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Effects of epilepsy and medications on learning and behaviour in children

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Behaviour and learning

BEHAVIOUR

- Perception, experience and expression of emotions
- Motivation, energy levels
- Understanding of social situations
- Ability to react to dynamic situations



Interaction with others

LEARNING

- Attention and concentration
- Processing speed
- Mental Arithmetic
- Language
- Memory and Learning
- Planning and organisation functions



Academic achievement

A common misperception

Learning & Behaviour
Problems

Anticonvulsant
medications



Uncontrolled frontal lobe epilepsy

- 10 y.o. boy with 1 yr history of frontal lobe seizures
- Several seizures per night
- Struggling at school, difficulty concentrating
- Impulsive, getting into trouble in the classroom
- Teasing by other students, getting into fights
- Mood swings, behavioural outbursts, parents not coping
- Previously no response to Tegretol, Epilim, Trileptal, currently on Dilantin and Topamax

“I think the medications are affecting his learning doctor”

Learning and behavioural problems in children with epilepsy

- Multiple factors are at play
 - The frequency, duration and severity of seizures
 - The electrical disturbance in the brain; what doctors call "epileptic activity"
 - Coexistent physical and sensory disabilities
 - Age of the child: the "maturational state" of the brain
 - The underlying brain lesion that is causing the seizures
 - Psychological and social consequences of epilepsy
 - The number and doses of medications

