

Lymphocytic Choriomeningitis Virus (LCMV)

Selected References:

- Anderson JL, et. al. 2014. Congenital lymphocytic choriomeningitis virus: when to consider the diagnosis. *J Child Neurol* 29(6):837-42.
- Barton LL and Mets MB. 2001. Congenital lymphocytic choriomeningitis virus infection: decade of rediscovery. *CID* 33:370-374.
- Barton LL, et al. 1995. Lymphocytic choriomeningitis virus: an unrecognized teratogenic pathogen. *Emerg Infect Dis* 1(4):152-153.
- Bonthius DJ. 2009. Lymphocytic choriomeningitis virus: a prenatal and postnatal threat. *Advances in Pediatrics* 56:75-86.
- Bonthius DJ. 2012. Lymphocytic choriomeningitis virus: An underrecognized cause of neurologic disease in the fetus, child and adult. *Semin Pediatr Neurol* 19:89-95.
- Bonthius DJ. 2024. Lymphocytic choriomeningitis virus injures the developing brain: effects and mechanisms. *Pediatr Res* 95(2):551-557.
- Centers for Disease Control and Prevention. 2014. Lymphocytic choriomeningitis. [Accessed 2/2021]. Available at URL: <https://www.cdc.gov/vhf/lcm/> and <https://www.cdc.gov/vhf/lcm/pdf/factsheet.pdf>.
- Childs JE, et al. 1992. Lymphocytic choriomeningitis virus infection and house mouse (*Mus musculus*) distribution in urban Baltimore. *Am J Trop Med Hyg* 47(1):27-34.
- Delaine M, et al. 2017. Microcephaly caused by lymphocytic choriomeningitis virus. *Emerg Infect Dis* 23(9):1548-1550.
- Enninga AA, et al. 2019. Lymphocytic Choriomeningitis Virus Infection Demonstrates Higher Replicative Capacity and Decreased Antiviral Response in the First-Trimester Placenta. *J Immunol Res*. Feb 7;2019:7375217. doi: 10.1155/2019/7375217. eCollection 2019.
- Ferenc T, et al. Lymphocytic choriomeningitis virus: An under-recognized congenital teratogen. *World J Clin Cases*. 2022 Sep 6;10(25):8922-8931.
- Fortin O, et al. 2024. Congenital infectious encephalopathies from the intrapartum period to postnatal life. *Semin Fetal Neonatal Med*. Epub 2024 Apr 10. PMID: 38677956.
- Hirsch MS, et al. 1974. Lymphocytic-choriomeningitis-virus infection traced to a pet hamster. *NEJM* 291(12):610-611.
- Jamieson D, et al. 2005. Lymphocytic choriomeningitis virus: An emerging obstetric pathogen. *Am J Obstet Gynecol* 194:1532-1536.
- Komrower GM, et al. 1955. Lymphocytic choriomeningitis in the newborn: probable transplacental infection. *Lancet* 1:697-698.
- Meritet JF, et al. 2009. A case of congenital lymphocytic choriomeningitis virus infection revealed by hydrops fetalis. *Prenatal Diagnosis* 20:626-627.
- Olivieri NR, et al. 2024. Transmission, seroprevalence, and maternal-fetal impact of lymphocytic choriomeningitis virus. *Pediatr Res*; 95(2):456-463.
- Pencole L, et al. Congenital lymphocytic choriomeningitis virus: A review. *Prenat Diagn*. 2022 Jul;42(8):1059-1069.
- Schulte D, et al. 2006. Congenital lymphocytic choriomeningitis virus: an underdiagnosed cause of neonatal hydrocephalus. *The Pediatric Infectious Disease Journal* 25(6):560-562.
- Tevaeearai F, Moser L, Pomar L. Prenatal Diagnosis of Congenital Lymphocytic Choriomeningitis Virus Infection: A Case Report. *Viruses*. 2022 Nov 21;14(11):2586
- Traube E. 1973. LCM Virus research, retrospect and prospects, in *Lymphocytic Choriomeningitis Virus and Other Arenaviruses*, Lehmann-Grube F. (ed.) Berlin: Springer-Verlag, pp.3-10.

- Wright R, et al. 1997. Congenital lymphocytic choriomeningitis virus syndrome: A disease that mimics congenital toxoplasmosis or cytomegalovirus. *Pediatrics* 100(1):1-6.

