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A Holistic Review of Rosacea and Its Association with Cardiovascular Diseases

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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Review Article

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ABSTRACT

Rosacea is a chronic inflammatory dermatological condition with different clinical phenotypes, usually diagnosed clinically and treated with systemic and topical medications. Rosacea is one of the skin conditions that is often believed to just have cutaneous manifestation, but it is actually a systemic condition that affects many different systems. The correlation between rosacea and a variety of comorbidities, including depression, gastrointestinal disorders, migraines, autoimmune conditions, and cardiovascular diseases (CVD) are noted in many different studies. There are

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numerous risk factors for CVD, including hypertension (HTN), diabetes mellitus (DM), metabolic syndrome (MS), and dyslipidemia. CVD has a high mortality rate and should not be overlooked. Rosacea patients must receive the appropriate education regarding the management of CVD risk factors in addition to rosacea. We thought it was important to conduct a literature review to investigate the association between rosacea and the risk factors associated with CVDs, since both conditions are chronic and involve the interaction of genetic and inflammatory factors. The purpose of this narrative review is to overview rosacea, draw attention to the cardiovascular risk that rosacea patients face, and alert dermatologists, cardiologists, and primary care physicians to the need for immediate risk factor treatment.

Keywords: Rosacea; cardiovascular diseases; atherosclerosis; diabetes mellitus; metabolic syndrome; insulin resistance.

1. INTRODUCTION

Rosacea is an inflammatory dermatosis that mostly affects facial convexities, for example, the forehead chin, cheeks, and nose. It is a chronic, relapsing condition. Affected individuals make up to ten percent of the global population, with women more commonly affected than men [1]. External triggers of rosacea include UV exposure, certain foods and drinks (including spicy foods, dairy products, and alcohol), emotional stress, and medications (including amiodarone and topical steroids [2].

The pathophysiology of rosacea can be divided into the following categories: innate immune system dysregulation, neurovascular dysfunction, environmental risk factors, microorganisms, and genetics. We will discuss the pathophysiology in full detail on the next pages [2,3].

Four subtypes of rosacea—papulopustular, phymatous, ocular, and erythematotelangiectatic—as well as one variant—lupoid or granulomatous rosacea—have been identified by the National Rosacea Society (NRS) [4,5]. Rosacea is a highly prevalent disease. A prevalence ranging from 0.09% to 22.41%, with an average of 5.46% worldwide, was discovered in a systematic review and meta-analysis of 41 patient cohorts totaling 26 million individuals [6].

"Flushing" (physiologic acute neurogenic inflammation) and "blushing" (sympathetic-driven temporary pinkness of the face) are symptoms seen in rosacea patients. People with rosacea have more nonspecific cation channel expression and density on sensory neurons and keratinocytes, according to the current conceptual framework [3]. The most common extracutaneous manifestation of rosacea is ocular rosacea. The disease affects the meibomian glands, resulting in reduced tear production and the development of dry eye syndrome [2].

Systemic affection in patients with rosacea includes cardiovascular diseases (CVD), metabolic syndrome (MS), chronic inflammatory bowel diseases (IBD), chronic kidney disease (CKD), autoimmune disorders, psychiatric disorders, neurological disorders, and cancers [7].

CVD, which includes coronary artery disease (CAD), stroke, heart failure (HF), and aortic diseases, is one of the leading causes of death around the globe. Major risk factors for the development of cardiovascular disease include hypertension (HTN), atherosclerosis, diabetes mellitus (DM), obesity, and smoking [8]. As rosacea is a chronic inflammatory disease, and In light of the increased risk of cardiovascular disease (CVD) because chronic inflammation also contributes significantly to the pathophysiology of atherosclerosis, people with rosacea should have more intensive surveillance and measures to address systemic comorbidities [9].

We aim to provide a comprehensive overview of rosacea, with a focus on the correlation between rosacea and cardiovascular diseases. We wish to reflect on the current scientific evidence of this association to provide a more accurate underestimation of this association and a more prudent approach to rosacea patients. As regards the methodology, we searched for articles in PubMed and Google Scholar.

1.1 Risk Factors for Developing Rosacea

To date, no specific risk factors have been associated with rosacea. However, there is well-established and ongoing research on some risk factors [10,11].

