Case Report

Reversible Cerebral Vasoconstriction Syndrome: A Report on Three Cases

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Reversible cerebral vasoconstriction syndrome (RCVS), a recently recognized syndrome, is defined as an intermittent segmental vasospasm of cerebral arteries accompanied by thunderclap headache. The major complications of RCVS include ischemic or hemorrhagic stroke, which may cause morbidity and mortality. It is important to detect RCVS in clinical practice because misdiagnosis may lead to inappropriate treatment. In Thailand, there are only two reported cases of RCVS, which may reflect an underdiagnosis of this syndrome. To raise awareness of RCVS, we reported a case series of three RCVS cases. Two of the presented cases had interesting precipitating factors, and two cases had an unusual delayed clinical course.

Keywords: *Reversible cerebral vasoconstriction syndrome, Thunderclap headache, Herbal supplements, Biologically fermented juice*

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Reversible cerebral vasoconstriction syndrome (RCVS) is a clinico-radiological syndrome characterized by recurrent thunderclap headache with or without neurological deficits and transient constriction of cerebral arteries that resolve within three months[1,2]. Thunderclap headache, usually described as the "worst headache ever", is the normal initial presentation of RCVS[2-4]. It is characterized by focal or diffuse sudden severe headache, reaching a peak of maximum severity within a few seconds or minutes[1,5,6]. Reversible cerebral vasoconstriction shown by vascular imaging may be complicated by ischemic or hemorrhagic stroke[4,6]. Early recognition of the syndrome is very important, because RCVS may cause neurological complications, and misdiagnosis as primary angiitis of the central nervous system (PACNS) may contribute to an unnecessary brain biopsy and immunosuppressive therapy. RCVS has been widely recognized in the past decade, as reflected by increasing publications in the literature; nevertheless, there are only two reports of RCVS in Thailand[7,8]. Given the importance of RCVS in clinical practice, we present three RCVS cases from a tertiary care center. Two of the presented cases had interesting precipitating factors, and two cases had an unusual delayed clinical course. Written informed consents were obtained from all reported patients for publication of the present case reports and accompanying images.

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Case Report

Case 1

A 50-year-old Thai female presented with thunderclap headache in the right frontal area while she was getting out of bed at 2 a.m. The headache lasted three hours and the pain was alleviated by one tablet of paracetamol. She woke up in the morning with a mild headache that lasted throughout the day. Two days later, while she was talking with a colleague, she had a recurrent thunderclap headache in the right frontal area and was admitted to a private hospital. On examination, her blood pressure was 180/100 mmHg. Neurological examinations were normal. Non-contrasted computed tomography (NCCT) of the brain on the second day after the initial headache revealed cortical subarachnoid hemorrhage (cSAH) in the right superior frontal sulcus (Fig. 1). Magnetic resonance angiography (MRA) of the brain on the sixth day after the initial headache revealed multifocal segmental narrowing of the bilateral middle cerebral arteries (MCAs), the left

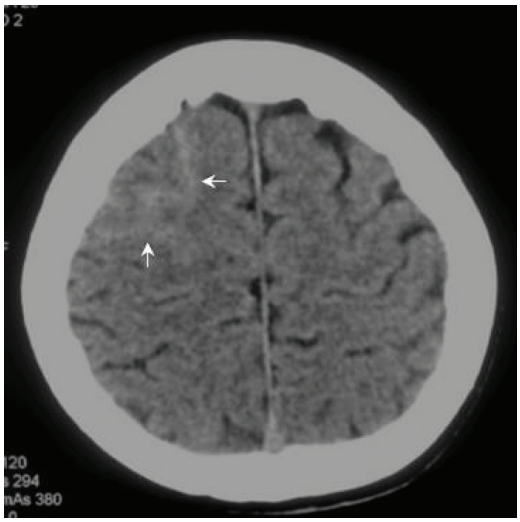

Fig. 1 An axial non-contrasted CT scan of the brain on day 2 after the initial headache, obtained from case 1, shows a linear sulcal hyperdensity in the right superior frontal sulcus (white arrows), which is consistent with cortical subarachnoid hemorrhage.

anterior cerebral artery (ACA), and the right posterior cerebral artery (PCA). During the week after her admission, she was treated with oral analgesic drugs for her constant mild headache. However, the headache persisted and she was referred to King Chulalongkorn Memorial Hospital (KCMH). She had no underlying disease and did not take any other medication.

