA; Tel: (740) 652-4779; E-mail: drcgibson@fmchealth.org

METHODS

Study Design

This was a cross-sectional study based on the Healthcare Cost and Utilization Project's National Inpatient Sample (NIS) database. We performed a cross-sectional study from years 2015-2016 to examine the risk of incidence of AMI among patients with psoriasis. The NIS is the largest inpatient care database in the United States, containing demographic and clinical information from approximately 8 million hospital stays from about 1000 hospitals sampled to approximate a 20% stratified sample of U.S. community hospitals. We queried the NIS database and identified hospitalized adults ≥ 18 and < 100 years. Patients hospitalized with PsO were identified when assigned with an International Classification of Diseases, Tenth Revision (ICD-10) system [7].

Study Participants

Patients with PsO were identified by hospitalizations with diagnostic codes consistent with a major adverse

E-ISSN: 2310-998X/19

cardiac event. We defined a major cardiac event as ST elevation (STEMI) myocardial infarction, Non-ST elevation (NSTEMI) myocardial infarction, subsequent STEMI and NSTEMI, and acute myocardial infarction of the various parts of the cardiac wall. We used the appropriate ICD-10 codes to identify hospitalizations of patients for which the previously aforementioned conditions were the primary discharge diagnosis. In this large database, we identified risk factors for AMI, including history of tobacco use, obesity, and Diabetes Mellitus defined by their appropriate ICD-10 codes. Body mass index (BMI) was calculated as weight over height squared (kg/m^2).

Table 1: Overall Characteristics of Patients

Characteristic	Overall N (wt%)
Age	
18-24 years	372560 (5.2)
25-34 years	796843 11.2)
35-49 years	882041 (12.4)
50-64 years	1446936 (20.3)
≥65 years	2539347 (35.6)
Gender	
Male	3086070 (43.3)
Female	4044830 (56.7)
Race	
White	4425832 (65.4)
Black	1029307 (15.2)
Hispanic	830225 (12.3)
Other	482615 (7.1)
Income	
0-25th percentile	2152900 (30.7)
26th to 50th percentile	1783192 (25.4)
51st to 75th percentile	1677599 (23.9)
76th to 100th percentile	1399948 (20.0)
Length of stay	
≤3 days	4325540 (60.6)
4-7 days	1827537 (25.6)
8-14 days	672194 (9.4)
15-30 days	245501 (3.4)
≥31 days	63961 (0.9)
Died	
No	6992652 (98.1)
Yes	136118 (1.9)
Psoriasis	
No	7103377 (99.6)
Yes	31713 (0.4)
Acute myocardial infarction	
No	7060584 (99.0)
Yes	74506 (1.0)

Abbreviation: N Frequency; wt.% weighted percentage.

Statistical Analysis

Descriptive statistics was performed to summarize and describe the distribution of study variables. Bivariate analysis was performed using chi-square (χ^2) statistic to evaluate the association between diagnosis of AMI and study characteristics. Alpha was set at 0.05. All analyses were performed using SAS version 9.4 [8]. PsO status was included as a time dependent variable, age, gender, smoking status, insurance status, household income, BMI, race, were included as fixed variables.

RESULTS

A total of 31,713 patients were diagnosed with PsO in a sample size of 7,135,090. Table **2** shows the distributions of sociodemographic characteristics and selected comorbid medical disorders for patients with PsO and patients in the comparison cohort. Patients with psoriasis demonstrated a statistically significant increased risk of AMI in adjusted and unadjusted analyses (Table **2**). 74,506 (1.0%) of the entire study population were diagnosed with AMI. 392 patients with PsO were diagnosed with an AMI (1.2%) which was statistically significant with a p-value of < 0.001. 74,114 (1.0%) of those without PsO did not experience an AMI. Males tended to have a higher proportion of AMI 40,102 (1.3%) compared to Females 34378 (0.8%). Those who were more likely to develop AMI were greater than 65 years old, 52185 (2.1%), white, male, have a higher BMI, and lower income. We found that the risk of AMI is increased for the patients with psoriasis, after adjusting for coronary risk factors, such as diabetes, hyperlipidemia, and hypertension, and demographic risk factors.