1.1.1 Family history

Individuals who have a family history of rosacea may be at a higher risk of developing the condition [12]. Up to 30% of patients in a certain case series have a family history of rosacea [13]. The risk of developing rosacea may be enhanced by genetic differences in antigen presentation. Rosacea has been associated with human leukocyte antigen (HLA) alleles implicated in extracellular antigen presentation (HLA-DRB103:01, HLA-DQB102:01, and HLA-DQA1*05:01). Additionally, it is connected to a single nucleotide polymorphism (SNP) on chromosome 6 that is located in an intergenic location. This is situated downstream of BTNL2 (butyrophilin-like 2) and close to HLA-DRA (HLA class II histocompatibility antigen, DR alpha chain) [14].

1.1.2 Skin phototypes

The majority of research suggests that persons with fair or pale skin tones (phototypes I and II, respectively) are more likely to develop rosacea [15].

1.1.3 Ultraviolet (UV) exposure

It is recognized as a possible risk factor for rosacea development. This factor's pathophysiology is that UV light may trigger innate immunological reactions that might result in rosacea, particularly in people with lighter skin phenotypes [16].

1.1.4 Smoking

Surprisingly, a prospective cohort study found that smoking decreased the risk of developing rosacea; however, the risk increased in prior smokers. However, uncontrolled confounding variables, especially comorbidities, and a self-reported rosacea diagnosis compromised the validity of the study's findings [17]. According to a large population-based cohort study, there is a correlation between current smoking and a lower incidence of rosacea. Furthermore, among current smokers, a higher intensity of smoking was linked to a lower risk of rosacea [18]. Cigarette smoking leads to peripheral artery vasoconstriction, which may decrease vasodilation associated with rosacea. Additionally, nicotine's anti-inflammatory properties may reduce inflammation in rosacea [17].

1.1.5 Microorganisms

There are several bacteria and Demodex mites that are thought to trigger cutaneous inflammation in rosacea patients. It is unclear, therefore, what part these organisms have in the pathophysiology of rosacea. Numerous studies have shown that patients with rosacea have a higher density of Demodex mites. A meta-analysis of case-control studies found a correlation between Demodex infestation and rosacea, with the degree of infestation being more significant than the infection rate. A few studies have connected rosacea to other microorganisms, including Staphylococcus epidermidis, Bacillus oleronius, and Chlamydia pneumoniae. According to other studies, rosacea may be caused by a disruption of the microbiome as a whole instead of due to a particular bacterial infection [19–29].

The gut-skin axis is a theory that explains the pathophysiology of many chronic inflammatory diseases. It postulates that gastrointestinal health influences skin homeostasis through intricate interactions between the neurological, metabolic, and immune systems. The precise processes by which the gut microbiota contributes to the emergence and progression of rosacea remain unclear. The pathophysiology of rosacea entails the activation of the skin’s immunological and neurological systems in response to external, internal, or biological cues. Therefore, alterations triggered by gut dysbiosis may result in the progression, exacerbation, or persistence of the disease's symptoms [24,25].

1.1.6 Alcohol

Use of alcohol has been dose-dependently associated with an increased risk of rosacea. This could be caused by a variety of things, such as concurrent temperature increases and alcohol-induced vasodilation. Alcohol consumption, in particular, can lead to catecholamine release, resulting in bradykinin-induced facial vasodilation. Furthermore, Cell cycle regulators can be activated by alcohol, which may lead to epidermal hyperproliferation in rosacea patients [30,31].

1.1.7 Excessive facial cleansing

Deep cleaning practices and the regularity with which they are practiced appear to be risk factors for rosacea. Moreover, some facial cleansers and cosmetic products may contain irritants that can worsen rosacea symptoms [32].