On examination, she was normotensive with a normal neurological examination. Digital subtraction angiography (DSA) of the brain was done on the ninth day after the initial headache and showed mild to moderate multiple segmental vascular narrowing involving A3-A5 branches of bilateral ACAs, M2-M4 branches of the right MCA, and P2-P4 branches of bilateral PCAs, without evidence of intracranial aneurysm. Transcranial Doppler ultrasound (TCD) on the tenth day after the initial headache showed high-flow velocities in the bilateral MCAs, with a mean flow velocity (V_{MCA}) of 100 to 108 cm/second (the normal mean flow velocity of the MCA is less than 80 cm/second)[9]. RCVS was diagnosed and nimodipine was prescribed at 240 mg/day for three months. The headache subsided within the first month of the treatment. However, a follow-up computed tomography angiography (CTA) of the brain during this period revealed a new multifocal caliber narrowing of the MCA bilaterally. Unfortunately, at the end of the third month, the patient developed a diffuse mild to moderate headache again. Follow-up TCD revealed high-flow velocities in bilateral MCAs and ACAs. Nimodipine was prescribed at 240 mg/day until TCD showed normal flow velocity of all affected vessels, and follow-up CTA showed a complete resolution of cerebral vasoconstriction at 6-month.

Case 2

A 35-year-old Thai female had an episode of thunderclap headache localized around the vertex area while she was taking a shower 10 days prior to admission at KCMH. Two recurrent thunderclap headaches occurred on the second and fifth day after the initial headache. The headaches were accompanied by nausea and vomiting, and each attack lasted three hours. She was admitted to a private hospital on the first day of thunderclap headache, and neurological examination was normal. The initial NCCT showed cSAH along cerebral sulci in the left frontal lobe, and magnetic resonance imaging (MRI) of the brain on the third day after the initial headache showed cSAH in the left frontal region. The MRA of the brain revealed multiple subtle vascular irregularities in MCA, PCA, and superior cerebellar artery (SCA) branches. She was treated with intravenous analgesic and was pain-free during the episode of thunderclap headache. She had drunk biologically fermented juice such as fermented star fruit juice, fermented *Tinospora crispa* juice, and fermented mangosteen juice for three weeks before the development of the headache.

On initial examination at KCMH, she was normotensive, and neurological examination findings were normal. The DSA of the brain was done on the tenth day after the initial headache and showed multifocal narrowing of distal intracranial branches involving M2, M3, and M4 of the left MCA, M3 and M4 of the right MCA, and A2-A5 of bilateral ACAs and bilateral SCAs, with no evidence of outpouching vascular lesion. The TCD on the fifteenth day after the initial headache showed normal flow velocity in the right MCA. One day later, TCD showed increasing flow velocities in the right MCA branches (Fig. 2). During her hospitalization, she had an intermittent mild intensity headache at the vertex area. RCVS was diagnosed and she was treated with nimodipine at 240 mg/day. She was advised to stop taking any biologically fermented juice. Thereafter, her headache subsided within a few days, and she never had thunderclap headache again, even when taking a shower. The 3-month follow-up MRA showed new focal segmental vasoconstriction at bilateral ACAs

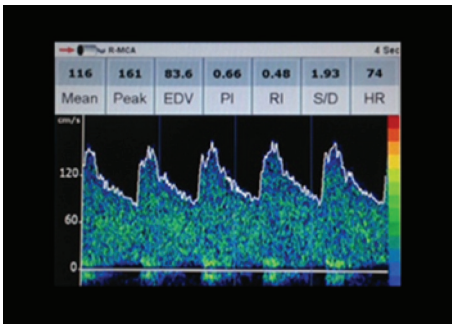

Fig. 2 Transcranial Doppler ultrasound (TCD) waveform on day 16 after the initial headache, obtained from case 2 demonstrates elevated right middle cerebral artery flow velocity. The mean flow velocity was 116 cm/second at a depth of 60 mm.

and the M2 branch of the left MCA, with subsequent resolution of the right MCA vasoconstriction. Nimodipine was prescribed at 240 mg/day until all intracranial vessels appeared normal on follow-up MRA of the brain at 6-month.

Case 3

A 53-year-old Thai female presented with diffused thunderclap headache predominant at bi-temporal regions occurred while she was driving 17 days prior to admission at KCMH. She did not have nausea or vomiting. At that time, she was admitted to a private hospital. The physical and neurological examination findings were unremarkable. The NCCT, MRI, MRA, magnetic resonance venography (MRV) of the brain, and lumbar puncture (LP) on the first day of the initial headache were normal. The pain lasted for a few hours and was alleviated by intravenous analgesic. One day later, the headache improved and she was discharged from the hospital with a mild headache. Four hours after being discharged, she had a recurrent thunderclap headache and was readmitted at the same hospital.

On examination, her blood pressure was slightly elevated at 145/90 mmHg. Neurological examination findings were normal. The MRI and MRV of the brain were repeated, with normal findings on the third day after the initial headache. After intravenous analgesic every 8 to 12 hours, the headache improved again. During the first week after admission, she had only a mild headache. However, on the seventh day after initial symptoms, the headache worsened, persisted all day, and was not relieved by any analgesic. She developed progressive deterioration of consciousness within two days. NCCT of the brain on the ninth day after the initial headache revealed intracerebral hemorrhage (ICH) in the right frontal lobe (Fig. 3A). A craniotomy with clot removal was performed. Pathology of the brain tissue was negative for inflammatory change including vasculitis. Three days after the craniotomy, she developed asymmetrical paraparesis, with the left side more affected, and MRI and MRA of the brain were repeated. New bilateral small infarctions in parasagittal area and wedge-shaped infarct in the left parietal lobe were detected (Fig. 3B). The MRA of the brain on the twelfth day after the initial headache demonstrated diffuse irregularity, with multifocal moderate to severe stenosis of intracranial arteries (Fig. 4A).

