LRC
LYME RESOURCE CENTRE

Registered Scottish charity SC049151

PAEDIATRIC LYME NEUROBORRELIOSIS

Lyme disease has been described as 'The New Great Imitator"

OVERVIEW:

Lyme Borreliosis (Lyme disease) is caused by the spirochete Borrelia burgdorferi and transmitted via the bite of an infected Ixodes tick. Lyme Neuroborreliosis (LNB) is the most common manifestation of disseminated Lyme borreliosis in Europe,

The most common features in children include facial nerve palsy (unilateral or bilateral), headache, fatigue, and lymphocytic meningitis. Younger children may present with irritability, neck stiffness, or poor appetite, while older children may report radicular pain or sensory changes. Fever is often absent.
Diagnosis can be challenging - consider Lyme disease when assessing children with unusual neurological symptoms.

POSSIBLE PRESENTING FEATURES:

General	Neurological	Multi-system features
Low grade fever Erythema migrans Malaise Fatigue Myalgia (can be migratory) Abdominal pain History of possible tick exposure Sensitivity to light/sound	Headache Neck stiffness **Facial palsy / cranial nerve palsy** Cognitive dysfunction Paraesthesia Sensory/motor neuropathies Radiculopathies **Aseptic meningitis** Mononeuropathy multiplex Balance abnormalities Neuropsychiatric symptoms Visual disturbance (blurring/diplopia/ papilloedema) Bannwarth's syndrome	Cardiac - Myocarditis/pericarditis - Arrhythmia - AV conduction defects - sudden cardiac death Musculoskeletal - Joint swelling - Myositis - Tendinitis Dermatological - Borrelial lymphocytoma - Acrodermatitis chronica atrophicans Ophthalmological - Keratitis , uveitis - Episcleritis

DIAGNOSIS:

- Often clinical - based on history & examination -may require a high index of suspicion
- Tick bites are painless and often go unnoticed. Consider potential tick exposure.
- There may be a long period between tick exposure, the first appearance of the rash, and then neurological symptoms - eg: weeks, or months.
- Erythema migrans (EM) rash:
    - Diagnostic (serology not required). Usually appears 3-30 days after the bite.
    - Present in approx 70% of cases. Often erythematous rash >3m in size (bull's eye appearance only approx. ⅓ of EM rashes)
    - Different appearances in melanated skin tones. Can be heat sensitive (appears when skin warmed e.g. post shower).
    - May have resolved prior to onset of neurological symptoms.
    - If multiple, higher suspicion of disseminated disease.
- Serology and CSF may help to confirm but not necessarily exclude the diagnosis.
- **A negative test result does not exclude the diagnosis.** (NICE Guideline NG95)
- MRI may be normal.
- Symptoms may be migratory and fluctuate in intensity.

ng95/resources/lyme-disease-rash-images-pdf-4792273597
https://www.cdc.gov/lyme/signs-symptoms/lyme-disease-rashes.html

TREATMENT:

- Overview | Lyme disease | Guidance | NICE
- Lyme disease: Antibiotic choices - BMJ Visual summary
- Antibiotic treatment - as per NG95 - based on age and symptoms
- NB - dosages are higher and for longer duration than for many other conditions.
- Early and adequate treatment provides the best chance of cure.
- Guideline committee acknowledges the limited evidence base for these guidelines.

USEFUL PAPERS:

- **Immune evasive infection**: Bamm VV, Ko JT, Mainprize IL, Sanderson VP, Wills MKB. Lyme Disease Frontiers: Reconciling *Borrelia* Biology and Clinical Conundrums. Pathogens. 2019 https://pubmed.ncbi.nlm.nih.gov/31888245
- **Lyme Neuroborreliosis in Children.** Brain Sci. 2021 Jun 7;11(6):758. Kozak S, Kaminiów K, Kozak K,Paprocka J https://pmc.ncbi.nlm.nih.gov/articles/PMC8226969/
- **Clinical presentation of childhood neuroborreliosis; neurological examination may be normal.** Arch Dis Child. 2010 Nov;95(11):910-4. Broekhuijsen-van Henten DM, Braun KP, Wolfs TF.https://adc.bmj.com/content/95/11/910.abstract
  'Even in the absence of neurological signs, neuroborreliosis may be suspected in children with typical antecedents and multiple symptoms.'
- **Travel Can Be a Real "Pain in the Neck": A Rare Presentation of European Lyme Neuroborreliosis**
  https://scholarlyworks.lvhn.org/cgi/viewcontent.cgi?article=1437&context=pediatrics

