The THAI Journal of SURGERY 2005; 26:60-64.
Official Publication of the Royal College of Surgeons of Thailand

Sturge-Weber Syndrome : A Case with Choroid Plexus Hemangioma

Pradit Chaiyabud, MD*
Sirirat Kittiwongsopon, MD**
Puripakorn Pakdirat, MD#

**Neurosurgery Unit, Department of Surgery, **Department of Radiology, #Department of Pathology, Ratchaburi Hospital, Ratchaburi, Thailand*

Abstract **Sturge-Weber syndrome (encephalotrigeminal angiomatosis) is an uncommon neurocutaneous disorder. Not many cases of this syndrome have been under the care of neurosurgeons. The syndrome is characterized principally by facial and leptomeningeal angiomas. Hemorrhage from intracranial angiomas in this syndrome is rare. In contrast, epilepsy occurred in nearly every published case. The only known indication for neurosurgical management is to control intractable seizures. This report describes a case of Sturge-Weber syndrome who presented with clinical subarachnoid hemorrhage. The angioma involving the choroid plexus, which was a probable cause of leakage, was demonstrated by computed tomography and surgical removal was performed. Histologic examination revealed a hemangioma of the cavernous type. The literature was reviewed.**

In 1879 Sturge[1] described a patient with a facial nevus flammeus who developed contralateral partial seizures and suggested a cortical vascular lesion as the epileptic source. Sturge's expectation was proved by Kalischer (1897) who demonstrated cortical angiomas in similar cases. Weber[2] in 1922 reported a radiographic finding of intracranial calcification associated with this condition and believed that the calcification was located in pial angiomas. In 1923, Dimitri described the characteristic double contoured (tramline) radiographic shadows in this syndrome. In 1934 Krabb[3] showed conclusively that the calcification was deposited in the second and third layers of cerebral cortex. Sturge-Weber syndrome (encephalotrigeminal angiomatosis) is one of the neurocutaneous disorders traditionally known as the fourth phakomatoses. Classic features of Sturge-Weber syndrome include facial port wine stain, contralateral seizure and ipsilateral cortical calcification. Principal pathology is angiomas involving both facial dermis and leptomeninges. The ocular choroid is another site commonly involved by angiomas resulting in glaucoma and buphthalmos.[4] Choroid plexus angioma in Sturge-Weber syndrome has seldom been reported in the literature.[5] Although intracranial angioma is the essential finding in Sturge-Weber syndrome, intracranial bleeding is rare.[4,6] We report a case of Sturge-Weber syndrome that had choroid plexus hemangioma as a probable cause of bleeding.

Correspondence address: *Pradit Chaiyabud, MD, Neurosurgery Unit, Department of Surgery, Ratchaburi Hospital, Ratchaburi, Thailand. E-mail: pradit815@yahoo.com*

Case Report

A 12-year-old child with port wine colored nevi located on the left side of his face (mainly in the distribution of the first division of trigeminal nerve) was admitted to our service. (Figure 1) He had a normal intellectual level. From two years of age, he had suffered from occasional partial motor seizure on the right side. There was no family history of a similar disorder. Three days before this admission, he had complained of a sudden severe headache and frequent vomiting and he was treated in a local hospital. On the day of admission, he had a brief period of unconsciousness with decerebrate posturing and opisthotonus. After regaining consciousness, he remained drowsy. Physical examination showed low grade fever, nuchal rigidity and early papilledema. Skull radiography showed no abnormal calcification. Computerized tomography demonstrated calvarial hemiatrophy, mild atrophy of parietal, temporal and occipital lobes, occipital gyral calcification, enlargement and increased enhancement of the glomus of the choroid plexus with prominent subependymal veins on the left side. (Figure 2) The patient was considered to have Sturge-Weber syndrome with choroid plexus angioma and was suffering from subarachnoid hemorrhage. Operation aimed at removal of choroid plexus angioma was performed on the 12th day of admission. At the time of left parieto-occipital craniotomy, findings included cloudy and thickened arachnoid membrane, and numerous tortuous dilated vessels over the atrophic parieto-occipital cortex. Large abnormal vessels were obliterated by cauterization. The trigone of the lateral ventricle was then approached by superior parietal occipital incision and a cerebrospinal fluid sample was collected. After that, a well circumscribed, dark red, grape-like mass (two centimeter in diameter) was removed from the glomus. Ventricular CSF examination revealed xanthochromic fluid containing 15 erythrocytes per cubic millimeter and 65 milligram of protein per deciliter (normal ventricular CSF protein is 6-12 mg/dl). Light microscopic examination showed a vascular tumor with dilated, blood-filled lumina. Walls were lined with flattened epithelium. There was little intervening

