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The Impact of CAROtid plaque Screening on Smoking (CAROSS) cessation and control of other cardiovascular risk factors: Rationale and design of a randomized controlled trial

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ABSTRACT

Background: Screening tests for subclinical cardiovascular disease, such as markers of atherosclerosis, are increasingly used in clinical prevention to identify individuals at high cardiovascular risk. Being aware of these test results might also enhance patient motivation to change unhealthy behaviors but the effectiveness of such a screening strategy has been poorly studied.

Methods: The CAROtid plaque Screening trial on Smoking cessation (CAROSS) is a randomized controlled trial in 530 regular smokers aged 40–70 years to test the hypothesis that carotid plaque screening will influence smokers' behavior with an increased rate of smoking cessation (primary outcome) and an improved control of other cardiovascular risk factors (secondary outcomes) after 1-year follow-up. All smokers will receive a brief advice for smoking cessation, and will subsequently be randomly assigned to either the intervention group (with plaque screening) or the control group (without plaque screening). Carotid ultrasound will be conducted with a standard protocol. Smokers with at least one carotid plaque will receive pictures of their own plaques with a structured explanation on the general significance of plaques. To ensure equal contact conditions, smokers not undergoing ultrasound and those without plaque will receive a relevant explanation on the risks associated with tobacco smoking. Study outcomes will be compared between smokers randomized to plaque screening and smokers not submitted to plaque screening.

Summary: This will be the first trial to assess the impact of carotid plaque screening on 1-year smoking cessation rates and levels of control of other cardiovascular risk factors.

In recent years, several tests for subclinical – asymptomatic – cardiovascular disease (CVD), ranging from serum and urinary markers to direct vascular imaging of atherosclerosis, have been proposed for improving the prevention of CVD [1–4]. Several of these interventions are widely used in clinical prevention [3], but their impact on improving cardiovascular risk factor control and other health outcomes has been poorly studied [1,3,5]. Furthermore, recommendations for the use of several of these markers in clinical practice are still controversial [5–7].

Being aware of test results of atherosclerosis might also enhance patients' motivation to change unhealthy behaviors [1] and subsequent risk factor levels, but this strategy has been poorly studied so far [5]. As smokers are known to underestimate their personal risks of smoking-related diseases [8], showing them evidence of their own atherosclerosis might be an efficacious strategy to enhance both their motivation for smoking cessation and control of other cardiovascular risk factors. A recent systematic review of biomedical risk assessment as an aid for smoking cessation (such as exhaled CO) [9]

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has shown that the only strategy with promising results was showing smokers pictures of their own atherosclerosis in one study [10] that was performed in smokers with low nicotine dependence. However, the authors of this review concluded that current evidence did not support the use of biomedical risk assessment for smoking cessation, as available data of sufficient quality were limited. Other studies using the presence of atherosclerosis as a motivational tool yielded conflicting results on smoking cessation and improvement of control of other cardiovascular risk factors [11,12].

To assess whether pictures of subclinical CVD, as measured by atherosclerotic plaques, has an effect on patients' behavior, we propose a randomized controlled trial to test the hypotheses that carotid plaque screening will i) improve rate of smoking cessation and ii) improve the control of other cardiovascular risk factors after 1-year follow-up. Our intent is to capture the "teachable moment" in those with plaques [12]. Similarly, acute events, such as acute myocardial infarction or coronary artery bypass surgery, have been shown to be very effective "teachable moments", when smoking habits are particularly susceptible to intervention for smoking cessation [13,14]. This report describes the rationale and study design and baseline characteristics of the CAROSS trial.

