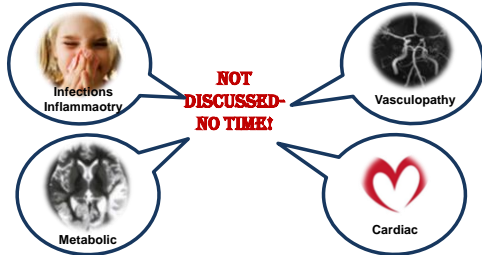


RISK FACTORS



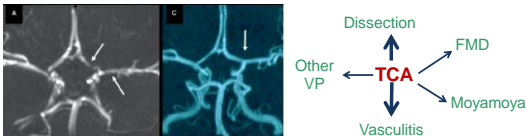
Vasculopathy: in about 50% of children with stroke

| PCS | Swiss (Bürki et al) | British (Wraige et al) | | |
|----------------------------|---------------------|------------------------|---------------------------|-------------------------------|
| Sickle cell | 0 | 16 (12%) | | |
| Cardioembolic | 16 (20%) | 10 (7% ⁹) | Arteriopathy n=277 | |
| Moyamoya | 5 (6%) | 18 (13%) | | FCA 69 (25%) |
| Art. dissection | 2 (3%) | 18 (13%) | | Moyamoya 61 (22%) |
| Stenocclusive | 25 (31%) | 42 (31%) | | Art. dissection 56 (20%) |
| Other determined | 16 (20%) | 15 (11%) | | Vasculitis 33 (12%) |
| Multiple probable/possible | 8 (10%) | 5 (5%) | | Sickle cell arteriop. 21 (8%) |
| Undetermined | 4 (5%) | 15 (11%) | | Postvarizella 19 (7%) |
| Not classifiable | 3 (5%) | | | Other 10 (4%) |
| | | | | Unspecified 9 (3%) |

DMCN: 2010, Bürki et al; 2005 Wraige et al

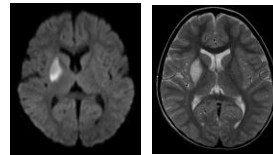
Circulation, Amlie-Lefond 2009

Transient focal arteriopathy



- Stenosis pref. M1 and A1, unilateral
Irregularities 32% Collaterals 5% +/-Vessel enhancement
- Worsening in acute phase:
FU Normalisation (23%) improvement /stabilisation (45/32%)
- Recurrence in first year: 18%? No recurrence on longterm

Transient focal arteriopathy



- Previously healthy child
- Stuttering onset of symptoms
- hemiparesis with dystonic involvement
- Varicella preceded in 44% (Braun et al, 2009)

Typical location of infarction: Basalganglia
Sometimes involving caudate, adjacent grey/white matter
Sparing of internal capsule

Medium to large vessel vasculitis

Non progressive
Transient focal arteriopathy?
Stroke

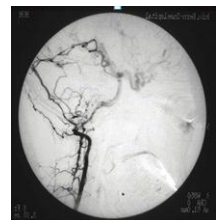
Progressiv
Persistent headache/
Cognitive problems
Stroke

focal unilateral stenosis medial and anterior CA
vessel wall thickening

T1 dark blood
multifocal, > 1 vessel bed
unilateral seldom bilateral
vessel wall thickening

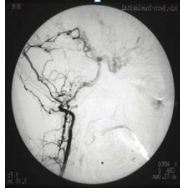
Moyamoya chronic progressive stenosing vasculopathy with typical collaterals

- Typically terminal internal carotid/posterior circulation in about 30%
- Frequently warnings: TIA, minor strokes
- Children more likely to have ischaemic problems
- Fluctuant symptoms, increasing neuropsychological problems

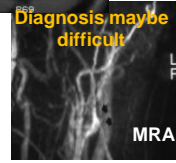
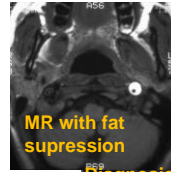


Moyamoya a spectrum!

- Associated with:
 - Sickl cells
 - Neurofibromatosis
 - Downs syndrom
 - Radiation
- RNF213 polymorphism in Japanese
- Coriskfactors for ischaemic events:
 - Infection, art. Hypertension
 - Coagulopathy, homocystinemie



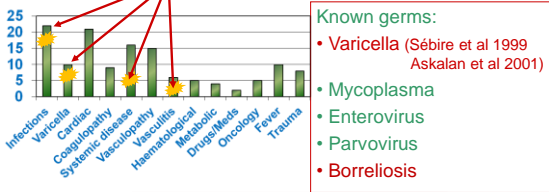
Dissection: cervical and intracranial



- Infection (31%) (Guillon, 2003)
- Trauma (minimal)
- Cervical bone abnormalities (Cushing 2001, Ganesan; Hasan 2002)
- Homocystinemia (Ganesan 2002, Pezzini 2002)
- Vasculopathy
- Migraine (Tzourio 2002)

Infections are frequent!

Infection /inflammation in 1/3 of paediatric stroke a risk factor!



