Review Article

Hypertension and Coronary Heart Disease in Diabetic Patients: A Systematic Review

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Abstract

Background: Diabetes mellitus is accountable for a wide variety of cardiovascular diseases (CVDs), which are the chief reasons of mortality in diabetic individuals, and various influences, comprising hypertension, contribute to this extraordinary prevalence of CVD. The most important reason for morbidity and mortality in diabetes is a cardiovascular illness that is intensified by hypertension. The objective of this review article is to discuss evidence of hypertension and coronary heart ailment in diabetic patients. **Method:** This is a systematic review was carried out, including PubMed, Google Scholar, and EBSCO. Topics concerning hypertension and coronary heart disease in diabetic patients and other articles were used in the making of the article. The founded articles were screened by titles and reviewing the abstracts. No software will be utilized to analyze the data. Double revision of each member's outcomes was applied to ensure the validity and minimize the mistakes. **Results and Conclusion:** The review included 10 randomized studies. Diabetes mellitus (DM), hypertension (HT), and coronary heart disease (CHD) are closely related. DM is a well-known risk factor for CVD generally including CHD. The prevalence of DM, HT, and CHD is growing worldwide. Lifestyle changing and treatment adherence are essential for the prevention of morbidity and mortality related to both diseases and play a major role in the occurrence of these diseases.

Keywords: Diabetes mellitus, cardiovascular disease, hypertension, coronary heart disease, diabetic patients

Introduction

Diabetes mellitus is accountable for a wide variety of cardiovascular diseases (CVDs), which are the chief reasons of mortality in diabetic individuals, and various influences, comprising hypertension, contribute to this extraordinary prevalence of CVD [1].

CVD encompassing coronary heart (CHD) are presently the chief reason of mortality globally, concerning for 21.9% of the overall deaths, also, is expected to rise to 26.3% by 2030 [2]. Of the risk factors, diabetes, and its predominant form, type 2 diabetes mellitus (T2DM), has a distinctive association with CHD. Persons with diabetes ensure 2-4 fold higher hazard of getting the coronary disease than non-diabetic persons, and CVD is responsible for an irresistible 65-75 percent of mortality in diabetic individuals [3].

Hypertension is dual as prevalent in diabetics if matched with non-diabetics [4-7]. Moreover, hypertensive cases every so frequently displays insulin resistance, also, they are at more hazard of getting diabetes than those who remain normotensive. In recent times, the occurrence of hypertension besides T2DM is growing in several Asian nations, with numeral countries with blood pressure (BP) and glucose levels exceeding the international figures [8]. The chief reason for diseases and deaths in diabetes is CVD that aggravated due to hypertension.

Epidemiologic researches must reveal that hypertension and T2DM are worldwide public health concerns and come to be the chief cause of disease affliction and mortality [9]. Impediments stand up due to endothelial injury, oxidation, inflammation, and vascular remodeling that lead to atherogenesis [10]. The mechanisms of the pathogenesis of CVD in diabetes are correlated to epigenetic, hereditary, and cell-signaling deficiencies in inter-related metabolic and inflammatory pathways.

These metabolic deficiencies could be elicited by several ecological influences such as extraordinary caloric consumption, smoking, glycation end-products, glucose

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poisonousness, and several drugs [11].

The foremost reason for diseases and deaths in diabetes is CVD that is aggravated by way of hypertension.

The objective of this review is to discuss evidence of hypertension and coronary heart disease in diabetic patients.

Methods and Materials

Sample & study groups

PubMed and EBSCO Information Services were chosen as the search databases for the publications used within the study, as they are high-quality sources. PubMed is one of the largest digital libraries on the internet developed by the National Center for Biotechnology Information (NCBI) which is a part of the United States National Library of Medicine. Topics concerning hypertension and coronary heart disease in diabetic patients and other articles were used in the making of the article. The founded articles were screened by titles and reviewing the abstracts.

Inclusion criteria: As shown in figure (1), the articles were selected based on the relevance to the project which should include one of the following topics; 'diabetes as a CHD risk factor, hypertension in diabetic patients, hypertension and diabetes, CVD in diabetic patients'.

Exclusion criteria: all other articles which do not have one of these topics as their primary end of repeated studies, and reviews studies were excluded.