1. Study objectives and design

1.1. Objectives

The first main objective of this trial (Clinicaltrials.gov: ID number NCT00548665) is to test the hypothesis that carotid plaque screening will improve rate of smoking cessation, as assessed by self-report and confirmed by exhaled carbon monoxide (CO) measured at each visit and cotinine concentration measured at the final visit [15]. The main outcome will be one-week point prevalence abstinence at 1 year (i.e. not having smoked and not having used other tobacco products in the preceding week of the last exam) and, as a secondary outcome, continuous abstinence from quit date to the end of the study, as described in the Russell Standard Criteria for smoking cessation trials [15]. We will also examine, as secondary endpoints, the one-week point prevalence abstinence at weeks 8 and 26 and prevalence of continuous abstinence between weeks 3 and 8 and between weeks 3 and 26, similar to a previous study [16].

The second main objective of the study is to test the hypothesis that carotid plaque screening will improve the control of the following cardiovascular risk factors: low-density lipoprotein cholesterol, hemoglobin A1C (if diabetes), high-sensitivity C-reactive protein (hs-CRP), blood pressure, and overall 10-year cardiovascular risk [12], as measured by the Framingham risk score. We hypothesize that patients' knowledge of these test results might enhance adherence to treatment [3] and enhance motivation for lifestyle change, with subsequent risk factor improvement.

1.2. Study design and follow-up

This study is a randomized controlled trial (RCT) of carotid plaque screening in 530 regular male and female smokers aged 40 to 70 years. Our protocol follows the revised CONSORT statement to conduct RCT [17] and Russell Standard criteria for smoking cessation trials [15]. This is a single-centre study conducted at the Department of Ambulatory Care and Community Medicine at the University of Lausanne, Switzerland. The prevalence of smoking is high in Switzerland with one third (31%) of adults currently smoking [18], as compared to 22% in the United States, for example [19].

Smokers will be randomly assigned to either the group with carotid plaque screening or the control group without plaque screening (Fig. 1). Carotid ultrasound will be performed according to a standard protocol. Smokers with at least one plaque will receive 2 pictures of one of their plaques with a 7-min structured explanation on the general significance of plaques, as previously tested in a pilot study [20]. The tutorial informs smokers with plaques that their cardiovascular risk is increased in presence of atherosclerotic plaques. Smokers without plaques will receive a 7-min structured explanation on the risks associated with tobacco smoking. To ensure similar contact conditions, smokers randomized to the control group without ultrasound will also receive a brief advice for smoking cessation and a 7-min structured explanation on the risks associated with tobacco smoking. All tutorials highlight the benefits of smoking cessation on CVD, in particular that the risk of myocardial infarction decreases by half after 1 year of cessation and is equal to that of non-smoker 10 years after cessation [21]. Following the tutorial, patients' understanding of the significance of atherosclerosis is assessed through completion of a ten-question multiple-choice test [20]. All smokers will receive a brief advice for smoking cessation. Participants will be asked to set a quit date within the week following the ultrasound.

After the test results, participants of both groups will be followed during 1-year by a nurse trained in smoking cessation. At each visit, smokers will receive smoking cessation counseling and nicotine replacement therapy (NRT). At the 2nd visit, before randomization (Fig. 1), a resident will give results on cardiovascular risk factors, and provide recommendations based on guidelines for cardiovascular risk factor control [22–24]. Participants who have uncontrolled cardiovascular risk factors with a need for risk-reducing medications according to these guidelines will be referred to their own primary care physicians for management of these risk factors. Other participants with abnormal lipid or glucose levels according to current guidelines will receive advice for lifestyle modification. All outcomes, including smoking cessation, will be collected by a psychologist (outcome assessor). The psychologist and the nurse will be as much as possible blinded to the assigned group and ultrasound result. Study investigators will not be involved in the care of the participants. Participants will be blinded to the specific aims of the study, but will not be blinded to the assigned group and ultrasound result, as the ultrasound result is the potential motivational tool we will assess.

1.3. Rationale for the randomized trial

The effect of testing for subclinical CVD on patients' behavior and cardiovascular risk factor control has been poorly studied [1,5]. A previous randomized controlled trial (RCT) of our group has shown that providing smokers with pictures of their own atherosclerotic plaques improved smoking cessation in the Seychelles Islands with 17.6% in the screened group and 22.2% in smokers who had plaque vs.