- Known germs:
- Varicella (Sébire et al 1999 Askalan et al 2001)
 - Mycoplasma
 - Enterovirus
 - Parvovirus
 - Borreliosis

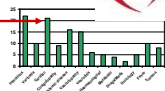
- Focal vasculopathy
- Dissection
- Medium to large vessel vasculitis

Infections in childhood stroke IPSS



- 310 cases compared to 289 controls (35 centres)
- Infection ≤1week prior to stroke: 6.5-fold risk of AIS
OR 4.7, 95% CI 3.1-13.5, p<0.0001
- Cases were under-vaccinated compared to controls
Some/few/no routine vaccinations: risk of AIS risk ↑ OR 6.7, (95% CI 2.3-19.6) p<0.0001
- Protective: Having received an MMR, polio, or pneumococcus vaccine

Cardiac problems: children Second on the hit list



- 5.4 stroke per 1000 children operated
risk increased: older age at operation cardiopulmonary bypass reoperation
- Co risk factors hereditary coagulopathy infection

Cardiac problems: neonates



- Perinterventionally silent!
Missed !!?
- Preoperative stroke in 39% - significantly higher risk after balloon atrial septostomy
- Postoperative: injury of white matter in 35% especially: single ventricles and aortic arch obstructions after cp bypass, low intraoperative Hb, low mean blood pressure during first day postop

Metabolic problems: rare but....

Metabolic infarction Vasculopathy
 Cardiac problems Coagulopathy



Menkes
Fabry disease

Hyperlipidemia

OUTCOME



Motor



Quality of life



Cognitive

**NOT
DISCUSSED-
NO TIME!**

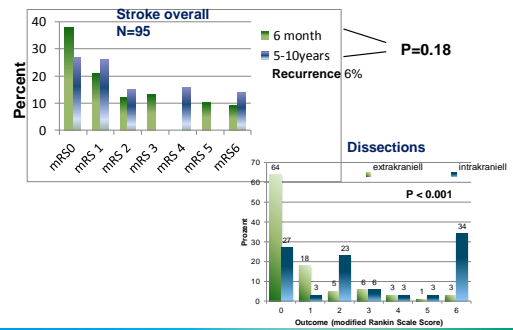
Mortality



- **Top 10 causes of death in children in US**
 Haemorrhagic stroke > SVT > arterial ischaemic stroke

- **Mortality arterial ischaemic stroke**
- California (Fullerton et al) 5%
- Canada (de Veber et al) 10%
- London area (Gandesan/Kirkham et al) 6%
- Sweden (Christerson 2010) 8%
- Denmark (first 30 days) (Tuckuviene 2011) 4%
- CH (SNPSR 2000-2008) 7%; 1/3 due to stroke
- Melbourne (Mackay)

Outcome over years / different subpopulations

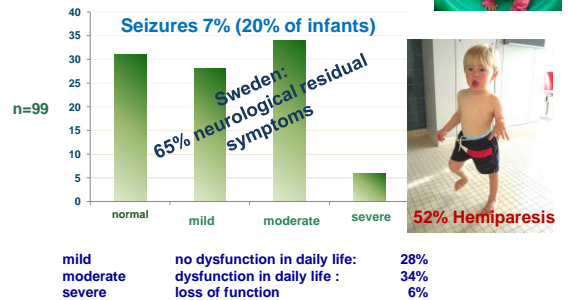


Stroke in children and young adults

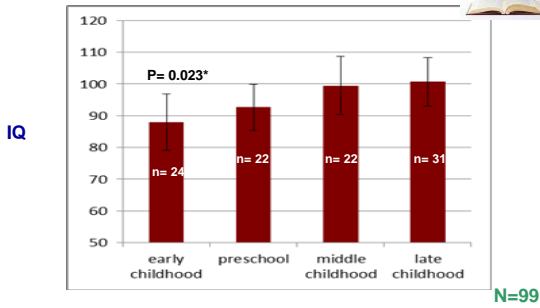


| | Children n=128 | Adults n=199 | P value |
|-----------------------|-------------------|-----------------|---------|
| pedNIH/ NIH scores | 5 | 6 | 0.102 |
| Mod Ranking score 0-1 | 59% | 60% | 0.907 |
| Mortality | 4% | 6% | 0.436 |

Outcome after 2 years SNPSR

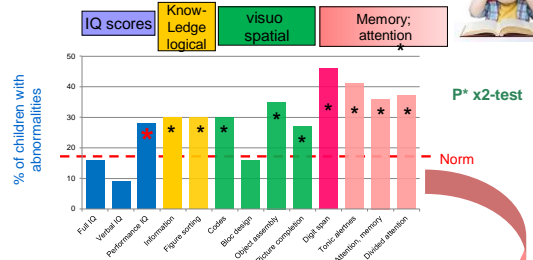


Cognitive outcome and age at stroke



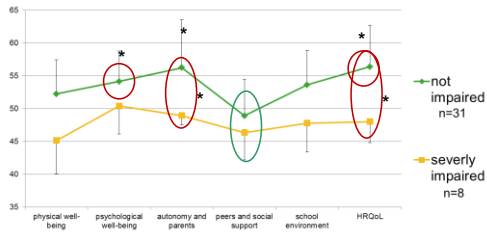
N=99

Follow Up: Neuropsychology n=37/31



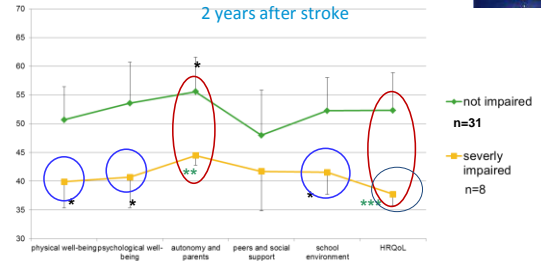
Conners RS: Global Index 43% 0.043*
Attention 57% 0.001**

Children Rating stratified by neurological impairment 2 years after stroke



One sample t-test: Significant better results compared to norms. *p<.05, **p<.01
Independent t-test: Significant difference in one scale

Parent Rating stratified by neurological impairment 2 years after stroke



One sample t-test: Significant better/worse results compared to norms *p<.05, **p<.01, p<.001
Independent sample t-test: significant differences (p<.05, p<.01)