Acute Ataxia

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Overview

- General remarks – terminology
- Clinical examination – Additional investigations: general hints
- Selected causes of acute ataxia

„Acute"

- Not defined by consensus
- Ryan and Engle (2003) evolution time < 72 hours
- **Symptoms within hours („over night"), < 2 days**

„Ataxia"

- „Lack of order"
- Ataxia ≠ cerebellar disorder
- *Afferent* pathways involved → *sensory* ataxia(s)
  - chronic - acute
  - hereditary - acquired
- Vestibular
- Psychogenic
- …

Sensory versus cerebellar ataxia

- No dysarthria
- «no» oculomotor deficits
- Romberg test abnormal
  eyes closed – no visual compensation – ataxia worse

Neuropediatrics 2013;44:127-141

Review Article

Acute Ataxia in Children: Approach to Clinical Presentation and Role of Additional Investigations

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Table 1 Causes of acute pediatric ataxia

Acute cerebellar ataxia	Infectious/immune mediated	Acute postinfectious cerebellar ataxia
		Acute cerebellitis
		Acute disseminated encephalomyelitis
		Multiple sclerosis
	Intoxications	
	Paraneoplastic	Opsoclonus-myoclonus syndrome
	Traumatic	Postconcussion ataxia
		Traumatic vertebral dissection
	Vascular	Ischemic stroke
		Hemorrhagic stroke
	First event intermittent ataxia*	Maple syrup urine disease
		Pyruvate dehydrogenase deficiency
		Urea cycle disorders
		Glucose transporter type 1 deficiency
	First episode episodic ataxia	
Acute vestibular ataxia	Migraine related	Vestibular migraine, first episode
		Benign paroxysmal vertigo
	Acute unilateral vestibular dysfunction	Vestibular neuritis
		Labyrinthitis
		Vestibular contusion
Acute sensory ataxia	Inflammatory	Guillain-Barré syndrome
		Miller Fisher syndrome
Acute epileptic pseudoataxia		
Acute psychogenic ataxia		

Ataxias in childhood - Categories

according presentation and course (~ arbitrary)

- **Acute ataxia** (< 2-3 days)
- Subacute ataxia

- **Episodic ataxia**
  [historic term, implies dominant channelopathy]

- ***Intermittent ataxia***

- Congenital non-progressive ataxia
- Chronic progressive ataxia

Distinction not always possible at onset

Repeated events of acute ataxia

Ad terminology:
„Episodic ataxia" implies channelopathies

→ »***intermittent***» is preferable

DD
- Repeated intoxications («external»)
- Benign paroxysmal vertigo
- Basilar migraine
- *Metabolic disorders* («internal intoxication») (usualy in catabolic situation)
- Episodic ataxias EA1, EA2..
- .....

Ataxia in metabolic disorders

- Mostly in catabolic situations (infection, fever..)
- «internal intoxication» (simplified)
  → usually ataxia *plus*
- No symptoms in intervall
- **Typical examples**
  - urea cycle disorders
  - amino acid disorders (as MSUD, maple syrup urine disease)
  - organic acidurias
- **Investigations** (provide plan for next «crisis»)
  - «routine» lab incl. lactate, ammonia, blood gases
  - plasma: amino acids, acylcarnitine, homocysteine
  - urine: organic acids
- **MRI** – may be helpful (pattern recognition)

	EA 1	EA2
Gene	*KCNA1*	*CACNA1A* (allelic FHM1, SCA6)
Age at onset	Early childhood	Before age 20
Precipitating factors	Abrupt postural change, emotion, startle...	Physical/emotional stress, infection (alcohol)
Episode duration	Up to minutes	Often > 30 minutes to hours
Frequency	Many per day	Variable, less frequent
Features	Ataxia – dizziness – no nystagmus	Ataxia, instability, dysarthria, nystagmus Ev. vertigo, nausea, headache
Additional features	EMG neuromyotonia; myokymia clinically	Downbeating nystagmus (between epis.) Some patients develop cerebellar atrophy
Treatment	Carbamazepine (phenytoin)	Acetazolamide

Acute postinf. cerebellar ataxia	**Acute cerebellitis**
No neuroimaging correlate	Neuroimaging correlate +
Isolited ataxia	Often additional symptoms ev. oedema - hydrocephalus herniation
General outcome favorable	Overall prognosis less favorable

Distinction justified ? arbitrary ?
Rather a spectrum – a continuum ?
In praxi distinction often helpful:
→ Different management

Examination Points to consider in acute ataxia

- **Ataxia pure ? «plus»?**
- Ataxia (Dys-metria)
  Trunk ? Limbs ? Tongue ? Ocular movements ?
- Weakness? (pareses)
- Focal findings – asymmetry ?
- Consciousness behavior
- Head impulse test
- Red flags ?

