
UNIVERSITE DE LAUSANNE - FACULTE DE BIOLOGIE ET DE MEDECINE

Département des Neurosciences Cliniques
Service de Neurochirurgie

**Syndrome de vasoconstriction cérébrale réversible
Identifications de facteurs pronostiques**

THESE

préparée sous la direction du Docteur Antoine Uské

(avec la collaboration de la Doctoresse Aida Kawkabani Marchini et du
Docteur Gaston Oumarou)

et présentée à la Faculté de biologie et de médecine de
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***Syndrome de vasoconstriction cérébrale réversible
Identifications de facteurs pronostiques***

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*pour Le Doyen
de la Faculté de Biologie et de Médecine*



*Madame le Professeur Stephanie Clarke
Directrice de l'Ecole doctorale*

Résumé

Objectif : Le syndrome de vasoconstriction cérébrale réversible (SVCR) est une entité clinico-radiologique associant des céphalées paroxystiques à un vasospasme uni- ou multifocal réversible des artères cérébrales avec ou sans déficit neurologique transitoire ou crise comitiale. Le but de notre étude est de rechercher les facteurs de mauvais pronostic des patients présentant un SVCR.

Méthode : Nous avons réalisé une étude rétrospective des imageries vasculaires cérébrales invasives et non invasives entre janvier 2006 et 2011 et avons retenu 10 patients présentant les critères du RCVS. Les données démographiques, facteurs de risque vasculaires ainsi que l'évolution de chaque patient ont été notés.

Résultats : Sept des 10 patients sont des femmes, avec un âge médian de 46 ans. Quatre patients ne présentaient pas de facteur étiologique, deux femmes se trouvaient en période post-partum (entre la première et la troisième semaine) et les trois autres cas sont induits par des drogues vaso-actives (cannabis pour 2 cas dont un associé à la cyclosporine, sumatriptan pour un cas). La durée moyenne du suivi est de 10,2 mois (0-28 mois). Deux patients ont présentés une séquelle neurologique : un a gardé des troubles phasiques et l'autre une hémianopsie latérale homonyme. Deux autres patients sont décédés dans les suites, ce qui est inhabituel. Nous n'avons pas trouvé de corrélation d'évolution différente entre les cas de SVCR primaire ou secondaire. Les seuls facteurs corrélaient à l'évolution clinique sont le status neurologique à l'admission et la présence de lésion parenchymateuse (ischémie ou hématome) à l'imagerie.

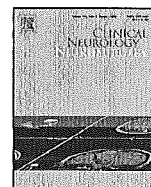
Conclusion : La vasoconstriction cérébrale réversible impliquant des déficits neurologiques ou la mort a été, rarement, rapportée. Nous devons garder à l'esprit qu'une telle évolution peut survenir notamment pour les cas présentant un état neurologique dégradé à l'admission ou présentant des lésions parenchymateuses à l'imagerie.



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Reversible cerebral vasoconstriction syndrome identification of prognostic factors

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ABSTRACT

Object: Reversible cerebral vasoconstriction syndrome (RCVS) is described as a clinical and radiological entity characterized by thunderclap headaches, a reversible segmental or multifocal vasoconstriction of cerebral arteries with or without focal neurological deficits or seizures. The purpose of this study is to determine risk factors of poor outcome in patients presented a RCVS.

Methods: A retrospective multi-center review of invasive and non-invasive neurovascular imaging between January 2006 and January 2011 has identified 10 patients with criterion of reversible segmental vasoconstriction syndrome. Demographics data, vascular risks and evolution of each of these patients were analyzed.

Results: Seven of the ten patients were females with a mean age of 46 years. In four patients, we did not found any causative factors. Two cases presented RCVS in post-partum period between their first and their third week after delivery. The other three cases were drug-induced RCVS, mainly vaso-active drugs. Cannabis was found as the causative factor in two patient, Sumatriptan identified in one patient while cyclosporine was the causative agent in also one patient. The mean duration of clinical follow-up was 10.2 months (range: 0–28 months). Two patients had neurological sequelae: one patient kept a dysphasia and the other had a homonymous lateral hemianopia. We could not find any significant difference of the evolution between secondary RCVS and idiopathic RCVS. The only two factors, which could be correlated to the clinical outcome were the neurological status at admission and the presence of intraparenchymal abnormalities (ischemic stroke, hematoma) in brain imaging.

