Residência RP Pediátrica
Publicação Oficial da Sociedade Brasileira de Pediatria
ISSN-Online: 2236-6814

Submitted on: 07/21/2025
Approved on: 11/28/2025

REVIEW ARTICLE

Assistance Protocol for diagnostic investigation and monitoring of congenital cytomegalovirus in newborns: inclusion of screening exam in the SUS

Isabella da Cruz Marcuzzo[1], Maria Clara da Silva Valadão[1]

Keywords:
Cytomegalovirus Infections.
Deafness.
Infectious Disease Transmission, Vertical

Abstract

Human Cytomegalovirus (CMVH) belongs to the class of human herpesviruses, being highly species specific. The disease can present itself in the neonatal period, known as Congenital Cytomegalovirus (CMVC), which is classified by the manifestation of the virus in newborns (NB). CMVH transmission occurs mainly through the respiratory route, while CMVC occurs mainly through cervical secretion, intrauterine transmission or through breast milk. CMVH has a worldwide prevalence of up to 83% of the population, while CMVC represents around 1.3% of those infected globally. Diagnosis of the disease ideally consists of culture or PCR of the newborns urine/saliva up to 3 weeks of age, and its treatment, for symptomatic patients, should begin at neonatal age. CMVC can lead to serious sequelae such as sensorineural deafness and delay in neuropsychomotor development for those affected, and therefore the importance and objective of the work consists of creation of a Care Protocol on CMVC to be used in the diagnostic investigation and monitoring of newborns in the Brazilian Public Health System, the Sistema Único de Saúde (SUS).

[1] Universidade Franciscana, Departamento do Curso de Medicina - Santa Maria - Rio Grande do Sul - Brazil.

Correspondence to:
Isabella da Cruz Marcuzzo
Universidade Franciscana. Rua Silva Jardim, nº 1175, Bairro Nossa Senhora do Rosário, CEP: 97010-491, Santa Maria – RS. E-mail: isamarcuzzo@gmail.com

DOI: https://doi.org/10.25060/residpediatr-2026-1519

Creative Commons. Attribution-NonCommercial-ShareAlike 4.0 International.

INTRODUCTION

Human Cytomegalovirus (HCMV), or simply Cytomegalovirus (CMV), belongs to the class of human herpesviruses, being classified as the largest virus in the class and highly specific to the human species, which is characterized as its only host[1]. In addition, it may occur in the neonatal period, where it is called Congenital Cytomegalovirus Infection (cCMV), which is classified by the manifestation of the virus in newborns (NB)[2]. CMV transmission occurs mainly through the respiratory route, whereas cCMV occurs mainly through cervical secretion, intrauterine transmission, or breast milk[3].

Regarding epidemiology, CMV is a disease with high worldwide prevalence (approximately 83% in the general population), and it is estimated to be even higher in underdeveloped countries, such as Brazil[3,4]. In addition, its congenital form represents a prevalence of 35 thousand new cases annually in Brazil[4].

In this context, with regard to cCMV, it is observed that it is responsible for one of the main causes of congenital infections worldwide, with a probability of 0.48 to 1.3% of cases globally[5].

Around 5 to 15% of NB infected intrauterinely present neurological impairment or deafness at birth. Diagnosis is preferably performed by PCR (Polymerase Chain Reaction) or viral culture, which should be carried out in saliva or urine up to 21 days of life. Treatment should be initiated in the neonatal period with the aim of reducing sequelae, for example, auditory sequelae, which are the most common[6,7,8].

In the context of the SUS, screening for CMV is not part of the basic prenatal and postnatal tests, such as syphilis, toxoplasmosis, hepatitis, and HIV, for example[1,7]. It is believed that this non-inclusion in screening results from the fact that maternal diagnosis modifies the NB prognosis in few cases. In addition, most NB with congenital CMV infection are asymptomatic. On the other hand, it is estimated that up to 15% of infected NB present symptomatic infection, with a risk of developing long-term neurodevelopmental sequelae, particularly due to sensorineural hearing loss[5].

Thus, the creation of this protocol aims to identify NB at risk of congenital infection, since it is believed that, even though it is sometimes not possible to modify the NB prognosis, knowing the diagnosis makes follow-up and treatment of possible sequelae recommended. In addition, the protocol will be created for use in diagnostic investigation and follow-up of NB in the Brazilian Public Health System, the Unified Health System (SUS). To this end, its preparation was carried out with an updated literature review on cCMV, describing the most important findings on the pathology.