Laboratory investigations for vasculitis including antinuclear antibody (ANA), anti-double stranded DNA (anti-dsDNA), anti-Smith (anti-Sm), venereal disease research laboratory (VDRL), anti-nuclear ribonucleoprotein (anti-nRNP), anti-Sjögren's syndrome antigen A (anti-SSA), anti-Sjögren's syndrome antigen B (anti-SSB), C3 complement, and C4 complement were all unremarkable. Erythrocyte sedimentation rate (ESR) was 85 mm/hour (normal range 0-15 mm/hour) and C-reactive protein (CRP) was 12.85 mg/L (normal range <3 mg/L). Pulse methylprednisolone, dexamethasone, nimodipine, and cyclophosphamide were prescribed for three days and she was referred to KCMH. She had no underlying

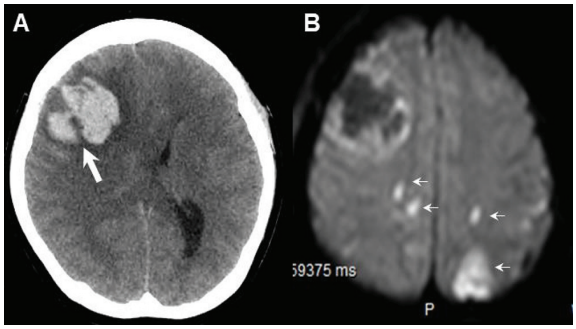

Fig. 3 Case 3 with lobar intracerebral hemorrhage and ischemic infarcts. (A) Axial non-contrasted CT scan of the brain obtained on day 9 after the initial headache demonstrates lobar intracerebral hemorrhage in the right frontal lobe (white arrow). (B) Axial diffusion-weighted image (DWI) on day 12 after the initial headache shows several small foci of diffusion restriction in bilateral parasagittal area and a larger wedge-shaped diffusion-restricted lesion involving both the cortical and subcortical area of the left parietal lobe, representing acute/subacute ischemic infarctions (white arrows).

disease but took many vitamins and supplements including vitamin C, vitamin B, shark oil, calcium, coenzyme Q10, melatonin, Banner protein capsules composed of 18 amino acids, senokot, Nutrilite® supplements, Thai herbal medicine including Curcuma longa capsule, Ya-Khiaw, and Indian herbal medicine including Symphytum officinale 200 CK.

The examination at KCMH revealed a blood pressure of 116/80 mmHg. She was drowsy and had triparesis. Motor power at the left upper extremity was grade 4/5 (MRC), at the left lower extremity was grade 1/5 (MRC), and at the right lower extremity was grade 2/5 (MRC). The MRA and MRI of the brain on the nineteenth day after the initial headache showed mild focal narrowing of the M1 segment of the left MCA, irregular contour of both ACAs, and the infarcts remained unchanged. The RCVS was diagnosed and nimodipine was initially prescribed at 30 mg orally every four hours. However, she became hypotensive after taking three doses of nimodipine, and nimodipine was withdrawn. Pulse methylprednisolone, dexamethasone, and cyclophosphamide were discontinued. The TCD on the eighteenth day after initial headache showed elevated flow velocity in the right MCA with a V_{MCA} of 89 to 101 cm/second. On the twenty-ninth day after her initial headache, MRA showed some reversal of narrowing segments of the cerebral vessels, and all of the narrowing segments of the cerebral vessels returned to normal by the forty-eighth day after the initial headache (Fig. 4B).

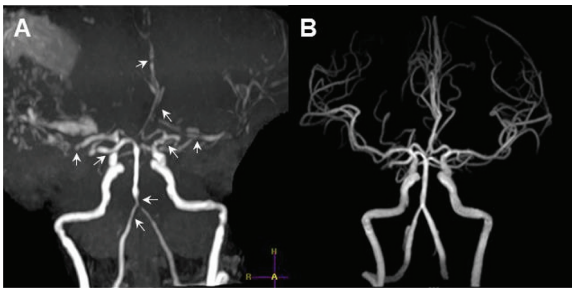

Fig. 4 Magnetic resonance angiography (MRA) of the brain, obtained from case 3, demonstrates a resolution of cerebral vasoconstriction. (A) MRA performed on day 12 after the initial headache shows diffuse irregularity with multifocal moderate to severe stenosis of intracranial arteries including bilateral supraclinoid ICAs, bilateral ACAs, bilateral MCAs, and vertebrobasilar junction (white arrows). (B) MRA on day 48 day after initial headache reveals complete resolution of vasoconstriction of all affected vessels.

Thirty-two days after admission to KCMH, the patient still had paraparesis and was transferred to a rehabilitation center.

