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The Acute Effects of Water-pipe Smoking on the Cardiorespiratory System

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Abstract and Introduction

Abstract

Objective: There are limited data on the acute effects of water-pipe tobacco smoking, commonly known as water-pipe smoking (WPS), on cardiopulmonary parameters. This study evaluated the acute effects of a single 30-min session of WPS on carboxyhemoglobin (COHb) levels, pulmonary function test results, vital signs, fractional exhaled nitric oxide (Feno) levels, and exhaled breath condensate (EBC) cytokine levels in volunteers in a domestic, open-air, group smoking setting.

Methods: This prospective study evaluated the above-noted outcome parameters before and after 30 min of WPS. The primary outcome parameter was the change in COHb levels.

Results: Forty-five volunteers (30 men, 15 women), aged 32.35 ± 15.33 years, were recruited. After one session of WPS, the COHb levels rose significantly, from $1.47\% \pm 0.57\%$ (median 1.4) to $9.47\% \pm 5.52\%$ (median 7.4), $P < .001$. Systolic and diastolic BP levels significantly increased after smoking (systolic, 119.52 ± 12.07 mm Hg vs 131.98 ± 17.8 mm Hg; diastolic, 74.84 ± 7.89 mm Hg vs 82.98 ± 12.52 mm Hg, respectively; $P < .001$). Heart rates increased from 80.39 ± 9.92 beats/min to 95.59 ± 17.41 beats/min, $P < .001$; and respiratory rates increased from 14.36 ± 1.63 breaths/min to 16.68 ± 2.24 breaths/min, $P < .001$. There were decreases in forced expiratory flow between 25% and 75% of FVC, peak expiratory flow rate, Feno levels, percentage of eosinophils in peripheral blood, and 8-isoprostane levels in EBC.

Conclusions: This study shows that one session of WPS causes acute biologic changes that might result in marked health problems. It adds to the limited evidence that WPS is harmful and supports interventions to control the continuing global spread of WPS, especially among youth.

Introduction

Smoking with a water pipe (WP), also known as a hookah, shisha, goza, narghile, and hubble-bubble, has been practiced extensively for about 400 years. Water-pipe tobacco smoking, commonly known as water-pipe smoking (WPS), is considered by the public to be less harmful than cigarette smoking, leading to tolerance of this practice. It has been claimed that > 100 million people worldwide smoke WPs daily. Initially, WPS was common mainly

in the Middle East, Turkey, India, and Pakistan. With globalization and immigration from these countries, WPS spread to Western countries, notably among youth. It has been estimated that 20% to 40% of college students in the United States have experienced WPS. A recent study found that WP use was not restricted to any single racial, ethnic, or cultural group.^[1] Among the reasons for the growing popularity of WPS are low cost; easy access; the social interaction that accompanies it; the sweetened, flavored, and aromatic tobacco that can mask the taste of tobacco; the misperception of its impact on health, including the idea that WPS is less addictive than cigarette smoking; and the lack of public health warnings on the use of WPs.^[2]

While there is a large amount of data regarding the acute and chronic effects of cigarette smoking, there is a paucity of data regarding WPS. The tobacco used in WPS ("moassel") typically weighs 10 to 20 g per session and contains 30% tobacco and 70% honey or molasses. Burning charcoal is placed above the tobacco, separated by a piece of perforated tin foil. Several types of charcoal can be used; the most common are lump charcoal and briquettes containing wood by-products, hydrocarbons, and other chemicals. During inhalation, air heated by the burning charcoal passes through the tobacco and vaporizes it, producing smoke. The types of charcoal and tobacco used affect the combustion product content. Most smoking sessions last 30 min to several hours. WP smoke contains harmful constituents, including nicotine, carbon monoxide, carcinogens, tar, and heavy metals.^[3]

Estimates of the equivalence between cigarette smoking and WPS vary between two and 10 cigarettes for occasional and daily WPS, respectively,^[4] and 100 cigarettes for 200 puffs per WPS session.^[5] Only a few studies have investigated the acute effects of WPS on cardiorespiratory parameters. Two studies reported markedly different increases in carboxyhemoglobin (COHb) levels after WPS.^[6,7] Two studies evaluated vital signs after WPS, but female subjects were not included.^[8,9] The acute effects on pulmonary function test results, fractional exhaled nitric oxide (Feno) levels, eosinophil levels, and exhaled breath condensate (EBC) parameters were studied in cigarette smokers but not WP smokers.^[10]

Our hypothesis was that WPS can affect multiple parameters, similar to cigarette smoking. It is assumed that determination of the short-term effects of WPS can assist in understanding its long-term effects. The objective of our study is to evaluate the short-term effects of a single, 30-min session of WPS on COHb levels and cardiorespiratory and airway inflammatory parameters in volunteers.