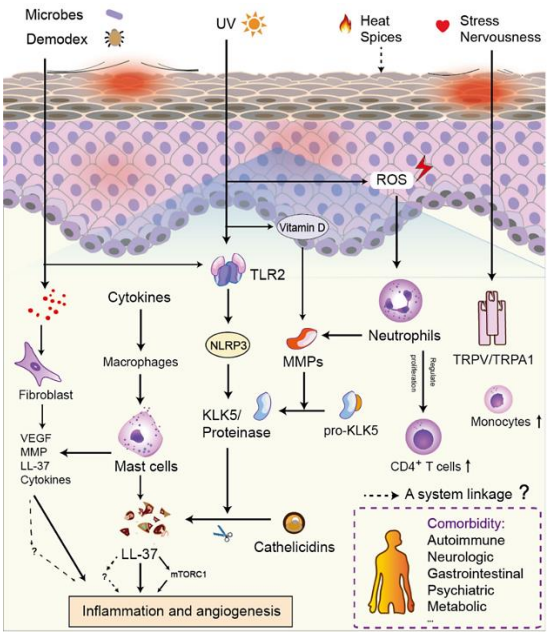

Fig. 1. Mechanisms known to contribute to the pathophysiology of rosacea [24]

Table 1. Characteristics of different types of rosacea [34]

Subtype	Characteristics
Subtype I: Erythemato-telangiectatic rosacea (ETR)	1. Subtype 2 rosacea pimples and bumps can appear before or at the same time as flushing and persistent redness in the center of the face. 2. There can also be blood vessels that are visible. 3. persistent erythema affecting the face's center areas. 4. Due to their extremely sensitive skin, people with this rosacea may occasionally feel as though their skin is burning or stinging.
Subtype II: Papulopustular rosacea	1. May coexist with rosacea subtype 1 facial flushing and redness. 2. The following are some of the symptoms: sporadic papules and/or pustules along with temporary or chronic facial redness, particularly in the middle of the face; burning and stinging; small visible blood vessels (telangiectasia); elevated, scaly red spots known as plaques. 3. This kind of rosacea usually affects women more than men and manifests itself in middle age.
Subtype III: Rhinophyma (Phymatous rosacea)	1. Affect the eyelids (blepharophyma), forehead (metophyma), ears (otophyma), chin (gnatophyma), nose (rhinophyma), and ears (otophyma). 2. The most common site exhibits noticeable thickening of the skin and irregularities in the surface nodules, particularly on the nose. 3. Additionally, telangiectasia may manifest. 4. There are four histological forms of rhinophyma: actinic, glandular, fibrous, and fibroangiomatous. 5. Men experience problems far more frequently than women do.
Subtype IV: Ocular rosacea	1. Varies from mild dryness, irritation, feeling of a foreign body, and blurred vision to severe disruption of the ocular surface and inflammatory keratitis. 2. Additional findings related to the eyes include telangiectasias of the lid margin and conjunctiva, thickening of the eyelids, crusts and scales on the lids, corneal infiltrates, corneal ulcers, corneal scars, and vascularization. 3. Problem is common in 20% of patients with rosacea. Severity of facial rosacea does not correspond with severity of ocular disease.

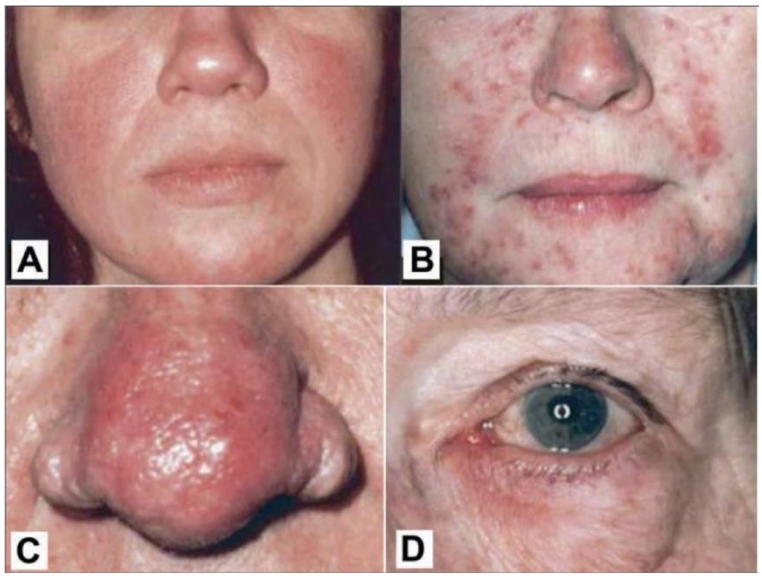

Fig. 2. The four types of rosacea [35]

1.1.8 Etiology and Pathogenesis

The etiology of rosacea remains to be fully elucidated. Numerous causes have been linked to its pathophysiology; some are supported by scientific research, while others are based on anecdotal observation [33]. The suggested etiologic processes are categorized into abnormalities in immunity and neurovascular dysfunction [34].