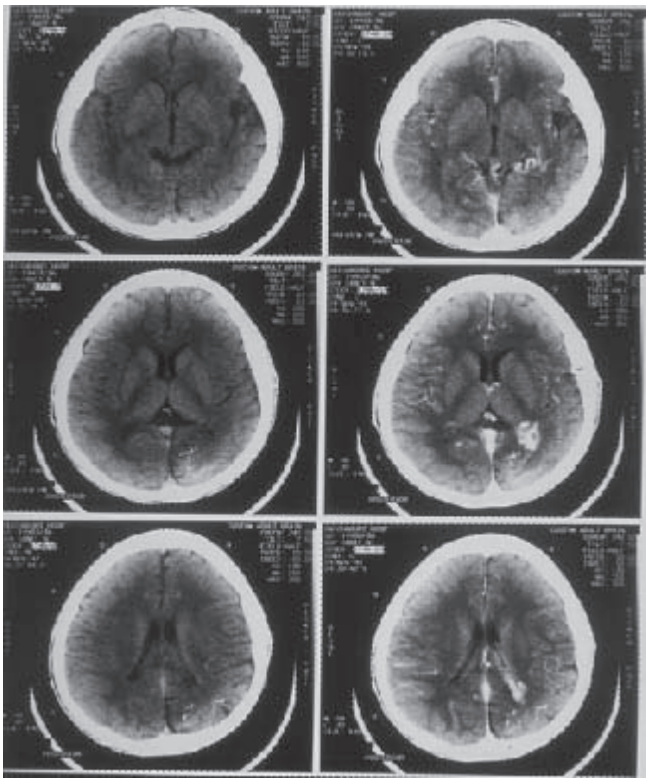

Fig. 2 Computerized tomography (left-plain CT, right-contrast CT) demonstrated calvarial hemiatrophy, atrophy of parietal, temporal and occipital lobes, occipital gyral calcification, enlargement and increased enhancement of the glomus of the choroid plexus with prominent subependymal veins on the left side.

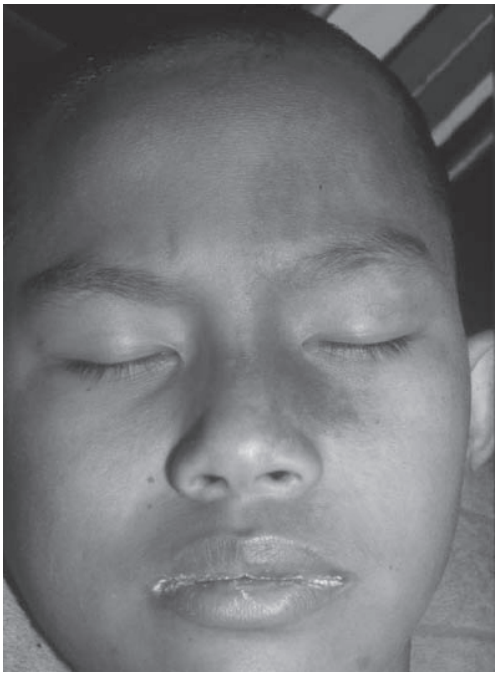

Fig. 1 Facial port wine nevus located on the left side of the face, mainly in the distribution of the first division of trigeminal nerve.