Statistical analysis

No software will be utilized to analyze the data. The data was extracted based on a specific form that contains (Author's name, year of publication, study type, objective, and outcomes). Double revision of each member's outcomes was applied to ensure the validity and minimize the mistakes.

During articles selection, studies were doubled-reviewed, and their results to assure that we enroll the studies related to the objective of our study, and to avoid or minimize errors in the results.

Results:

The search of the mentioned databases returned a total of 103 studies that were included for title screening. 47 of them were included for abstract screening, which leads to the exclusion of 24 articles. The remaining 23 publications full-texts were reviewed. The full-text revision leads to the exclusion of 13 studies, and 10 were enrolled for final data extraction (Table 1).

The included studies had different study designs.

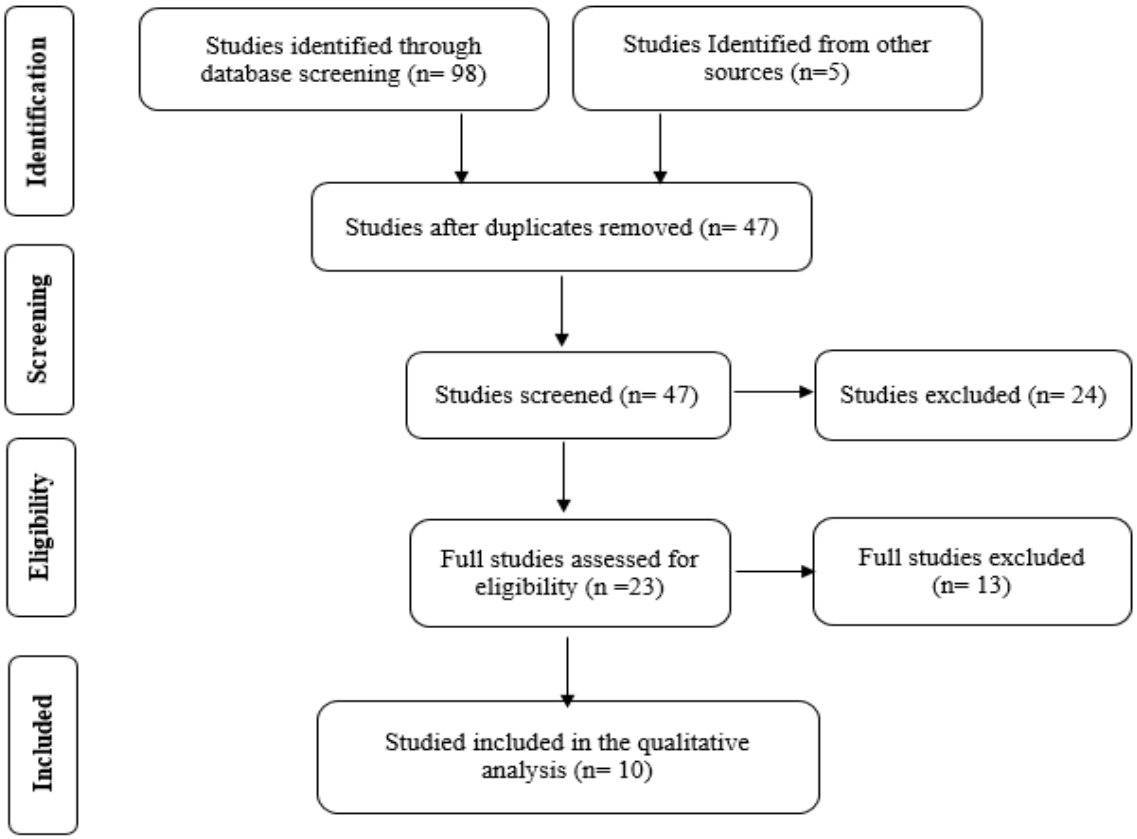

Figure 1: Flow chart illustrating the process of data extraction for the study

Table 1: Author, year of publication, study type, objective, and outcomes:

Author and Publishing Year	Study type and Objective	Outcomes
Petrie, John R, et al. (2018) [12]	A review article was undertaken to debate diabetes and hypertension as associated diseases and converse the pathophysiological structures of vascular problems related to these disorders.	The authors stated that diabetes is correlated with an elevated risk of CVD, which is exaggerated by coexisting hypertension. Controlling comorbidities, specifically hypertension, and targeting interventions to improve vascular health, may be particularly effective in reducing the microvascular and macrovascular diabetes-related complications.
Ali, Mohammed K, et al. (2010) [13]	The goal of the review article was to work out by way of unwieldy facts, holding those observations in perspective, a better message for the sense of South Asia and cardio-metabolic risk management.	The regulation of Glycemic and CVD risk influences could be thought-provoking in any setting, not least in deputize -landmass. Evidence-based standards for diabetes treatment, primarily based on studies in Anglo-Caucasian people, are existing, although there is little indicator of how well these protocols are followed in South Asia, and there is no evidence of randomized trials conducted in this specific demographic group.
Shen, Y., Dai, Y., Wang, X.Q. et al. (2019) [14]	Review article to define the potential optimal doses of BP based on guidelines for the treatment of hypertension in accordance with our clinical results for type 2 diabetic patients with coronary artery disease.	Hypertension and T2DM share several common features of pathophysiology, and BP management can be individualized to reduce adverse events and enhance benefits, especially for patients with T2DM and coronary artery disease.
Leon, B. M., & Maddox, T. M. (2015) [15]	The review article reviews the relationship between diabetes and CVD, explores alternative pathways for disease development, addresses existing clinical guidelines, and outlines prospective avenues for study.	If the incidence of DM tends to grow, linked CVD-through both conventional CV risk factors and the direct impact of DM on CVD-can also be predicted to increase. As a result, careful monitoring and care of DM, along with active treatment of related risk factors for CV, is key to increasing the prevalence and development of DM and CVD.
Sunkara, N., & H Ahsan, C. (2017) [16]	Review Article	Diabetes and HTN share similar patient clinical influences and pathophysiological pathways. Such directions intersect and affect each other and can also contribute to a vicious circle. HTN and diabetes are elements of the metabolic process—metabolic syndrome. They can then evolve into the same person one after the other. Lifestyle factors play an essential role in the pathogenic process.
Chiha, Maguy, et al. (2012) [17]	The study focuses on type 2 diabetes mellitus as a risk factor for coronary heart disease, discusses the causes of atherogenesis in diabetics, the effect of hypertension and treatment targets in diabetics, recommendations for screening, and a global review of epidemiological effects of diabetes and heart disease.	Diabetes mellitus is associated with an elevated risk of premature mortality and a greater prevalence of the cardiovascular disease, including coronary heart disease. The dramatic growth in the incidence of diabetes would eventually lead to a significant rise in demand for primary, secondary, and tertiary health care worldwide.
Lin, Mao-Jen, et al. 2017 [18]	A prospective cohort study was conducted to explain and liken the long-term consequences in four groups of patients: those who have diabetes and hypertension, those who have lone DM, those who have just hypertension, and those free from either DM or hypertension.	Patients with DM alone have higher mortality after PCI relative to patients with DM and hypertension, DM and hypertension, and hypertension alone. Comorbid hypertension does not appear to raise the hazard in DM cases, while comorbid DM tends to upsurge the hazard in hypertensive patients.
De Rosa, Salvatore et al. 2018 [19]	The review discusses current awareness of coinciding hereditary and epigenetic features of type 2 DM and CVD, comprising microRNAs and extended non-coding RNAs, the pathological regulation of that associated by both disease disorders, either etiologically or as a reason of their development.	Patients with diabetes and hypertension have an elevated risk of macrovascular and microvascular risks. The targeting of several risk factors is important to avoid and slow down the development of these complications. Optimization of glycemic, lipid, and blood pressure control has been shown to improve patient results.
Long, A. N., & Dagogo-Jack, S. (2011) [20]	Community-based cohort research of CV risk influences and ailments in 4,549 participants verified the theory that diabetes influences HF autonomously of hypertension and underlying myocardial infarction (MI).	Type 2 DM is a dominant, independent risk factor for HF. The danger of HF in diabetics cannot be entirely clarified by the occurrence of MI and synchronized risk factors for CV.
Martín-Timón, Iciar et al. (2014) [21]	Review article to demonstrate the risk factors for cardiovascular disease in the environment of type 2 diabetes mellitus and to address their role in the pathogenesis of excess cardiovascular disease mortality and morbidity in these patients.	There is significant evidence that optimum glycemic regulation and control of hypertension, dyslipidemia, smoking cessation, and weight loss are required to minimize cardiovascular risk in T2DM patients. Cardiovascular advantages are accomplished as management of conventional cardiovascular risk factors starts early on in subjects with a short term of DM and low cardiovascular risk.