Discussion

The RCVS is known as an increasingly common cause of thunderclap headache. Cheng et al recently reported that nearly half of the patients who present with thunderclap headache (45.8%) and sudden headache (45.2%) were ultimately diagnosed with RCVS[10]. In RCVS, the unique characteristic of thunderclap headache is the frequency of the attacks. Almost all RCVS patients (80-100%) had recurrent thunderclap headache, with a mean frequency of four attacks within four weeks[4,6,11-13]; whereas, 80% of patients with aneurysmal SAH merely had a single attack of thunderclap headache[14]. In addition, 50 to 75% of RCVS patients had a baseline mild headache between each attack of thunderclap headache[6,9,13]. All patients in the present series had multiple episodes of thunderclap headache, and the first and third case had mild headache between thunderclap headache occurrences.

Other clinical presentations of RCVS are focal neurological deficits and seizure. In a large series by Singhal et al, focal neurological deficits such as aphasia, hemiparesis, ataxia, and visual deficits were found in 43% of RCVS patients, and seizures were found in 17%[4]. Most neurological deficits are transient, but intracerebral hemorrhage or ischemic stroke can cause persistent deficit[4,6,15]. In the present series, persistent focal neurological deficit in the third case was a result of bilateral infarction in parasagittal area. She also had deterioration of consciousness from intracerebral hematoma.

Neurological examination of RCVS patients is usually normal on initial presentation. Neuroimaging such as NCCT, CTA, MRI, MRA, DSA, or high-resolution vessel wall MRI play major roles in the definite diagnosis of RCVS. Angiographic findings of RCVS patients typically manifest as a "strings and beads appearance", which is defined as alternating segmental arterial constriction and dilatation of intracranial and extracranial vasculatures on CTA, MRA, or DSA[1,16-18]. Initial angiographic evaluation can appear normal in up to 33% of patients within the first week due to the natural history of vasoconstriction[15]. The small distal arteries (the third or fourth order branch of cerebral arteries) are affected first, and are usually not visualized on angiography[19]. The large proximal arteries (the first or second order branch)

are subsequently affected and can be detected by angiography later on[6,15].

Angiographic findings for the first and second case in the present study showed complete resolution of vasoconstriction at the sixth month after clinical onset, which was beyond the normalization period proposed in diagnostic criteria for RCVS[1,2]. However, RCVS was diagnosed due to evidence of reversibility of vasoconstriction and improvement of the clinical syndrome. There are few papers reporting the delayed resolution of vasoconstriction at 6-month in RCVS[20,21]. From this evidence, we strongly believe that the timing of resolution of vasoconstriction is not limited to 12 weeks, and the duration of resolution of vasoconstriction in the diagnostic criteria should be extended.

The TCD is a noninvasive, less expensive tool to evaluate hemodynamic properties of medium to large cerebral arteries[22,23]. Serial TCD monitoring is a sensitive tool to detect hemodynamic changes of cerebral arteries and may be helpful in the diagnosis and treatment of RCVS as demonstrated in the second case of the present case series.

Apart from the vascular imaging findings, the neuroimaging obtained by NCCT or MRI includes cSAH, ICH, cerebral infarction, or reversible brain edema. Previous series reported that cSAH was found in 30 to 81% of RCVS patients[4,15,21] and usually appears within the first week of the initial headache[6,15]. ICH was found in 12 to 20% of patients and was mostly present with a single lobar hemorrhage, usually occurring within a week of the initial headache[4,6,15]. Cerebral infarctions can be found in 39% of RCVS cases and mainly occur in arterial watershed regions[1,4]. Generally, cerebral infarcts related to RCVS are found in the second week after the initial headache[4,6,12]. In the third week after the initial headache, 9 to 38% of RCVS cases may also face reversible brain edema in the posterior part of the cerebral hemisphere, which is consistent with posterior reversible encephalopathy syndrome (PRES)[4,12]. In the present series, the first and second cases had cSAH within one or two days after the initial headache, whereas the third case had lobar ICH and cerebral infarction in the second week after the initial headache, which were associated with subsequent neurological deficits.

The RCVS can spontaneously occur, or it can be secondary to precipitating factors[6,9,13]. Major precipitating factors are the postpartum period and vasoactive drugs[1,4,6]. Other precipitating factors that have been reported include bathing or showering[6,10,13,24], sexual activity (just before or at orgasm)[6,13,25], exertion[6,13], valsalva maneuver[13], emotion[6], bending[26], altitudinal change (cold weather)[7], catecholamine-secreting tumors[27], exposure to immunosuppressants[6,28], blood transfusion[29-31], extracranial or intracranial large artery disorders[6,32-34], head trauma[35-37], carotid endarterectomy[38,39], spontaneous intracranial hypotension[40], and consumption of herbal energy drinks[41,42]. Among these triggers, bathing or showering is a unique trigger that may precipitate RCVS[10,24]. Cheng et al recently reported that all patients with sudden or thunderclap headache who reported bathing as a trigger were diagnosed with RCVS (100%, n = 6)[10]. Wang et al also reported that 62% of patients with bath-related thunderclap headache had evidence of RCVS[24].

