

Pediatric Neurology Orientation Information For Medical Students:

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Chief Resident Contact Information:

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1. Department Info

The pediatric neurology service at ACH runs as a combination of both outpatient and inpatient care. You will be exposed to both.

The neurology team is separated into the general neurology team, and the neurocritical care (NCC) team. Usually, only pediatric neurology residents will be assigned to NCC, unless we have a large team and NCC is busy, or you have specific objectives you would like to meet by seeing NCC patients. NCC is responsible to urgent NICU and PICU consults, and follow these patients while they are admitted to intensive care.

The team is led by a single staff neurologist who is on service for 1 week at a time. The staff neurologists and their particular areas of interest are:

Dr. Michael Esser	Section Head, Neurocritical Care
Dr. Colleen Curtis	General Neurology, Program Director
Dr. Aleksandra Mineyko	Stroke
Dr. Adam Kirton	Stroke
Dr. Jean Mah	Neuromuscular, Neuroinflammatory
Dr. Alice Ho	Epilepsy/Sleep
Dr. Julia Jacobs-Levan	Epilepsy
Dr. JP Appendino	Epilepsy
Dr. Morris Scantlebury	Epilepsy
Dr. Kara Murias	Developmental
Dr. Harvey Sarnat	Neuropathology
Dr. Serena Orr	Headache
Dr. Mary Dunbar	Stroke
Dr. Megan Crone	Neuromuscular
Leah Foster	NCC Nurse Practitioner
Lindsay Craddock	Headache Nurse Practitioner

A pediatric neurology resident usually runs the day-to-day operations of the service. There may be 1 or 2 on service at a time. The residents are (as of July 2023):

Dr. Alison Marshall	PGY-5
Dr. Jordan Van Dyk	PGY-4
Dr. Sarila Sanhan	PGY-3
Dr. Rebecca Lindsay	PGY-3
Dr. Ray Sun	PGY-2
Dr. Zeanna Jadavji	PGY-1

Additional house staff may include a resident from pediatrics, adult neurology, or other residents or medical students on elective.

2. Tips for the inpatient service (you will have help with this)

Paging

- Go to insite webpage. Click on 'ROCA' at top of page to search who is on call.
- Go to insite webpage. Click on 'paging' then 'Calgary area paging system'. Can search by pager number or name.
- Remember to leave phone number to call back on (5**** numbers can be called from outside of hospital (403-955-****) but 7**** numbers can only be called from inside the hospital. If I get a page asking to be called back on a 7 number, I page the person back with my phone number or... google the hospital phone number, talk to switchboard, and ask them to transfer you to that extension.

The following tips are typically performed and provided to residents, but may be good for you to know as well!

→ MRIs

- Routine MRI's ordered on ConnectCare, need to **provide good clinical history** so the radiologist can choose the best sequences and add-ons (MRS, MRA, etc). Feel free to offer to place the order and save it for practice - just make sure to tell the residents when it's ready so they can approve it!
- **GA days are usually Tuesday, Wednesday, Thursday.** If you need GA on weekends or Monday/Friday they need to be put on the red list, which means we need to call the radiologist and also speak to anesthesia on call (look on ROCA under DI/IR anesthesia). If on the weekend or after business hours (800-1700) regardless of if it is with GA, you need to speak with the radiologist +/- anesthetist if with GA. → this is typically done by residents anyway but included as an FYI

→ LPs: medical students can perform lumbar punctures with supervision by senior residents or staff!

- LP kits can be found in the neurology clinic area, Unit 1, Unit 3, ED, PICU. Not all of them have manometers.
- LPs are sometimes done under conscious sedation. If in ED, an emerg doc can help you arrange ketamine in the procedure room and they will administer while you perform the LP. If on the unit, the charge nurse knows where the conscious sedation checklists are which you need to fill out before performing (we usually use Ativan or midaz). If it will be a very difficult procedure, they can be booked in the induction room (floor 3 by the ORs) but this needs to be done ahead of time (this is where anesthesia comes to help and have them quite sedated).

→ Admissions/discharge:

- There is a standard 'neurology admission – pediatric' order set under 'orders' on ConnectCare. You can complete admission orders and then save them to be submitted by a resident/staff.
- **Provide family with nurse's contact card if they are to follow up in the neurology clinic**
- **When giving a nurse's business card to a patient/family in the ER or on the ward, let the nurse know about the patient (in person or via email).**

3. How To Complete A Good Pediatric Neurology Consult

Completing a quality consult in child neurology rests on the same principles as any other area of medicine. However, there are a few elements of pediatric neurology that are different and learning and practicing these will improve your abilities at assessing and managing children with neurological problems.