→ Targeted investigations (what to do, what not do to..)

Additional investigations

- Individual work-up targeted on the basis of differentiated *clinical suspicion*

- Acute isolated ataxia without red flags
- Acute ataxia with red flags
  high value of neuroimaging
  Consider ev. risk of LP (cerebellitis, stroke)
  ? CSF, serological tests etc
  further investigations depending on MRI, course…
- ? Intoxication: EEG, body fluid collection
- ? Metabolic disorder – collect body fluids in acute stage
- OMS
  Investigations according protocol
- Functional (psychogenic) disorder – no further tests !!
- ….

Acute ataxia - what is „common“ ?

Common

- Acute postinfectious cerebellar ataxia
- Intoxication
- Acute Demyelinating EncephaloMyelitis ADEM

Rare

- Cerebellitis
- Opsoclonus - Myoclonus Syndrome OMS
- Stroke
- Varia

NOT PRESENTING AS *ACUTE* ATAXIA

- Cerebellar tumor
- Meningitis

Acute (postinfectious) cerebellar ataxia

- Occurrence
  post viral and non-viral infections
  (varicella, EBV, mumps, parvovirus…)
  in ~20% no previous infection
- Age
  predominant in young children (~2-5 y)
  but at any age reported
- Onset
  acute, „over night“, max. symptoms in 1-2 days
- Course
  spontaneous improvement over days to few weeks
  no relapses (rare exceptions to the rule)

Acute cerebellar ataxia

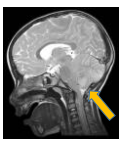
- Symptoms
  Ataxia trunk > limbs
  Nystagmus, dysarthria : not consistant
  RED FLAGS: papilledema, vomiting, strabismus
  impaired level of consciousness, *absent reflexes*
- Additional investigations
  EEG, CSF, imaging: usually normal (→ no strict indication)
  ((Serology ?))
- Course: remission in days – weeks
- Recovery: favorable (exceptions)
- Treatment : no steroids - wait and see
- Admission to hospital ? – individual decision

Cerebellitis

Variable signs and symptoms – **spectrum**

Focal – Hemi- -- entire cerebellum

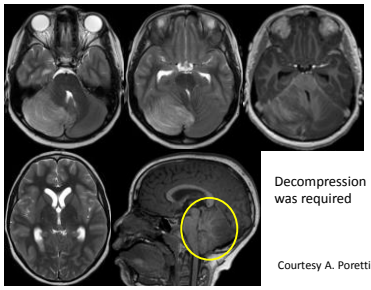
Swelling (oedema)
→ compression brain stem / herniation
→ acute obstructive hydrocephalus
(→ NO Lumbar Puncture
(→ surgical decompression ?



Extreme end of spectrums
Near fatal cerebellar swelling

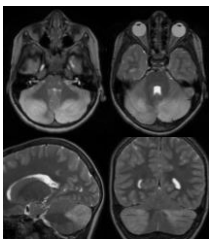
Fulminant cerebellitis: a fatal clinically isolated syndrome. Kamate 2009
Near-fatal cerebellar swelling caused by…Burri 2003
Acute fatal parainfectious cerebellar swelling…Roulet Perez 1993

Hemi-Cerebellitis – midline shift - hydrocephalus - Mycoplasma infection



Decompression was required

Courtesy A. Poretti



Cerebellitis bilateral

Grey and white matter
No significant swelling

6 year old
History of non-specific findings, vomiting, fever, Reduced condition

Increasing *headache*
No cerebellar signs

Spontaneous recovery

Opsoclonus – Myoclonus Syndrome OMS

- Very rare....but diagnosis important for treatment
- Characteristic symptoms
- → *Diagnosis made by history / clinical examination - observation* (EEG, MRI, CSF not contributory)
- Age predilection
  months to 3 years

- Synonyma
  Kinsbourne syndrome [1962, 6 infants, collected P. Sandifer]
  Myoclonic encephalopathy of infancy
  Dancing eyes syndrome

Opsoclonus - Myoclonus Syndrome

Pathogenesis

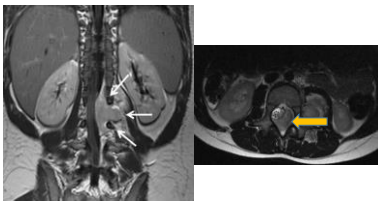
- „postinfectious"…no obvious other cause
- „paraneoplastic" associated with neuroblastoma or ganglioneuroma

