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Smoking and vascular risk: are all forms of smoking harmful to all types of vascular disease?



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ABSTRACT

Smoking, both active and passive, is an established vascular risk factor. The present narrative review considers the effects of different forms of smoking (i.e. cannabis, cigar, pipe, smokeless tobacco and cigarette) on cardiovascular risk. Furthermore, the impact of smoking on several vascular risk factors [e.g. hypertension, diabetes mellitus (DM), dyslipidaemia and haemostasis] and on vascular diseases such as coronary heart disease (CHD), peripheral arterial disease (PAD), abdominal aortic aneurysms (AAA) and carotid arterial disease, is discussed.

The adverse effects of all forms of smoking and the interactions between smoking and established vascular risk factors highlight the importance of smoking cessation in high-risk patients in terms of both primary and secondary vascular disease prevention. Healthcare providers should discourage people (especially the young) from becoming smokers, strongly encourage all vascular patients to stop smoking and support those who decide to quit by pharmaceutical and psychological interventions. In high-risk populations such as patients with CHD, DM and/or PAD, smoking cessation should always be a part of a multifactorial treatment to reduce vascular risk.

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Introduction

Smoking (active^{1–4} or passive^{5–7}) is an established vascular risk factor. Smoking cessation is also an important intervention in patients with vascular disease.⁸ Passive smoking has been discussed elsewhere.⁶ The exact role of each of the components of the cigarettes smoked has not been established.

In the present narrative review, the effects of different forms of smoking on cardiovascular disease (CVD) and CVD risk factors are discussed, highlighting the importance of smoking cessation in both primary and secondary CVD prevention.

Search methods

MEDLINE search was carried out till August 22, 2011 for relevant publications using combinations of the following keywords: smoking, cannabis, cigar, pipe, smokeless tobacco, cigarette, smoking cessation, non-cardiac vascular diseases, vascular risk factors, cardiovascular disease, cardiovascular disease risk, primary and secondary prevention.

The reference list of articles identified by this search strategy was examined and those that were judged relevant, according to the keywords, were selected. Recent original

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papers and reviews, so as to reflect the latest evidence, were focussed.

Cannabis use and cardiovascular risk

Cannabis use has been reported to exert several adverse effects,⁹ including an increased risk of fatal¹⁰ and non-fatal myocardial infarction (MI).¹¹ A recent meta-regression analysis showed that smoking cannabis was a major trigger for non-fatal MI.¹² A link between cannabis use and stroke has been also reported.¹³ It has been suggested that acute use of cannabinoids may increase heart rate and blood pressure (BP), whereas prolonged administration may reduce heart rate and BP.¹⁴ In this context, it may be relevant that some smokers may mix tobacco with the cannabis.

As the endocannabinoid system was found to influence several metabolic pathways and cardiovascular risk factors,^{15,16} selective cannabinoid type 1 (CB1) receptor ligands (e.g. rimonabant) were developed for the management of obesity, diabetes mellitus (DM) and metabolic syndrome (MetS).¹⁷ Rimonabant was also assessed for smoking cessation as it increases the likelihood of quitting with less postquitting weight gain.¹⁸ Despite some encouraging results,¹⁹ rimonabant was withdrawn from the market in 2008 due to psychiatric adverse effects. Current research focuses on new 'cleaner' CB1 receptor blockers, selective for peripheral receptors;²⁰ these drugs may exert beneficial metabolic effects without central nervous system-related adverse effects.¹⁹

Cigar smoking and cardiovascular risk

Cigar smoking has been associated with increased risk of coronary heart disease (CHD) morbidity^{21,22} and mortality.^{22,23} Furthermore, the risks of non-fatal²² and fatal stroke^{22,24} were higher in cigar smokers compared with never or previous cigarette smokers. Interestingly, acute increases in arterial stiffness were observed in healthy individuals who smoked cigars.²⁵

Pipe smoking and cardiovascular risk

Pipe smoking was also shown to significantly increase the risk of CHD events²² and death from CHD [relative risk (RR) = 1.30, 95% confidence interval (CI) = 1.18–1.43] and cerebrovascular disease (RR = 1.27, 95% CI = 1.09–1.48).²⁶ Of note, these effects were greater in cigarette smokers and similar to or smaller in cigar smokers.²⁶ The risks of non-fatal²² and fatal stroke^{22,24} were higher in pipe smokers compared with never or previous cigarette smokers.