History

- *ID* – include age and hand preference
- *HPI* – try to get a detailed history of all the chief complaint
 - Headaches – frequency, location, duration, nature (?throbbing), associated symptoms (?aura, photo/phonophobia)
 - Seizures – frequency, onset (try to be as precise as possible), duration, post ictal weakness/speech problems, loss of sphincter control, ?multiple types
- *ROS* – include both general and neurologic symptoms
- *PMHx* – child's as well as maternal pre and perinatal history
- *Medications/Allergies/Immunizations*
- *Developmental history* – If you don't know your milestones, grab a developmental screen from the clinic and work through it with the family
- *Family history* – there are a lot of genetic conditions in neurology. Make sure you ask about consanguinity and ask *specifically* about people with neurological symptoms, not just “any neurological problems.” Ask about >5 miscarriages, learning disabilities, trouble with balance or walking, visual or hearing problems, etc.
- *Social History* – Make sure to ask about family, school, and other social situations. It is also helpful to know about health care coverage in case medication will be recommended.

Physical Exam

Observation – much of your impression will need to come from observing the child while you take the history. With young children, these may form the bulk of your exam.

Format – a structured approach to the neurological exam can be helpful and make you less likely to forget something. While difficult in small children, you should try and include the following elements of the neurological examination:

- *Vital signs* – include trends (ie. ‘tachycardic, trending down from 150-130s’; ‘on 0.5L NP currently, previously 2L maximum on [date]’)
- *General statement* – include dysmorphic features, neurocutaneous signs
- *Growth* – height, weight and head circumference with percentiles.
- *Cognitive* – comment on LOC, behavior, affect. If there are concerns about cognitive delay, describe deficits here e.g. can do simple arithmetic only, unable to read grade 2 passage, etc.
- *Language* – simple assessment is naming (identify 3 objects), comprehension (2-step task), repetition (“no ifs ands or buts”), and fluency
- *Cranial nerves* – describe your findings rather than generalizing “II to XII intact”. Try to describe the findings in order of the cranial nerves (ie. start with CNII, end with CNXII).
- *Motor* – bulk, tone, power
- *Deep Tendon reflexes, plantar response, clonus* (+/- primitive reflexes)

- *Sensory* – test light touch, pin prick, temp, vibration, proprioception, Romberg, and cortical sensation as needed
- *Coordination* – finger-to-nose, rapid alternating movements, fine finger movements, heel-to-shin
- *Gait* – Posture, stance, arm swing, turning, etc. including toes, heels, and tandem walk
- *Systemic* – put this last – HEENT (fontanelles, dysmorphisms), cardiac, resp, GI, GU, derm, MSK

Follow this order when you are presenting the exam to the team. You should complete a full neurological and general physical examination for each new patient.

Impression

Try to summarize the main issues in 2-3 sentences. In neurology, the next step is often an attempt to “localize” the lesion. Don’t feel you need to know all the detailed neuroanatomy but think about where the problem might be in big categories. Below is an approach to localization:

1) Symptoms pattern (UMN vs LMN vs mixed)

- UMN (central)
 - Weakness
 - Spasticity
 - Hyperreflexia
 - Extensor plantar response/Positive Babinski
- LMN (peripheral)
 - Weakness
 - Atrophy
 - Reflex loss
 - Fasciculations

2) Localization (Central vs Peripheral)

- Central:
 - Subarachnoid space/meninges: headache, aLOC, CN deficits
 - Cerebral cortex: UMN hemiplegia (weak on one side with brisk reflexes) +/- hemisensory loss, aphasia, neglect, hemianopia, dementia, seizure
 - Basal ganglia: chorea, athetosis, dystonia, tremor, rigidity
 - Thalamus: LOC or memory disturbance, hemisensory loss +/- pain, hemiataxia neglect or aphasia
 - Cerebellum: ataxia, tremor, nystagmus
 - Brainstem: CN deficits, impaired LOC, crossed or bilateral motor or sensory deficits
 - Spinal cord: LMN weakness at level of lesion, UMN below level of lesion, sensory level present, dissociated sensory loss, neurogenic bladder
- Peripheral:
 - Dorsal root ganglion: sensory loss and reflex loss
 - Anterior horn cell: LMN weakness and reflex loss
 - Spinal nerve roots: Radicular pain; motor, sensory, reflex loss in specific root distribution
 - Plexus: mixed nerve and root distribution
 - Peripheral nerves: pain; motor, sensory, and reflex loss in specific nerve distribution OR distal symmetric sensory loss +/- weakness
 - Neuromuscular junction: fatigable weakness (motor only), reflexes intact