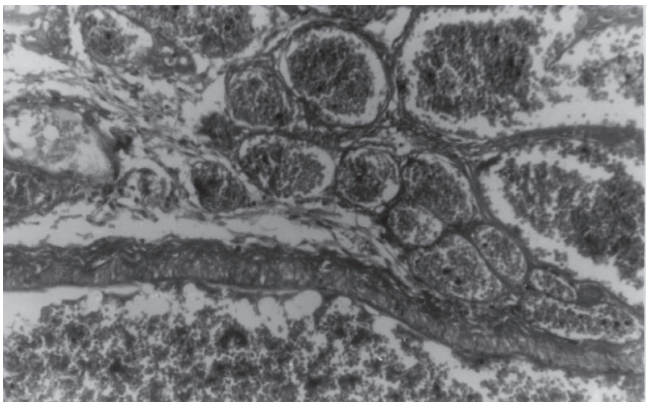

Fig. 3 Light microscopy showed a vascular mass with dilated, blood-filled lumina. There was little intervascular tissue.

intervascular tissue. Calcification was round in shape and intravascular. The histologic diagnosis was cavernous hemangioma with calcospherules. (Figure 3) The patient was discharged from the hospital without complications and he was free of symptoms during the 8-month follow-up period.

Discussion

Sturge[1] originally described the syndrome as consisting of facial port wine nevus associated with partial epilepsy and buphthalmos. Basic pathology of Sturge-Weber syndrome is angioma involving a few essential areas (facial dermis, leptomeninges and ocular choroid). Alexander, referring to Streeter's embryologic studies, suggested that pathogenesis of Sturge-Weber syndrome was due to vascular anomalies occurring during Streeter's third stage of cerebral vascularization at 4th to 8th weeks of gestation. At this early stage, the ectoderm that is to form the forehead skin lies directly over the part of the neural tube destined to form the posterior part (occipital lobe) of the cerebral hemisphere[7]. Based on new knowledge about cephalic embryogenesis, Enjolras[8] proposed a new hypothesis that a morphogenetic error, arising in a limited part of the cephalic neural crest could explain the syndrome. It is noteworthy that the three involved areas of the Sturge-Weber syndrome (i.e. facial dermis, leptomeninges and ocular choroid) are all mesenchymal derivatives of the neurectodermal germ layer, called the mesectoderm (the term ectomesenchyme is synonymous).[9,10] Sturge-Weber syndrome is also classified in the category of phakomatoses because both the skin and the nervous system are involved. Most phakomatoses are inherited, but not Sturge-Weber syndrome. The syndrome is usually sporadic in occurrence.[11] Recently it has been proposed that several sporadic syndromes are due to the action of an autosomal dominant lethal gene surviving by mosaicism.[11] The disorders cannot be transmitted to another individual because the underlying gene, when present in the zygote, leads to death of the embryo in an early stage of development. Cell bearing the mutation can survive only in a mosaic state, in close proximity with normal cells. A port wine nevus (nevus flammeus) is a dermal capillary hemangioma, and by definition, it is present at birth and remains fairly static in its extent. Involvement of the ophthalmic trigeminal area by port wine stains carries the risk of Sturge-Weber syndrome.[8] Ocular abnormalities due to choroidal angioma (glaucoma and buphthalmos) are found in approximately 30-40% of patients with this syndrome.[12] The risk of ocular problems is highest in patients with both ophthalmic and maxillary involvement by port wine lesions.[8,13] In our case, there was port wine stain overspread mainly on the ophthalmic area and over only a very small part of the maxillary area. No ocular abnormality was detected in this case. Ipsilateral to the facial nevus, abnormal leptomeningeal venous plexi are most commonly located over the posterior part of the cerebrum.[14] These vessels are nonfunctional because of their greatly delayed and prolonged filling. Anoxia and impairment of metabolism due to stasis might well be able to produce regional sclerotic atrophy with calcification in the cortical layers.[15,16] As the choroid plexus is a rich network of blood vessels of the pia mater (part of leptomeninges) which projects into each ventricular cavity, leptomeningeal angiomatosis might affect the choroid plexus as well. Choroid plexus hemangioma in Sturge-Weber syndrome has been previously reported in the literature.[5] Although subarachnoid hemorrhage in Sturge-Weber syndrome was noted in 1906 by Cushing but the first to prove subarachnoid hemorrhage with this entity was Anderson[6] in 1974. It is a very rare episode. Clinical findings (sudden severe headache, vomiting, brief loss of consciousness, nuchal rigidity and papilledema) along with operative and laboratory findings (xanthochromic ventricular CSF with erythrocyte and high protein content) in our case indicated that the patient had subarachnoid hemorrhage as a result of