Conclusions: Fulminant vasoconstriction resulting in progressive symptoms or death has been reported in exceptional frequency. Physicians had to remember that such evolution could happen and predict them by identifying all factors of poor prognosis (neurological status at admission, the presence of intraparenchymal abnormalities).

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1. Introduction

Reversible cerebral vasoconstriction syndrome (RCVS) has been proposed as a unifying term for a variety of similar syndromes [1,2] including Call-Fleming syndrome [3], benign angiopathy of the central nervous system [4], postpartum cerebral angiopathy

[5], migrainous vasospasm, thunderclap headaches with reversible vasospasm and drug-induced angiopathy [6]. RCVS is described as a clinical and radiological entity characterized by thunderclap headaches, a reversible segmental or multifocal vasoconstriction of cerebral arteries with or without focal neurological deficits or seizures [1,6–8].

Approximately, 60% of cases are secondary to a known etiology [9]; the most frequently inferred ones are exposure to vasoactive drugs such as serotonergics [9–13], sympathomimetics [14–16] and chemotherapeutics [18,19], some clinical states such as pregnancy [20–24] and puerperium [25]. RCVS has a middle-aged female preponderance [1,3,6–9,26–31]. The most common clinical feature of RCVS is a severe acute headache [6,9] presented as thunderclap headache, often accompanied by nausea, vomiting, photophobia, blurred vision and transient motor deficit [7,32–34]. Neurovascular imaging (conventional cerebral angiography or non-invasive imaging) typically shows diffuse, multifocal, segmental narrowing involving large and medium-sized arteries with strings

Abbreviations: RCVS, reversible cerebral vasoconstriction syndrome; CT, computerized tomography; CTA, computerized tomographic angiography; MRI, magnetic resonance imaging; MRA, magnetic resonance angiography; DSA, digital subtraction angiography; SAH, subarachnoid hemorrhage; AVM, arteriovenous malformation; CSF, cerebrospinal fluid; HLH, homonymous lateral hemianopia; mRS, modified Rankin score.

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and bead appearance [6–9,35–37]. These radiological abnormalities disappeared spontaneously or in response to calcium-channel blockers in a delay of 2–3 weeks [1,7,38]. Despite the reversibility of angiographic signs, RCVS could be complicated by ischemic stroke [7–9,38–40] or convexity subarachnoid hemorrhage [1,7,8]. These complications are rare and without identified precipitating factors.

Recent literature reflected the growing interest for RCVS. Approximately 75 isolated cases are described between 1992 and 2011. However, only two studies [6] including more than ten cases have been published. The combination of more frequent cerebrovascular imaging with non-invasive techniques and the use of vaso-active drugs put a growing number of patients within RCVS spectrum. Complications and prognostic factors of RCVS were not developed in published studies.

We present our experience on reversible cerebral vasoconstriction syndrome with ten consecutive cases of angiographically proven RCVS, which were diagnosed between the university hospital of Lausanne and the regional hospital of Sion. Two patients in our study developed fatal complications; we discuss prognostic factors of RCVS in light of a review of the literature.

2. Patients and methods

We retrospectively reviewed invasive and non-invasive neurovascular imaging performed in our medical centers between January 2006 and January 2011 in the radiological database. 318 patients were selected who presented cerebral vasospasm. We excluded all patients with a history of cerebral aneurysm and other cerebro-vascular malformations (282 patients). We also excluded patients without documentation of the reversibility of neurovascular abnormalities (287 patients). After the exclusion criteria, 10 patients were identified as presenting a reversible cerebral vasoconstriction syndrome and satisfying the three diagnostic criteria for RCVS: (i) unusual, severe headaches with or without focal neurological deficit or seizures; (ii) cerebral vasoconstriction assessed by computerized tomographyangiography (CTA), magnetic resonance angiography (MRA) or conventional digital subtraction angiography (DSA) with at least two different arteries involved; (iii) reversibility of radiological abnormalities in less than three months from the initial event (Fig. 1).