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Lymphocytic Choriomeningitis Virus (LCMV)

Selected References:

- Alder SP and Nigro G. 2013. Prevention of maternal-fetal transmission of cytomegalovirus. *Clinical Infectious Diseases* 57(S4):S189-S192.
- American College of Obstetricians and Gynecologists. 2015. Practice bulletin no. 151: Cytomegalovirus, parvovirus B19, varicella zoster, and toxoplasmosis in pregnancy. *Obstet Gynecol.* 125(6):1510-25.
- Azam A, et al. 2001. Prenatal diagnosis of congenital cytomegalovirus infection. *Obstet Gynecol* 97:443-448.
- Balegamire SJ, et al. 2024. Association Between Maternal Cytomegalovirus Seropositivity, Preterm Birth, and Preeclampsia in Two Cohorts From Quebec, Canada: A Mediation Analysis. *Am J Reprod Immunol.*;92(4):e13941.
- Barlinn R, et al. 2022. Maternal cytomegalovirus infection and delayed language development in children at 3 years of age—a nested case-control study in a large population-based pregnancy cohort. *PLoS ONE* 17(12):e0278623.
- Boppana SB et al. 2013. Congenital cytomegalovirus infection: clinical outcome. *Clinical Infectious Diseases* 57(S4):S178-181.
- Carlson A, et al. 2010. Cytomegalovirus infection in pregnancy: Should all women be screened? *Reviews in OB & GYN*; 3(4):172-179.
- Centers for Disease Control and Prevention (CDC). 2016. Handwashing. Available at: <https://www.cdc.gov/handwashing/when-how-handwashing.html>.
- Centers for Disease Control and Prevention (CDC). 2018. Cytomegalovirus (CMV) and Congenital CMV Infection. Available at: <https://www.cdc.gov/cmv/clinical/features.html>.
- Centers of Disease Control and Prevention (CDC). 2020. About cytomegalovirus and congenital CMV infection.

- Chatzakis C, et al. 2020. Timing of primary maternal cytomegalovirus infection and rates of vertical transmission and fetal consequences. *Am J Obstet Gynecol.* 223(6):870-883.e11.
- Chiopris G, et al. 2020. Congenital Cytomegalovirus Infection: Update on Diagnosis and Treatment. *Microorganisms* Oct 1;8(10):1516.
- Cito G, et al. 2020. Can cytomegalovirus infection affect male reproductive function? Results of a retrospective single-centre analysis. *Andrologia*; 52(9):e13699.
- Diav-Citrin O, et al. 2003. Cytomegalovirus in pregnancy: primary versus secondary infection: a prospective cohort study on 208 pregnancies. *Birth Defects Res Part A Clin Mol Teratol*;67:392.
- Demmler-Harrison GJ, Miller JA. 2020. Houston Congenital Cytomegalovirus Longitudinal Study Group. Maternal cytomegalovirus immune status and hearing loss outcomes in congenital cytomegalovirus-infected offspring. *PLoS One*.15(10):e0240172.
- Enders G, et al. 2001. Prenatal diagnosis of congenital cytomegalovirus infection in 189 pregnancies with known outcome. *Prenat Diag* 21: 362-377.
- Grazia Revello M, et al. 2014. A randomized trial of hyperimmune globulin to prevent congenital cytomegalovirus. *NEJM*; 370:14: 1316-26.
- Farsimadan M, Motamedifar, 2021. The effects of human immunodeficiency virus, human papillomavirus, herpes simplex virus-1 and -2, human herpesvirus-6 and -8, cytomegalovirus, and hepatitis B and C virus on female fertility and pregnancy. *Br J Biomed Sci*;78(1):1-11.
- Feldman DM, et al. 2010. Toxoplasmosis, parvovirus and cytomegalovirus in pregnancy. *Clin Lab Med* 30(3):709-720.
- Foulon I, et al. 2008. Hearing loss in children with congenital cytomegalovirus infection in relation to maternal trimester in which the maternal primary infection occurred. *Pediatrics* 122(6):e1123-e1127.
- Fowler KB, et al. 2003. Congenital cytomegalovirus infection. *Curr Probl Pediatr Adolesc Health Care* 33:70-93.
- Fowler KB. 2013. Congenital cytomegalovirus infection: audiologic outcome. *Clinical Infectious Diseases* 57(S4):S182-S184.
- Harnprecht K, et al. 2001. Epidemiology of transmission of cytomegalovirus from mother to preterm infant by breastfeeding. *Lancet* 357:513-8.
- Hughes BL, et al. 2021. Eunice Kennedy Shriver National Institute of Child Health and Human Development Maternal-Fetal Medicine Units Network. A Trial of Hyperimmune Globulin to Prevent Congenital Cytomegalovirus Infection. *N Engl J Med.* 385(5):436-444.
- Iwasenko JM, et al. 2011. Human cytomegalovirus infection is detected frequently in stillbirths and is associated with fetal thrombotic vasculopathy. *The Journal of Infectious Diseases* 203(11):1526-1533.
- James SH, Kimberlin DW. 2016. Advances in the prevention and treatment of congenital cytomegalovirus infection. *Curr Opin Pediatr.* 28(1):81-5.
- Kagan KO, et al. 2021. Outcome of pregnancies with recent primary cytomegalovirus infection in first trimester treated with hyperimmunoglobulin: observational study. *Ultrasound Obstet Gynecol.* 57(4):560-567.
- Kirschen GW, Burd I. 2023. Modeling of vertical transmission and pathogenesis of cytomegalovirus in pregnancy: Opportunities and challenges. *Front Virol*; 3:1106634.
- Leruez-Ville M, et al. 2020. Quantifying the Burden of Congenital Cytomegalovirus Infection With Long-term Sequelae in Subsequent Pregnancies of Women Seronegative at Their First Pregnancy. *Clin Infect Dis.* 71(7):1598-1603.
- Lipitz S, et al. 2002. Outcome of pregnancies with vertical transmission of primary cytomegalovirus infection. *Am J Obstet Gynecol*: 100:428-33.
- Mocanu AG, et al. 2024. The Impact of Latent Cytomegalovirus Infection on Spontaneous Abortion History and Pregnancy Outcomes in Romanian Pregnant Women. *Microorganisms*.;12(4):731.
- Mestas E. 2016. Congenital cytomegalovirus. *Adv Neonatal Care.* 16(1):60-5.
- National CMV Foundation. 2023. *For healthcare providers*. Physician and OB-GYN Resources, National CMV Foundation, National CMV Foundation.
- National CMV Foundation. 2023. *Possible outcomes*. Congenital CMV Outcomes, National CMV Foundation,

