

Prediabetes Effects on Acute Coronary Syndrome Outcomes: A Review

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ABSTRACT: Acute coronary syndrome is the leading cause of mortality worldwide and prediabetes is among the leading risk factors. The study aimed to review the effects of prediabetes on acute coronary syndrome outcomes. A systematic literature search was conducted in the PubMed and Google Scholar for relevant articles published in English language during the period from 2009-August 2020. The keyword prediabetes, acute coronary syndrome, outcomes, revascularization, cardiovascular outcomes, and heart failure were used. Among the thirty-six articles retrieved, twenty-six full text were eligible. The author's name, country, year of publication, type of study and conclusion were recorded. Out of the manuscripts reviewed, seven were from Asia; seven were from Europe and the USA each, three from South America, and one from Australia. The studies were prospective cohort (13), 6 were cross-sectional, while seven were retrospective. The studies enrolled 360033 patients, the results were mixed with some studies showed the negative effects of PD on acute coronary syndrome outcomes, while other showed no effects. The studies showed conflicting effects regarding the effects of prediabetes on acute coronary syndrome outcomes.

KEYWORDS: Prediabetes, acute coronary syndrome, outcomes, major cardiovascular adverse events

1. INTRODUCTION

It is estimated that 415 people are affected by prediabetes in the year 2015 and the number is expected to jump to 642 million by the year 2040, insulin resistance, hypersecretion, and impaired incretin secretion are the pathophysiology of prediabetes. Lifestyle intervention to restore euglycemia was shown to reduce all-cause mortality among patients with prediabetes ^[1].

Coronary artery disease is a major cause of mortality and morbidity in the developed world, unfriendly diet, and work involving physical inactivity, dyslipidemia, diabetes mellitus, and smoking are the major risk factors for coronary artery disease ^[2]

The risk of cardiovascular adverse events are higher among those with prediabetes and in particular among patients with the metabolic syndrome ^[3]. Thus, the current review aimed to assess the effects of prediabetes on acute coronary syndrome outcomes.

2. SUBJECTS AND METHODS:

2.1. Eligibility criteria according to PICOS:

2.2. Types of studies:

All articles investigating the relationship of prediabetes, and acute coronary syndrome outcomes and published in the last ten years were included.

2.3. Type of participants:

All observational studies conducted on human were eligible, animal and experimental studies were not included.

2.4. Type of outcome measures:

We included studies that investigated at least one of the following:

The relationship between prediabetes and acute coronary syndrome recurrence, functional capacity, mortality, revascularization, and unrecognized myocardial infarction

2.5. Information sources and search methods:

A systematic electronic search was conducted in Pub Med (including E pub and ahead of print) and Google Scholar databases. The search was limited to articles published in English language during the period 2008- December 2020. The keywords acute coronary syndrome, prediabetes, acute coronary syndrome recurrence, heart failure, revascularization, major cardiovascular adverse events with the protean AND or OR.

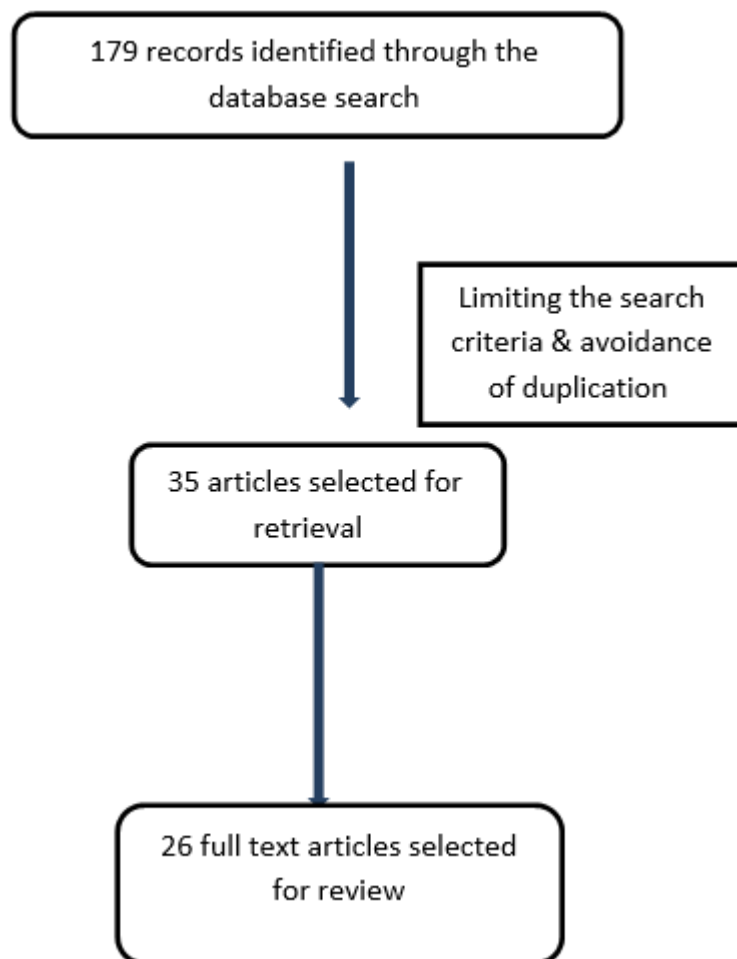
2.6. Study selection and data extraction:

The results were searched manually for relevant articles. The authors independently screened the titles and abstracts. They checked all articles for eligibility according to the mentioned selection. Out of 179 articles retrieved, only twenty-six articles fulfilled the

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inclusion and exclusion criteria. The author name, country, year of publication, type of study, number of patients, the duration of follow-up, and the outcomes were extracted. The different phases of the systematic review were reported in **Figure 1**

Figure 1. The different phases of the literature search



3. RESULTS AND DISCUSSION

Out of 179 articles retrieved, twenty-six manuscripts remain after the removal of duplication and irrelevant articles. Out of the manuscripts reviewed, seven were from Asia; seven were from Europe and the USA each, three from South America, and one from Australia. The studies were prospective cohort (13), 6 were cross-sectional, while seven were retrospective. The studies enrolled 360033 patients, the prospective cohorts results were mixed, some showed a negative effects of PD on acute coronary syndrome outcomes, while other reported no effects, the same apply for cross-sectional and retrospective studies. Table 1

In the present review, a prospective study conducted in the USA and included 1226 patients with acute coronary syndrome^[4] showed that prediabetes increase the recurrence of acute coronary syndrome putting them at a greater risk of morbidity and mortality^[5]. Russo et al.^[6] who showed a reduced poor exercise and functional capacity among patients with PD and acute coronary syndrome supported this observation. Another study published in Denmark^[7] showed similar bad prognosis among middle-age and elderly populations affected by silent coronary syndrome and impaired fasting glucose, two studies^[8,9] (a retrospective and a cross-sectional study) showed that prediabetes was not associated with heart failure among elderly patients, myocardial infarction and death respectively. Similarly, Tian et al.^[10] in their prospective cohort showed that admission glucose but not prediabetes was associated with MACE in contradiction to a retrospective study^[11] that showed a higher rate of mortality among patients with PD. A large prospective cohort^[12] showed the association of PD with subclinical myocardial damage; Jiménez-Navarro et al.^[13] found that only previous diabetes was associated with cardiovascular events, while Stacey et al.^[14] found subclinical MI among patients with PD. Further retrospective studies from Korea and Colombia^[15, 16] showed no association of PD and acute coronary syndrome regarding MACE. In the present review, a study published in India^[17] showed that 69% of acute coronary syndrome were either PD or normal. A prospective study with a long duration of follow-up^[18] showed that patients with prediabetes and DM had a higher rate of CV events 3 years post-MI, Wang et al.^[19] found a relationship between proteinuria and MI among patients with PD high lightening the importance of microvascular complications in the prediction of macrovascular disease. A retrospective study^[20] found a relationship between MI and stroke among young people with high BMI an observation supported by Bamberg et al.^[21]. In addition,

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a study [22] found the importance of pre-hypertension and PD combination in the prediction of cardiovascular disease. In this, review and Kok et al. [23] Rospleszcz et al. [24] reported the association of prediabetes and MI, death, and increased left ventricular wall thickness. Similar findings were reported in Spain [25], Korea [26], Germany [27], and the USA [28], on the other hand Mahendran et al. [29] found that DM, but not prediabetes was associated with pulmonary edema, and recurrence of ACS, while a prospective cohort from the USA [30] reported the association of FPS but not postprandial blood sugar with unrecognized myocardial infarctions.

4. CONCLUSION

The studies showed mixed results, some showed the negative effects of PD on acute coronary syndrome outcomes, while other showed no effects.