The following data were collected: age, sex, history of headache, blood pressure, vaso-active drug, history of postpartum period,

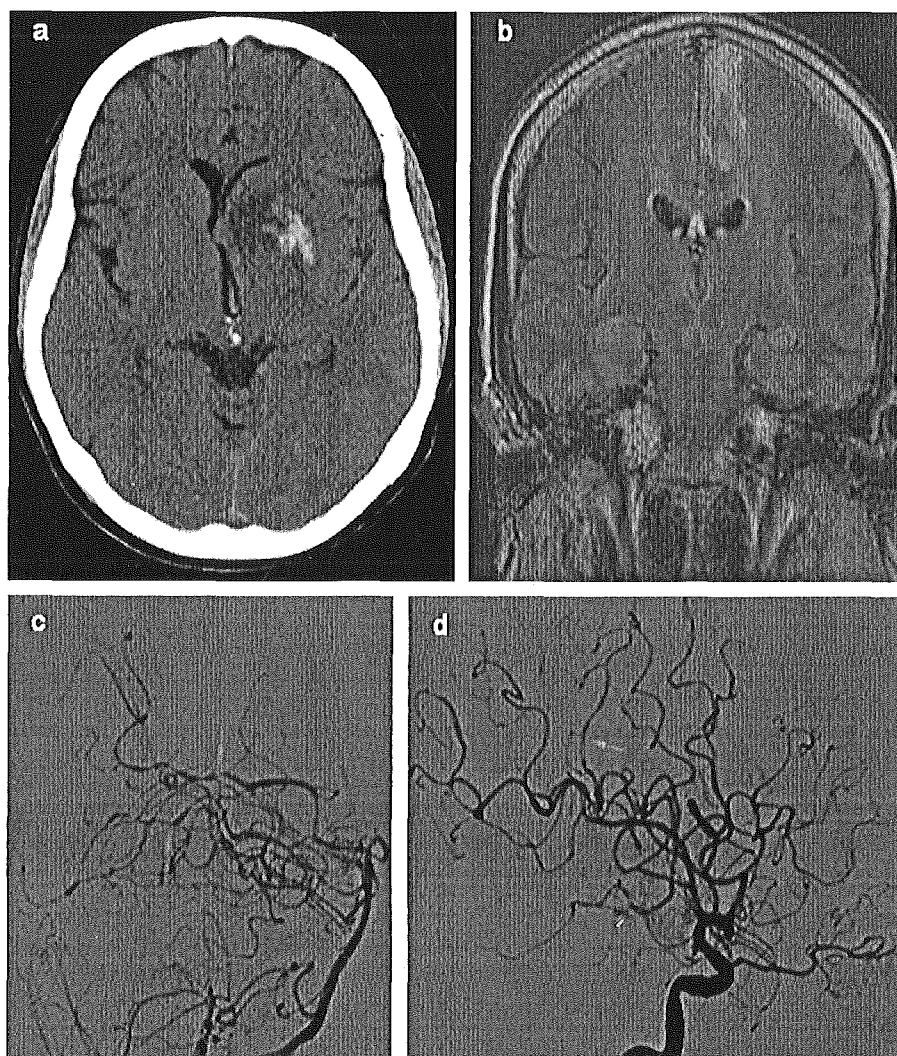


Fig. 1. Typical neuro-imaging features of reversible cerebral vasoconstriction syndrome. Axial computerized tomography (a) showed a capsular hematoma with mass effect. Coronal fluid attenuated inversion recovery (FLAIR) MR scan (b) with ischemia in the territory of the anterior cerebral artery. Right vertebral (c) and right internal carotid artery (d) digital subtraction angiography with lateral views demonstrating multifocal vasoconstrictions of large and middle-size arteries.

Table 1
Demographic data.

	Total (n = 10)	Males (n = 3)	Females (n = 7)
Age	46 (23–68)	48 (39–64)	39 (23–68)
History of hypertension	60% (n = 6)	33% (n = 1)	71% (n = 5)
History of migraine	30% (n = 3)	33% (n = 1)	28% (n = 2)
Single thunderclap headache	10% (n = 1)	0% (n = 0)	14% (n = 1)
Recurrent thunderclap headache	90% (n = 9)	100% (n = 3)	86% (n = 6)
Vasoactive substances	40% (n = 4)	0% (n = 0)	57% (n = 4)
Postpartum period	20% (n = 2)		29% (n = 2)

focal neurological deficits, seizures, associated-subarachnoid hemorrhage (SAH), radiological and clinical evolution with the modified Ranking score (mRS). We also recorded the evidence of complications: ischemic stroke, intra-cerebral hemorrhage.