FACIAL / OTHER CRANIAL NERVE PALSIES:

- **Clinical predictors of Lyme disease among children with a peripheral facial palsy at an emergency department in a Lyme disease-endemic area.** Nigrovic LE, Thompson AD, Fine AM, Kimia A. Pediatrics. 2008 Nov;122(5):e1080-5. https://pubmed.ncbi.nlm.nih.gov/18931349/
  '*Facial palsy with headache and fever has been shown to predict early Lyme disease in children during peak Lyme disease season in endemic areas (May – Oct)'*
- **Approach of pediatric neuroborreliosis.** Julie Vanbekbergen, Liesbeth De Waele, Katrien Jansen, 2021, Beglian Jounral of Paediatrics, https://www.belgjpaediatrics.com/index.php/bjp/article/view/143/262
  'The majority of patients will have no clear notion of a previous tick bite or EM lesion'.
- **High frequency of paediatric facial nerve palsy due to Lyme disease in a geographically endemic region.** Munro APS, Dorey RB, Owens DR, Steed DJ, Petridou C, Herdman T, Jones CE, Patel SV, Pryde K, Faust SN. Int J Pediatr Otorhinolaryngol. 2020 May;132:109905. https://pubmed.ncbi.nlm.nih.gov/32035348/
  "In areas endemic with Lyme disease, Lyme disease should be considered as the likely cause of facial nerve palsy in children until proven otherwise."
- **Steroid use in Lyme disease-associated facial palsy is associated with worse long-term outcomes.** Jowett N, Gaudin RA, Banks CA, Hadlock TA Laryngoscope. 2017 Jun;127(6):1451-1458., https://pubmed.ncbi.nlm.nih.gov/27598389/

MENINGITIS / ENCEPHALITIS:

- lymphocytic meningitis (particularly children and teenagers)
  Lyme neuroborreliosis in children: Report of nine cases and a review of the literature. Guet-Revillet H, Levy C, Vallet C, Maghraoui-Slim V, Dommergues MA, Hentgen V, Paget C, Laugel V, Cohen R, Ferroni A. Arch Pediatr. 2019 Apr;26(3):133-137. https://www.sciencedirect.com/science/article/abs/pii/S0929693X1930034X

SENSORY / MOTOR NEUROPATHIES, RADICULITIS:

- **Pain as presenting symptom in Lyme neuroborreliosis,** Leif Dotevall, Tore Eliasson, Lars Hagberg, Clas Mannheimer, European Journal of Pain, Volume 7, Issue 3, 2003, Pages 235-239, ISSN 1090-3801,
  'triad of radicular pain, cranial or peripheral paresis, and lymphocytic meningitis ("Bannwarth's syndrome")...The pain has been reported to be the only clinical manifestation in about 20% of the patients with neuroborreliosis'
  https://www.sciencedirect.com/science/article/abs/pii/S1090380102001210
- **Abdominal pain as first manifestation of lyme neuroborreliosis in children, case report and review of literature.** Savasta S, Fiorito I, Foiadelli T, Pichiecchio A, Cambieri P, Mariani B, Marone P, Marseglia G. Ital J Pediatr. 2020 Nov 23;46(1):172. https://link.springer.com/article/10.1186/s13052-020-00936-y

INTERCRANIAL HYPERTENSION:

- **Lyme Neuroborreliosis Presenting with Isolated Intracranial Hypertension: A Case Report.** Bourcier D, Beshara J, Pauli G, Henry T, Peckford M, Huntsman R, Bata BM, Kollmann TR. Case Rep Neurol. 2025 May 26;17(1):72-78., https://pubmed.ncbi.nlm.nih.gov/40557037/
- **Neuroborreliosis with intracranial hypertension and visual loss in a pediatric patient: illustrative case.** Ku A, Sweeney JF, Terry ML, Bheemireddy S, Prabhala T, Adamo MA. J Neurosurg Case Lessons. 2024 Sep 23;8(13):CASE2451. https://pmc.ncbi.nlm.nih.gov/articles/PMC11418640/

CEREBRAL VASCULITIS, ANEURYSMS, STROKE:

- **Lyme Neuroborreliosis: A Potentially Preventable Cause of Stroke** - The Journal of Pediatrics, https://www.jpeds.com/article/S0022-3476(15)01489-4/fulltext
- **Pediatric stroke related to Lyme neuroborreliosis**: Data from the Swiss NeuroPaediatric Stroke Registry and literature review. Monteventi O, Steinlin M, Regényi M, Roulet-Perez E, Weber P, Fluss J. Eur J Paediatr Neurol. 2018 Jan;22(1):113-121, https://pubmed.ncbi.nlm.nih.gov/29208342/
- **Cerebral Vasculitis and Intracranial Multiple Aneurysms in a Child With Lyme Neuroborreliosis - PubMed** https://pubmed.ncbi.nlm.nih.gov/29026617/
- **Stroke due to lyme neuroborreliosis: changes in vessel wall contrast enhancement**. Lebas A, Toulgoat F, Saliou G, Husson B, Tardieu M. J Neuroimaging. 2012 Apr;22(2):210-2., https://pubmed.ncbi.nlm.nih.gov/21122000/

DIPLOPIA AND GAIT ABNORMALITIES:

- **Cerebellar ataxia as the presenting manifestation of Lyme disease.** Arav-Boger R, Crawford T, Steere AC, Halsey NA. Pediatr Infect Dis J. 2002 Apr;21(4):353-6. https://journals.lww.com/pidj/fulltext/2002/04000/cerebellar_ataxia_as_the_presenting_manifestation.21.aspx
- **Acute cerebellar ataxia in a pediatric case of Lyme disease and a review of literature.** Erol I, Saygı S, Alehan F. Pediatr Neurol. 2013 May;48(5):407-10. https://pubmed.ncbi.nlm.nih.gov/23583062/
- **A 4-year-old boy with ataxia and aphasia.**Myette RL, Webber J, Mikhail H, Leifso K. CMAJ. 2020 May 25;192(21):E578-E582. https://www.cmaj.ca/content/192/21/e578

UNUSUAL PRESENTATIONS:

- **Uncommon manifestations of neuroborreliosis in children.** Baumann M, Birnbacher R, Koch J, Strobl R, Rostásy K. Eur J Paediatr Neurol. 2010 May;14(3):274-7. https://www.ejpn-journal.com/article/S1090-3798%2809%2900154-8/abstract *'seizures with regional leptomeningeal enhancement, acute transverse myelitis, meningoradiculitis with pain and paraesthesia and cranial nerve palsies other than facial nerve palsy can be the leading symptoms of children with neuroborreliosis'*
- **Rare Presentation of Pediatric Nervous System Lyme Disease: A Case Report.** Khurtsilava I, Kanjaradze D, Tsirdava N, Parulava T, Darsania I. Cureus. 2024 May 18;16(5):e60535.**https://www.cureus.com/articles/246340-rare-presentation-of-pediatric-nervous-system-lyme-disease-a-case-report#!/**

NEUROPSYCHIATRIC SYMPTOMS:

- **A controlled study of cognitive deficits in children with chronic Lyme disease.** Tager FA, Fallon BA, Keilp J, Rissenberg M, Jones CR, Liebowitz MR. J Neuropsychiatry Clin Neurosci. 2001 Fall;13(4):500-7. https://pubmed.ncbi.nlm.nih.gov/11748319/
- **The Underdiagnosis of neuropsychiatric Lyme Disease in children and Adults** - Science Direct Fallon BA, Kochevar JM, Gaito A, Nields JA. https://www.sciencedirect.com/science/article/pii/S0193953X05700320

PERSISTENT SYMPTOMS:

- **Chronic neurologic manifestations of Lyme disease**. Logigian EL, Kaplan RF, Steere AC. N Engl J Med. 1990 Nov 22;323(21):1438-44., https://www.nejm.org/doi/full/10.1056/NEJM199011223232102
- **Dysautonomia following Lyme disease: a key component of post-treatment Lyme disease syndrome?** Adler BL, Chung T, Rowe PC, Aucott J. Front Neurol. 2024 Feb 8;15:1344862. https://pmc.ncbi.nlm.nih.gov/articles/PMC10883079/

FURTHER INFORMATION:

Overview | Lyme disease | Guidance | NICE
Lyme disease | Health topics A to Z | CKS | NICE
Overview | Lyme disease | Quality standards | NICE
Lyme disease: Antibiotic choices - BMJ visual summary
Lyme disease: sample testing advice - GOV.UK

Course: Lyme Disease Toolkit | RCGP Learning
Course information | Lyme Disease | RCGP Learning

Lyme Resource Centre
For Health Professionals | Lyme Resource Centre
Lyme Disease Experience Survey 2024 - Infected 18 and Under - Summary Posters |
Life Sciences | Cambridge Open Engage

Research Organisations:
Johns Hopkins Lyme Disease Research Center
Columbia-Lyme.org
Bay Area Lyme Foundation