Seizures

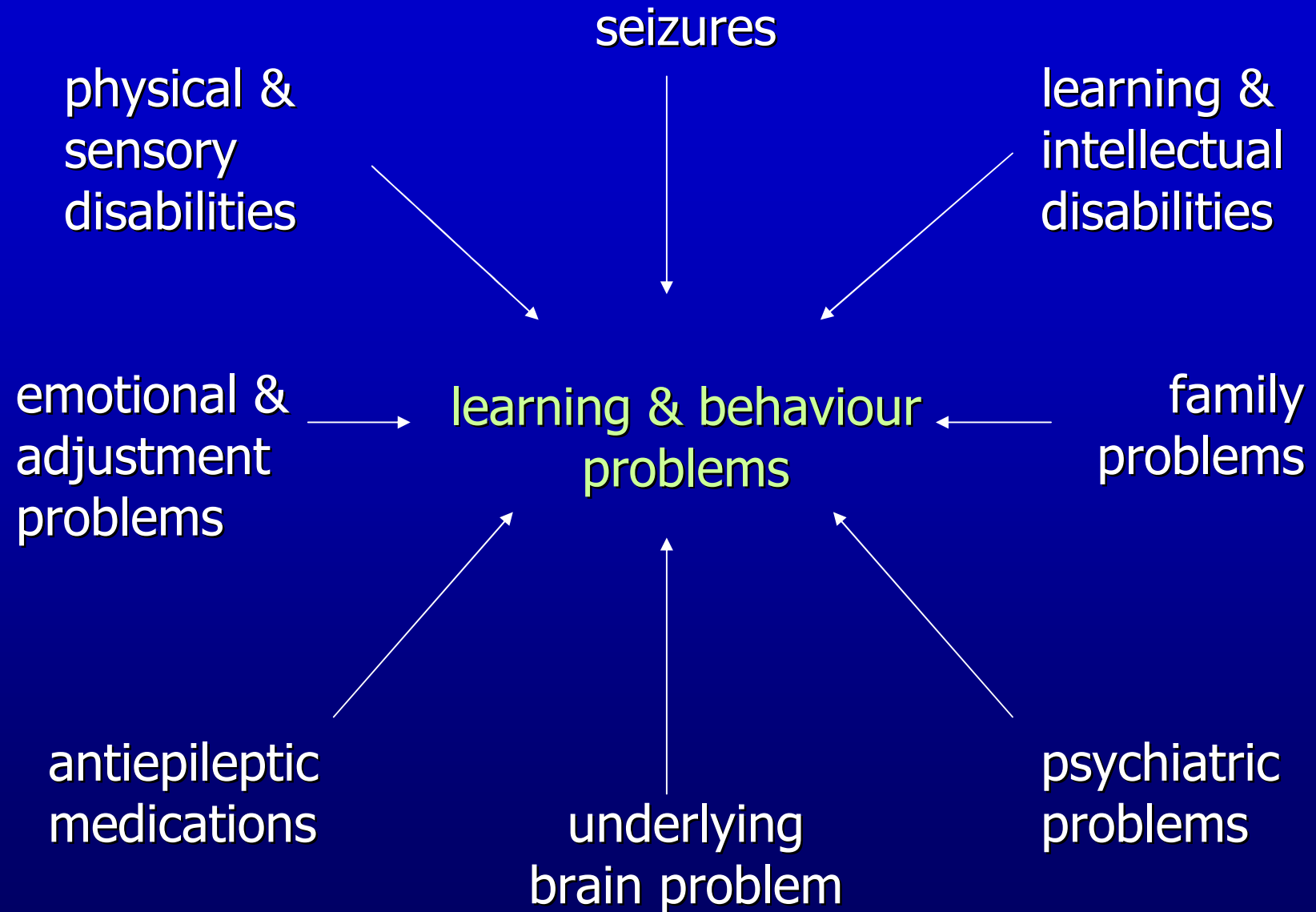
physical &
sensory
disabilities

learning &
intellectual
disabilities

behavioural
problems

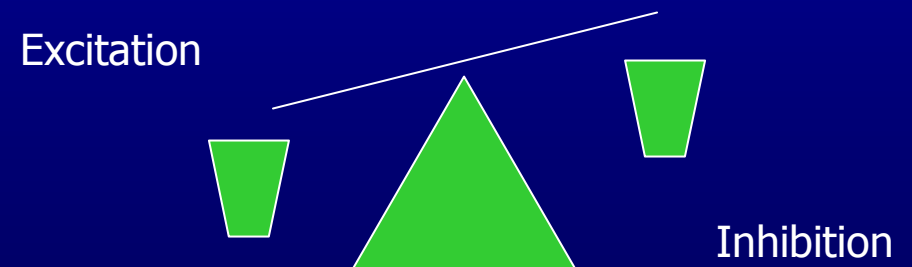
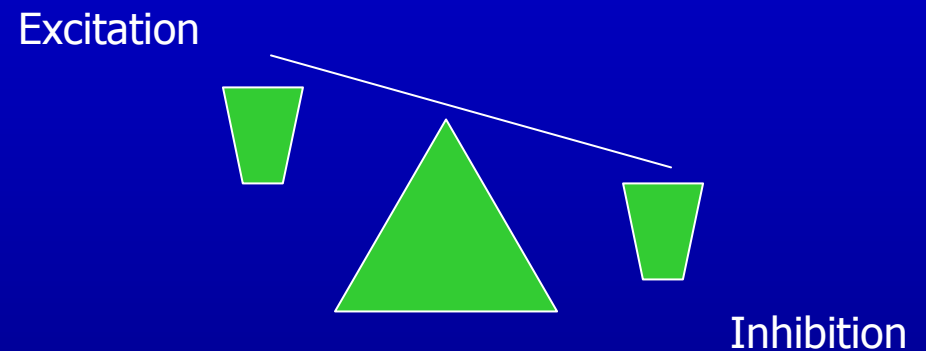
psychiatric
problems





The balance between controlling seizures and minimising side effects

- Seizures are due to an imbalance between excitatory and inhibitory influences in the brain
- Medicines either increase the amount of inhibition in the brain or decrease the amount of excitation
- This raises the bar in the brain
- However this explains why medications can sometimes cause side effects because they are tipping the scales



There are lots of problems with interpreting scientific studies

- Spontaneous fluctuations in learning and behaviour can occur in children with epilepsy
- Uncontrolled seizures and persistent EEG abnormalities can have a negative effect on learning and behaviour
- Seizure reduction and EEG improvement can have a positive effect on learning and behaviour
- Attributing improvement or deterioration to the drug by default
- Comparisons of drugs that are not at equivalent doses
- Lack of well designed scientifically sound studies
- Small numbers of children in the studies

The older drugs: Before and after **starting** treatment

Year of Study	Drugs	No	Controls	Learning problems
1991	Tegretol, Epilim, Zarontin, Lamictal, Dilantin	37	Diabetes	Nil
1992	Tegretol, Epilim	63	Normal	No worse*
1997	Tegretol, Epilim	43	Nil	No worse
1999	Tegretol	10	Normal	Memory**
1991	Tegretol, Epilim Dilantin	64	Nil	Tegretol: Memory Tegretol Dilantin: processing