National CMV Foundation.

- Nigro G, et al. 2005. Passive immunization during pregnancy for congenital cytomegalovirus infection. *N Engl J Med* 353:1350-1362.
- Nigro G. 2017. Hyperimmune globulin in pregnancy for the prevention of congenital cytomegalovirus disease. *Expert Rev Anti Infect Ther* 15(11):977-986.
- Nigro G and Alder SP. 2013. Hyperimmunoglobulin for prevention of congenital cytomegalovirus disease. *Clinical Infectious Diseases* 57(S4):S193-S195.
- Ornoy A and Diav-Citrin O. 2006. Fetal effects of primary and secondary cytomegalovirus infection in pregnancy. *Reprod Toxicol* 21:399-409.
- Oliveira GM, et al. 2019. Detection of cytomegalovirus, herpes virus simplex, and parvovirus b19 in spontaneous abortion placentas. *J Matern Fetal Neonatal Med* 32(5):768-775.
- Page JM, et al. 2019. Stillbirth Associated With Infection in a Diverse U.S. Cohort. *Obstet Gynecol* 134(6):1187-1196.
- Pereira L, et al. 2014. Intrauterine growth restriction causes by underlying congenital cytomegalovirus infection. *J Infect Disease* 209: 1573-1584.
- Pesch MH, et al. 2021. Cytomegalovirus Infection in Pregnancy: Prevention, Presentation, Management and Neonatal Outcomes. *J Midwifery Womens Health*. 66(3):397-402.
- Pesch MH, et al. 2024. Intrauterine Fetal Demise, Spontaneous Abortion and Congenital Cytomegalovirus: A Systematic Review of the Incidence and Histopathologic Features. *Viruses*; 16(10):1552.
- Picone O, et al. 2013. A series of 238 cytomegalovirus primary infections during pregnancy: description and outcomes. *Prenatal Diag* 33: 751-758.
- El-Qushayri AE, et al 2020. Hyperimmunoglobulin therapy for the prevention and treatment of congenital cytomegalovirus: a systematic review and meta-analysis. *Expert Rev Anti Infect Ther*. Nov 30;1-9.
- Saade GR 2020. The effect of treatment of maternal CMV infection on the development of placental syndrome. *AJOG* 222(1) Supp:S2-3.
- Seidenari A, et al. 2024. Follow-Up of Infants With Congenital Cytomegalovirus Following Maternal Primary Infection in the First Trimester and Normal Fetal Brain Imaging at Midgestation. *Prenat Diagn*; 45(2):178-184.
- Simonazzi G, et al. 2018. Perinatal outcomes of non-primary maternal cytomegalovirus infection: A 15-year experience. *Fetal Diagn Ther*. 43(2):138-142.
- Sorrenti S, et al. 2025. Diagnosis and management of congenital Cytomegalovirus: Critical Appraisal of Clinical Practice Guidelines. *Eur J Obstet Gynecol Reprod Biol*; 306:172-180.
- Williams EJ, et al. 2013. Viral infections: contributions to late fetal death, stillbirth, and infant death. *J Pediatr* 163(2): 424-428.
- Yinon T et al. 2010. Cytomegalovirus infection in pregnancy. *J Obstet Gynaecol Can* 32(4):348-354.