THEORETICAL FRAMEWORK

DEFINITION OF CMV AND cCMV

Human Cytomegalovirus (HCMV), or simply Cytomegalovirus (CMV), belongs to the class of human herpesviruses, being part of the Herpesviridae family and presenting as the largest virus in the class. It is specific to the human species and encodes approximately 170 to 750 proteins. The properties of its genome enable the existence of diversity in the patterns of infection in its only host, in this case, humans[1]. CMV infection is ubiquitous, infecting most of the world population and generally going unnoticed in healthy children and adults[9].

In addition, there is a variation of CMV, namely Congenital Cytomegalovirus Infection (cCMV), which is the manifestation of the virus in newborns (NB). It is responsible for affecting up to 1.3% of live births[2,5]. cCMV is the most common cause of congenital disorders of the central nervous system in developed countries[10].

EPIDEMIOLOGY

Worldwide

In general terms, among adults, global seroprevalence was estimated at 83% in the general population, 86% in women of reproductive age, and 86% in blood or organ donors. The prevalence rate was highest in the Eastern Mediterranean region (90%) and lowest in the European population (66%)[3]. Seroepidemiological studies have shown that the prevalence of antibodies to CMV is influenced by several factors, such as culture, age, geography, socioeconomic status, and childcare practices[11].

With regard to the congenital manifestation worldwide, it is believed to be the most common viral congenital disease; nevertheless, the data reflect that there may possibly be underreporting due to limited screening for the virus at birth[8]. Overall, the worldwide prevalence of cCMV is estimated to average 0.48 to 1.3% of cases[5].

It is believed that 85% to 90% of cases are asymptomatic at birth, versus 10 to 15% symptomatic. Even so, 5 to 15% of children who are asymptomatic at birth may develop future progressive and irreversible sequelae, such as impairment of the central nervous system, hearing, vision, and delayed mental and psychomotor development[3].

Brazil

In Brazil, the epidemiology of CMV infection has been evaluated in few studies, with different prevalence rates demonstrated in Santa Catarina (96.4%), Rio de Janeiro (78.7%), and São Paulo (84.8%). It was observed that the available epidemiological data are concentrated mainly in the Southeast region, with the other regions lacking data to estimate the true prevalence of CMV in the Brazilian population[4].

When referring to cCMV, the infection occurs in a large number of infants, with an estimated 35,000 new cases per year in Brazil based on birth rates. Some studies demonstrate that the prevalence of cCMV infection found was around 1% in the country, and it is believed that this number may be

higher due to the lack of screening for the virus at birth in most NB in Brazil[4].

CLINICAL MANIFESTATIONS

The main clinical manifestations described in symptomatic congenital CMV infection are sensorineural deafness, visual loss, microcephaly, thrombocytopenia, jaundice, petechiae, motor defects, and strabismus[3]. The disease may also present cardiovascular abnormalities such as myocarditis, as well as periventricular calcifications[12].

cCMV infection may lead to permanent sequelae in 15% to 18% of births, including death in 1%, as well as neurocognitive sequelae in 5% to 15% and hearing loss in 12% of individuals[6]. Another more recent study estimates that up to 15% of infected NB may present symptomatic infection with a risk of long-term neuropsychomotor developmental delay, particularly sensorineural hearing loss[5].

It was shown that perinatal and early postnatal CMV infection in preterm infants is frequent and may lead to severe consequences, such as respiratory deterioration, hepatosplenomegaly, or sepsis-like syndrome[3].

TRANSMISSION

CMV transmission occurs mainly through the respiratory route, via oropharyngeal secretions, whereas cCMV occurs mainly through cervical secretion, intrauterine transmission, or breast milk. In addition, contaminated urine, tears, blood transfusion, and solid organ or hematopoietic stem cell transplantation also represent forms of cCMV transmission if contact occurs up to the third week of life[3,12].

CMV is characterized by latency, remaining within the human organism, with reactivations possible under different circumstances. Infection may be considered congenital when it occurs in the intrauterine period (through transplacental passage), perinatal (when it occurs at the time of delivery), or early postnatal (through blood transfusion or breast milk[1,6].