DISCUSSION

Cardiovascular disease is a leading cause of mortality estimated to occur in at least 1% to 2% of the general population [9]. Cardiovascular disease has been proven to be a major cause of mortality in patients with psoriasis.

Table 2: Bivariate Association between Acute Myocardial Infarction and the Study Variables

	Acute myocardial infarction		*p* value
	No	Yes	
	N(wt.%)	N(wt.%)	
Age			<0.001***
18-24 years	372335 (99.9)	225 (0.1)	
25-34 years	795978 (99.8)	865 (0.2)	
35-49 years	877941 (99.5)	4100 (0.5)	
50-64 years	1429837 (98.8)	17099 (1.2)	
≥65 years	2487162 (97.9)	52185 (2.1)	
Gender			<0.001***
Male	3045968 (98.7)	40102 (1.3)	
Female	4010452 (99.2)	34378 (0.8)	
Race			<0.001***
White	4373013 (98.8)	52819 (1.2)	
Black	1020254 (99.1)	9053 (0.9)	
Hispanic	824923 (99.4)	5302 (0.6)	
Other	478568 (99.2)	4047 (0.8)	
Income			<0.001***
0-25th percentile	2129314 (98.9)	23586 (1.1)	
26th to 50th percentile (median)	1763936 (98.9)	19256 (1.1)	
51st to 75th percentile	1660488 (99.0)	17111 (1.0)	
76th to 100th percentile	1386713 (99.1)	13235 (0.9)	
Body mass index			<0.001***
Underweight	111533 (98.0)	2290 (2.0)	
Normal	67784 (98.3)	1173 (1.7)	
Overweight	77886 (98.4)	1250 (1.6)	
Obese	754432 (98.9)	8579 (1.1)	
Length of stay			<0.001***
≤3 days	4302737 (99.5)	22803 (0.5)	
4-7 days	1802779 (98.6)	24758 (1.4)	
8-14 days	654973 (97.4)	17221 (2.6)	
15-30 days	237533 (96.8)	7968 (3.2)	
≥31 days	62210 (97.3)	1751 (2.7)	
Tobacco			<0.001***
No	6971783 (99.0)	73431 (1.0)	
Yes	88801 (98.8)	1075 (1.2)	
Diabetes mellitus			<0.001***
No	5508550 (99.2)	43572 (0.8)	
Yes	1552034 (98.0)	30934 (2.0)	
Hypertension			<0.001***
No	4768294 (99.1)	44330 (0.9)	
Yes	2292290 (98.7)	30176 (1.3)	

(Table 2). Continued.

	Acute myocardial infarction		*p* value
	No	Yes	
	N(wt.%)	N(wt.%)	
Hyperlipidemia			<0.001***
No	5268717 (99.3)	38605 (0.7)	
Yes	1791867 (98.0)	35901 (2.0)	
Died			<0.001***
No	6929013 (99.1)	63639 (0.9)	
Yes	125348 (92.1)	10770 (7.9)	
Psoriasis			<0.001***
No	7029263 (99.0)	74114 (1.0)	
Yes	31321 (98.8)	392 (1.2)	

Abbreviation: N Frequency; wt.% weighted percentage; ***p<0.001.