1.1.9 Immune dysfunction

In the early phases of rosacea development, both the innate and adaptive immune systems are involved. Toll-like receptor (TLR) activation in the immune system causes the stimulation of conserved anti-pathogen signaling cascades, involving the production of proinflammatory cytokines and chemokines as well as the release of antimicrobial peptides (AMPs) such as cathelicidin. The TLR family member TLR2 is overexpressed in rosacea patients, and this is linked to increased activation of TLR2 in response to external stimuli. This finding is supported by the fact that AMP cathelicidin and kallikrein5 (KLK5), the main serine protease that cleaves cathelicidin into its active peptide form, LL-37, are expressed at higher levels in rosacea patients. Leukocyte chemotaxis, angiogenesis increase, and NF-kB activation are among the effects of LL-37 that are correlated with morphologic aspects of rosacea, including facial erythema, telangiectasis, and papules and pustules [35].

1.1.10 Neurogenic inflammation and vascular hyperreactivity

The complex network of mono-and/or bidirectional pathways that connects the skin to the immune, hormonal, and neurological systems is known as cutaneous neurobiology. Numerous physiological and pathological processes, including as cellular formation, proliferation, differentiation, vasoregulation, pruritus, immune activities, leukocyte recruitment, and neurogenic inflammation, are coordinated by this network. Stressors that can cause neurotransmitter release and cause vasodilation, flushing, increased skin sensitivity, stinging, itching, and lower pain thresholds in rosacea patients include UV radiation, microbial antigens, trauma, psychological distress, and endogenous hormones. Extreme sensitivity to heat, chemicals, and/or mechanical stimuli is exhibited by TRP vanilloid type (TRPV) 1 and 4, as well as TRP ankyrin 1 (TRPA) ion channels expressed on nerve cells, keratinocytes, mast cells, and/or immune cells. Vasoactive neuropeptides, such as substance P, calcitonin gene-related peptide (CGRP), vasoactive intestinal peptide (VIP), and pituitary adenylate cyclase-activating polypeptide (PACAP), are released when TRP is activated. These neuropeptides have all been connected to rosacea. Substance P controls local blood flow and causes mast cell degranulation, which raises levels of tumor necrosis factor (TNF), chemokines (such as CCL2, CXCL9, CXCL10, CCL5, and CXCL8), and pro-inflammatory cytokines (like IL-1, IL-3, and IL-8) suggesting

that neurogenic inflammatory processes are probably involved in rosacea [36–41].

1.1.11 Diagnosis of rosacea

Rosacea is a gradually developed disease. Patients usually are unaware that they have a curable cutaneous condition and believe that their intermittent face flushing, papules, and pustules are caused by adult acne, sun or windburn, or the natural aging process [42]. It is a clinical diagnosis based on history and physical examination, NRS provided a provisional diagnosis and classification system [3].

The examination of patients with rosacea will reveal redness in the central part of the face, telangiectasia, and acne-like papules or pustules. Also, dry red eyes and an enlarged nose are known as ocular rosacea and rhinophyma, respectively. Acne is one of the most important differential diagnoses of rosacea. In contrast to rosacea, patients with acne have papules, pustules, and open and closed comedones on their face, chest, and back, with surrounding localized redness and no telangiectasia [43].

According to many variables, as illustrated in Table 1, there are many different types of rosacea [43]. Fig. 2 illustrates the four categories that it has been divided into based on its signs and symptoms: erythematotelangiectatic (A), papulopustular (B), phymatous (C), and ocular (D). These subtypes frequently co-occur [44,45].

Skin pigmentation increases can lead to misdiagnosis because melanin can mask telangiectasias and erythema. However, other symptoms of rosacea, like burning or stinging in the face, flushing, edema, dry-looking skin, and papules and pustules, can aid in identifying rosacea in those whose skin is extremely pigmented [46]. As rosacea can cause permanent disfigurement if left untreated, early detection and therapy are essential [33].