All patients benefited neurovascular imaging at admission and after two weeks of follow-up. A lumbar puncture was performed in all patients to exclude differential diagnoses of primary angiitis of the central nervous system (CNS). A clinical and radiological follow-up by MRA or CTA was performed in all patients at 3 months of discharge.

No standard treatment protocol was used.

2.1. Statistics

Descriptive statistics are presented as mean and standard deviation or as frequency and percent. Multi-variant analysis of prognostic factors is performed for each patient.

3. Results

3.1. Demographics and patients past medical histories

The demographic data of the 10 patients are indicated in Table 1. Seven of the ten patients were female; their ages ranged from 23 to 68 years with a mean age of 46 years. Six patients (60%) had a history of hypertension. Other chronic medical conditions included depression, diabetes mellitus and hypercholesterolemia. Five patients presented a history of primary headaches disorders or migraine. Two patients did not have any relevant past medical history.

One of the patients had a history of arterio-venous malformation (AVM). It was an occipital AVM grade Spetzler-Martin 3 which was treated 11 years before by endovascular treatment and surgical resection. He also had a right postero-inferior cerebellar artery (PICA) aneurysm treated 10 years before by endovascular coiling. There was no personal or family history of migraine, no particular medication at admission and no history of drugs abuse. Neurological examination revealed isolated right homonymous hemianopia with no altered level of consciousness and no motor deficit. A cerebral computerized tomography (CT) with angiographic sequences (CTA) at admission showed a left cortical subarachnoid hemorrhage (SAH) without any vascular etiology. Regarding neuro-vascular history of the patient, a cerebral angiography was performed, which revealed diffuse cerebral vasoconstriction without finding the etiology of the SAH (there was no new aneurysm, no residual AVM). Cerebrospinal fluid (CSF) examination including autoimmune antibody was normal. A repeated CT angiography 3 months later was entirely normal and demonstrated that cerebral vasoconstriction completely disappeared which was the proof of the reversibility of the patient's condition.

3.2. Risk factors

We classified RCVS as secondary (post partum period or drug-induced vasospasm) or as idiopathic. In four patients, we did not

found any causative factors. Two cases presented RCVS in post partum period between their first and their third week after the delivery. The other four cases were drug-induced RCVS. Vaso-active substances used were cannabis (two patients), sumatriptan (one patient) and cyclosporine (one patient). These data are summarized in Tables 1 and 2.

3.3. Headaches characteristics

On average, patients presented 4 (from 1 to 6) thunderclap headache attacks during the disease course. The median duration of thunderclap headache attacks was 30 min. The headaches were described as explosive at onset then throbbing. Headache was generally bilateral (90%). Nausea and vomiting were the most common associated symptoms (70%). The headaches completely disappeared at a mean of 17 days (two dead patients were excluded). The blood pressure of each patient was noted at the first examination and 70% (7 patients) presented an elevated blood pressure (systolic upper than 140 or diastolic upper than 90) at admission. We have noticed that all patient with a mRS 0 at 3 months had had no elevated blood pressure at presentation but the difference was not statically significant.

3.4. Other neurological symptoms

Eight patients (80%) had other neurological symptoms. Seven patients (70%) presented focal neurological deficit, which was rapidly reversible in six patients. Visual symptoms were the most frequent, followed by hemiparesis and aphasia. Two patients also presented confusion at admission. Other two patients presented generalized tonic-clonic seizures which have been controlled by antiepileptic drugs.

Two patients (20%) had persistent deficits due to ischemic stroke (case 2 and 3). The first one was a young woman who presented bifrontal ischemic stroke five days after admission, secondary to a bilateral anterior cerebral arteries vasospasm. After a comatose state during 12 days, she died unfortunately. The other one was also a woman who presented diffuse cerebral vasospasm interesting both anterior and posterior circulations. Three days after her admission, she developed multifocal ischemic stroke in both hemispheres and died 13 days later.