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Selected References:

- Ackerman JP, et al. 2010. A review of the effects of prenatal cocaine exposure among school-aged children. *Pediatrics* 125(3):554-565.
- Akyuz N, et al. 2014. Structural brain imaging in children and adolescents following prenatal cocaine exposure: preliminary longitudinal findings. *Dev Neurosci*. 316-28.
- Behnke M, et al. 2001. The search for congenital malformations in newborns with fetal cocaine exposure. *Pediatrics* 107(5):E74.
- Bracken MB, et al. 1990. Association of cocaine use with sperm concentration, motility, and morphology. *Fertil Steril* 53:315-322
- British Columbia Reproductive Care Program. 1999. Substance Use Guideline 5B: Prenatal Cocaine Exposure, Care of the Newborn. Retrieved from: www.perinatalservicesbc.ca/Documents/Guidelines-Standards/Newborn/CocaineExposureNewbornCareGuideline.pdf.
- Cestonari, C, et al. 2022. Infants of mothers with cocaine use: Review of clinical and medico-legal aspects. *Children* 9(1):67-84.
- Chiriboga C, et al. 2007. Prenatal cocaine exposures and dose-related cocaine effects on infant tone and behavior. *Neurotoxicol Teratol* 29: 323-330.
- Chiriboga CA, et al. 2009. Prenatal cocaine exposure and prolonged focus attention. Poor infant information processing ability or precocious maturation of attentional systems? *Dev Neurosci* 31(1-2):149-158.
- Cone EJ, et al. 1996. Cocaine excretion in the semen of drug users. *J Anal Toxicol* 20:139-140.
- De Genna, N. M., Goldschmidt, L., & Richardson, G. A. (2022). Prenatal cocaine exposure, early cannabis use, and risky sexual behavior at age 25. *Neurotoxicology and teratology*, 89, 107060. <https://doi.org/10.1016/j.ntt.2021.107060>
- Dos Santos JF, et al. 2018. Maternal, fetal and neonatal consequences associated with the use of crack cocaine during the gestational period: a systematic review and meta-analysis. *Arch Gynecol Obstet*. 298(3):487-503.
- Hoyme HE, et al. 1990. Prenatal cocaine exposure and fetal vascular disruption. *Pediatrics* 85:743-747.
- Jufer RA, et al. 2000. Elimination of cocaine and metabolites in plasma, saliva, and urine following repeated oral administration to human volunteers. *Journal of analytical toxicology*; 24(7), 467-477.
- Karpova N, 2021. Prenatal drug exposure and executive function in early adolescence. *Neurotoxicology and teratology*; 88, 107036.
- Landi N, et al. 2017. Prenatal Cocaine Exposure Impacts Language and Reading Into Late Adolescence: Behavioral and ERP Evidence. *Dev Neuropsychol*. 42(6):369-386.
- Levine TP, et al. 2008. Effects of prenatal cocaine exposure on special education in school-aged children. *Pediatrics* 122 (1): e83-91.
- Lewis BA, et al. 2007. Prenatal cocaine and tobacco effects on children's language trajectories. *Pediatrics*

120(1):e78-85.