Diagnostic procedures such as dermoscopy and diascopy are also beneficial. Dermoscopy provides a comprehensive view of the pigmentary and vascular characteristics of rosacea. The ability to see vascular patterns, such as tortuous capillaries and telangiectasias, helps to distinguish rosacea from other cutaneous disorders. Even though it's not a common occurrence, scaling can be observed by dermoscopy and may indicate a more phymatous skin presentation [47]. Diascopy can detect mild erythema by pressing a glass microscope slide on the skin to test for blanching and if the erythema presents it will be blanch. Photographing patients against a dark blue background may also make erythema more visible [46,48]. The purpose of obtaining a skin biopsy is solely to exclude other diagnoses, as the histological characteristics of rosacea are generally non-specific [49].

1.1.12 Management of rosacea

Although there is no documented natural progression for rosacea, symptoms can evolve with time [50]. In light of the clinical manifestations of the patients, treatment decisions are made [51]. Avoiding recognized triggers is advised because rosacea can be brought on by a range of stimuli. To recognize possible triggers, patients have to be urged to keep a diary that details their exposures, diet, and activities that provoke flare-ups [52].

Carefully selected skin care products help to maintain and build the stratum corneum permeability barrier while reducing skin irritation [53]. Patient satisfaction is increased by gentle washing and moisturizing routines. Cleansers should have a pH range of mildly acidic to neutral and be free of fragrance and abrasives. Lipid-free, non-alkaline cleansers are suggested for cleansing the skin. For optimal absorption of moisturizers, patients should avoid using abrasive products, clean gently with the fingertips, and pat dry [52].

Although no skin care product has been thoroughly researched, various products have been proven to reduce dryness, such as ceramide-based formulas, lipid-free nonalkaline, and polyhydroxy acid. Astringents, toners, sensory stimulants, and possibly irritating chemicals should be avoided by patients [54,55].

Universally, photoprotection is advised, including the use of broad-spectrum sunscreens with a minimum sun protection factor (SPF) of 30 and wide-brimmed hats [50]. Products with titanium dioxide and zinc oxide that are simethicone- and dimethicone-based may be more tolerable. To hide redness, apply cosmetics with a green or yellow tint to the central facial erythema [52].

The primary line of treatment for mild to moderate rosacea is topical medicine. The intensity of the symptoms, the patient's reaction to prior treatments, and the presence or absence

of persistent central facial erythema or inflammation (such as papules, pustules, lesional, and perilesional erythema) all influence the recommendation of medication therapy [51,56–59].

Metronidazole has shown success in lowering erythema and inflammation, and it is hypothesized to lessen oxidative stress [57]. Using various vehicles (gel, cream, or lotion) or strengths (0.75% or 1%), no appreciable difference in therapeutic effect was discovered. The side effects, which included dryness, irritation, and pruritus, were minor [52,60]. Azelaic acid works to treat erythema and inflammatory lesions by preventing neutrophils from producing reactive oxygen species. There was no difference in efficacy between once- and twice-daily doses. Mild and temporary burning, stinging, and itching are examples of its adverse effects [57].

Sulfacetamide/sulfur was approved by the FDA principally based on historical use preceding to the introduction of rigorous standards. Studies demonstrated effectiveness, but they also included a significant or unclear bias risk. Some patients mention the smell, and transient application site reactions do occur. Use of this second-line therapy should be avoided if you have a sulfa allergy [56,57].

Topical 5% brimonidine tartrate gel is an alpha-adrenergic agonist and works by vasoconstricting blood vessels; it improves persistent erythema and flushing. Transit worsening was noted in a few patients, and allergic contact dermatitis was noted over the long term. Oxymetazoline hydrochloride alpha-1 agonists are used for persistent erythema; studies showed that oxymetazoline is superior to vehicles. When treating moderate to severe persistent erythema, 1% cream is applied once a day. Ivermectin, an antiparasitic, demonstrated an anti-inflammatory effect in rosacea. 1% cream application showed superior efficacy compared to vehicle in the treatment of moderate to severe papulopustular rosacea (PPR). Ivermectin 1% cream applied once daily was more effective than metronidazole 0.75% cream applied twice daily in reducing inflammatory lesions. Additionally, oral ivermectin has proven to be useful in treating patients with Demodex colonization and oculocutaneous rosacea [1,39].