In the second case of the present series, the precipitating factor might be related to showering. In addition, this patient had a history of drinking biologically fermented juice, which may be another precipitating factor of RCVS. However, there are no published reports regarding this issue. Theoretically, fermented fruit or fermented vegetables contain excess tyramine, a monoamine product that acts as a catecholamine-releasing agent, may cause systemic as well as intracranial vasoconstriction[43-45]. In the third case, the patient took various supplements such as vitamins and herbal medicine. Two previous case reports demonstrated that cerebral vasculopathy and stroke occurred after consuming an herbal energy drink that contained a sympathomimetic component[41,42]. Accordingly, herbal medicine may be related to RCVS in the third case. Indeed, definite cause relate between biologically fermented juice, herbal supplement, and RCVS cannot be established based on case reports; however, these findings might be of interest for future studies.

Incidence and prevalence of RCVS have not been established at the time of the present report. However, this syndrome usually affects females more commonly than males, and age of onset is around 42 years[4,6,11,12]. All of the patients in the present series were females aged 35 to 53 years, which is consistent with the epidemiological data from the previous studies.

At the time of the present study, a randomized control trial for specific treatment of RCVS has not been established. Calcium channel blockers such as nimodipine[46], verapamil[47], and magnesium sulfate[32,48] have been used for reducing the intensity and frequency of the headache but did not substantially improve the

outcome[4]. Glucocorticoid seems to be ineffective for preventing clinical deterioration; furthermore, it relates to poor outcome[4]. In the present series, after removing precipitating factors and calcium channel blocker treatment, the clinical features improved and angiographic findings returned to normal. The majority of RCVS patients have a good prognosis and outcome. Headache and angiographic findings of most RCVS patients spontaneously resolve without residual deficit within three months. The fatality rate was less than 1%[11]. However, sequential stroke, including intracerebral hemorrhage or ischemic stroke, may cause permanent deficit.

Recurrence of RCVS can occur after the first attack. A long-term follow-up study from Chen et al demonstrated that 5% of RCVS patients had recurrences of RCVS from six months to seven years after the initial diagnosis of RCVS[49]. In the present study, at the third month, the first case had recurrent mild to moderate headache with increasing flow velocity of bilateral MCAs and ACAs detected by TCD, and the second case had evidence of new vasoconstriction. However, we cannot conclude that they had recurrences of RCVS, due to a lack of evidence of complete resolution of vasoconstriction before the recurrence of symptoms. This dynamic change could be counted as part of the first bout even beyond 12 weeks.

The clinical picture of a thunderclap headache and features of vascular imaging suggest two important differential diagnoses, i.e., aneurysmal SAH and PACNS. Aneurysmal SAH usually has a single attack of thunderclap headache with clinical syndromes of meningeal irritation and increased intracranial pressure[14,50,51]. The CSF typically shows evidence of subarachnoid hemorrhage[52]. Furthermore, vasoconstrictions secondary to aneurysmal SAH typically present around the area of aneurysmal rupture[1,21]. In PACNS, the headache is often characterized by insidious onset and a slowly progressive course[19,53]. The CSF analysis in PACNS typically reveals an aseptic meningitis profile[53], in contrast to a normal to near-normal CSF profile in RCVS[1,2,4,21]. The MRI and MRA of the brain in PACNS typically demonstrate various ages of multifocal infarcts with persistent or progressive intracranial arterial narrowing[19,54]. Additionally, high-resolution vessel wall MRI in PACNS generally shows vessel wall enhancement due to the inflammatory nature of the underlying pathology[55,56]. In cases with equivocal diagnosis, a brain biopsy that shows evidence of inflammation of small and medium vessels may be an appropriate diagnostic test[53]. The ESR and CRP in RCVS are usually normal, whereas elevated ESR has been reported in 22.4% of PACNS cases[4,11,53,57,58]. The elevated ESR and CRP in the third case of the present study may be related to inflammatory response after craniotomy[59,60].

In conclusion, RCVS is a common disease and should be detected in patients who present with recurrent thunderclap headache. Initial vascular neuroimaging in the first few days can be normal, and serial imaging is helpful for diagnosis. Discontinuation of precipitating factors plays a major role in the treatment, and calcium channel blockers can be used for reducing pain intensity and frequency. Corticosteroid treatment is not recommended for treatment of RCVS due to its ineffectiveness and the possibility of leading to a poor outcome.

What is already known on this topic?

RCVS is a clinico-pathologic syndrome, which is defined as intermittent cerebral vasospasm with thunderclap headache. Most of the signs and symptoms of RCVS usually resolve spontaneously within 3 months. The RCVS was recently recognized in the past decade; however, only two cases have been reported in Thailand.

What this study adds?