leakage from choroid plexus hemangioma. Sturge-Weber syndrome produces a variety of characteristic changes in diagnostic imaging. The classic radiographic features (tramline gyral calcification) of this syndrome as seen on plain skull radiographs are relatively late since calcification is slight in infancy, gradually becoming denser until the maximum degree is attained probably by the second decade.[14,17] It is rare to show cortical calcification in plain radiography within the first year, and only 50-60% of patients by the age of 20 years demonstrate them on radiographs.[13,18,19] Relatively few cases of this syndrome have been studied by means of cerebral angiography. A localized increase in the size and number of veins and large capillaries (venous angioma and telangiectases) has been considered typical angiographic findings in Sturge-Weber syndrome. That only 24% of the cases are found by cerebral angiography might be explained by the slow circulation in the angiomatous area.[15,16]

Diagnostic imaging in Sturge-Weber syndrome is now based on computerized tomographic and magnetic resonance evaluation. Imaging findings include cortical calcification, cerebral lobar atrophy, calvarial hemiatrophy, prominent deep venous systems and choroid plexus enlargement.[20-22] Computerized tomography has the advantage of earlier and more precise detection of cortical calcification. Magnetic resonance imaging more sensitively demonstrates gray and white matter abnormalities and engorgement of the deep venous system.[23,24] Sturge-Weber syndrome produces major neurological problems such as epilepsy, sensorimotor deficits and intellectual deterioration. Since the syndrome is relatively rare and few neurosurgeons will encounter several examples during their professional life, so the best line of treatment still has not been developed. Surgical management is seldom, and only reluctantly, performed in various stages of the syndrome, mostly as a desperate attempt to control intractable seizures.[25,26] The basic abnormality in Sturge-Weber syndrome is non-function of the superficial cortical veins.[15,16] Blood flow is redistributed and the deep medullary veins then become overloaded, dilated and angiographically prominent. Occlusion of the deep venous drainage pathways, or their overloading and radial stasis might be the pathogenic factor for a general damaging process leading to intellectual impairment and dementia.[16,27] Surgical intervention prior to the stage of non-function of the central venous pathways could prevent such event. Frobst[16] suggested a close angiographic evaluation for this.

The choroid plexus angiomas in Sturge-Weber syndrome have been noted in a few neuropathology reports. But enlargement and increased enhancement of the choroid plexus, compatible with the presence of angiomatous malformation, showed by diagnostic imaging, appears to be a common finding in their syndrome.[20,22,24,28] The glomus, the most heavily vascularized portion of the choroid plexus, seems to be the most commonly involved site. Bleeding from choroid plexus angiomas as a cause of intraventricular hemorrhage has been mentioned in the literature.[29,30] The hemorrhage is usually sudden and massive but it may occur more slowly. The indication for excision should be established in patients with evidence of ruptured choroid plexus angiomas to prevent repeated hemorrhage. Further information is required concerning the risks of hemorrhage from asymptomatic choroid plexus angiomas in Sturge-Weber syndrome.

REFERENCES

1. Sturge WA. A case of partial epilepsy, apparently due to a lesion of one of the vaso-motor centers of the brain. Trans Clin Soc London 1879; 12: 162-7.
2. Weber FP. Right-sided hemi-hypertrophy resulting from right-sided congenital spastic hemiplegia, with a morbid condition of the left side of the brain, revealed by radiograms. J Neurol Psychopathol 1992; 3: 134-9.
3. Krabbe KH. Facial and meningeal angiomatosis associated with calcifications of the brain cortex: clinical and anatomopathologic contributions. Arch Neurol Psychiat 1934; 32: 737-55.
4. Alexander GL, Norman RM. The Sturge-Weber syndrome. Bristol: John Wright & Sons; 1960.
5. Bentz MS, Towfighi J, Greenwood S, et al. Sturge-Weber syndrome. A case with thyroid and choroid plexus hemangiomas and leptomeningeal melanosis. Arch Pathol Lab Med 1982; 106: 75.
6. Anderson FH, Duncan GW. Sturge-Weber disease with subarachnoid hemorrhage. Stroke 1974; 5: 509-11.
7. Streeter GL. The developmental alterations in the vascular system of the brain of the human embryo. Contr Embryol Carneg Inst 1918; 8: 5-38.
8. Enjolras O, Riche MC, Merland JJ. Facial port-wine stains and Sturge-Weber syndrome. Pediatrics 1985; 76: 48-51.