Tetracyclines' anti-inflammatory qualities have shown them to be useful in treating rosacea. The FDA has approved modified-release doxycycline for the treatment of PPR. It offers efficient treatment without leading to candidiasis or bacterial resistance. For the treatment of PPR, macrolides have been used successfully and safely. Comparing azithromycin and clarithromycin to traditional macrolides, they have a quicker onset of action, cause fewer gastrointestinal adverse effects, and increase tolerance. In a side-by-side comparison, clarithromycin produced faster and more effective results than doxycycline. Patients with tetracycline allergy or intolerance benefit most from azithromycin [1].

1.1.13 Comorbidities of rosacea

Rosacea is linked to several systemic diseases. Numerous studies have investigated the possibility of comorbidities in individuals with rosacea. Based on the data provided in this review, there may be correlations between rosacea and other conditions [7,61–67].

A case-control study conducted in 2015 showed that patients with rosacea were more likely to have allergies, respiratory diseases, HTN, urogenital disorders, metabolic diseases, gastroesophageal reflux disease (GERD), and female hormone imbalance. Borderline significant associations were observed between rosacea and drug allergy, migraine, and musculoskeletal diseases [61]. In 2016 a population-based study was done to investigate the association between rosacea and dementia and found a significant correlation with dementia especially Alzheimer's disease, in patients with rosacea. The correlation was strongest in individuals 60 years old at baseline [64]. In 2016 a cohort study was done to explore the association between rosacea and Parkinson’s disease, the results observed a significantly increased risk of new-onset Parkinson's disease in patients with rosacea [63].

To investigate the relationship between rosacea and new-onset depression and anxiety a cohort study was done in 2016. The study found that rosacea patients had an enhanced risk of newly developing anxiety and depression depending on the severity of rosacea. Younger individuals were more likely to experience anxiety and depressive disorders. Only a few research have demonstrated how rosacea lowers quality of life and is more frequently linked to depression in rosacea sufferers (62). a national cohort study conducted in Taiwan in 2017 was done between

1997 and 2013 to identify the risk of IBD in rosacea patients, the result showed that patients with rosacea may have an increased risk of IBD [65].

1.1.14 Association of rosacea and CVD

Several conditions can affect the cardiovascular system; these include endocarditis, rheumatic heart disease, and disruptions in the conduction system. CAD, peripheral artery disease (PAD), and aortic atherosclerosis [68]. The leading cause of death for people of both genders, those over 45, and a majority of racial and Hispanic origin groups is heart disease [69]. However, the morbidity and mortality of cardiovascular disease (CVD) have decreased as a result of improvements in medical care and a decrease in heart disease risk factors, such as high blood pressure, high cholesterol, smoking, and obesity. When diagnosed with CVD, patients must learn how to cope with the changes in their daily lives caused by the disease and treatment [70]. A pro-inflammatory state underlies both rosacea and CVD. When managing individuals with rosacea, clinicians ought to consider looking into and treating any underlying cardiovascular risk factors that may exist as required. CRP, white blood cell counts, and erythrocyte sedimentation rates are elevated in patients with severe rosacea [71].

In 2015, a case-control study examined the relationship between MS, insulin resistance (IR), and rosacea included 47 patients and 50 controls. The connection between rosacea, IR, and MS might be explained by the presence of similar elements throughout the pathogenesis of both rosacea and metabolic diseases, such as elevated cathelicidin LL-37 levels, endoplasmic reticulum, inflammatory cytokines, and oxidative stress. The findings revealed that while there was no considerable difference in the rate of MS, IR was considerably greater in the rosacea group. Significantly increased levels of total cholesterol, systolic and diastolic blood pressure, and fasting blood glucose were seen in the rosacea group. The study emphasized the correlation between rosacea and IR and advised IR testing for rosacea patients [72].

In a case-control study that was published in 2015, 33,553 rosacea patients and 67,106 controls were included. Rosacea was substantially correlated with dyslipidemia, CAD, and HTN. The study revealed that even after adjusting for HTN, DM, and dyslipidemia, CAD continued to be independently linked with rosacea. In comparison to female patients with rosacea, male patients showed increased risks for all comorbidities [73].