The present study reported the clinical history, radiographic findings, treatment, and outcome of three RCVS cases. Two cases in this series had interesting precipitating factors, including herbal supplements and biologically fermented juice, which are widely used in Thailand. Moreover, two of three cases had an unusual delayed course. Therefore, the present case series may reflect a broad spectrum of precipitating factors and natural history of RCVS.

Potential conflicts of interest

None.

References

1. Calabrese LH, Dodick DW, Schwedt TJ, Singhal AB. Narrative review: reversible cerebral vasoconstriction syndromes. Ann Intern Med 2007; 146: 34-44.
2. Ducros A. Reversible cerebral vasoconstriction syndrome. Handb Clin Neurol 2014; 121: 1725-41.
3. Mehdi A, Hajj-Ali RA. Reversible cerebral vasoconstriction syndrome: a comprehensive update. Curr Pain Headache Rep 2014; 18: 443.

4. Singhal AB, Hajj-Ali RA, Topcuoglu MA, Fok J, Bena J, Yang D, et al. Reversible cerebral vasoconstriction syndromes: analysis of 139 cases. Arch Neurol 2011; 68: 1005-12.
5. Dodick DW. Thunderclap headache. J Neurol Neurosurg Psychiatry 2002; 72: 6-11.
6. Ducros A, Boukobza M, Porcher R, Sarov M, Valade D, Bousser MG. The clinical and radiological spectrum of reversible cerebral vasoconstriction syndrome. A prospective series of 67 patients. Brain 2007; 130: 3091-101.
7. Tienviboon C, Punyagupta S, Pongtarakulpanit A, Prichanond S. Reversible cerebral vasoconstriction syndrome with increased intracranial pressure, probably related to altitude changes and windy winter travelling. J Med Assoc Thai 2011; 94: 622-8.
8. Roongpiboonsopit D, Chutinet A, Suwanwela NC. Interesting case. Bull Thai Stroke Soc 2013; 12: 27-35.
9. Chen SP, Fuh JL, Chang FC, Lirng JF, Shia BC, Wang SJ. Transcranial color doppler study for reversible cerebral vasoconstriction syndromes. Ann Neurol 2008; 63: 751-7.
10. Cheng YC, Kuo KH, Lai TH. A common cause of sudden and thunderclap headaches: reversible cerebral vasoconstriction syndrome. J Headache Pain 2014; 15: 13.
11. Ducros A. Reversible cerebral vasoconstriction syndrome. Lancet Neurol 2012; 11: 906-17.
12. Chen SP, Fuh JL, Wang SJ, Chang FC, Lirng JF, Fang YC, et al. Magnetic resonance angiography in reversible cerebral vasoconstriction syndromes. Ann Neurol 2010; 67: 648-56.
13. Chen SP, Fuh JL, Lirng JF, Chang FC, Wang SJ. Recurrent primary thunderclap headache and benign CNS angiopathy: spectra of the same disorder? Neurology 2006; 67: 2164-9.
14. Muehlschlegel S, Kursun O, Topcuoglu MA, Fok J, Singhal AB. Differentiating reversible cerebral vasoconstriction syndrome with subarachnoid hemorrhage from other causes of subarachnoid hemorrhage. JAMA Neurol 2013; 70: 1254-60.
15. Ducros A, Fiedler U, Porcher R, Boukobza M, Stapf C, Bousser MG. Hemorrhagic manifestations of reversible cerebral vasoconstriction syndrome: frequency, features, and risk factors. Stroke 2010; 41: 2505-11.
16. Melki E, Denier C, Theaudin-Saliou M, Sachet M, Ducreux D, Saliou G. External carotid artery branches involvement in reversible cerebral vasoconstriction syndrome. J Neurol Sci 2012; 313: 46-7.
17. Shaik S, Chhetri SK, Roberts G, Wuppalapati S, Emsley HC. Reversible cerebral vasoconstriction syndrome with involvement of external carotid artery branches. Neurohospitalist 2014; 4: 141-3.
18. Kushkuley J, Feroze AH, Choudhri OA. Diffuse intracranial and extracranial vascular involvement in reversible cerebral vasoconstriction syndrome. Clin Neuroradiol 2015; 25: 301-4.
19. Ducros A, Bousser MG. Reversible cerebral vasoconstriction syndrome. Pract Neurol 2009; 9: 256-67.
20. Quartuccio L, Tuniz F, Petralia B, Zanotti B, Skrap M, Vita SD. Delayed positivization of cerebral angiography in reversible cerebral vasoconstriction syndrome (RCVS) presenting with recurrent subarachnoid haemorrhage. Open Rheumatol J 2012; 6: 175-9.
21. Ansari SA, Rath TJ, Gandhi D. Reversible cerebral vasoconstriction syndromes presenting with subarachnoid hemorrhage: a case series. J Neurointerv Surg 2011; 3: 272-8.
22. Aaslid R. Transcranial Doppler assessment of cerebral vasospasm. Eur J Ultrasound 2002; 16: 3-10.
23. Aaslid R, Huber P, Nornes H. Evaluation of cerebrovascular spasm with transcranial Doppler ultrasound. J Neurosurg 1984; 60: 37-41.
24. Wang SJ, Fuh JL, Wu ZA, Chen SP, Lirng JF. Bath-related thunderclap headache: a study of 21 consecutive patients. Cephalalgia 2008; 28: 524-30.
25. Hu CM, Lin YJ, Fan YK, Chen SP, Lai TH. Isolated thunderclap headache during sex: Orgasmic headache or reversible cerebral vasoconstriction syndrome? J Clin Neurosci 2010; 17: 1349-51.
26. Headache Classification Committee of the International Headache Society (IHS). The International Classification of Headache Disorders, 3rd edition (beta version). Cephalalgia 2013; 33: 629-808.
27. Razavi M, Bendixen B, Maley JE, Shoaib M, Zargarian M, Razavi B, et al. CNS pseudovasculitis in a patient with pheochromocytoma. Neurology 1999; 52: 1088-90.
28. Doss-Esper CE, Singhal AB, Smith MS, Henderson GV. Reversible posterior leukoencephalopathy, cerebral vasoconstriction, and strokes after intravenous immune globulin therapy in guillain-barre