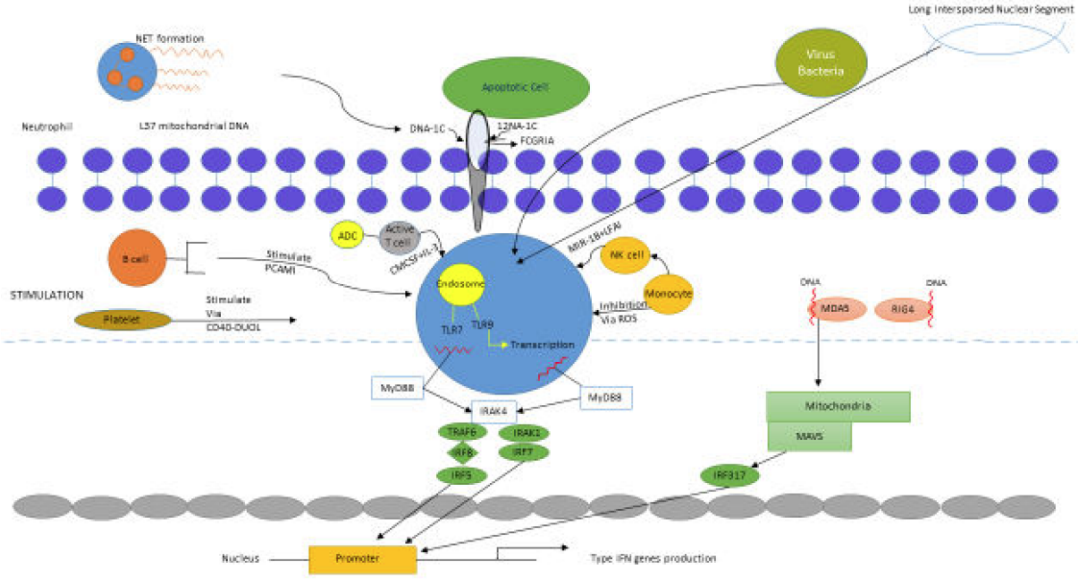

Figure 1: Mechanism of AMI in psoriasis.

The mechanism of AMI in psoriasis is multifactorial involving genetic and immune factors. Psoriasis is a chronic inflammatory state characterized by T-cell activation and T-helper cell (Th1, Th17) cytokines with other studies showing an increase of markers of systemic inflammation such as serum c-reactive protein (CRP), interleukin (IL)-6, IL-8, interferon (IFN)-γ and tumor necrosis factor (TNF-α) [10-12]. In addition, psoriasis has been shown to increase platelet activation [7] and platelet hypercoagulability [7]. These same inflammatory markers are well documented to participate in adverse cardiovascular events. Patients are at increased risk for additional components of metabolic syndrome such as hypertension, atherosclerosis, and type 2 diabetes, further potentiating the risk for cardiovascular disease. McDonald *et al.* report that patients with psoriasis have a 2.2 times greater risk than the general population to develop arterial and vascular diseases [13].

This study, to our knowledge, is one of the first that utilizes a large national sample to investigate the prevalence, incidence and socioeconomic burden for patients with psoriasis and AMI. Previous studies have demonstrated that in high-income countries, low socioeconomic status is associated with an increased risk of cardiovascular disease and mortality [14]. Chronic stress associated with high income inequality has been hypothesized to increase CVD risk and other adverse health outcomes [14]. Psoriasis has a profoundly negative impact on the physical, social, and

financial quality of life, resulting in an increased incidence of depression, poor self-image, and lack of self-confidence [13]. Recent studies have demonstrated that geographic region, income, and stress are associated with psoriasis [6,7,9,13]. Moreover, stress and urbanization are closely related [15]. In concert with the aforementioned studies, this study demonstrated significant differences in regard to the impact of urbanization, geography and income on outcomes of AMI in patients with and without psoriasis.

In conclusion, we found an increased risk of MI in patients with psoriasis. Notably, the risk was increased among those with lower income, increased age, male, and those with an increased length of stay. In our study, the presence of psoriasis was the most important independent correlate of atherosclerosis other than age. Our results suggest there tends to be a predilection of adverse events in those with PsO in those with lower socioeconomic status. The correlation between atherosclerosis and aggressive therapy suggests that more vigorous therapy might decrease the likelihood and burden of atherosclerosis in patients with PsO and thus a lower incidence of AMI.