- Muscle: proximal muscle weakness (motor only), DTRs may be lost

3) Time frame

- a) Acute (mins to hrs)
 - Ischemia
 - Seizure
 - Trauma
- b) Subacute (days to weeks; pattern of symptom progression smooth, stair-step, or crescendo)
 - Expanding lesion (tumours, abscesses, etc)
- c) Recurrent-remittent (episodic attacks with rapid recovery to baseline)
 - TIA
 - Seizures
 - Migraine
 - MS
- d) Chronic-progressive (months to years)
 - Friedreich's ataxia
 - Huntington's chorea

4) Etiology

- a) VITAMIN CD
- b) Neuro specific stuff: Demyelination, epilepsy, migraine

Hot tips:

- If cranial nerve involvement, follow the course of the nerve and think about associated symptoms you would expect at each spot
 - o Ex/ CN6: subarachnoid space, cavernous sinus, superior orbital fissure, orbit, nucleus in pons

Differential Diagnosis

Depending on the problem, a classification scheme may be helpful:

VITAMIN D GETS

Vascular, Infectious, Toxic, Autoimmune, Metabolic, Inflammatory, Neoplastic, Drugs, Genetic, Endocrine, Trauma, Structural

Plan

Based on your impression and differential, list the investigations and management you would suggest. This is often best done as a problem list with a plan for each issue.

Following a structured approach will improve your skills in neurological history taking and examination. The above are just a few suggestions – you will pick up things from the neurologists as you go along.

4. Developmental Screening for the Non-Pediatrician

Developmental screening is an important part of every pediatric neurology consultation. It can be intimidating, but if you memorize a few key milestones, you should be able to decide whether a patient is on track or delayed.

- Children who are in school with a normal academic performance and normal sports activities need only a brief assessment to rule out any red flags.
- Younger children need a more detailed evaluation. Ask about regression/loss of skills and plateau/no new skills.
- Ask about the four areas of functioning: gross motor, fine motor, speech/language, social/adaptive. Cognitive is another area (ie. numbers, letters, colours).

Below are the bare bones of milestones to memorize:

Age	Gross Motor	Fine Motor	Speech/Language	Social
1 month				Social smile – red flag if not present at 2 mo
3 months			<i>Coos</i>	
4 months	Rolls front to back No head lag	Reach and grasp objects to mouth		Moro extinguished
6 months	Tripod sit	Ulnar grasp	<i>babbles</i>	
8 months	<i>Sits alone</i>	Transfer across midline		
9 months	Pull to stand		“mama” “dada” appropriate	Separation anxiety
12 months	Cruises	<i>Pincer grasp</i>	<i>12-19 months minimum acceptable # words is age – 10 Most children have 100 words by age 2</i>	Peek-a-boo
15 months	<i>Walks independently</i>			<i>Points to needs</i>
18 months	Stairs with help	Uses spoon		Points to body parts
24 months			<i>2-3 word phrases 50% understandable</i>	Parallel play
3 years	Tricycle	Draws circle	Prepositions 75% understandable	
4 years	Hop on 1 foot	Draws square	<i>Speech intelligible</i>	Toilet trained
5 years	Skips	Draws triangle	Alphabet	

More detailed chart below:



The Division of Developmental Pediatrics,
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SNAPSHOTS* DEVELOPMENTAL MILESTONES

