Childhood Neurologic Conditions

We are seeking an author or author group to write a manuscript for this edition of *FP Essentials*™ that will update family physicians about childhood neurologic conditions. This edition will cover four topics:

1. Evaluation of a first childhood seizure
2. Management of chronic seizures in children
3. Movement disorders in children
4. Neuroanatomic anomalies in children

The main text of the manuscript should be approximately 10,000 words in length, divided into four sections of approximately 2,500 words each with an abstract of 200 words maximum for each section. In addition, there should be key practice recommendations, a maximum of 15 tables and figures), suggested readings, and a single reference list with up to 200 references to provide support for all factual statements in the manuscript.

The edition should focus on what is new in each topic and should answer the key questions listed for each section. Each section should begin with an illustrative case, similar to the examples provided, with modifications to emphasize key points; each case should have a conclusion that demonstrates resolution of the clinical situation. The references here include information that should be considered in preparation of this edition. However, these references are only a useful starting point.

Needs Assessment: Pediatric neurologic concerns that present in family practices can be intimidating for clinicians to diagnose and treat, and frequently require collaboration with various subspecialists for appropriate management. Referral resources, including pediatric neurology and neurosurgery subspecialists as well as specialized behavioral therapists, may be limited in certain practice areas and may have long waiting times for evaluation. A detailed understanding of diagnostic and therapeutic options for common and rare pediatric neurologic conditions is important for academic and community-based family physicians, as is the ability to triage pediatric neurologic emergencies. In an American Academy of Family Physicians (AAFP) survey, members ranked some of the conditions discussed in this edition in the top 10% of conditions for which there is a gap between relevance to practice and current skill and knowledge in diagnosing and managing the conditions. This edition will narrow that knowledge gap and build confidence within clinicians relative to the diagnosis and initial versus longitudinal management of these often challenging and perplexing neurologic conditions.

Section 1: Evaluation of a First Childhood Seizure

Example case: *CR is a 22-month-old girl with an unremarkable birth and medical history. Her mother brings her to your office for evaluation after a possible seizure at home. She has had a 2-day history of progressive rhinorrhea and cough, and last night her temperature was 40°C (104°F). Her mother noticed that for approximately 1 to 2 minutes CR was shaking uncontrollably, her eyes rolled upward, she was moaning, then she fell asleep but was arousable.*

Key questions to consider:

- What is the prevalence of childhood seizures? What percentage of children will only have a single, self-limited seizure versus recurrent and chronic seizures?
- Which childhood age groups and sexes are most likely to have seizures?
- What are the common risk factors for the development of childhood seizures?
- What are the common etiologies of childhood seizures?
- What are the common types of epileptic and nonepileptic seizures in children, and what are their presenting signs and symptoms?
- What is the difference between provoked and unprovoked seizures?
- What are pseudoseizures, and how are they different from epileptic seizures? What are the most common causes of pseudoseizures at various ages of presentation?
- What is the appropriate strategy for office and emergency department evaluation of a child with a suspected or confirmed seizure?
- What are the current recommended diagnostic strategies for epileptic and nonepileptic seizures (eg, laboratory evaluation, radiographic imaging, electroencephalography, lumbar puncture), and when are they indicated?
- When is a referral to pediatric neurology or behavioral subspecialist indicated?
- What is the prognosis for children who experience a first seizure? What is the likelihood of epilepsy and/or recurrence following a febrile seizure? For example, what clinical factors or electroencephalography findings predict future seizure events?
- What are the best strategies for clinicians to assess the risk of a possible recurrence of each type of seizure?
- What medical and psychological comorbidities are associated with childhood seizures?
- Is there a relationship between childhood vaccinations and the development of seizures?

Initial references to consider:

- Ellis CA, Ottman R, Epstein MP, Berkovic SF. Generalized, focal, and combined epilepsies in families: new evidence for distinct genetic factors. *Epilepsia*. 2020;61(12):2667-2674.
- Hesdorffer DC, Shinnar S, Lewis DV, et al. Design and phenomenology of the FEBSTAT study. *Epilepsia*. 2012;53(9):1471-1480.
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- Kwak BO, Kim K, Kim SN, Lee R. Relationship between iron deficiency anemia and febrile seizures in children: a systematic review and meta-analysis. *Seizure*. 2017;52:27-34.
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- Foy JM. Enhancing pediatric mental health care: algorithms for primary care. *Pediatrics*. 2010;125(Suppl 3):S109-S125.
- Hambidge SJ, Newcomer SR, Narwaney KJ, et al. Timely versus delayed early childhood vaccination and seizures. *Pediatrics*. 2014;133(6):e1492-e1499.
- Wolf SM, McGoldrick PE. Seizure patterns in childhood. *Pediatr Ann*. 2015;44(2):e24-e29.
- Rawat VS, Dhiman V, Sinha S, et al. Co-morbidities and outcome of childhood psychogenic non-epileptic seizures—an observational study. *Seizure*. 2015;25:95-98.
- Reilly C, Menlove L, Fenton V, Das KB. Psychogenic nonepileptic seizures in children: a review. *Epilepsia*. 2013;54(10):1715-1724.
- Khan A, Lim H, Almubarak S. Importance of prompt diagnosis in pediatric epilepsy outcomes. *Seizure*. 2020;80:24-30.