syndrome. J Neuroimaging 2005; 15: 188-92.
29. Liang H, Xu Z, Zheng Z, Lou H, Yue W. Reversible cerebral vasoconstriction syndrome following red blood cells transfusion: a case series of 7 patients. Orphanet J Rare Dis 2015; 10: 47.
30. Dou YH, Fuh JL, Chen SP, Wang SJ. Reversible cerebral vasoconstriction syndrome after blood transfusion. Headache 2014; 54: 736-44.
31. Boughammoura A, Touze E, Oppenheim C, Trystram D, Mas JL. Reversible angiopathy and encephalopathy after blood transfusion. J Neurol 2003; 250: 116-8.
32. Singhal AB. Postpartum angiopathy with reversible posterior leukoencephalopathy. Arch Neurol 2004; 61: 411-6.
33. Field DK, Kleinig TJ, Thompson PD, Kimber TE. Reversible cerebral vasoconstriction, internal carotid artery dissection and renal artery stenosis. Cephalalgia 2010; 30: 983-6.
34. Mawet J, Boukobza M, Franc J, Sarov M, Arnold M, Bousser MG, et al. Reversible cerebral vasoconstriction syndrome and cervical artery dissection in 20 patients. Neurology 2013; 81: 821-4.
35. Wilkins RH, Odom GL. Intracranial arterial spasm associated with craniocerebral trauma. J Neurosurg 1970; 32: 626-33.
36. Suwanwela C, Suwanwela N. Intracranial arterial narrowing and spasm in acute head injury. J Neurosurg 1972; 36: 314-23.
37. Lee JH, Martin NA, Alsina G, McArthur DL, Zaucha K, Hovda DA, et al. Hemodynamically significant cerebral vasospasm and outcome after head injury: a prospective study. J Neurosurg 1997; 87: 221-33.
38. Lopez-Valdes E, Chang HM, Pessin MS, Caplan LR. Cerebral vasoconstriction after carotid surgery. Neurology 1997; 49: 303-4.
39. Rosenbloom MH, Singhal AB. CT angiography and diffusion-perfusion MR imaging in a patient with ipsilateral reversible cerebral vasoconstriction after carotid endarterectomy. AJNR Am J Neuroradiol 2007; 28: 920-2.
40. Schievink WI, Maya MM, Chow W, Louy C. Reversible cerebral vasoconstriction in spontaneous intracranial hypotension. Headache 2007; 47: 284-7.
41. Worrall BB, Phillips CD, Henderson KK. Herbal energy drinks, phenylpropanoid compounds, and cerebral vasculopathy. Neurology 2005; 65: 1137-8.
42. Samanta D. Reversible cerebral vasoconstriction syndrome: another health hazard of energy drinks? Clin Pediatr (Phila) 2015; 54: 186-7.
43. Marin J, Salaices M, Sanchez CF, Conde MV, Gomez B, Lluch S. Vasoconstrictor effects of tyramine and noradrenaline on goat brain vessels. Gen Pharmacol 1981; 12: 187-91.
44. Naila A, Flint S, Fletcher G, Bremer P, Meerdink G. Control of biogenic amines in food--existing and emerging approaches. J Food Sci 2010; 75: R139-R150.
45. Praman S, Mulvany MJ, Williams DE, Andersen RJ, Jansakul C. Crude extract and purified components isolated from the stems of Tinospora crispa exhibit positive inotropic effects on the isolated left atrium of rats. J Ethnopharmacol 2013; 149: 123-32.
46. Lu SR, Liao YC, Fuh JL, Lirng JF, Wang SJ. Nimodipine for treatment of primary thunderclap headache. Neurology 2004; 62: 1414-6.
47. Theeler BJ, Krasnokutsky MV, Scott BR. Exertional reversible cerebral vasoconstriction responsive to verapamil. Neurol Sci 2010; 31: 773-5.
48. Chik Y, Hoesch RE, Lazaridis C, Weisman CJ, Llinas RH. A case of postpartum cerebral angiopathy with subarachnoid hemorrhage. Nat Rev Neurol 2009; 5: 512-6.
49. Chen SP, Fuh JL, Lirng JF, Wang YF, Wang SJ. Recurrence of reversible cerebral vasoconstriction syndrome: a long-term follow-up study. Neurology 2015; 84: 1552-8.
50. van Gijn J, Rinkel GJ. Subarachnoid haemorrhage: diagnosis, causes and management. Brain 2001; 124: 249-78.
51. Fontanarosa PB. Recognition of subarachnoid hemorrhage. Ann Emerg Med 1989; 18: 1199-205.
52. Vermeulen M, Hasan D, Blijenberg BG, Hijdra A, van Gijn J. Xanthochromia after subarachnoid haemorrhage needs no revisitation. J Neurol Neurosurg Psychiatry 1989; 52: 826-8.
53. Hajj-Ali RA, Singhal AB, Benseler S, Molloy E, Calabrese LH. Primary angiitis of the CNS. Lancet Neurol 2011; 10: 561-72.
54. Koopman K, Uyttenboogaart M, Luijckx GJ, De Keyser J, Vroomen PC. Pitfalls in the diagnosis of reversible cerebral vasoconstriction syndrome and primary angiitis of the central nervous system. Eur J Neurol 2007; 14: 1085-7.
55. Mandell DM, Matouk CC, Farb RI, Krings T, Agid R, terBrugge K, et al. Vessel wall MRI

