EXTRA Cerebrovascular Diseases

Cerebrovasc Dis Extra 2015;5:146–151
DOI: 10.1159/000441395
Received: May 17, 2015
Accepted: September 29, 2015
Published online: November 4, 2015

1664–5456/15/0053–0146$39.50/0
www.karger.com/cee

ESC Award 2015

Subarachnoid Haemorrhage and Sports

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Key Words
Subarachnoid haemorrhage · Cerebral aneurysm · Sport · Running · Aerobics · Cycling · Body balance · Dance · Surf · Windsurf

Abstract
Background: Some cases of subarachnoid haemorrhage (SAH) have been associated with vigorous physical activity, including sports. Our research aimed to describe the association between SAH and sports and to identify the types of sports that were more frequently found as precipitating factors in a tertiary single-centre SAH register. ***Methods:*** We retrieved information from a prospectively collected SAH registry and reviewed discharge notes of acute SAH patients admitted to the Stroke Unit of Hospital de Santa Maria, Lisbon, between 1995 and 2014. ***Results:*** Out of 738 patients included in the analysis, 424 (57.5%) cases of SAH were preceded by physical activity. Nine cases (1.2%) were associated with sports, namely running (2 cases), aerobics (2 cases), cycling, body balance, dance, surf and windsurf. Patients with SAH while practicing sports were younger than controls (average age 43.1 vs. 57.0 years; p = 0.007). In 1 patient, there was a report of trauma to the neck. Patients in the sports group only had Hunt and Hess scale grades 1 (11.1%) or 2 (88.9%) at admission, while patients in the control group had a wider distribution in severity. ***Conclusions:*** Our findings indicate that SAH precipitated by sports is not very frequent and is uncommonly related to trauma. Patients who suffered SAH associated with sports were younger and apparently had a milder clinical presentation.

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Introduction

Subarachnoid haemorrhage (SAH) is a stroke subtype that only covers 1–7% of stroke cases, yet it is responsible for 25% of all deaths related to stroke and requires lengthy rehabilitation in those who survive [1, 2]. The burden is even more significant when we take into account that it affects younger adults compared to those who suffer an ischemic stroke [3].

Although the role of regular physical activity as a long-term protective factor for stroke is established, some cases of SAH have been associated with vigorous physical activity, including sports [1, 4, 5]. SAH cases have been associated with swimming, diving, gymnastics, golf and weight training, among other sports [6–11]. In fact, this increase in the risk of SAH during or after an episode of moderate or vigorous physical activity can be related to the activation of the sympathetic nervous system, with an increase in heart rate and blood pressure, and/or to Valsalva manoeuvres during physical efforts.

This research aims to describe the association between SAH and sports and to identify the types of sports that were more frequently found as precipitating of SAH in a tertiary single-centre SAH register.

Methods

We retrieved information from a prospectively collected registry of acute SAH patients admitted to the Stroke Unit of Hospital de Santa Maria, Lisbon, between 1995 and 2014. Whenever necessary, discharge notes were reviewed for editing missing or incomplete information.

All patients were managed following a standardized protocol, which included urgent intra-arterial angiography (digital subtraction angiography) and aneurysm treatment. If no aneurysm was found in the first angiography, intra-arterial angiography was repeated an average of 2 weeks later.

For each patient, we collected information on age, gender, vascular risk factors (hypertension, smoking, alcohol drinking, oral contraceptive use and hormone replacement therapy), circumstances at onset of symptoms, sentinel headache, clinical severity at admission (as assessed by the Hunt and Hess scale), identification and location of the ruptured aneurysm and outcome (disability and death) at discharge by the modified Rankin Scale (mRS) or the modified Glasgow Outcome Scale (mGOS). Disability was considered to be present when patients had mRS grades 3–5 or mGOS grades 2–4.

SAH associated with sports was defined as SAH with symptom onset during or immediately after sport practice. Specific information for assessing cases associated with sports included the type of sport practiced, history of trauma and the time interval between practice and admission.

The characteristics of patients with SAH associated with sports were compared with the remaining SAH patients using χ^2 tests with Yates correction (for dichotomous variables) and independent-samples t test (for continuous variables), with 95% confidence intervals and p values with statistical significance set at <0.05. Information on patients with SAH associated with sports was reported in a descriptive table. Statistical analysis was performed using IBM® SPSS® Statistics 21.