Section 2: Management of Chronic Seizures in Children

Example case: *JH is an 8-year-old boy with an unremarkable birth and medical history who was diagnosed with generalized tonic-clonic seizures at age 3 years. He had a negative neurologic assessment, and there was no definable etiology for his seizures. He loves to run, climb, and play sports but has been limited due to occasional breakthrough seizures despite taking daily antiepileptic drugs.*

Key questions to consider:

- What is the prevalence of chronic seizures in children?
- Which childhood age groups and sexes are most likely to be affected?
- What are the common types of chronic epileptic and nonepileptic seizures in children?
- What are the current evidence-based treatments for each type of seizure, including abortive and prophylactic options?
- What are the current recommendations for longitudinal surveillance and testing of children with chronic seizures? What adverse effects may occur with common antiepileptic drugs?
- What are the current recommended activity restrictions (eg, sports, swimming, driving) and limitations for children with seizures?
- What is the natural course of chronic childhood seizures? Which forms commonly subside in childhood, and which forms commonly continue through adolescence and into adulthood?
- When should children with chronic seizures be referred to a subspecialist for treatment guidance and/or follow-up?
- What are the common complications associated with each form of childhood seizure?
- What is the psychological effect on the child with chronic and refractory seizures?
- What options exist for the child with medically refractory seizures? For example, when is vagus nerve stimulation or surgery indicated for the management of childhood seizures? How successful are these and other treatments and what are their risks?
- Is there a role for integrative medicine in the management of childhood seizures? Is there any proven efficacy with delta-9-tetrahydrocannabinol (THC) or cannabidiol (CBD) products?
- What is the role of telemedicine in triaging and managing chronic seizures in children? Are there any studies that show that it can be used safely and accurately?

Initial references to consider:

- Wilmshurst JM, Gaillard WD, Vinayan KP, et al. Summary of recommendations for the management of infantile seizures: task force report for the ILAE Commission of Pediatrics. *Epilepsia*. 2015;56(8):1185-1197.
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- Kenney D, Wirrell E. Patient considerations in the management of focal seizures in children and adolescents. *Adolesc Health Med Ther*. 2014;5:49-65.
- Nevitt SJ, Sudell M, Tudur Smith C, Marson AG. Topiramate versus carbamazepine monotherapy for epilepsy: an individual participant data review. *Cochrane Database Syst Rev*. 2019;(6):CD012065.
- Englot DJ, Han SJ, Rolston JD, et al. Epilepsy surgery failure in children: a quantitative and qualitative analysis. *J Neurosurg Pediatr*. 2014;14(4):386-395.
- Ramey WL, Martirosyan NL, Lieu CM, Hasham HA, Lemole GM Jr, Weinand ME. Current management and surgical outcomes of medically intractable epilepsy. *Clin Neurol Neurosurg*. 2013;115(12):2411-2418.
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- Knorr C, Greuter L, Constantini S, et al. Subgroup analysis of seizure and cognitive outcome after vagal nerve stimulator implantation in children. *Childs Nerv Syst*. 2021;37(1):243-252.
- Soleman J, Stein M, Knorr C, et al. Improved quality of life and cognition after early vagal nerve stimulator implantation in children. *Epilepsy Behav*. 2018;88:139-145.
- McWilliams A, Reilly C, Gupta J, Hadji-Michael M, Srinivasan R, Heyman I. Autism spectrum disorder in children and young people with non-epileptic seizures. *Seizure*. 2019;73:51-55.
- Pujar S, Scott RC. Long-term outcomes after childhood convulsive status epilepticus. *Curr Opin Pediatr*. 2019;31(6):763-768.

Section 3: Movement Disorders in Children

Example case: *SA is a 10-year-old girl with an unremarkable birth and medical history who is brought to your office by her parents for evaluation of twitching. Recently, her parents have noticed that spontaneously, and when she is stressed, SA exhibits uncontrolled twitches of the eyelids, lips, and head. SA reports that initially, she was not aware of these movements, but the children at school have made fun of her because of it. She has become anxious about this and does not want to go to school or sometimes does not even want to come out of her room.*

Key questions to consider:
Please review: Tourette syndrome, simple versus complex tics, dystonia, tremor, each to be discussed in separate subsections.

- What is the prevalence of each condition? Which childhood ages and sexes are most likely to be affected?
- What is the pathophysiology of each condition?
- What are the common risk factors and etiologies of each condition?
- What are the common presenting signs and symptoms associated with each condition?
- How does a clinician distinguish each of these movement disorders from the others? That is, what are the current diagnostic criteria for each condition, and what is the recommended evaluation to ensure an accurate diagnosis?
- What are the current evidence-based treatments for each condition, highlighting behavioral therapy, pharmacotherapy, and surgical options? How effective are they?
- What are the common complications associated with each condition? What are the consequences of unmanaged disease or a delay in diagnosis?
- What medical and psychological comorbidities are associated with each condition?
- When are these conditions considered to be *normal* or self-limited versus continuing into adolescence and adulthood? What is the long-term prognosis?
- When should children with these conditions be referred to a subspecialist and/or therapist for guidance with diagnostic evaluation, treatment, and/or follow-up?