* But children with epilepsy had more attentional, visuo-motor problems at baseline

** No effect on IQ, attention, language or motor skills

Before and after coming off treatment

- 100 children seizure free for >1 year on Epilim, Tegretol and Dilantin
- They were compared to children the same age at baseline and then 4 months after stopping treatment
- Dilantin had more effect on motor and processing speed than other drugs at baseline
- Improved alertness, concentration, memory, processing speed after stopping all treatments but this was also seen in the controls!
- Motor speed was the only significant improvement compared to baseline
- This study suggested that the drugs had a minimal effect on cognitive function

Learning and the Older Drugs: Conclusions

- Phenobarbitone *may* lower IQ
- Phenytoin has a mild effect on memory and processing speed
- Carbamazepine and Valproate do not affect IQ but they can affect memory, information processing speed and attention
- The baseline status of child is more important in determining presence of learning or behavioural problems

The Newer Drugs

- There are few scientific studies in children examining the effects of newer drugs on learning
- **Topiramate (Topamax)**
 - Can affect attention, information processing speed and concentration in healthy adults
 - Word finding and memory problems well described in adults with epilepsy
 - Probably the most likely newer drug to impact on learning
- **Oxcarbazepine (Trileptal) and Levetiracetam (Keppra)**
 - Not shown to affect attention and information processing speed in a recent study and some areas of cognitive function actually improved

Behavioural Side effects

- Behavioural problems are more prevalent in children with intellectual disability
 - 6% of normal popn,
 - 12% physical disabilities not caused by brain problems
 - 29% uncomplicated seizures
 - 38% with CNS damage
 - 58% with seizure and CNS damage
- More common than other chronic diseases like IDDM, asthma

Effects of the older drugs on behaviour

- 392 children on anticonvulsant treatment for epilepsy or febrile convulsions.
- Behavioral side effects including irritability, restless, short sleep, hyperactivity or drowsiness were seen in
 - 61% of children receiving phenobarbitone
 - 31% of children receiving carbamazepine
 - 22% of children receiving primidone
 - 17% of children receiving Valproate
 - 16% of children receiving phenytoin

Behavioural problems with the older drugs

- Frequent (>10%)
 - Phenobarbitone-irritability, hyperactivity, listlessness
- Infrequent (<10%)
 - Valproate-irritability, hyperactivity, mood swings and aggressiveness'
 - Carbamazepine-irritability, agitation, mood swings and aggressiveness
 - Phenytoin-sleepiness, apathy or nervousness

Behavioural problems with the newer drugs

- Gabapentin-sleepiness
- Lamotrigine- difficulty sleeping, restlessness
- Oxcarbazepine-sleepiness
- Keppra-nervousness, aggressiveness, mood swings
- Topamax-sleepiness, loss of appetite, irritability, nervousness

Conclusions

- Seizures beginning earlier in childhood are more likely to impact on learning and behaviour
- Children with epilepsy are more likely to have cognitive and behavioural problems than children without epilepsy
 - Related to the epileptic electrical disturbance itself or to underlying structural brain problems
- Uncontrolled seizures are just as likely to affect learning and behaviour as side effects from medication

Conclusions

- Medications can affect attention, concentration, information processing but the effect is usually mild
- There is some evidence that phenobarbitone can have a long term effect IQ but scientific studies have not shown significant deterioration in IQ with other drugs
- The potential cognitive and behavioural side effects of the newer anticonvulsants have not been well studied in children but most are better tolerated with the possible exception of Topiramate

How to minimise the chance of medication side effects

- Start low and go slow
- If the child develops unacceptable side effects then lower the dose or try another medication
- The impact on learning and behaviour are minimised when drugs are used at low to moderate doses
- Reducing the number of antiepileptic drugs may result in cognitive and behavioural improvement
- However in some circumstances moderate doses of two drugs can be better than high doses of one drug

Management of learning and behavioural problems

- Speak to your child's teachers to ensure they understand the potential impact of epilepsy and medications on your child's learning
 - Allow more time to complete school work
 - Deliver information in smaller chunks
 - Seat the child at the front of the classroom
- Try simple strategies for managing behaviour
- Enlist the help of support organisations like Epilepsy Australia
- Seek advice from your child's paediatrician or a clinical psychologist if simple strategies don't work