Smokeless tobacco use and cardiovascular risk

Smokeless tobacco use was found to increase the risk of CVD.²⁷ In this context, waterpipe smoking may be spreading worldwide.^{28,29} Although regarded as less harmful than the other forms of smoking, nicotine absorption by a single

waterpipe session was found to be equivalent to smoking ten³⁰ or even 50 cigarettes/day.²⁹ Furthermore, waterpipe smoking was shown to acutely significantly increase systolic and diastolic BP and heart rate.³¹

Tobacco chewing was found to cause acute coronary vasoconstriction and increases in heart rate.³² Chewing tobacco has been also associated with increased risk of CHD morbidity³³ and CVD mortality.³⁴ Interestingly, the rates of all-cause, CHD and stroke mortality were significantly higher in those smokers who switched from cigarette smoking to chewing tobacco than those who stopped using tobacco.³⁵

Cigarette smoking and cardiovascular risk

Cigarette smoking is associated with increased CHD morbidity^{36,37} and mortality.³⁶ The use of filters was proven ineffective 'to mitigate the health hazards of smoking'.³⁸ Acute active and passive smoking can increase arterial stiffness; data for chronic smoking is contradictory.³⁹ As expected, smoke-free policies, when implemented, may lead to a reduced incidence of acute coronary events.⁴⁰ Furthermore, in a meta-analysis⁴¹ quitting smoking was shown to significantly reduce CHD mortality (OR = 0.54, 95% CI = 0.46–0.62). This protective effect was greater than that achieved by other treatments such as the use of thrombolysis (OR = 0.75, 95% CI = 0.71–0.79), aspirin (OR = 0.77, 95% CI = 0.70–0.84) and beta-blockers (OR = 0.88, 95% CI = 0.80–0.98), as reported in a previous meta-analysis.⁴² Of note, a Cochrane systematic review⁴³ found that smoking cessation was associated with a significant (36%; OR = 0.64, 95% CI = 0.58–0.71) reduction in the risk of all-cause mortality in CHD patients, a result that was regarded 'substantial compared with other secondary preventive therapies such as cholesterol lowering'.

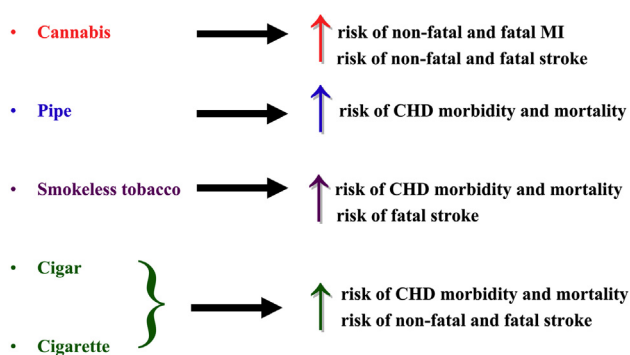
Cigarette smoking has been also related to an increased risk of non-fatal⁴⁴ and fatal stroke²⁴ which rapidly decreases after quitting smoking,²⁴ especially in lighter smokers (i.e. <20 cigarettes/day).⁴⁵ Of note, this link between cigarette smoking and stroke is characterized by a strong dose–response relationship.⁴⁶

Fig. 1 summarizes the adverse effects of different forms of smoking on CVD morbidity and mortality.