Initial references to consider:

- Hallett M. Tourette syndrome: update. *Brain Dev*. 2015;37(7):651-655.
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- Coenen MA, Eggink H, Tijssen MA, Spikman JM. Cognition in childhood dystonia: a systematic review. *Dev Med Child Neurol*. 2018;60(3):244-255.
- Carecchio M, Invernizzi F, Gonzàlez-Latapi P, et al. Frequency and phenotypic spectrum of KMT2B dystonia in childhood: a single-center cohort study. *Mov Disord*. 2019;34(10):1516-1527.
- Elkaim LM, De Vloo P, Kalia SK, Lozano AM, Ibrahim GM. Deep brain stimulation for childhood dystonia: current evidence and emerging practice. *Expert Rev Neurother*. 2018;18(10):773-784.
- Sanger TD, Chen D, Fehlings DL, et al. Definition and classification of hyperkinetic movements in childhood. *Mov Disord*. 2010;25(11):1538-1549.
- Kirkham FJ, Haywood P, Kashyape P, et al. Movement disorder emergencies in childhood. *Eur J Paediatr Neurol*. 2011;15(5):390-404.
- Blaes F, Dharmalingam B. Childhood opsoclonus-myoclonus syndrome: diagnosis and treatment. *Expert Rev Neurother*. 2016;16(6):641-648.

Section 4: Neuroanatomic Anomalies in Children

Example case: *TT is a 9-month-old boy with an unremarkable birth and medical history who is brought to your office by his father for a well-child examination. On review of his growth chart, you notice that his head circumference was above the 50th percentile at birth although weight and length were at the 25th percentile. Head circumference has increased sequentially at every well-child examination measurement. At the 6-month visit, head circumference was at the 80th percentile, and today it is above the growth curve.*

Key questions to consider:
Please review: macrocephaly, microcephaly, hydrocephalus, craniosynostosis, each to be discussed in separate subsections.

- What is the prevalence of each condition, and how are they defined?
- Which childhood ages and sexes are most likely to be affected?
- What are the common risk factors and etiologies of each condition? Are they typically associated with other abnormalities?
- What are the common presenting signs and symptoms associated with each condition?
- When should family physicians be concerned that head circumference and other neuroanatomic measurements exceed normal variation (ie, when is it a problem)? What strategies can help distinguish benign or self-limited conditions from those that need intervention?
- What are the current diagnostic criteria for each condition, and what is the recommended evaluation (eg, cranial imaging) to ensure an accurate diagnosis?
- What are the current evidence-based treatments for each condition, highlighting behavioral therapy, pharmacotherapy, and surgical options?
- What are the common complications associated with each condition? What are the consequences of unmanaged disease or a delay in diagnosis?
- Which of these conditions can persist into adolescence and adulthood?
- When should children with these conditions be referred to a subspecialist and/or therapist for guidance with diagnostic evaluation, treatment, and/or follow-up?
- What medical and psychological comorbidities are associated with each condition?

Initial references to consider:

- Yılmazbaş P, Gökçay G, Eren T, Karapınar E, Kural B. Macrocephaly diagnosed during well child visits. *Pediatr Int*. 2018;60(5):474-477.
- Orrù E, Calloni SF, Tekes A, Huisman TAGM, Soares BP. The child with macrocephaly: differential diagnosis and neuroimaging findings. *AJR Am J Roentgenol*. 2018;210(4):848-859.
- Pierson TM, Otero MG, Grand K, et al. The NuRD complex and macrocephaly associated neurodevelopmental disorders. *Am J Med Genet C Semin Med Genet*. 2019;181(4):548-556.
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- Sharawat IK, Dawman L. Risk factors for pathologic macrocephaly in children. *Pediatr Neurol*. 2019;98:93.

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- Morris LM. Nonsyndromic craniosynostosis and deformational head shape disorders. *Facial Plast Surg Clin North Am*. 2016;24(4):517-530.
- Liu Y, Kadlub N, da Silva Freitas R, Persing JA, Duncan C, Shin JH. The misdiagnosis of craniosynostosis as deformational plagiocephaly. *J Craniofac Surg*. 2008;19(1):132-136.
- Kahle KT, Kulkarni AV, Limbrick DD Jr, Warf BC. Hydrocephalus in children. *Lancet*. 2016;387(10020):788-799.
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- Perenc L, Guzik A, Podgórska-Bednarz J, Drużbicki M. Abnormal head size in children and adolescents with congenital nervous system disorders or neurological syndromes with one or more neurodysfunction visible since infancy. *J Clin Med*. 2020;20;9(11):3739.