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Review Article

Coronary artery disease and diabetes mellitus

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لملخص

أهداف البحث: هناك علاقة وطيدة بين مرض السكري ومرض الشرايين التاجية. ولا تعد الإصابة بمرض السكري مجرد عامل خطورة للإصابة بأمراض الشرايين التاجية، وإنما تعتبر مساوية لمن هو فعلا مصاب بأمراض الشرايين التاجية. نسب انتشار المرضين في ازدياد، ويُعزى ذلك بالدرجة الأولى إلى زيادة انتشار السمنة. ويلعب التغير السريع في نمط الحياة، لاسيما في الدول النامية، دورا رئيسا في الإصابة بالمرضين.

طرق البحث: قمنا بدراسة استرجاعية للأدبيات بهدف تلخيص واستكشاف العلاقة بين مرض السكري وأمراض الشرايين التاجية، مع تركيز خاص على الدول العربية في ما يخص عوامل الخطورة ونسبة الانتشار. كما نقترح اتجاهات مستقبلية لمنع الزيادة في انتشار المرضين في الدول العربية.

الاستنتاجات: يجب أن يشتمل أي برنامج وقائي لأمراض الشرايين التاجية على استراتيجيات للوقاية من مرض السكري، وغيره من عوامل الخطورة الأيضية المصاحبة له مثل السمنة. كما ينبغي التشجيع على الإجراءات الوقائية مثل التمارين الرياضية في الفئات المجتمعية المعرضة للإصابة.

الكلمات المفتاحية: العالم العربي؛ مرض السكري؛ السمنة؛ أمراض الشرايين التاجية؛ التمارين الرياضية

Abstract

Objectives: Diabetes mellitus (DM) and coronary artery disease (CAD) are closely related. DM is a risk factor for CAD, but it is also equivalent to established CAD. The prevalence of DM and CAD is growing primarily due to the rising prevalence of obesity. The rapidly changing life style, especially in developing countries, plays major role in the occurrence of these diseases.

Methods: We performed a literature review to summarize and explore the relationship between CAD and DM with a special focus on Arab countries in terms of risk factors and prevalence. We suggest future directions to prevent escalation in the incidence of DM and CAD in Arab countries.

Conclusion: An important part of any preventive program for CAD should include clear prevention strategies for DM and other associated metabolic risk factors, such as obesity. Preventive measures, such as physical exercise in high-risk groups, at the population level should be encouraged.

Keywords: Arab world; Coronary artery disease; Diabetes mellitus; Obesity; Physical exercise

Introduction

Coronary artery disease (CAD) is a major cause of death in Western countries, and it is becoming a major cause of death in developing countries. This increase may be due to the rising prevalence of many CAD risk factors, such as diabetes, which is one of the most important of these risk factors. The prevalence of diabetes is increasing globally, and it has reached pandemic levels in the Middle East and worldwide.[1]

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The prevalence of diabetes in patients with CAD is up to 50% in many countries.[2] The impact of tighter control of diabetes on cardiovascular morbidity and mortality has been controversial with conflicting results, which attracted special attention in current diabetes management guidelines. The measurement of this impact remains an active area of research.

Diabetes and atherosclerosis

Type 2 diabetes mellitus (DM) is a strong risk factor for CAD, and experts consider DM an equivalent to established CAD risk.[3] Patients with diabetes have 2- to 4-fold greater risk of developing CAD than non-diabetic patients.[4,5]

Diabetic patients exhibit an increased risk for development of atherosclerotic CAD for many reasons, including metabolic factors, like hyperglycaemia, dyslipidemia and insulin resistance, which lead to endothelial cell, vascular smooth muscle dysfunction,[6,7] impaired platelet function and abnormal coagulation.[8] Diabetic patients tend to exhibit other risk factors for CAD, like hypertension and obesity. Patients with diabetes have lipid-rich atherosclerotic plaques, which are more vulnerable to rupture than the plaques seen in non-diabetic patients.[9,10] Yoo et al. described an overall increase in atherosclerotic burden and a 3.5-fold higher risk of coronary stenosis that was independent of other cardiovascular risk factors in diabetic patients.[11]

