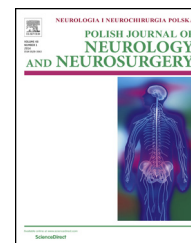


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Original research article

Angiographic assessment of variants of basal vein of Rosenthal in idiopathic subarachnoid hemorrhage

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ABSTRACT

Previous studies have reported the possible contribution of a primitive variant of the basal vein of Rosenthal (BVR) in the cause of idiopathic subarachnoid hemorrhage (ISAH). The purpose of this study was to assess the drainage patterns of the BVR among ISAH patients. The venous phase at cerebral angiography was retrospectively analyzed in 19 patients with ISAH and then compared with patients with unruptured aneurysms as controls. A relationship was found between ISAH and the presence of a primitive variant. However, the venous configuration effect on bleeding is still unknown.

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1. Introduction

Non-traumatic subarachnoid hemorrhage (SAH) generally occurs as a result of aneurysm rupture. In approximately 15% of cases, neither aneurysm nor other vascular malformation can be identified by cerebral angiography; in this case it is defined as idiopathic SAH (ISAH) [1,2]. ISAH have a benign clinical course and a much better outcome than patients with aneurysmal SAH [1,3]. In the literature, studies have suggested a possible contribution by primitive variants of Basal vein of Rosenthal (BVR) in the pathogenesis of ISAH [2,4,5]. The way in which this venous configuration might

influence bleeding is still unknown. In this paper we retrospectively studied the prevalence of angiographic variants of BVR to determine whether there were differences between patients with ISAH and those with unruptured aneurysms.

2. Materials and methods

During the period of 2012–2014 a retrospective evaluation of patients with SAH was carried out. Patients were selected if SAH was seen on a cranial computed tomography (CT) image and a negative digital subtraction angiography (DSA).

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Inclusion criteria for this study were repeating radiological imaging (either DSA or MRA) after 2–4 weeks which again proved negative. Exclusion criteria for the study was SAH secondary to head trauma, the presence of an aneurysm or other intracranial vascular malformations and blood dyscrasia. As a control group we evaluated the patients having an incidental unruptured aneurysm. These patients were selected at random, independently of the site of aneurysm. The initial admission cranial CT pattern was defined according to the Nayak CT-based classification system for non-aneurysmal SAH. Type 1a; blood in basal cisterns only. Type 1b; type 1a with extension into the sylvian fissures. Type 2; type 1 (including 1a&1b) with extension of blood into cortical sulci $\pm$ ventricles. Type 3; SAH without blood in basal cisterns. Type 4; any type of SAH with subarachnoid blood in the posterior fossa/cerebellar vermis [6]. Clinical grades were determined using the Hunt and Hess grade [7].

2.1. DSA technique

The preprocedural 6 h fasting was provided. Written informed consent was obtained from the patients. Complete blood count, blood biochemistry and coagulation parameters were obtained and confirmed to be within normal ranges. Both groins were prepared and draped. The common femoral artery (usually right femoral artery) was palpated. Lidocain (%) was injected into the skin and a skin incision was made. A single wall puncture technique with retrograde manner and 18 G angiographic needle was used to introduce 6 Fr 11 cm vascular sheath (Medtronic, Minneapolis, Minnesota, USA) into the common femoral artery.

Catheters used for selective cerebral angiography were Headhunter, vertebral and Simmons 2 (Boston Scientific, Natick, MA). Bilateral selective internal carotid artery catheterization was performed under the roadmapping technique. Standard anteroposterior (AP), lateral views and the late venous phase were obtained. The images of all patients were loaded in the picture archiving and communications system (PACS). The venous phases of angiography were reviewed independently by one neurosurgeon and one neuroradiologist, each blind to the patient features. After this first examination the results were compared and discussed. The results were classified according to the Watanabe classification (type A, B and C) [5]. Type A; normal pattern; the vein drains mainly into the vein of Galen. Type B; normal discontinuous pattern; the vein drains anteriorly (uncal vein) and posteriorly (into the Galenic system). Type C; primitive pattern; the veins drain into the cavernous or sphenoparietal sinus, into the superior petrosal sinus via perimesencephalic veins, or into the transverse/straight sinus directly, other than the Galenic system.

2.2. Statistical analysis

Chi-square tests were applied to assess the independency of variables, such as a comparison of the study-control groups in terms of other variables. Additionally, the proportions of the study and control groups at the level of other variables were compared using Z tests. Descriptive information as counts and percentages were also reported in cross tabulation tables.

3. Results

A total of 19 patients' 38 BVR were examined, within which the mean age was 53 years (range 18–77); 13 patients were female while six were male. A total 35 patients' 70 BVR were evaluated as a control group. The mean age of patients with unruptured aneurysm was 56 years (range 32–83); 25 were female while 10 were male. At the time of diagnosis 3 patients were classified as Hunt and Hess grade I, 11 as grade II, and 5 as grade III. The amount of blood in the CT was evaluated by Nayak classification; 6 patients were presented as type 1a, 5 as type 1b, 5 as type 2, and 3 as type 3. Eleven patients had previously experienced hypertension. No patients had hydrocephalus. Four showed radiologically vasospasm on DSA but only 2 patients were clinically effected by this. All patients were treated only conservatively and recovered completely. A total of 38 studies of BVR patients were evaluated, including 19 who were both sides cases (Figs. 1–3). Type A, 24 (63.1%), B, 1 (2.7%) and C 13 (34.2%) were noted in ISAH patients, while type A, 51 (72.9%), B, 12 (17.1%) and C 7 (10%) were noted in control group patients (Table 1). In ISAH patients, normal drainage (AA) pattern in 10 (52.6%), normal variants (AB, or BB) in 1 (5.3%) and primitive pattern (CA, CB, CC) in 8 (42.1%) patients were observed. In control groups with unruptured aneurysm, 19 (54.3%) patients normal, 10 (28.6%) patients normal variant, 6 (17.1%) patients primitive pattern were found. The primitive pattern was statistically more significant in the study group ($p < 0.05$). The normal variant pattern was statistically more significant in the control group ($p < 0.05$) while the normal pattern was found not to be significant. The analysis of ISAH with regard to CT findings did not reveal any significant difference in variations of the BVR.

4. Discussion

Spontaneous SAH is generally caused by rupture of an aneurysm, although DSA could not locate the cause of bleeding in about 15% of patients with spontaneous SAH [2,3,8]. In a subtype of DSA negative SAH patients the blood is placed in the cisterns around the mid-brain and the center of bleeding is anterior to the mid-brain in 21–68% of the ISAH cases known to have perimesencephalic SAH (PMSAH) [9–11]. The etiology of ISAH has not yet been determined. Several risk factors of PMSAH have been suggested, such as smoking, female gender, and youth, although hypertension is the only risk factor consistently present across studies [12–14]. The clinical features of PMSAH include the slower onset of headaches, infrequent loss of consciousness, the limited extension of hemorrhage. Benign clinical courses show that the cause is likely to be a local leakage of venous or capillary bleeding rather than a high pressure arterial source [2,4,15]. Although the etiology of PMSAH has not yet been determined, the ventriculostriate or thalamoperforating arteries, anterior longitudinal pontine or interpeduncular and posterior communicating veins, cryptic brain stem arteriovenous malformations, primary intramural hematoma of the basilar artery have each been proposed as sources of hemorrhage [16–19]. Work on the categorization of the venous system in normal

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