

Vascular risk factors and morphometric data in cervical artery dissection: a case-control study

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See Editorial Commentary, p 130

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ABSTRACT

Background: Limited knowledge exists on vascular risk factors, body height and weight in patients with spontaneous cervical artery dissection (sCAD).

Patients and methods: In this case-control study, major vascular risk factors, body weight, body height and body mass index (BMI) of 239 patients obtained from a prospective hospital-based sCAD registry were compared with 516 age- and sex-matched healthy controls undergoing systematic health examinations in the Clinical and Preventive Investigations Center, Paris. Gender-specific analyses were performed.

Results: The mean body height was higher in sCAD patients than in controls (171.3 cm (SD 8.6) vs 167.7 cm (8.9); $p < 0.0001$) and sCAD patients had a significantly lower mean body weight (67.5 (12.2) kg vs 69.3 (14.6) kg; $p < 0.001$) and mean BMI (22.9 (3.3) kg/m² vs 24.5 (4.2) kg/m²; $p < 0.0001$) than controls. The overall frequency of hypertension, diabetes, current smoking, past smoking and hypercholesterolaemia did not differ significantly between sCAD patients and controls. The mean total plasma cholesterol level was identical in both groups (5.5 mmol/l, SD 1.1). Gender specific subgroup analyses showed similar results for men and women.

Conclusion: Patients with sCAD had a higher body height and a lower body weight and BMI than controls, while major vascular risk factors were similar in sCAD patients and controls.

The aetiology of spontaneous cervical artery dissection (sCAD) remains poorly known. Several constitutional and environmental risk factors are thought to be associated with sCAD.¹ A previous case control study showed that hypertension tended to be associated with sCAD.² However, knowledge on risk factors in patients with sCAD is sparse and mainly based on case-control studies comparing sCAD patients with non-CAD patients with stroke.³⁻⁶ Furthermore, the relationship between body height, and body weight and sCAD has not been evaluated so far. Therefore, we aimed to compare major vascular risk factors and morphometric data of sCAD patients with age- and sex-matched healthy controls.

METHODS

Patients

We analysed prospectively collected data of consecutive patients presenting with sCAD at the University Hospital, Lariboisière, Paris from December 1996 through December 2005. CAD were categorised as spontaneous when occurring spontaneously or after an effort or minor trauma.⁷ In addition to the physical and neurological

examinations, all patients underwent routine blood examinations, cervical MRI with fat suppression technique, and MRA or DSA, or both. The definite diagnosis of sCAD was based on cervical MRI and MRA or digital subtraction angiography (DSA), or both.^{8,9}

Clinical and imaging findings of some patients have been reported previously.¹⁰⁻¹²

Recruitment of controls and matching procedure

Controls were randomly selected from healthy persons undergoing systematic health examinations at Investigations Préventives et Cliniques (IPC) Center, Paris.

The IPC, subsidised by the French national healthcare system, offers all working and retired individuals and their families a free medical examination every 5 years. It performs about 25 000 health examinations per year for people living in the Paris area.¹³ Two to three healthy controls examined during the same period when the dissection was diagnosed in our patients were randomly selected and matched to each case for age and sex. Selection of controls proceeded in a blinded fashion.

Morphometric data and vascular risk factors

Preadmission vascular risk factors and morphometric data of patients were recorded from admission and hospital reports and by a structured interview with the patient or their relatives, if the patient was not able to provide adequate information. Healthy control subjects were investigated at the IPC Center, Paris, by a standardised autoquestionnaire and biological and clinical examinations. The questionnaire included information on body height weight, and body mass index (BMI) was calculated. The following vascular risk factors were assessed: current and past smoking, hypercholesterolaemia, hypertension and diabetes mellitus. Hypercholesterolaemia was defined as a total plasma cholesterol value of >5.2 mmol/l. Cholesterol level was measured under fasting conditions. Hypertension was defined as previous or current antihypertensive medication or a history of hypertension (systolic blood pressure (BP) >160 mm Hg or diastolic BP >95 mm Hg), or both.¹⁴ The previous WHO definition of hypertension was used in this study in order to obtain a homogeneous definition during the whole observation period.¹⁵ Diabetes mellitus was defined as a preadmission history of diabetes mellitus.

Statistical analyses

Statistical analyses were performed with the SPSS 10.0 for Macintosh program (SPSS, Chicago). For differences in categorical variables, the χ^2 test was performed. Continuous variables were compared with the Mann–Whitney test.

Logistic regression analyses were performed to determine an independent association between sCAD and morphometric data and vascular risk factors. The variables included were sex, age, body height, body weight, BMI, current smoking, past smoking, diabetes, hypertension, hypercholesterolaemia and total plasma cholesterol level. Confidence intervals (95%) were calculated. After Bonferroni correction for 11 analysed variables, the two-sided significance level was defined as $p = 0.05/11 = 0.0045$.

RESULTS

The study includes 239 patients (50% women) with sCAD and 516 healthy controls.

Of the 239 patients with sCAD, 150 (63%) presented with internal carotid artery dissection (sICAD), 71 (30%) with vertebral artery dissection (sVAD) and 18 (7%) with both, at least one sICAD and sVAD.