3.5. Neurovascular imaging

All patients had a cerebral CT scan without angio-CT as the first imaging investigation. This initial CT was performed at a mean of 2 days after the onset of the headache and was abnormal in 4 patients (two patients presented convexity SAH, one patient an ischemic stroke and other the both). Between the five patients who presented a parenchymal abnormality on cerebral imaging during the evolution, 2 of them presented the abnormality on the first imaging.

All patients also have a MRI during the acute phase of the disease, which was abnormal in 5 patients (50%). The most frequent findings are convexity SAH and ischemic stroke.

In our institutions, non-invasive cerebro-vascular imaging was performed for all patients who presented thunderclap headaches and/or new neurological deficit. CT angiography or magnetic resonance angiography showed diffuse segmental vasoconstriction in all 10 patients. It was detectable on the first exam performed at a mean of 4 days after headaches onset. Cerebral vasospasm interested large and middle-size arteries in all cases. Anterior and posterior circulations were involved in 6 patients, cerebral vasospasms were bilateral in 9 patients, and only one patient presented an isolated middle cerebral artery vasoconstriction. The most frequent artery involved by vasoconstriction was the

Table 2
 Clinical and neuro-imaging data.

Patient	Age	Sex	Type of headaches	High blood pressure	Blood pressure at admission (systolic/diastolic)	Drug	Post partum period	Seizure	Subarachnoid hemorrhage	Neurological deficit	Localization of vasospasm	Stroke	Clinical outcome (mRS at 3 months)
1	64	M	Thunderclap	Yes	142/84	No	Not applied	No	Yes	Hemiparesis, blurred vision	Diffuse	No	Total recovery (mRS 0)
2	68	F	Nonconscious	Yes	186/105	Sumatriptan	No	No	no	Hemiparesis	Anterior circulation	Ischemic	Death (mRS 6)
3	53	F	Thunderclap	Yes	144/91	Cannabis	No	No	Yes	Hemiparesis	Diffuse	Ischemic	Death (mRS 6)
4	39	M	Fronto-temporal	No	138/75	No	Not applied	No	No	Transitory HLH	Posterior circulation	No	Total recovery (mRS 0)
5	42	M	Occipital	No	121/68	No	Not applied	No	No	Hemiparesis, HLH	ACA, MCA, BA	Hemorrhagic	HLH (mRS 2)
6	35	F	Explosive	No	146/79	No	Yes	No	No	Confusion, aphasia	Bilateral MCA	Hemorrhagic	Dysphasia (mRS 2)
7	62	F	Thunderclap	Yes	152/96	Ciclosporine	No	Yes	No	Confusion	Diffuse	No	Total recovery (mRS 0)
8	34	F	Thunderclap	No	113/67	No	Yes	No	No	Blurred vision	Posterior circulation	No	Total recovery (mRS 0)
9	23	F	Explosive	Yes	184/112	Cannabis	No	Yes	Yes	Hemiparesis	Diffuse	Ischemic	Total recovery (mRS 1)
10	43	F	Thunderclap	Yes	166/89	No	No	No	No	No	Diffuse	No	Total recovery (mRS 1)

ACA: anterior cerebral artery, MCA: middle cerebral artery, BA: basilar artery, HLH: homonymous lateral hemianopia, mRS: modified Rankin Score.

middle cerebral artery (8 cases). One patient was known for AVM and aneurysm.

3.6. Cerebrospinal fluid analysis (CSF)

Lumbar puncture was performed in seven patients. CSF was abnormal in three patients, two had elevated CSF white blood cells and red blood cells, and one patient had elevated CSF protein level. It was considered mainly as minor abnormalities attributed to underlying stroke or the SAH. There was no evidence for arterial inflammation or infection. Blood analysis showed no significant abnormalities. Erythrocyte sedimentation rate and C-reactive protein level were normal in 90% of cases at admission.

3.7. Treatment

All precipitating factors were stopped including vaso-active drugs. All patients known for hypertension were actively treated with anti-hypertensive drugs. No standard treatment was used in these 7 patients. Nimodipine by oral administration (30–60 mg every 4 h adapted to blood pressure) was used in 3 patients for vaso-protection and vasospasm prevention. We could not find any correlation between the treatment and the clinical evolution in our series.