Studies have shown that the main route of vertical transmission is maternal viremia, leading to placental infection and subsequent transplacental transmission to the fetus, since placental cytotrophoblasts are permissive to CMV replication[5].

TREATMENT

Intravenous ganciclovir and its orally available prodrug, valganciclovir, are the first-line antiviral agents of choice for the treatment of cCMV. They have been evaluated in randomized clinical trials in NB with symptomatic congenital CMV infection and demonstrated benefit when treatment is initiated within the first month of life.

The antivirals foscarnet and cidofovir are reserved for manifestations of refractory cCMV disease, resistance and/or toxicity to ganciclovir, and coinfection with adenovirus[8,13].

When the disease presents asymptomatically, pharmacological treatment is not the standard approach, given the toxicity of the drugs and the limited benefit observed; thus, only monitoring of the patient's evolution should be performed[1,6].

The main adverse effects of pharmacological treatment include neutropenia (mainly with ganciclovir use), thrombocytopenia, and elevated creatinine, in which case the responsible professional should review medication doses[14,15].

In addition, it is worth noting that, although low, there is a possibility of treatment failure, with the main reason tending to be progressive target-organ disease despite adequate treatment. There is also the possibility that CMV may be resistant to the antiviral or that the host may have a poor response, which most commonly occurs in NB with primary immunodeficiency and in those using corticosteroids. It should be made clear that there is no repetition of treatment[13,15].

Finally, it is worth emphasizing that many patients, despite treatment, may die, reaching 30% in the neonatal period and up to 8% in the first year of life[8].

JUSTIFICATION

Neonatal CMV infection may be congenital when it occurs in the intrauterine period through transplacental passage, as well as perinatal when it occurs at the time of delivery, or early postnatal through blood transfusion or breast milk, all of which are classified as cCMV[1,6].

In the context of the SUS, screening for CMV is not part of the basic prenatal and postnatal tests, such as syphilis, toxoplasmosis, hepatitis, and HIV, for example[16]. It is believed that this occurs because maternal diagnosis rarely modifies the NB prognosis. However, it is estimated that up to 15% of infected NB may present sequelae involving delayed neuropsychomotor development, especially sensorineural hearing loss[5], and if the pregnant woman does not have the infection, an attempt can be made to prevent transmission. Thus, it is believed that the inclusion of CMV screening for pregnant women during prenatal care is essential, and consequently, so is the search for the presence of the virus in NB.

OBJECTIVES

GENERAL OBJECTIVE

Produce a Care Protocol on Congenital Cytomegalovirus Infection to be used in the diagnostic investigation and follow-up of newborns in the Brazilian Public Health System, the Unified Health System (SUS).

SPECIFIC OBJECTIVES

Review the updated literature on Congenital Cytomegalovirus Infection, describing the most important findings on the pathology.

Include in the Care Protocol points related to diagnosis, treatment, and follow-up of screened newborns.

METHODOLOGY

The literature review was conducted in databases such as UpToDate, PubMed, government materials, and university journals with reference to publications from the last 05 years. The keywords used were: "cytomegalovirus," "congenital cytomegalovirus," "congenital cytomegalovirus review," and "cytomegalovirus protocol."

The study was review-based, with the objective of constructing a flowchart to be offered as an institutional protocol for the care of NB born to mothers with reactive IgM serology for CMV at the time of delivery.

Thus, together with the theoretical framework, a Care Protocol was developed for use in the SUS. The protocol was executed respecting all ethical and moral concepts related to Medicine and proposed in the Code of Medical Ethics.

DIAGNOSIS IN PREGNANT WOMEN

The Brazilian Ministry of Health does not adopt CMV screening during prenatal care for pregnant women as a standard and mandatory practice. Nevertheless, some services, mostly private, have proposed performing CMV serology for screening during the prenatal period, with the intention of monitoring the patient in order to try to prevent contamination with the virus, especially in the first trimester[16].

IgM becomes reactive between 1 and 3 weeks after infection and remains reactive until the end of the acute phase of the disease; however, in some cases, it may remain reactive for up to 12 months, whereas IgG becomes reactive 3 to 5 weeks after infection and remains reactive indefinitely. Patients with reactive IgM will be considered suspected of having acute infection[17].