to differentiate between reversible cerebral vasoconstriction syndrome and central nervous system vasculitis: preliminary results. Stroke 2012; 43: 860-2.
56. Obusez EC, Hui F, Hajj-Ali RA, Cerejo R, Calabrese LH, Hammad T, et al. High-resolution MRI vessel wall imaging: spatial and temporal patterns of reversible cerebral vasoconstriction syndrome and central nervous system vasculitis. AJNR Am J Neuroradiol 2014; 35: 1527-32.
57. Birnbaum J, Hellmann DB. Primary angiitis of the central nervous system. Arch Neurol 2009; 66: 704-9.
58. Salvarani C, Brown RD Jr, Calamia KT, Christianson TJ, Weigand SD, Miller DV, et al. Primary central nervous system vasculitis: analysis of 101 patients. Ann Neurol 2007; 62: 442-51.
59. Mirzayan MJ, Gharabaghi A, Samii M, Tatagiba M, Krauss JK, Rosahl SK. Response of C-reactive protein after craniotomy for microsurgery of intracranial tumors. Neurosurgery 2007; 60: 621-5.
60. Mirzayan MJ, Gharabaghi A, Samii M, Fromke C, Tatagiba M, Krauss JK, et al. The diagnostic value of erythrocyte sedimentation rate in management of brain tumors. Neurol Res 2009; 31: 514-7.

กลุ่มอาการหลอดเลือดสมองหดตัวชั่วคราว: รายงานผู้ป่วย 3 ราย

ดวงนภา รุ่งพิบูลโสภิษฐ์, กรรณิการ์ คงบุญเกียรติ, กัมมันต์ พันธุมจินดา

กลุ่มอาการหลอดเลือดสมองหดตัวชั่วคราวเป็นกลุ่มอาการที่พบการหดตัวของหลอดเลือดสมองชั่วคราวของหลอดเลือดสมองร่วมกับอาการปวดศีรษะอย่างรุนแรงฉับพลัน ภาวะแทรกซ้อนที่สำคัญประกอบด้วย ภาวะสมองขาดเลือดและการมีภาวะเลือดออกในสมอง ซึ่งอาจเป็นเหตุให้เกิดภาวะทุพพลภาพและเสียชีวิต การค้นหากลุ่มอาการหลอดเลือดสมองหดตัวชั่วคราวมีความสำคัญทางเวชปฏิบัติเนื่องจากหากวินิจฉัยผิดพลาดอาจนำไปสู่การส่งตรวจและการรักษาที่ไม่เหมาะสม สำหรับประเทศไทยมีรายงานกลุ่มอาการหลอดเลือดสมองหดตัวชั่วคราวเพียง 2 รายงาน ซึ่งสะท้อนให้เห็นว่ากลุ่มอาการนี้ยังไม่ได้รับการวินิจฉัยอย่างแพร่หลาย เพื่อให้กลุ่มอาการหลอดเลือดสมองหดตัวชั่วคราวเป็นที่ตระหนักมากขึ้น คณะผู้นิพนธ์จึงรายงานผู้ป่วยที่ได้รับการวินิจฉัยว่ามีกลุ่มอาการหลอดเลือดสมองหดตัวชั่วคราวจำนวน 3 ราย ในจำนวนนี้ผู้ป่วย 2 ราย มีปัจจัยกระตุ้นที่น่าสนใจ และผู้ป่วยอีก 2 ราย มีการดำเนินโรคที่นานผิดปกติ