3.8. Clinical outcome

The mean duration of clinical follow-up was 10.2 months (range: 0–28 months). First follow-up visit 6 weeks after the discharge was marked by disappearance of headache in all but 2 cases (Fig. 2) who died at hospital during first weeks of the evolution. Two patients presented neurological sequelae: one patient had a dysphasia and the other had a homonymous hemianopia. No neurological deficit appeared after the discharge of patients. No recurrent thunderclap headaches occurred during the follow-up. However, 3 patients developed migraine, which responded to low-level analgesic drugs. Good clinical outcome (modified Rankin Score, mRS 0–2) was noted in 8 (80%) patients. The other 2 patients died and had, by definition, a mRS at 6. All patients were strongly advised to abstain from all vaso-active drugs.

3.9. Cases with fatal evolution

The first case (patient 2) was a female, 68 years old, with migraine treated by sumatriptan who presented spontaneous thunderclap headache followed by right hemiparesis and loss of consciousness. At admission, the patient presented a right hemiparesis with a Glasgow Coma scale at 6. After intubation and sedation for cerebral protection, we performed a CTA and a MRA, which showed an ischemia in the left anterior cerebral artery and left anterior choroidal artery territories. Severe vasoconstriction was also finding in the left carotid siphon and the left A1. The patient was then admitted to the intensive care unit for medical neuro-reanimation. A DSA was performed the day after which confirmed severe vasospasm on the left side with hypoplasia of the segment A1 on the right side. Despite chemical and balloon angioplasty, no improvement of the cerebral perfusion was noted and the patient developed progressively a cerebral edema. Regarding the age, the neurological status at admission and the evolution of the imaging, we decided not to perform a bifrontal craniectomy and the patient died 4 days after her admission. No autopsy was performed.

The second case (patient 3, Fig. 2) was a 53 years-old female who presented a right hemiparesis and thunderclap headache at admission without loss of consciousness. The first CT (Fig. 2a) showed fronto-parietal subarachnoid hemorrhage with cortical hematoma. DSA performed at day 1 (Fig. 2b and c) highlighted

