Epilepsy in vascular malformations

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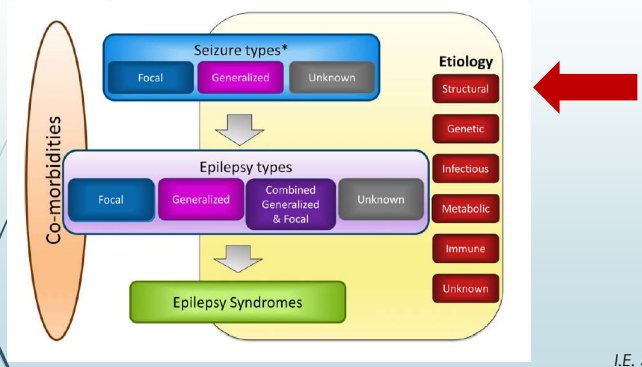
Outlines

- Classification of vascular malformations
- Example of vascular lesion as a symptomatic cause of epilepsy
- Predictive factors for epilepsy in vascular malformation

Framework for classification of the epilepsy



I.E. Scheffer et al.

Symptoms of vascular malformations of the brain

- Depend on the type, size and location of the malformation
- **Headache**
- **Seizure**
- **Bruits, Tinnitus**
- Bleeding from thin vessel walls (of vas malformation) → IICP (nausea, vomiting, headache, loss of consciousness) → **stroke**

2014 ISSVA Classification of Vascular Anomalies

Vascular Tumors	Vascular malformations			
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• Benign • Borderline or locally aggressive • Malignant	Capillary malformation	≥ 2 vascular malformations in 1 lesion		KTS SWS Proteus etc
	Lymphatic malformation			
	Venous malformation			
	Arteriovenous malformation			
	Arteriovenous fistula			

Pediatrics 2015;136.1

Port-wine stain PWS: cutaneous capillary malformation

- Incidence of PWS = 0.3 % of newborns (3 per 1,000)
- Present at birth and persist throughout life
- Sex ratio = 1:1
- Unilateral and involves several dermatome of face and neck
- PWS associated with SWS : 1 per 20 to 50,000 live births.
- The overall risk of SWS associated with any kind of facial nevous vascular malformation is 8%

Pediatric Dermatology 2012;29:32-37
Pediatr Neurol 2016;64:52-58

SWS: Encephalotrigeminal Angiomatosis

- Facial port-wine stain (PWS)
- Neurological malformations (ipsilateral leptomeningeal capillarovenous anomaly)
- Sometimes, ophthalmologic abnormalities (choroid vascular anomaly or congenital glaucoma)

Classification of SWS (Roach scale)

Type	Facial angioma	Leptomeningeal angioma	Glaucoma
I[a]	+	+	+/-
II	+	-	+/-
III	-	+	-/+[b]

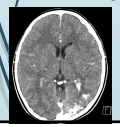
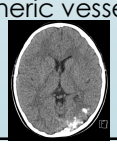
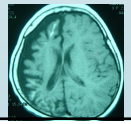
[a] Classic Sturge Weber syndrome
[b] Usually not present

European Journal of Paediatric Neurology 2014;18:257-266
Pediatr Neurol 2016;64:52-58

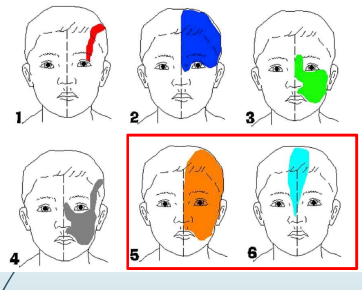
Imaging finding in SWS

At least one of the following:

1. contrast-enhanced leptomeningeal vascular anomalies
2. choroid plexus enlargement
3. cortical calcifications
4. cerebral atrophy
5. absence of superficial venous drainage or enlarged deep hemispheric vessels

Can PWS predict SWS ?