Results

Between 1995 and 2014, a total of 1,728 SAH patients were admitted to the hospital (including cases of readmission for angiography or due to medical complications related to recent SAH). A total of 738 patients of both genders and between 19 and 94 years of age were

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Table 1. Characteristics of the sample

	Sports group (n = 9)	Control group (n = 729)	p values
Mean age (SD), years	43.1 (13.2)	57.0 (15.2)	0.007*
Sex			0.480
Males	5 (55.6)	280 (38.4)	
Females	4 (44.4)	449 (61.6)	
Hypertension			0.645
Treated	2 (25.0)	246 (39.3)	
Nontreated	1 (12.5)	90 (14.4)	
Smoking	2 (25.0)	204 (31.8)	0.976
Alcohol drinking	2 (40.0)	180 (31.4)	1.000
Oral contraceptive use	3 (60.0)	161 (28.9)	0.289
Hormone replacement therapy	0	19 (3.6)	1.000
Aneurysms	3 (33.3)	359 (60.3)	0.194
Sentinel headache	3 (33.3)	95 (17.3)	0.419
Hunt and Hess scale			0.437
1	1 (11.1)	60 (8.7)	
2	8 (88.9)	428 (61.8)	
3	0	155 (22.4)	
4	0	42 (6.1)	
5	0	8 (1.2)	
Disability	2 (22.2)	111 (15.2)	0.910
Death	0	29 (4.0)	1.000

Values are numbers with percentages in parentheses, unless otherwise indicated. The percentages shown are in regard to valid data. SD = standard deviation. * Significant.

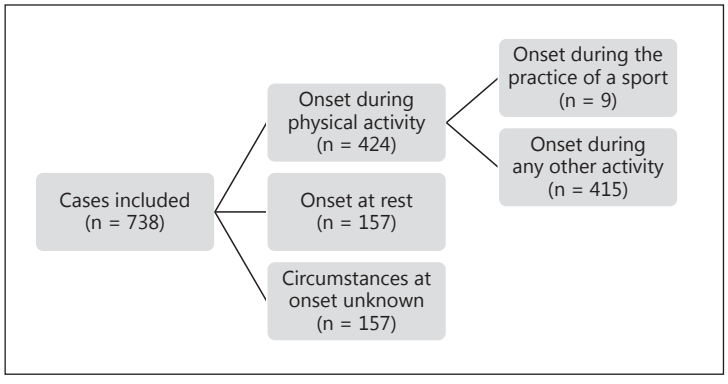

Fig. 1. Circumstances at the onset of symptoms.

admitted to the Stroke Unit, while 950 patients were admitted to the Neurosurgical Department and the remaining patients were admitted to other departments. Figure 1 summarizes the distribution of patients admitted to the Stroke Unit according to their circumstances at the onset of symptoms. Table 1 details the characteristics of all included patients.

Out of the 738 cases, SAH onset occurred at rest in 157 (21.3%), while circumstances preceding SAH were unknown in 157 (21.3%) cases. In 424 (57.5%) cases, SAH was preceded by physical activity. Nine cases were associated with the practice of a sport, representing

Table 2. General description of the SAH cases associated with sports

No.	Year	Age, years/ gender	Sport	Sentinel headache	Risk factors	Trauma	Aneurysm	Hunt and Hess scale	Outcome
1	1996	25/female	Aerobics	No	Previous smoking, oral contraceptive use	No	Left posterior communicating artery	2	No disability
2	1999	41/female	Running	No	Alcohol drinking, previous oral contraceptive use	No	No	2	No disability
3	2006	50/female	Body balance	Yes	Treated hypertension, diabetes	No	Right posterior communicating artery	2	Mild disability
4	2007	57/male	Dance	No	Hypercholesterolemia, alcohol drinking	No	No	2	Mild disability
5	2007	45/male	Windsurf	No	Non-treated hypertension, hypercholesterolemia, smoking, heroin and cocaine use	No	Left middle cerebral artery	2	No disability
6	2009	66/male	Running	Yes	Treated hypertension, hypercholesterolemia, alcohol drinking	No	No	2	No disability
7	2009	34/female	Cycling	No	Smoking, alcohol drinking, previous oral contraceptive use	No	No	2	No disability
8	2009	29/male	Aerobics	No	No	No	No	2	No disability
9	2014	41/male	Surf	Yes	Not available	Neck	No	1	No disability

2.1% of the patients who were performing any physical activity and 1.2% of all patients included. An individual description of the case series is shown in table 2.