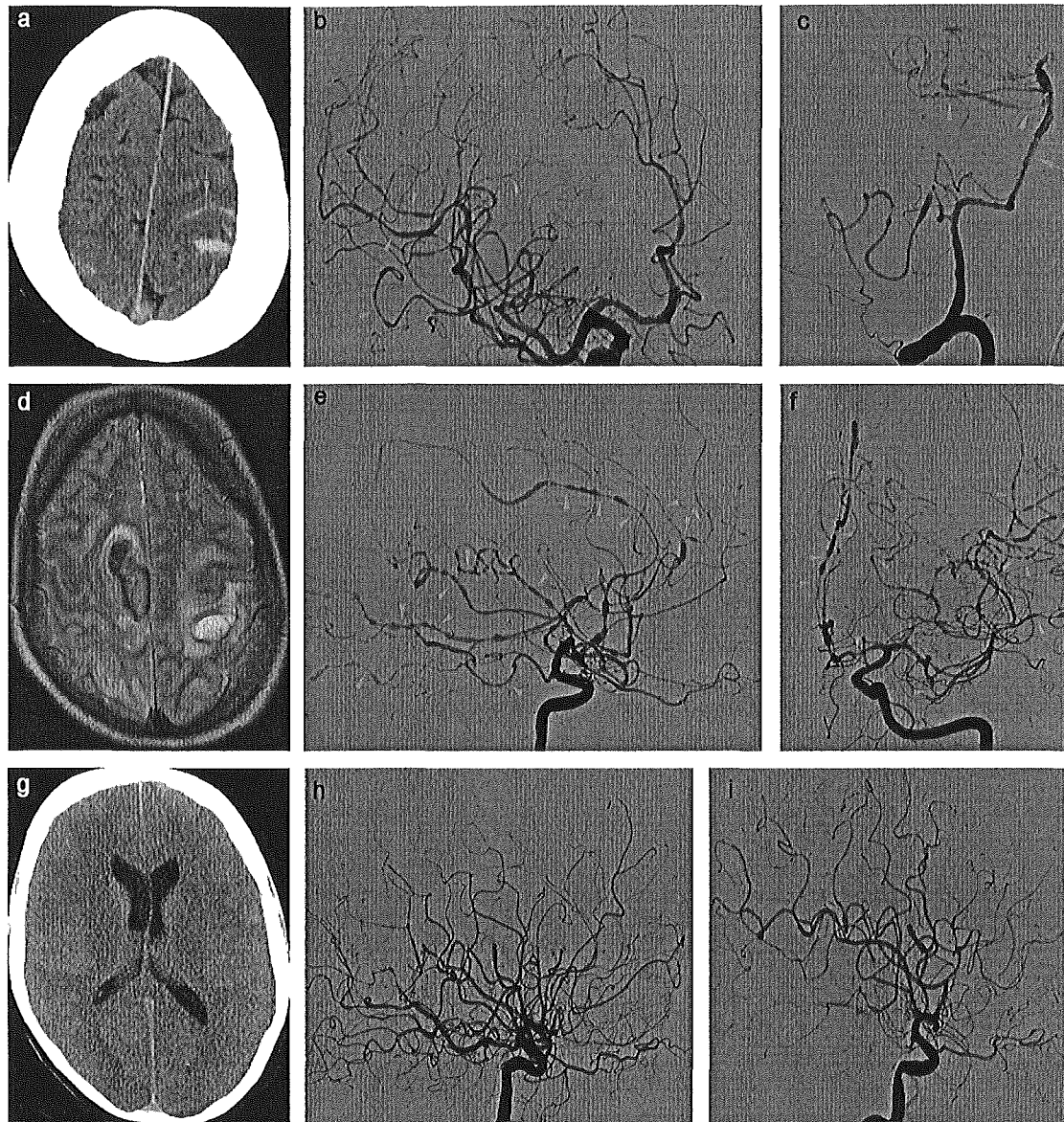


Fig. 2. Neuro-imaging of the case 3. 53 years-old female presented at admission a right hemiparesis and thunderclap headache. The axial head CT (a) showed cortical SAH and parenchymal hematoma. Right carotid artery (b) and left vertebral artery (c) DSA with lateral views showed at day 1 diffuse vasoconstriction in large and middle-size arteries (arrowheads). Five days later, the patient developed a right lower limb paresis and became confused. Axial T2-MR imaging (d) showed the apparition of a new left side frontal hematoma. Cerebral DSA (e-f) performed 5 days after the admission highlighted the progression of diffuse cerebral vasoconstriction (arrowheads). Despite the resolution of vasospasm as showed on cerebral DSA (h and i) performed 12 days after the admission, the patient presented a diffuse cerebral edema (g) and died at day 13.

diffuse vasoconstriction in large and middle-size arteries. Considering the diagnosis of drug-induced (cannabis) reversible cerebral vasoconstriction syndrome, we opted for a wait-and-see attitude. Five days after, the patient developed a right lower limb paresis and became confused. MR imaging (Fig. 2d) showed the apparition of a new left sided frontal hematoma. Cerebral DSA (Fig. 2e and f) performed 5 days after the admission highlighted the progression of diffuse cerebral vasoconstriction. Progressively, the level of conscious of the patient decreased despite of the active treatment of cerebral vasospasm (intravenous nimodipine and chemotherapy angioplasty) necessitating intubation, sedation and intensive care unit hospitalization. Despite the resolution of vasospasm seen on cerebral DSA (Fig. 2h and i) performed 12 days after the admission, the patient presented a diffuse cerebral edema (Fig. 2g) and died at day 13. The autopsy was performed and

showed large infarcts in both hemisphere with microclots and ischemic changes in different parts of the brain (hippocampus, cingulate and insular regions). Middle-size vascular changes have been noted as inflammatory processes, endothelial proliferation and apoptosis.

3.10. Radiological evolution

All surviving patients were controlled by MRA at 6 weeks, 3 months and 6 months after the discharge. MRA confirmed the resolution of cerebral vasoconstriction syndrome. No recurrent RCVS occurred during the rest of the follow-up. All patients who had presented with convexity SAH had a resolution on follow-up imaging. No secondary complication was noted by cerebral imaging.

3.11. Factors of poor outcome

Two patients (20%) died in the aftermath of the RCVS. Two others (20%) had neurological sequelae of the RCVS. We have not found any significant difference of evolution between secondary RCVS and idiopathic RCVS. The only two factors that could be correlated to the clinical outcome were the neurological status at admission and the presence of intraparenchymal abnormalities (ischemic stroke, hematoma) in cerebral imaging.

