CHILDHOOD EPILEPSY SURGERY AND THE ROLE OF ANATOMY

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EPILEPSY IN CHILDREN VS ADULTS

- Immature brain and skull
- Different seizure types
- Different surgical procedures
- Different indications and contraindications
- Different urgency
- Parents

Precocious growth of brain compared to body

Dendrite formation from 14 weeks gestation to 6 years

Figure 4.1. Precocious growth of the brain compared to that of the whole body.

Figure 4.3. Apical dendrites appear at 14 postmenstrual weeks and basal dendrites at 20 postmenstrual weeks. Secondary branches have appeared by term, and new dendrites develop up to about 6 years of age. (Adapted from Reference 1.)
Dendritic spine maturation from 6 postnatal weeks to 7 years

Synaptic density increases during the first 8 years

Impact of Seizures on the Developing Brain

- Frequent seizures interfere with:
  - (a) dendritic arborization, spine formation and synaptogenesis
  - (b) electrical fields and thus disturb axonal growth cone migration

CHILDHOOD SEIZURE TYPES

- West’s syndrome (Infantile spasms)
- Lennox Gastaut syndrome
- Sturge Weber syndrome
- Tuberous sclerosis
- Rasmussen’s encephalitis
- Hemimegalencephaly
- Hemiplegia/hemiseizure syndrome
- Gelastic seizures
Surgical procedures for epilepsy in childhood

- Hemispherectomy
- Corpus callosotomy
- Focal resections
- Vagus nerve stimulation
- Multiple subpial transections
- Temporal lobectomy

Advances in the Treatment of Epilepsy since 1970

- Improved methods of investigation
- Refinements in surgical technique
- Intraoperative guidance

More accurate methods of Investigation

- Computerized tomography CT (1970s)
- Magnetic resonance imaging MRI (1980s)
- Positron emission tomography PET (1980s)
- SPECT
- EEG-video telemetry
- Invasive EEG monitoring

Surgical advances

- Operating microscope
- Bipolar coagulation
- Pediatric anesthesia
INTRAOPERATIVE GUIDANCE

- Somatosensory evoked potentials (SSEPs)
- Motor evoked responses
- Image guided epilepsy surgery

Frameless image-guided depth electrode placement

WEST’S SYNDROME

- INFANTILE SPASMS
- HYPSARRHYTHMIA
- MENTAL RETARDATION
Cortical Dysplasia

Balloon cells of cortical dysplasia

Left parieto-occipital cortical dysplasia
INFANTILE SPASMS:
FUNDAMENTALLY NEW CONCEPT

- RESECTING A ZONE OF CORTICAL ABNORMALITY MAY STOP A GENERALIZED SEIZURE DISORDER
**ZONE OF CORTICAL ABNORMALITY**

- EEG ictal onset
- Increased delta
- Decreased beta
- MRI ABNL
- PET
- MEG Focus
- DTI Data

**ANATOMY OF HEMISPHERECTOMY**

- 1929 Walter Dandy (USA)
- 1950 Roland Krynauw (South Africa)
- 1966 Wylie McKissock (England)
- 1983 Theodore Rasmussen (Canada)
- 1986 UCLA (USA)

**Indications for hemispherectomy**

- Intractable seizures
- Hemiplegia contralateral to damaged hemisphere
- Hemisphere ipsilateral to hemiplegia essentially normal
- Developmental delay

**HEMISPHERECTOMY**

- Indications for intractable seizures: Hemiplegia contralateral, Hemisphere ipsilateral normal, Developmental delay

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*Note: The document appears to discuss various aspects of hemispherectomy, including neurological technology and historical milestones.*
Goals of Hemispherectomy

- To stop all seizures
- To prevent further damage to healthy brain
- Not to add an unacceptable new neurological deficit

By removing or disconnecting the epileptogenic hemisphere
Meningeal Arteries

Meninges and Superficial Cerebral Veins

MCA Territory Infarct
STURGE WEBER SYNDROME

hemimegalencephaly
Functional Hemispherectomy

- Fronto-parietal resection
- Disconnection of remainder of epileptogenic hemisphere

Functional hemispherectomy

Jean-Guy Villemure

Jaime Villablanca
M.D., Ph.D.

UCLA
Results of Hemispherectomy

- 85% of cases are seizure free (or 80% reduction in seizure frequency)

Complications of Hemispherectomy

- CSF pathway obstruction
- Meningitis (chemical and bacterial)
- Wound infection (including bone flap)
- Late hemorrhagic complications (hemosiderosis)
- Death
Multiple Subpial Transections

- Epileptogenic focus in an eloquent area

Multiple subpial transections

- Roger Sperry (1955): created 5mm wide subpial columns in the visual cortex of cats without interfering with function.

- Frank Morrell (1969): multiple subpial transections for focal cortical epilepsy

Landau-Kleffner syndrome. Treatment with subpial intracortical transections

Multiple subpial transections (Villémereure)

Multiple subpial transections (Telfeian, A)
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