Additional investigations

- Search for neuroblastoma

- **Characteristic symptoms**
  - Ataxia (usually no longer able to sit)
  - Myoclonia (easier to feel)
  - Opsoclonus (inconsistent)
  - Irritability, sleep disturbances
- **„Atypical" presentations (~20%)**
- Pathogenesis
- **Course** (untreated)
  Usually prolongued…over weeks and months
  Relapses with infection
  Majority of patients (untreated) with residual problems !!
- Investigations (CSF, EEG, MRI normal at onset) →clinical dg
- Treatment... („immunosuppressive")
- European protocoll for diagnosis und treatment

Infant with OMS
Ganglioneuroma paravertebral – intraspinal extension
no neurological deficit



Intoxication

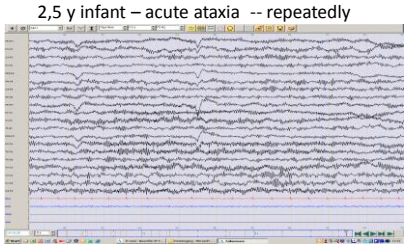
Age peaks
- Infancy
  also as Münchhausen by proxy
- [Teenage (alcohol, drugs, suicidal attempts…)]

Consider circumstances – awareness

Red flags ? Consciousness usually impaired

Investigations – consider
- „Tox" screening (serum, urine) – save samples
- EEG

2,5 y infant – acute ataxia -- repeatedly



Increased beta-activity due to benzodiazepin medication
[Münchhausen by proxy]

ADEM

Panel 3: Diagnostic criteria for definite acute disseminated encephalomyelitis[32]

Diagnosis can be made when all five of the following criteria have been met:

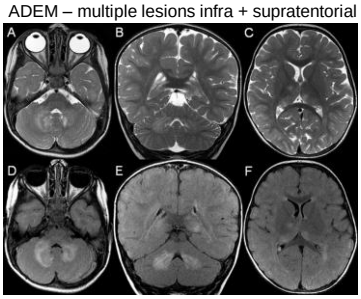
1. A first multifocal, clinical CNS event of presumed inflammatory demyelinating cause
2. Encephalopathy that cannot be explained by fever
3. Abnormal brain MRI:
   - Diffuse, poorly demarcated, large (>1–2 cm) lesions predominantly involving the cerebral white matter
   - T1-hypointense lesions in the white matter in rare cases
   - Deep grey matter abnormalities (eg, thalamus or basal ganglia) can be present
4. No new clinical or MRI findings after 3 months of symptom onset
5. Reasonable exclusion of alternative causes

32 Krupp LB, Tardieu M, Amato MP, et al, for the International Pediatric Multiple Sclerosis Study Group. International Pediatric Multiple Sclerosis Study Group criteria for pediatric multiple sclerosis and immune-mediated central nervous system demyelinating disorders: revisions to the 2007 definitions. Mult Scler 2013; 19: 1261–62

ADEM

- **Imaging**
  bilateral mulifocal subcortical white matter lesions
  central grey matter nuclei (bg,thalami) often affected
  spinal cord: lesions common, often extensive
  optic nerves: may be involved
- **CSF**
  Protein mostly elevated (mild to moderate)
  Pleocytosis common (lymphocytic)
  Oligoclonal bands usually not present (0-30%)
- **Serum**
  MOG antibodies prevalent (not specific)
- **Treatment**
  → steroids

ADEM – multiple lesions infra + supratentorial



Clinical and neuroradiological differences of paediatric acute disseminating encephalomyelitis with and without antibodies to the myelin oligodendrocyte glycoprotein

Baumann et al JNNP 2015

Children with ADEM and MOG antibodies
- Young age (peak < 5 years)
- Better outcome
- MRI brain - large, bilateral, widespread lesions
- MRI spine - often extensive longitudinal lesions
- Relapses prevalent

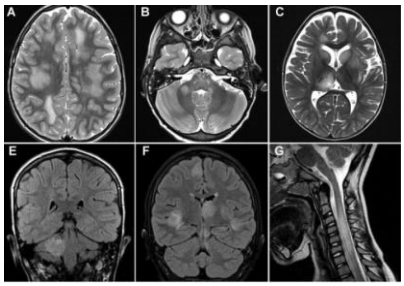
MOG antibodies (in children)

- MOG ab prevalent (> 1/3) in ADS
- MOG ab at presentation ~ 50% relapses
- MOG ab at onset → non-multiple sclerosis course
- [Adult ON, Optic Neuritis Treatment Trial (n=177) 1,7% +MOG]

- Disease phenotypes depent on age

younger children – ADEM
older children – ON, TM

Duignan et al DMCN 2018 (n=237 ADS)
- 64 % +MOG in ADEM (45/70)
- 96 % +MOG in relapsing DEM
- 43% +MOG in ON (28/65)
- 06% +MOG in TN (3/50)



Hennes EM, Baumann, Lechner, Rostasy, Neuropediatrics 2018;49:3-11