Table 1 summarises the results of univariate and multiple regression analyses comparing sCAD patients and controls. The mean body height was greater in sCAD patients than in controls (171.3 cm (SD 8.6) vs 167.7 cm (8.9); $p < 0.0001$), and the mean body weight was lower in patients than in controls (67.5 kg (12.2) vs 69.3 kg (14.6); $p < 0.0001$). The BMI was lower in patients than in controls (22.9 (3.3) vs 24.5 (4.2); $p < 0.0001$). The overall frequency of the other variables did not differ between patients and controls.

Gender-specific subgroup analyses showed similar results. The mean body height was significantly greater ($p < 0.0001$ for women (95% CI 0.843 to 0.936) and men (95% CI 0.855 to 0.941)) and mean body weight ($p = 0.011$ for women (95% CI 1.009 to 1.075); $p = 0.003$ for men (95% CI 1.016 to 1.080)). The mean BMI ($p = 0.005$ for women (95% CI 1.038 to 1.234); $p = 0.003$ for men (95% CI 1.048 to 1.251)) was significantly lower in both female and male patients than in controls. The other variables did not differ either between female patients and female controls or between male patients and male controls.

DISCUSSION

We found that patients with sCAD were taller, had a lower body weight and consecutively had a lower BMI than healthy controls. This so far unreported association was observed in

both men and women. In contrast, major vascular risk factors were not associated with sCAD.

The relationship between taller stature and lower weight and sCAD is difficult to explain. Potential explanations include redundancies of cervical arteries³ in taller subjects or mechanical factors such as increased neck mobility in taller subjects with a longer neck. However, this hypothesis cannot be proved by these data because the length of the neck was not measured, and no imaging was performed in controls. Genetic factors such as more frequent abnormalities of the connective tissue in taller subjects might be another explanation. Patients with Marfan syndrome are known to be taller than the normal population.¹⁶ However, in our sCAD patients, only two women suffered from connective tissue disorders.

Interestingly, the literature on height and the risk of stroke in the general population is controversial. Hebert *et al* observed no association between height and risk of stroke.¹⁷ In another study, taller men tended to have a lower risk of stroke.¹⁸

Although hypertension is a risk factor for stroke and aortic dissection,¹⁹ it is not clear whether individuals with hypertension are at increased risk for sCAD. Pezzini *et al* reported a trend towards a higher prevalence of hypertension in sCAD patients compared with matched controls.² We observed no significant association between hypertension and CAD in the present study. Further prospective population-based studies and large multicentre studies are needed to determine whether blood pressure is associated with sCAD.

Diabetes, smoking, hypercholesterolaemia and total cholesterol levels were not associated with sCAD in the present study using healthy controls. Our results are difficult to compare with previous studies in which patients with ischaemic stroke not related to dissection served as controls.^{1–6} Nevertheless, further large studies with healthy controls are needed to firmly exclude a weak association between sCAD and those vascular risk factors.

Our study has several limitations: body weight and height were self-reported by patients. However, the validity of self-reported measurements of body weight has been shown.²⁰ Moreover, there may be a potential selection bias among controls. It may be possible that subjects undergoing systematic volunteer health examination do not represent the general population. However, comparison with French population-based studies showed similar frequencies of vascular risk factors and similar morphometric data.^{14–21–22} Finally, we analysed only the main vascular risk factors, and other potential risk factors

Table 1 Demographics and potential risk factors in 239 patients with spontaneous cervical artery dissection and in 516 healthy controls

Characteristics	Patients	Controls	p Value univariate (95% CI)	p Value multivariate (95% CI)
Sex, women (%)	119 (50)	263 (51)	0.763	
Mean age, years (SD)	44.4 (9.4)	44.4 (9.7)	0.983	0.216 (0.963 to 1.009)
Mean plasma cholesterol, mmol/l (SD)	5.5 (1.1)	5.5 (1.1)	0.785	
Mean body height (SD)	171.3 (8.6)	167.7 (8.9)	<0.0001	<0.0001 (0.865 to 0.927)
Mean body weight (SD)	67.5 (12.2)	69.3 (14.6)	0.312	<0.0001 (1.025 to 1.070)
Mean body mass index (SD)	22.9 (3.3)	24.5 (4.2)	<0.0001	<0.0001 (1.1075 to 1.215)
Current smoking	65/238 (27)	163/516 (31)	0.235	0.448 (0.760 to 1.862)
Past smoking	41/238 (17)	96/516 (19)	0.648	0.902 (0.611 to 1.747)
Hypertension	41/239 (17)	80/516 (16)	0.565	0.087 (0.365 to 1.071)
Diabetes mellitus	3/236 (1)	6/508 (1)	0.918	0.616 (0.124 to 3.447)
Hypercholesterolaemia	122/178 (68)	332/515 (64)	0.324	0.240 (0.497 to 1.191)

The p value indicates the difference between subgroups by the χ^2 test, Fisher exact test or Mann–Whitney test in univariate and multiple regression analysis.

Short report

such as ethnicity, C reactive protein, homocysteine, oral contraceptive use and migraine were not investigated.^{1 5 23–25}

In conclusion, our study showed a significant association between sCAD and increased body height and lower body weight and lower BMI. Our results support the lack of association between sCAD and major vascular risk factors.

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