Inflammation plays an important role in atherosclerosis. Inflammation activation in type 2 DM results from obesity and insulin resistance, in which an acute phase reaction occur, and a large number of inflammatory and pro-inflammatory cytokines are released from adipose tissue.[12] Endothelial dysfunction is generally present in diabetic patients with CAD, as evidenced by high levels of endothelin 1 and low levels of nitric oxide.[13] Vascular endothelial (VE)-cadherin was identified recently as an updated marker of endothelial function that is well-correlated with endothelin 1 in diabetic patients with CAD.[14]

Enhanced thrombus formation occurs in type 2 DM because of increased platelet activity and blood coagulability.[15] Pathological alterations in fibrinogen and plasminogen activation inhibitors are primarily relevant for the short-term incidence of cardiovascular events in patients with type 2 DM.[16]

Notably, not all diabetic patients develop cardiovascular disease despite the presence of the same risk factors. However, recent studies focused on biomarkers of CVD in diabetic patients, such as serum phospholipids and their role in the progression of CVD. Beatriz García-Fontana and colleagues recently found low serum levels of 4 phospholipids in diabetic patients with CVD compared to diabetic patients without CVD.[17]

A recent study found a new biomarker in type 2 DM complicated with CAD that was significantly elevated and positively correlated with the degree of CAD stenosis. This new biomarker is called Osteonectin Secreted Protein Acidic and Rich in Cysteine (SPARC). The mechanism by which SPARC may cause CAD development requires further research.[18]

Palazhy et al. evaluated oxidative stress in CAD patients on statins in a cross-sectional study of 3 groups: Group 1, healthy control; Group 2, patients with DM and CAD on statins; Group 3, only diabetic patients. They found that oxidative stress was higher in the CAD and DM group despite statin therapy. These results highlighted the importance of oxidative stress.[19]

Diabetes as a risk factor for CAD

The prevalence of DM is increasing globally, and the International Diabetes Federation (IDF) estimated that there were 387 million people with DM in 2013, and this incidence is expected to rise to 592 million by 2035. An estimated 1 in 10 people have DM in the Middle East and North Africa (MENA) region.[20] Six of the top ten countries with a high estimated prevalence of DM were Arab countries in the 2011 IDF global estimate: Kuwait, Lebanon, Qatar, KSA, Bahrain and United Arab Emirates.[21] Three of the top 10 countries with a high estimated prevalence of DM were Arab countries in the updated 2014 IDF estimate: KSA, Kuwait and Qatar.[20] (Table 1 and 2).

The overall prevalence of DM was 23.7%, (26.2% in males & 21.5% in females) in a study of the prevalence of diabetes in KSA,[22] which was part of the Coronary Artery Disease in Saudis Study (CADISS),[23] and the impaired fasting blood glucose was 14.1% for males and females combined. A total of 27.9% of diabetics were unaware of having diabetes,[22] and 34% of diabetic patients were hypertensive compared to 21.4% without DM ($P < 0.001$).[24] These factors further contribute to the risk of CAD in the KSA population.

CADISS is a national community-based study that examined 17,232 KSA subjects aged 30–70 years from randomly selected households. The primary objective was to estimate the prevalence of CAD and its risk factors in KSA. The overall prevalence of CAD was 5.5% (6.6% in males, 4.4% in females).[23]

The prevalence of type 2 DM in KSA is expected to rise because of the high prevalence of obesity. The overall prevalence of obesity was 35.6% in CADISS with a higher prevalence in females (44%) compared to males (26.4%) ($P < 0.0001$).[25]

Another important factor in the high prevalence of DM in KSA is the high prevalence of physical inactivity, with an overall prevalence of 96.1% (98.1% in females vs. 93.9% in males) ($P < 0.001$).[26]

The prevalence of metabolic syndrome in KSA is also very high (39.3%), and it is higher in females (42%)

Table 1: The adjusted prevalence of diabetes in some Arab counties in 2011 [adopted from Top 10 countries/territories for prevalence (%) of people with diabetes (20–79 years), 2011 and 2030[a]].

Country	The adjusted prevalence (%)	Rank in top 10 countries for prevalence
Kuwait	20.7	3
Qatar	19.8	5
KSA	19.6	6
Lebanon	19.6	7
Bahrain	19.5	8
United Arab of Emirates	18.8	10

[a] Adopted from The IDF Diabetes Atlas 2011[21].