Concerning the cases of SAH associated with sports, the age of the patients ranged from 25 to 66 years, and the majority (5 out of 9) was male. SAH occurred after a variety of sports, namely running (2 cases), aerobics (2 cases), cycling, body balance, dance, surf and windsurf. All patients were admitted within the first 24 h after the practice of sport. Only 1 patient did not have vascular risk factors. One patient had a history of heroin and cocaine use. In another patient, there was a report of trauma to the neck. An aneurysm was detected in 3 patients (1 in the anterior cerebral circulation and 2 in the posterior cerebral circulation).

Patients in the sports group were significantly younger (average age 43.1 ± 13.2 vs. 57.0 ± 15.2 years; $p = 0.007$) and more frequently male (55.6 vs. 38.4%; $p = 0.480$). There were no significant differences in the frequency of hypertension, smoking, alcohol drinking or oral contraceptive use. Aneurysms were identified in only 3 (33.3%) of the sports cases, as opposed to 60.3% of the cases in the control group ($p = 0.194$). The frequency of sentinel headache was similar in the two groups (33.3 vs. 17.3%; $p = 0.419$). Patients in the sports group had a milder presentation with Hunt and Hess scale grades 1 (11.1%) or 2 (88.9%) at admission, while patients in the control group had a wider distribution in severity, with 8.7% having grade 1, 84.2% grades 2 or 3 and 7.3% grades 4 or 5 ($p = 0.437$). There were no deaths in the sports group, contrasting with the 4.0% death rate in the control group ($p = 1.000$). There was no significant difference in disability at discharge between the two groups.

Discussion

To our knowledge, this is the first study that describes the association between SAH and sports in a large SAH case registry. We found that the majority of SAH cases was associated with physical activity at the time of symptom onset, but the practice of a sport occurred in only 1.2% of the cases. This is consistent with the rarity of SAH, and stroke in general, in sports. Despite that, emergency and stroke physicians should be aware that this clinical entity can occur during the practice of sports.

Although the incidence of SAH increases with age, patients who suffered SAH associated with sports were significantly younger [3]. This case series of SAH associated with sports included adults aged between 25 and 66 years, most of them male (55.6%). This is probably because male and younger people practice moderate-intensity physical activity and presumably sports more frequently [12]. As stated before, cases of SAH after sport might be due to mechanisms that include a transient increase in heart rate and blood pressure due to activation of the sympathetic nervous system and/or Valsalva manoeuvres, which are more relevant in SAH related to aneurysmal rupture [13].

The cases were associated with a great diversity of sports and not only with sports with a high probability of impact and trauma, such as combat sports and martial arts, nor with sports that involve Valsalva manoeuvres, such as weightlifting. There was a history of trauma to the neck in 1 patient. It should be noted, however, that low-intensity trauma during sports may not be noticed or considered relevant by patients [14]. The fact that an aneurysm could be identified in only 3 patients raises the possibility of an alternative cause for SAH associated with sports, namely intracranial dissection [15].

Even though patients were quite young, especially if compared with other stroke populations, 7 (77.8%) of them had a clear history of cardiovascular risk factors for SAH [1]. Patient 5 had a history of heroin and cocaine use. Cocaine is one of the illicit drugs that have the strongest association with stroke, as studies have shown that both haemorrhagic and ischemic stroke can happen as a result of cocaine exposure, especially in young people, through a multifactorial mechanism that involves vasospasm and platelet aggregation [16, 17]. Although the connection is weaker, heroin use has also been associated with stroke [16].

There were some limitations to this study, mostly related to its retrospective design. This study did not allow for assessing whether the patients practiced the sport as amateurs or professionals, how frequently they practiced it or if they used doping. Also, not all SAH patients were admitted to the Stroke Unit, as more than half of them were admitted directly to the Neurosurgery Department or the Neurointensive Care Unit.

In conclusion, these findings indicate that SAH precipitated by sports is not very frequent and is uncommonly related to trauma. Patients who suffered SAH associated with sports were younger than the remaining SAH patients and apparently had a milder presentation.

Acknowledgment

This study was funded by Instituto de Medicina Molecular, University of Lisbon, Portugal.

Disclosure Statement

The authors report no conflict of interest.

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