Rosacea patients exhibited metabolic issues, namely obesity and hypertension among other comorbidities, according to a 2017 retrospective multicenter study which included 1,195 rosacea patients and 621 controls. Additionally, there was a significant association between the incidence of metabolic and CVDs and the duration and severity of rosacea [74].

According to a 2017 systemic review that included 29 research, the main CVD risk factors, HTN, DM, and dyslipidemia have been associated with statistically significant relationships with rosacea. Physicians should screen their rosacea patients for cardiovascular disease and consider rosacea as an additional risk factor for CAD. The study recommends 81 mg of aspirin should be advised for the primary prevention of heart disease, particularly in patients with multiple risk factors [7].

Interleukin-1 beta (IL-1), interleukin-6 (IL-6), tumor necrosis factor-alpha (TNF-alpha), and high-sensitivity C-reactive protein (hs-CRP) serum, levels were significantly higher in rosacea patients, according to a 2018 study. The mean carotid intima-media thickness (CIMT) values of the patient group and control group did not differ substantially. Rosacea does not appear to have an impact on the mean CIMT value. However, some subgroups, like those with moderate to severe disease or ocular involvement, are linked to an elevated risk of subclinical atherosclerosis and may need extra care to prevent cardiovascular disease [75].

In a case-control study that was published in 2019 and evaluated the risk of CVD in female rosacea patients. The study found that serum-free testosterone, insulin levels, and mean CIMT were all considerably higher in the rosacea group than in the controls. Female rosacea patients had a considerably higher free androgen index. The female groups did not differ in terms of any cardiovascular risk variables [76].

A systemic review and meta-analysis of the literature published in 2020 including 12 studies, involving 40,752 patients with rosacea. Patients with rosacea displayed higher diastolic and systolic blood pressures, total cholesterol, LDL, CRP, greater epicardial fat thickness, and higher

incidence of HTN and IR [9]. In a systemic review and meta-analysis that included 11 studies published in 2020, the results indicated an association of rosacea with higher odds of IR or DM, high systolic blood pressure, dyslipidemia, and CVD [77].

Rosacea and CVDs were not shown to be significantly associated, according to a systemic review and meta-analysis published in 2020. Although there is a strong correlation between rosacea patients and a number of CVD risk factors, such as hypertension, dyslipidemia, MS, total cholesterol, LDL, and CRP. DM, high-density lipoprotein, or triglycerides, on the other hand, did not show any correlation with rosacea. The study demonstrated the need for rosacea patients to pay closer attention to known CVD risk factors [78]. According to a retrospective cohort study that was published in 2021 including 2681 rosacea patients and 26 810 controls, persons with rosacea had an enhanced risk for CVD and CAD, but not a significantly raised risk for stroke. According to this study, rosacea sufferers are more likely to experience future CVD. The management of additional modifiable risk factors of CVD in addition to rosacea requires proper education for rosacea patients [79].

In a 2022 study that was published including 73 rosacea patients and 73 controls, endothelial dysfunction (ED) in rosacea patients was evaluated. According to the study, MS, systolic and diastolic blood pressure, and the plasma neutrophil/lymphocyte ratio (NLR) were all statistically greater in the rosacea group, whereas the measurement of flow-mediated dilatation (FMD) value revealed a substantial difference between the case and control groups, indicating rosacea may have an atherogenic effect [80].

2. CONCLUSION

Rosacea is a chronic inflammatory skin disorder, which has been highlighted more as a skin disorder rather than a systemic disease. The associated comorbidities with rosacea are numerous including gastrointestinal, neurological, and psychiatric disorders. The subject of rosacea and CVD association has been studied and documented in multiple studies. In this narrative review, we have provided an overview of rosacea and then focused on the importance of it. CVD risk factors were noted in almost all of the studies in patients with rosacea including IR, DM, HTN, and dyslipidemia. Also, it was noted that these risk factors were affected by the duration and severity of rosacea. Due to this, this review suggests that physicians should assess rosacea patients for CVD risk factors that prompt earlier treatment. However, it will not be conventional to screen all patients with rosacea for all these risk factors, subsequentially this association needs to be investigated among wider populations.

CONSENT AND ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that they have no known competing financial interests or non-financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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