Mnemonic	Gotta Find Strong Coffee Soon:				
	G = Gotta	F = Find	S = Strong	C = Coffee	S = Soon
Age	Gross Motor	Fine Motor	Speech / Language	Cognitive / Problem Solving	Social / Emotional
Newborn	Primitive reflexes – step, place, Moro, Babinski, ATNR Flexor posture	Primitive reflexes – grasp	Primitive reflexes – root, suck Alerts to sound Startles to loud sounds Variable cries	Visual focal length ~10" Fix & follow slow horizontal arc Prefers contrast, colours, face Prefers high pitched voice	Bonding (parent → child) Self-regulation/soothing
2 mos	Head steady when held Head up 45° prone	Hands open half of time Bats at objects	Turns to voice Cooing	Prefers usual caregiver Attends to moderate novelty Follows past midline	Attachment (child → parent) Social smile
4 mos	Sits with support Head up 90° prone, arms out Rolls front → back	Palmar grasp Reaches and obtains items Brings objects to midline	Laugh, razz, "ga", squeal	Anticipates routines Purposeful sensory exploration of objects (eyes, hands, mouth)	Turn-taking conversations Explores parent's face
6 mos	Postural reflexes Sits tripod Rolls both ways	Raking grasp Transfers hand to hand	Babble (nonspecific)	Stranger anxiety Looks for dropped or partially hidden object	Expresses emotions: happy, sad, mad Memory lasts ~24 hrs
9 mos	Gets from all 4s → sitting Sits well with hands free Pulls to stand Crawls on hands and knees	Inferior pincer grasp Pokes at objects	"Mama", "dada" (specific) Gestures "bye bye", "up" Gesture games ("pollycake")	Object permanence Uncovers toy "Peek-a-boo"	Separation anxiety
12 mos	Walks a few steps Wider-based gait	Fine pincer (fingertips) Voluntary release Throws objects Finger-feeds self cheerios	1 word with meaning (besides mama, dada) Inhibits with "no!" Responds to own name 1-step command with gesture	Cause & effect Trial & error Imitates gestures and sounds Uses objects functionally: eg rolls toy car	Explore from secure base Points at wanted items Narrative memory begins
15 mos	Walks well	Uses spoon, open top cup Tower of 2 blocks	Points to 1 body part 1-step command no gesture 5 words Jargonizing	Looks for moved hidden object if saw it being moved Experiments with toys to make them work	Shared attention: points at interesting items to show to parent Brings toys to parent
18 mos	Sloops and recovers Runs	Carries toys while walking Removes clothing Tower of 4 blocks Scribbles, fistled pencil grasp	Points to object, 3 body parts 10-25 words Embedded jargonizing Labels familiar objects	Imitates household Symbolic play with doll or bear, eg "Give teddy a drink"	Increased independence Parallel play
2 yr	Jumps on two feet Up & down stairs "marking time"	Handedness established Uses fork Tower of 6 blocks Imitates vertical stroke	Follows 2-step command 50+ words, 50% intelligible 2 word phrases "I", "me", "you", plurals	New problem-solving strategies without rehearsal Searches for hidden object after multiple displacements	Testing limits, tantrums Negativism ("no") Possessive ("mine")
3 yr	Pedals trike Up stairs alternating feet	Undresses Toilet trained (2 ½ - 3 ½ yrs) Draws circle, cross + Turns pages of books	3-step commands 200 words, 75% intelligible 3-4 word phrases W questions ("why?") States full name, age, gender	Simple time concepts Identifies shapes Compares 2 items (eg "bigger") Counts to 3	Separates easily Sharing, empathy Cooperative play Role play ("pretending")
4 yr	Hops on one foot Down stairs alternating feet	Draws x, o, triangles Cuts shape with scissors Buttons	Sentences, 100% intelligible Tells a story Past tense	Counts to 4 Opposites Identifies 4 colours	Has preferred friend Elaborate fantasy play
5 yr	Balance on one foot 10 secs May learn to ride bicycle (if available)	Draw person (10 body parts) Tripod pencil grasp Prints name, copies letters Independent ADLs, incl tying	5000 words Future tense Word play, jokes, puns Phonemic awareness	Counts to 10 accurately Recite ABC's by rote Recognises some letters Pre-literacy and numeracy skills	Has group of friends Follows group rules Games with rules

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*Milestone ages approx. make the 50th percentile.
† Sector heading mnemonic created by F. MacPherson, Class of 2012, University of Alberta Faculty of Medicine and Dentistry.

Pearls:

- Hand dominance before 12 months is a red flag.
- Try to estimate the developmental age if you suspect delay.
- Refer to the Denver Developmental Screening for more detailed assessment.

5. Literature Package for Pediatric Neurology Rotation

A literature package is available to help you cover some of the more common topics encountered in child neurology. The target audience is the pediatric resident but others rotating through the service should also find these useful.

These readings are not mandatory but will significantly supplement your learning and allow you to learn about common conditions you may not encounter during your rotation.

This package can be found on our website:

<https://sites.google.com/view/pediatricneurologyuofc/academic-resources/reading-material>

Please also see the PICU Guidelines for TBI, Status Epilepticus, and Status Dystonicus guidelines on AHS InSite.

Other references you may find helpful are available in the library (neurology section):

1. Pediatric Neurology – Swaiman (2006)
2. Child Neurology – Menkes and Sarnat (2005)
3. Disorders of the Nervous System in Childhood – Aicardi (2000)
4. Neurology of the Newborn – Volpe (2001)
5. Pediatric Neuroimaging – Barkovitch (2001)
6. Aid to Examination of Peripheral Nervous System (ask a resident)
7. www.geneclinics.org
8. <http://www.ucalgary.ca/library>
9. ACH -- <https://www.albertahealthservices.ca/findhealth/facility.aspx?id=1010904>