CONFIDENTIALITY AND RECORDS

Any identifying information was removed, the Office of Human Research Protections for Mount Carmel Health System and the Institutional Review Board approved of this paper.

DECLARATION OF CONFLICTING INTERESTS

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

FUNDING

The author(s) received no financial support for the research, authorship, and/or publication of this article.

REFERENCES

[1] Gelfand JM, Troxel AB, Lewis JD, Kurd SK, Shin DB, Wang X, *et al*. The risk of mortality in patients with psoriasis: results from a population-based study. Arch Dermatol 2007; 143: 1493-9. https://doi.org/10.1001/archderm.143.12.1493

[2] Mallbris L, Akre O, Granath F, Yin L, Lindelof B, Ekbom A, *et al*. Increased risk for cardiovascular mortality in psoriasis inpatients but not in outpatients. Eur J Epidemiol 2004; 19: 225-30. https://doi.org/10.1023/B:EJEP.0000020447.59150.f9

[3] Hansson GK. Inflammation, atherosclerosis, and coronary artery disease. N Engl J Med 2005; 352: 1685-1695. https://doi.org/10.1056/NEJMra043430

[4] Koo J. Population-based epidemiologic study of psoriasis with emphasis on quality of life assessment. Dermatol Clin 1996; 14: 485-96. https://doi.org/10.1016/S0733-8635(05)70376-4

[5] Griffiths CE, Richards HL. Psychological influences in psoriasis. Clin Exp Dermatol 2001; 26: 338-42. https://doi.org/10.1046/j.1365-2230.2001.00834.x

[6] Javitz HS, Ward MM, Farber E, Nail L, Vallow SG. The direct cost of care for psoriasis and psoriatic arthritis in the United States. J Am Acad Dermatol 2002; 46: 850-60. https://doi.org/10.1067/mjd.2002.119669

[7] HCUP Databases. Healthcare Cost and Utilization Project (HCUP). 2015-2016. Agency for Healthcare Research and Quality, Rockville, MD. www.hcup-us.ahrq.gov/databases.jsp.

[8] SAS Institute Inc 2013. SAS/ACCESS® 9.4 Interface to ADABAS: Reference. Cary, NC: SAS Institute Inc.

[9] Neimann AL, Porter SB, Gelfand JM. Epidemiology of psoriasis. Expert Rev Dermatol 2006; 1: 63-75. https://doi.org/10.1586/17469872.1.1.63

[10] Davidovici BB, Sattar N, Prinz J, *et al*. Psoriasis and systemic inflammatory diseases: potential mechanistic links between skin disease and co-morbid conditions. J Invest Dermatol 2010; 130: 1785-96. https://doi.org/10.1038/jid.2010.103

[11] Ghazizadeh R, Shimizu H, Tosa M, *et al*. Pathogenic mechanisms shared between psoriasis and cardiovascular disease. Int J Med Sci 2010; 7: 284-9. https://doi.org/10.7150/ijms.7.284

[12] Ryan C, Kirby B. Psoriasis is a systemic disease with multiple cardiovascular and metabolic comorbidities. Dermatol Clin 2015; 33: 41-55. https://doi.org/10.1016/j.det.2014.09.004

[13] McDonald CJ, Calabresi P. Occlusive vascular disease in psoriatic patients. N Engl J Med 1973; 288: 912. https://doi.org/10.1056/NEJM197304262881715

[14] Havranek EP, Mujahid MS, Barr DA, *et al*. Social determinants of risk and outcomes for cardiovascular disease: a scientific statement from the American Heart Association. Circulation 2015; 132: 873-898. https://doi.org/10.1161/CIR.0000000000000228

[15] Tabas I, Garcia-Cardeña G, Owens GK. Recent insights into the cellular biology of atherosclerosis. J Cell Biol 2015; 209: 13-22. https://doi.org/10.1083/jcb.201412052

Received on 08-12-2019 Accepted on 11-12-2019 Published on 22-12-2019

DOI: https://doi.org/10.12970/2310-998X.2019.07.03