- Mayer LC, Nicholls S. 2007. Neurocognitive development in middle-school age and adolescent prenatally cocaine-exposed children. *Birth Def Res (Part A)* 79:381-394.
- Modernel XD, et al. 2017. Use of crack in pregnancy: repercussions for the newborn. *Invest Educ Enferm.* 35(3).
- Montgomery DP, et al. 2008. Using umbilical cord tissue to detect fetal exposure to illicit drugs: a multicentered study in Utah and New Jersey. *J Perinatol* 28(11):750-753.
- Morie KP, et al. 2020. Alexithymia, Emotion-Regulation Strategies, and Traumatic Experiences in Prenatally Cocaine-Exposed Young Adults. *The American journal on addictions*; 29(6), 492-499.
- National Institute on Drug Abuse. "Substance Use While Pregnant and Breastfeeding." *National Institute on Drug Abuse*, 2020,
- National Library of Medicine (US), 2006. "Cocaine"
- Ness RB, et al. 1999. Cocaine and tobacco use and the risk of spontaneous abortion. *N Engl Med* 340(5):333-339.s
- Oliveira TA, et al. 2016. Perinatal outcomes in pregnant women users of illegal drugs. *Rev Bras Ginecol Obstet.* 38(4):183-188.
- Pires A, et al 2012. Repeated inhalation of crack-cocaine affects spermatogenesis in young and adult mice. *Inhal Toxicol.* 24(7):439-446.
- Reece-Stremtan S, Marinelli KA. 2015. ABM clinical protocol #21: guidelines for breastfeeding and substance use or substance use disorder, revised 2015. *Breastfeed Med.* 10(3):135-41.
- Richardson GA, et al. 2007. Effects of prenatal cocaine exposure on growth: a longitudinal analysis. *Pediatrics.* 120(4): e1017-1027.
- Richardson GA, et al. 2010. Prenatal cocaine exposure: Effects on mother- and teacher-rated behavior problems and growth in school-age children. *Neurotoxicol Teratol.*
- Richardson GA, et al. 2015. Effects of prenatal cocaine exposure on adolescent development. *Neurotoxicol Teratol.* 49:41-8.
- Roussotte F, et al. 2010. Structural, metabolic, and functional brain abnormalities as a result of prenatal exposure to drugs of abuse: evidence from neuroimaging. *Neuropsychol Rev.*
- Salzwedel A, et al. 2020. Functional dissection of prenatal drug effects on baby brain and behavioral development. *Human brain mapping*; 41(17), 4789-4803.
- Semet M, et al. 2017. The impact of drugs on male fertility: a review. *Andrology* 5:640-63.
- Serino D, et al. 2018. Psychological Functioning of Women Taking Illicit Drugs during Pregnancy and the Growth and Development of Their Offspring in Early Childhood. *J Dual Diagn.* 25:1-13.
- Singer LT, et al. 2000. Neurobehavioral outcomes of cocaine-exposed infant. *Neurotoxicol Teratol* 22(5):653-666.
- Singer LM, et al. 2008. Prenatal cocaine exposure: drug and environmental effects at 9 years. *J Pediatr* 153(1): 105-111.
- Van Gelder MMHJ, et al. 2009. Maternal periconceptional illicit drug use and the risk of congenital malformations. *Epidemiology* 20(1):60-66.
- Weathers WT, et al. 1993. Cocaine use in women from a defined population: prevalence at delivery and effects of growth in infants. *Pediatrics* 91(2):326-239.
- Yazigi RA, et al. 1991. Demonstration of specific binding of cocaine to human spermatozoa. *JAMA* 266:1956-1959.

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- Akorn Operating Company LLC. 2023. Olopatadine product label. Available at: <https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=f42d26f8-c583-411b-b17f-b3ca9eaba7a2>. Accessed 30 September 2024.

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Selected References:

- Aselton P, et al. 1985. First-trimester drug use and congenital disorders. *Obstet Gynecol* 65:451-5.
- Check J, et al. 1982. Improvement of cervical mucus factor with guaifenesin. *Fertility and Sterility*, 37(5): 707-708.
- Briggs GG, et al. 2017. *Drugs in pregnancy and lactation: a reference guide to fetal and neonatal risk*. 11th ed.

Cao Y, et al. 2021. Maternal use of cough medications during early pregnancy and selected birth defects: a US multisite, case-control study. *BMJ Open*, 11: e053604.

- Check JH, et al. 1982. Improvement of cervical factor with guaifenesin. *Fertil Steril* 37:707-8.
- Dicpinigattis, et al. 2003. Effects of guaifenesin on cough reflex and sensitivity. *Chest Journal*, 126(6): 2178-2181.
- Dude C, et al. 2021. Assessment of the Safety of Common Medications Used During Pregnancy. *JAMA*, 326(23):2421-2422.
- Heinonen OP, et al. 1977. Birth defects and drugs in pregnancy. Littleton, MA: Publishing Sciences Group.
- Means G, et al. 2010. Guaifenesin and increased sperm motility: a preliminary case report. *Int J Gen Med*, 4: 13-14.
- PDR.Net. 2024. Guaifenesin-Drug Summary. **PDR.Net** Accessed December 10, 2024. <https://www.pdr.net/drug-summary/Mucinex-guaifenesin-1275>.
- Servey J, et al. 2014. Over-the-Counter Medications in Pregnancy. *Am Fam Physician*, 90(8):548-55.
- Shaw G, et al. 1998. Maternal illness, including fever, and medication use as risk factors for neural tube defects. *Teratology*, 57: 1-7.
- Silva R, Lee J, et al. 2007. Is guaifenesin safe during pregnancy? *J. Family Practice* 56 (8): 669-670.

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