4. Discussion

Reversible cerebral vasoconstriction syndrome is emerging as an important cause of stroke in patients younger than 60 years [1,3,6–9]. Vasoconstriction syndromes remain poorly characterized and under-recognized mainly because of the lack of specific diagnostic tests or diagnostic criteria [1,2,6–9,39]. Misdiagnosis is frequent because the clinical, radiologic and angiographic abnormalities are often indistinguishable from conditions that cause irreversible arterial narrowing [24–26,29,32].

RCVS is considered an extremely rare syndrome [1,3,7–9]; however, the growing use of vaso-active drugs combined with more frequent use of non-invasive neurovascular imaging increase its incidence.

The patho-physiology of this syndrome is not known but factors such as vaso-active drugs [9–21] and post-partum period [22,24,25,30–38] has been identified as precipitating factors. In our series, we identified a causative factor in 60% of patients which correlated with results found in other series in the literature. In a review published in 2009, Ducros et al. [6,7] evaluated the rate of secondary RCVS as 25–60% of cases. The more frequent vasoactive drugs found are selective serotonin reuptake inhibitors [1–3,6–11,13], cannabis [1,3,6–9], ecstasy [3,6,9] and sumatriptan [1–3].

Most reported cases have been young and predominantly females [1,3,5–9]. Thunderclap headaches, which are often associated with nausea and vomiting, are typical at onset. A history of migraine [6,8,12,16], pregnancy [22,24,25,30–38] or recent exposure to vaso-active [9–21] drugs is usually present. The thunderclap headaches can be exacerbated by Valsalva maneuvers and can recur for weeks [1–3,5–9,14]. Focal neurological deficits can develop from stroke due to severe vasoconstriction [5–9]. Generalized seizures could occur at the onset or within the first few days [6–9,12]. Persistent focal deficits although infrequent, are usually due to a hematoma or infarction [1,3,6–8]. Our series is atypical because it contains two cases of persistent focal deficit due to intraparenchymal hemorrhage. An isolated case of fatal evolution after postpartum cerebral angiopathy had been described by Williams et al. [41] and could be compared with the fatal cases of our series.

The diagnosis of RCVS is based on the presence of segmental arterial narrowing and dilatation on invasive or non-invasive cerebral angiography [3,6]. Cerebral CT was generally the first investigation [6]. In the literature, 28–80% of patients presented abnormalities on the first CT including convexity subarachnoid hemorrhage [1,4,25–28] (12–34%), ischemic stroke [7–9] (9–39%) and intracerebral hematoma [7,8] (5–20%). Cerebral MRI could also be an alternative choice to diagnose RCVS but most reports showed an increased sensibility of the MRI between day 5 and 8 after the onset of headaches [6–9]. We recommend performing a cerebral CT scan the first day and cerebral MRI a few days after. Vascular imaging could be performed by CT or MRI, the use of conventional angiography could be reserved for particular cases.

Most patients with RCVS recovered completely within days [1,6]. Cases with minor disabilities were described in the literature [3,6] (visual field deficit, mild hemiparesis). Fulminant

vasoconstriction resulting in progressive symptoms or death, as our 2 cases, has been reported in exceptional frequency [38]. Physicians had to remember that such evolution could happen and to identify all factors of poor prognosis (neurological status at admission, the presence of intraparenchymal abnormalities).

There was no specific treatment established for RCVS even if a lot of vasodilator treatments have been tried. Calcium channel blockers such as nimodipine [1–3,6], magnesium [5–9], and steroids have been used without clear benefit. Balloon angioplasty has been used in patients with progressive neurological deficit secondary to ischemic stroke [6]. Progressive clinical improvement occurs in most patients however; some patients could keep long-term deficits for which specific therapy is extremely useful.

5. Conclusion

Reversible cerebral vasoconstriction syndrome is more frequent than previously thought. Our results highlight that RCVS could present a catastrophic neurological evolution and also they emphasize the need of considering the presence of parenchymal abnormalities at admission as an independent prognostic factor. Our study is limited by its retrospective nature and by the small number of patients. Larger series, even if it is difficult to conduct regarding the rarity of the pathology, will permit to determine which treatment could prevent poor outcomes.

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