Conflicts of interest: The authors declare that there is no conflicts of interest

Table 1. The relationship between prediabetes and myocardial infarction and post-interventional prognosis

Author	Year	Country	Study type	patients	result
Donahue et al.	2009	USA	A prospective cohort	1226 ACS	Risk of recurrence observed among females, but not males with prediabetes
Russo et al.	2012	Italy	Prospective cohort	230 ACS patients	Impaired glucose tolerance associated with poor exercise and functional capacity
Intzilakis et al.	2012	Denmark	A prospective cohort	569 healthy people	The combination of impaired fasting glucose and silent myocardial ischaemia was associated with the poorest prognosis in middle-aged and older subjects.
Deedwania et al.	2013	USA	Retrospective	4602, FBS measured	Prediabetes is not heart failure predictor in elderly patients
Giraldez et al.	2013	Brazil	Cross-sectional	8795 NSTEMI, FBG, and HbA1c estimated	DM, not prediabetes was associated with death and MI
Tian et al.	2014	China	Prospective cohort	4787 MI patients, HbA1c measured	Prediabetes (31.1%) not associated with short term MACE, admission glucose was
Arnold et al.	2014	USA	Retrospective	2,853 patients with AMI	Nearly 70% had dysglycemia based on HbA1c (31% prediabetes), a higher rate of mortality.
Selven et al.	2014	USA	A prospective cohort	9051 patients	Prediabetes and DM were independently associated with the development of subclinical myocardial damage, possibly microvascular
Jiménez-Navarro et al.	2015	Spain	A prospective cohort	374 post-PCI	81% were dysglycemic (24.3% prediabetes). Only previous DM was associated with CV events
Stacey et al.	2015	USA	Cross-sectional	6,814 participants	Prediabetes was associated with unrecognized MI
Chin et al.	2016	Korea	Retrospective	2470	HbA1c was not associated with MACE post-PCI for STEMI
Cueva-Recalde et al.	2016	Colombia	Retrospective	132	No difference between prediabetes and controls regarding long-term adverse cardiovascular outcomes in patients with CAD and PCI
Khan et al.	2016	India	Cross-sectional	200 with MI	69% of acute MI were prediabetes and normal glucose

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Gomez-Arbelaez et al.	2016	Colombia	Prospective cohort	439	Patients with prediabetes and DM showed a higher rate of CV events 3 years post-MI
Wang et al.	2017	China	Prospective cohort	17,625 participants followed for 6.69 years	Persistent proteinuria was associated with MI in prediabetes and DM
Chai et al.	2017	Singapore	Retrospective	2295 participants	Development of T2DM/AMI/stroke within the first five years of IFG is significantly high for subjects age 40-49 and those with high BMI
Bamberg et al.	2017	Germany	Prospective	400 prediabetes and DM	Prediabetes was associated with vascular, cardiac, and metabolic changes, as measured by whole-body MRI after adjusting for cardiometabolic risk factors.
Khosravi et al.	2017	Iran	Cross-sectional	6323 participants	Pre-hypertension and prediabetes and pre-hypertension together are superior than prediabetes alone in predicting CVD
Kok et al.	2018	Netherlands.	Prospective cohort	2,986 participants	Death, myocardial infarction, or revascularization were doubled among prediabetes one year after PCI
Rospleszcz et al.	2018	Germany	Cross-sectional	359 participants	Increased left ventricular wall thickness among DM and prediabetes irrespective of other risks
Garcia-Carretero et al.	2018	Spain	A prospective cohort	1652 participants	DM and prediabetes were associated with increased CV events
Lee et al.	2018	Korea	Retrospective	260,487 participants	Shifting from normal to impaired fasting glucose or DM was associated with higher mortality
Patscheider et al.	2018	Germany	Cross-sectional	337, MRI done	Subclinical changes in left ventricular volume in DM and prediabetes
Ali et al.	2018	USA	Retrospective	27 971	Cardiovascular and renal risks and disease have become highly prevalent in adults with prediabetes, irrespective of the definitions used
Mahendran et al.	2019	Australia	A prospective cohort	847 patients with ACS categorized based on HbA1c	DM, but not prediabetes (37%) was associated with pulmonary edema, and recurrence of ACS
Stacey et al.	2019	USA	A prospective cohort	4355 participants, FBG measured	DM (FBS) showed unrecognized myocardial infarctions, postprandial BG not associated

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