Comparison of different forms of smoking with regard to CVD risk

Cigarette smoking is more harmful than cigar or pipe smoking in terms of both morbidity and mortality;⁴⁷ however, there are studies reporting similar risk of CVD mortality between cigarette and pipe smokers.⁴⁸ Cigarette smokers who switched to cigars or pipe had a higher risk of death from CHD than those cigar or pipe smokers who had never smoked cigarettes.⁴⁹ Interestingly, switching from cigarette to cigar or pipe smoking was associated with a lower risk of CHD mortality compared with continuing cigarette smoking.⁴⁹

The risk of fatal stroke was increased in both cigarette and cigar or pipe smokers compared with never or previous



MI: myocardial infarction; CHD: coronary heart disease

Fig. 1 – Adverse effects of different forms of smoking on cardiovascular disease morbidity and mortality.

cigarette smokers.²⁴ However, the increase was greater in cigarette smoker (RR = 4.1, 95% CI = 2.3–7.4) than in cigar or pipe smokers (RR = 2.2, 95% CI = 0.9–5.5);²⁴ the highest risk was observed in combined cigarette and cigar or pipe smokers (RR = 6.1, CI 95% = 3.0–12.5). Cigarette smokers showed significantly higher levels of inflammatory markers such as C reactive protein, and haemostatic factors (e.g. fibrinogen), plasma viscosity and tissue plasminogen activator antigen, compared with never smokers, whereas cigar or pipe smokers showed similar levels to never smokers.⁵⁰

Smoking and non-cardiac vascular diseases

Smoking may affect other forms of vascular disease [e.g. peripheral arterial disease (PAD), abdominal aortic aneurysms (AAA) and carotid arterial disease] in addition to CHD.⁵¹ Cigarette smoking is a strong predictor of symptomatic PAD⁵² with a dose–response relationship;⁵³ the risk being doubled if smoking starts at the age of 16 years or earlier.⁵⁴ This causative link between cigarette smoking and PAD is even more prominent than the link with CHD.⁵⁵ Cannabis use has been associated with a form of PAD (i.e. cannabis arteritis) that differs from atherosclerotic PAD in terms of both aetiology and reversibility.⁵⁶ Data on PAD prevalence in cigar or pipe smokers are lacking. Of note, smoking cessation reduces PAD severity and progression (in terms of critical limb ischaemia or major amputation) as well as the risk of graft failure following lower-limb bypass surgery.⁵⁷

Cigarette smoking is a predictor of AAA,^{58–61} the duration of exposure is the main determinant of this risk.⁶¹ Of note, smoking was the strongest predictor of AAA development in the Aneurysm Detection and Management (ADAM) Veterans Affairs Cooperative Study among other vascular risk factors including age, gender, hypertension, hypercholesterolaemia, CHD and family history of AAA.⁶² Furthermore, the RR of AAA for smokers was greater than the association between smoking and CVD (i.e. CHD and cerebrovascular disease).⁶³ Smoking also increased the risk of AAA expansion and rupture, leading to a worse prognosis.⁶⁴ The effects of other forms of smoking (i.e. cannabis, cigar, pipe and waterpipe use) on AAA have not been defined.

Carotid intima media thickness has been associated with smoking status.^{65,66} Furthermore, cigar smoking was shown to acutely increase aortic stiffness.²⁵ No data exists on the prevalence of carotid disease in cannabis and pipe smokers.

Smoking is also a risk factor of thromboangiitis obliterans (Buerger's disease).⁶⁷ Buerger's disease mainly affects male cigarette smokers; switching to smokeless tobacco use may not protect from limb ischaemia.⁶⁸ Therefore, quitting smoking is of major importance to prevent Buerger's disease progression.⁶⁹ A link between current smoking and Raynaud's phenomenon has been reported,⁷⁰ but this may be more obvious in men.⁷¹ Smoking cessation plays a role in the treatment of Raynaud's phenomenon.⁷²

Smoking is also implicated in the development of atherosclerotic renal artery stenosis⁷³ and microalbuminuria.⁷⁴ In such cases, smoking cessation may slow down the progression of renal impairment^{74–76} and reduce the risk of vascular events.⁷⁷