Location that increased risk of SWS

1. Midline crossing *(p<0.001)*
2. Temporal area *(p=0.04)*
3. Nose area *(p=0.005)*

J Am Acad Dermatol 2015;72:473-480

- Involving V1 area
- Associated with upper eyelid involvement
- Extension to the contralateral (40%)
- Homolateral proximal territories (V1 and V2 or V1,V2 and V3: 80%)

Pediatric Dermatology 2012;29:32-37

Risk of seizure

- In patient with facial PWS in the absence of SWS = risk similar to general population
- In patient with facial PWS with SWS = frequency of seizure is higher (70-90%)

Pediatric Dermatology 2012;29:32-37
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Predictive factors for epilepsy in pediatric patient with SWS

- Bilateral port-wine (15%) stain is at higher risk of epilepsy
- Unilateral port-wine stain did not increase the risk of epilepsy regardless of its extent
- The presence of DVA(developmental venous anomalies increased the risk of developing epilepsy (p=0.03)

Pediatr Neurol 2016;64:52-58

Epilepsy in SWS(1)

- Occurs in 72% of unilateral cerebral involvement
- Occurs ≥ 90% in bilateral involvement
- Often begin in the 1st year of life and generally by 2 years of age (later in life = 10%)
- Focal onset with secondary generalization
- Seizures commonly occur in clusters or as status epilepticus
- Increased susceptibility for fever induced seizures at any age

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Epilepsy in SWS (2)

- Prolonged seizures in SWS = worsen cognitive function
- Seizure may be medically intractable in 30-50% of SWS patients
- Seizure in SWS can be progressive as brain atrophy → refractory epilepsy
- FCD is also associated with SWS, drug resistant epilepsy

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Epilepsia 2010;51:257-267

Epilepsy outcome in SWS (3)

- Poor outcome : seizures in early life (< 6 mo)
  : extensive brain pathology
- Better outcome : late onset of seizure (late childhood)

Glaucoma

- PWS in V1 territory had 12.2% of congenital glaucoma
- PWS with V1 and V2 extension had 92% of glaucoma
- SWS with congenital glaucoma (30-40%) occurred in all cases with V1 territory involvement
- Glaucoma is not always ipsilateral to facial PWS

Pediatric Dermatology 2012;29:32-37

Molecular basis of SWS

- Post zygotic somatic mosaic mutation of GNAQ
- Abnormal protein production
- Altered expression of angiogenesis factors: vascular endothelial growth factor, hypoxia-inducible factors alpha 1 and fibronectin
- Result = abnormal vessel development, cerebral calcification, neuronal loss, astrogliosis and cortical dysgenesis

Counselling pt with PWS

- If the PWS spares V1= family can be reassured
- If PWS involves V1, ophthalmologic examination should always be performed
- Imaging should be added if PWS (V1) associated with at least one of the following:
  - ophthalmologic,
  - neurologic abnormalities,
  - extension of the stain to the upper eyelid,
  - V2 or V3 territory,
  - contralateral hemiface

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Cerebral Cavernous Malformations (CCMs)

- 0.5% of the population
- Solitary or multiple nodular aggregated of thin-walled, round, closely packed veins → slow moving blood
- No normal tissue structures are enclosed in the lesion between the abnormal veins
- **Two forms**: familial and sporadic
- Familial forms: e.g. *KRIT1(CCM1), CCM2, PDCD10(CCM3)*
- **Symptoms**: asymptomatic, HA, **seizure**, stroke etc

Cerebral Cavernous Malformations (CCMs)

- Established risk factors of seizure
  : Supratentorial lesion
  : cortical involvement
  : mesial temporal lesion
- Controversial risk factors
  : number of cevernomas
  : size of cavernomas
  : presence of absence of hemosiderin rim around lesion
- Treatment: if seizure → AED
  : Uncontrolled sz with AED → Sx ?

Epilepsia 2013;54:2025-2035

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AVM (1)

- Commonest presentation: hemorrhage; 50%
  : epilepsy; 30%
- Small lesion (< 3 cm) presents with hemorrhage
- Large lesion presents with epilepsy
- Other manifestations: progressive neurological deficit

World Neurosurg 2015;84:645-652
Radiopedia.org

AVM(2)

- Overall annual rate of epilepsy: 1%
- Overall annual rate of hemorrhage: 3%
- Unruptured AVM has annual hemorrhage rate of 2.2%
- Ruptured AVM has annual hemorrhage rate of 4.5%
- Recurrent hemorrhage 6-18% in 1st year and declines to pre-hemorrhage rate over 5 years
- Mortality rate of 1% per year

AVM(3)

Seizure may related to

- Overt intracranial hemorrhage
- Hemosiderin deposition following recurrent micro hemorrhage
- Secondary to venous HT
- Ischemia

Predictor of seizure

- Unruptured, large, cortical-based AVM

World Neurosurg 2015;84:645-652

Treatment of AVM

- Conservative treatment
- Microsurgery
- Endovascular embolization
- Radiosurgery