9. Johnston MC. A radioautographic study of the migration and fate of cranial neural crest. Anat Rec 1966; 156: 143-55.
10. Le Douarin NM. The neural crest in developmental and cell biology series. Cambridge University Press; 1982, Vol.12.
11. Happle R. Lethal genes surviving by mosaicism: a possible explanation for sporadic birth defects involving the skin. J Am Acad Dermatol 1987; 16: 899-906.
12. Cibis GW, Tripathi RC, Tripathi BJ. Glaucoma in Sturge-Weber syndrome. Ophthalmology 1984; 91: 1061-71.
13. Uram M, Zubillage C. The cutaneous manifestations of Sturge-Weber syndrome. J Clin Neuroophthalmol 1982; 2: 145-8.
14. Taveras JM, Wood EH. Diagnostic neuroradiology. Baltimore: Williams & Wilkins Co.; 1964.
15. Bentson JR, Wilson GH, Newton TH. Cerebral venous drainage pattern of the Sturge-Weber syndrome. Radiology 1971; 101: 1111-8.
16. Probst FP. Vascular morphology and angiographic flow patterns in Sturge-Weber angiomatosis: facts, thoughts and suggestions. Neuroradiology 1980; 20: 73-8.
17. Nellhaus G, Haberland C, Hill BJ. Sturge-Weber disease with bilateral intracranial calcification of birth and unusual pathologic findings. Ada Neurol Scand 1967; 43: 314.
18. Johnson JF. Hemangiomatous calvarial trabecular pattern in newborns. Am J Neuroradiol 1981; 2: 48.
19. PallerAS. The Sturge-Weber syndrome. Pediatr Dermatol 1987; 4: 300-4.
20. Chamberlain MC, Press CA, Hesselink JR. MR imaging and CT in three cases of Sturge-Weber syndrome: prospective comparison. Am J Neuroradiol 1989; 10: 491-6.
21. Farman AG, Wilson S. Diagnostic imaging in Sturge-Weber syndrome. Dentomaxillofac Radiol 1985; 14: 97-100.
22. Maki Y, Semba A. Computed tomography of Sturge-Weber disease. Childs Brain 1979; 5: 51-61.
23. Marti Bonmati L, Menor F, Poyatos C, et al. Diagnosis of Sturge-Weber syndrome: comparison of the efficacy of CT and MR imaging in 14 cases. Am J Roentgenol 1992; 158: 867-71.
24. Wasenko JJ, Rosenbloom SA, Duchesneau PM, et al. The Sturge-Weber syndrome: comparison of MR and CT characteristics. Am J Neuroradiol 1990; 11: 131-4.
25. Falconer MA Ruschworth RG. Treatment of encephalotrigeminal angiomatosis by hemispherectomy. Arch Dis Child 1960; 35: 433-47.
26. Hoffman HJ, Hendrick EB, Dennis M, et al. Hemispherectomy for Sturge-Weber syndrome. Childs Brain 1979; 5: 233-48.
27. Garcia JC, Roach ES, McLean WT. Recurrent thrombotic deterioration in the Sturge-Weber syndrome. Childs Brain 1981; 8: 427-33.
28. Stimac GK, Solomon MA, Newton TH. CT and MRI of angiomatous malformations of the choroid plexus in patients with Sturge-Weber disease. AJNR 1986; 7: 623-7.
29. Crawford JU, Russell D. Cryptic arteriovenous and venous hamartomas of the brain. J Neurol Neurosurg Psychiat 1956; 19: 1-11.
30. Doe FD, Shuangshoti S, Netsky MG. Cryptic hemangioma of the choroids plexus: a cause of intraventricular hemorrhage. Neurology 1972; 22: 1232-9.