Discussion:

Epidemiological reports have demonstrated that hypertension and type 2 diabetes mellitus (T2DM) are international public health problems and are the main cause of disease incidence and mortality [22, 23]. The World Health Organization reports that 40 percent of adults worldwide have hypertension [24] and also that 422 million adults have diabetes [25]. Among the risk factors, diabetes, and its primary form, type 2 diabetes mellitus (T2DM) has a clear correlation with CHD. Diabetes sufferers are at two-to four-fold greater risk of contracting coronary heart disease than non-diabetes sufferers, and CVD accounts for an overwhelming 65-75 percent of deaths in diabetic patients [26] Hypertension occurs in a large percentage of individuals with diabetes. There is substantial variation between diabetes and HTN, suggesting marked overlaps in etiology and disease processes. Hypertension (HTN) is a significant risk influence on heart disease and its various manifestations. When paired by DM, hypertension has been revealed to expect and encourage increased risk of heart disease over and beyond every hazard influence only [17]. Multiple genetic factors through slight relations ensure been stated to be linked with DM and hypertension, comprising, nonetheless not restricted to, genetic factor encrypting angiotensinogen, adrenomedullin, apolipoprotein, and α-adductin, to name a few [27].

San Antonio Heart Study reported that; 85% of T2D patients had hypertension by almost age 50, whereas 50% of those with hypertension experienced impaired glucose tolerance or T2D [28]. A recent prospective cohort study included 12550 participants who reported the development of type II diabetes was almost 2.5 times as expected in individuals with hypertension than in their non-hypertensive equivalents [29]. Only 42% of diabetes cases possess normal BP and only 56% of patients with HTN had normal glucose tolerance as was reported in the Hong Kong Cardiovascular Risk Factor Prevalence Study [30]. Another study reported that about 10 to 30% of T1D and 60% of T2D patients have hypertension [31, 32].

Cardiovascular disease, like coronary heart disease (CHD), cerebrovascular disease, and peripheral artery disease, is often more prevalent in diabetes and is a significant cause of morbidity and mortality of diabetic patients worldwide [2]. Approximately 70% of patients with T2DM ≥65 years of age die from CVD [33]. Framingham Heart Study, Fox [11] recorded that along with the growing incidence of T2DM, the attributable risk of T2DM CVD rose from 5.4 percent [34]. Hateren et al. [35] suggested that the risk ratio for death due to CVD has slowly risen last year. As a result, a growing burden of diabetes is likely to be accompanied by a growing affliction of CVD. Mohammedi et al. [36] shows that significant peripheral arterial disease presenting as low-extremity ulcer otherwise amputation besides exterior revascularization is linked with an elevated hazard of mortality and CV proceedings in T2DM cases. Yoo et al. identified an average rise in atherosclerotic load and a 3.5-fold increase in coronary stenosis risk, which remained sovereign of additional cardiovascular hazard influences in diabetics [37].

Straka et al. [38] observed 29,863 patients (5501 with T2DM and 24,362 without T2DM) in an incidence-based sample of more than 1-year. Four of the cardiovascular results reported were substantially higher among those with T2DM. Patients with T2DM have a 10% higher risk of CAD, 53% higher risk of MI, 58% higher risk of stroke, and 112% higher risk of heart failure. T2DM is also a major risk factor for CVD and its effects. Of the 5,163 men who registered taking diabetes meds (mostly type 2), 9.7% died of cardiovascular disease during 12 years; the equivalent rate of cardiovascular mortality among the 342,815 men who did not take diabetes meds was 2.6% [39]. Overall, nearly 32.2 percent of all people with T2DM are impacted by complete CVD.

CVD is a significant cause of death for T2DM patients, comprising nearly 50% of demises along the period of study. Coronary artery ailments and stroke stayed the chief contributing factors [40].

Conclusion:

Diabetes mellitus (DM), hypertension (HT), and coronary heart disease (CHD) are closely related. DM is a well-known risk factor for CVD generally including CHD. The prevalence of DM, HT, and CHD is growing worldwide. Lifestyle changing and treatment adherence are essential for the prevention of morbidity and mortality related to both diseases and play a major role in the occurrence of these diseases.

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