Smoking and vascular risk factors

Smoking also interacts with several vascular risk factors (e.g. hypertension, DM, dyslipidaemia and haemostasis), further increasing vascular morbidity and mortality.^{78,79} In this context, the risk of haemorrhagic stroke for an additional 10 mmHg increase in systolic BP was significantly higher in cigarette smokers compared with non-smokers [hazard ratio (HR) = 1.81 (CI 95% = 1.73–1.90) vs 1.66 (CI 95% = 1.59–1.73), respectively; $P = 0.003$].⁸⁰ Furthermore, among women with type 2 DM, the increased risk of CHD morbidity and mortality was even greater (in a dose–response manner) in active cigarette smokers compared with past or non-smokers.^{81,82} In diabetic patients, apart from CVD, smoking has also been implicated in the development and progression of microvascular complications i.e. retinopathy, nephropathy and neuropathy.^{83–85} Cigarette smoking exaggerates the link between dyslipidaemia and CVD; total cholesterol, triglycerides and low-density lipoprotein levels are elevated, whereas high-density lipoprotein (HDL) levels are decreased in smokers, possibly due to changes in lipid transport enzymes.⁸⁶ Of note, abstinence from smoking was associated with increases in HDL cholesterol, total HDL and large HDL particles despite weight gain, especially in women.⁸⁷ Furthermore, a dose–response relationship between current cigarette smoking and risk of type 2 DM was reported in a meta-analysis.⁸⁸ Smoking can cause endothelial dysfunction, enhance platelet aggregation and impair fibrinolysis;^{89–91} these alterations may be, at least partly, responsible for the increased prevalence and severity of thrombotic CVD events in cigarette smokers compared with non-smokers.⁹¹

Smoking cessation and vascular risk

The aforementioned vascular adverse effects of all forms of smoking as well as the interactions between smoking and established vascular risk factors emphasize the importance of smoking cessation in high-risk patients; quitting smoking should be implemented in such patients along with other therapeutic interventions including antihypertensive, hypoglycaemic, lipid lowering and antiplatelet drugs.⁹² As previously mentioned, several studies found significant

reductions in CVD morbidity and mortality rates following smoking cessation.^{24,40,41,93} In this context, the Canadian Cardiovascular Society recently reported in their position paper⁹⁴ that ‘the identification and documentation of the smoking status of all patients, and the provision of cessation assistance, should be a priority in every cardiovascular setting’. The concomitant use of smoking cessation and other preventive measures is expected to have an ‘additive’ beneficial effect on reducing vascular risk.⁹⁵ Of note, smoking was shown to diminish the statin-induced cardiovascular benefit.⁹⁶

Interestingly, the implementation of smoke-free policies has been associated with increased rates of quit attempts.⁹⁷ Tobacco control programs were also found to be cost-saving,⁹⁸ a recent systematic review⁹⁹ reported that counselling and treatment for smoking cessation was very cost-effective in terms of both prevention and control of DM. Therefore, smoke-free legislation results in both health and financial benefits. Of note, smokers would like the governments to become more active in the field of smoking control,¹⁰⁰ even by increasing cigarette cost to fund anti-smoking activities.¹⁰¹ In this context, national and international standardized prevalence surveys should be regularly performed to estimate the magnitude of this public health problem,¹⁰² smoke-free measures should be implemented accordingly. Furthermore, the governments should take action to eliminate misleading marketing that may result in misperceptions of the harmfulness of ‘light’ and ‘low tar’ cigarettes¹⁰³ as well as of smokeless tobacco use.¹⁰⁴ Epidemiological evidence supports that all forms of smoking is a risk factor for acute myocardial infarction.¹⁰⁵

In **conclusion**, all forms of smoking exert harmful effects on the vasculature. Therefore, all vascular patients should be strongly encouraged to quit smoking. Healthcare providers that specialize in smoking cessation should support those who decide to quit, discourage people (especially the young) from becoming smokers and increase public awareness of smoking-related health risks. Smoking cessation should always be included in the multifactorial treatment of high-risk populations (e.g. patients with CHD, DM and/or PAD) to reduce vascular risk.

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Ethical approval

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Competing interests

DPM has given talks, attended conferences and participated in trials and advisory boards sponsored by MSD and Genzyme.

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