Although there is no protocol established by the Ministry of Health, it is suggested that the professional request inclusion of the IgG avidity test, conditional on IgM and IgG positivity. The IgG avidity test will be considered high when its value is ≥60%, and the interpretation will be that the infection probably occurred more than 12 weeks earlier. It will be considered low when its value is ≤40%, and the interpretation will be that the infection probably occurred less than 12 weeks earlier. Between 40% and 60%, the test will be considered indeterminate[16].

In addition, other references suggest that amniocentesis should also be performed for diagnosis during pregnancy when there is suspicion due to maternal infection or ultrasound findings, since this examination may demonstrate whether infection is present in the fetus[5].

It is important to emphasize that it is believed that serology (IgM and IgG) should also be performed for monitoring throughout prenatal care in pregnant women treated by the SUS, together with serology for the other conditions already investigated (for example, HIV, hepatitis B, and syphilis)[17].

Although it rarely changes the prognosis for the NB if acquired during pregnancy, closer monitoring can be performed regarding the period and intensity with which the disease occurred, since this makes it possible to also monitor fetal vitality and have greater confidence in the NB serology result at birth, allowing more precise management of the NB who had contact with CMV.

DIAGNOSIS IN NB

The gold-standard diagnosis of cCMV in NB occurs through saliva and/or urine culture[9], which detects CMV based on cytopathic changes in fibroblast cell culture; however, the PCR technique has been used as the method of choice due to its ease and availability in our setting[18].

This diagnosis should be performed by the third week of life, since, after this period, it becomes imprecise to determine whether viral transmission occurred congenitally or in the community[3].

In addition, although it is not commonly recommended, some centers choose to request IgM and IgG serology from the newborn as a way to complement the diagnostic investigation, as it may help identify the disease[17].

It is worth emphasizing that in many hospitals that provide care through the SUS, when a case of CMV is suspected, IgG/IgM serology is the requested test, since saliva and/or urine culture or PCR is scarcely available in most locations.

There is also the option of serum PCR, which, although it is not the main test, is one of the most available PCR tests and has high specificity[18]. Below, Table 1 shows, in a more simplified manner, the comparison between laboratory tests for the detection of cytomegalovirus in neonates with suspected congenital infection, citing the laboratory method, the sample used for the test, the sensitivity and specificity of the test and, finally, relevant comments.

INTERNATIONAL STATISTICAL CLASSIFICATION OF DISEASES (ICD-10)

B25.8 Other cytomegaloviral diseases
B25.9 Cytomegaloviral disease, unspecified
P35.1 Congenital cytomegalovirus infection

INCLUSION CRITERIA AND EXCLUSION CRITERIA

All Brazilian pregnant women and/or pregnant women domiciled in Brazil who are registered in the SUS were included in the use of the protocol.

Newborns born to pregnant women with nonreactive IgM serology for CMV were excluded from the use of the protocol.

SPECIAL CASES

Not applicable.

FLOWCHART

Flowchart 1, presented at the end of this section, begins with the pregnant woman being admitted to a hospital that provides care through the SUS, with screening performed through IgG and IgM for CMV.

Table 1: Comparison of laboratory tests for the detection of cytomegalovirus in neonates with suspected congenital infection.

Laboratory method	Sample used for testing	Reported sensitivity (percentage)*	Reported specificity (percentage)*	Comments
Viral culture	Urine or saliva collected in the first 3 weeks of life.	100	100	• International benchmark. • Detects CMV based on cytopathic changes in cell culture using fibroblast cell lines. • Generally positive within 1 to 3 days after incubation, but it can take up to 28 days for a negative result to be declared. • Disadvantages include: relatively long time required to detect the virus and intensive labor and resources.
Fast culture**	Urine or saliva collected in the first 3 weeks of life.	92.3 to 100	100	• Enhanced culture method using centrifugation and staining for early antigen production. • It allows for virus identification in up to 24 hours. • The advantage over standard viral culture is that it is quick, simple to perform, and less expensive. • False-positive results may occur due to retention of CMV antigen in the vial monolayer. • A confirmatory test (viral culture or PCR) should be performed to establish the diagnosis of congenital CMV.
PCR**	Urine or saliva collected in the first 3 weeks of life.	97.4 to 100	100	• Detects CMV DNA in urine or saliva. • Advantages over standard and bottle culture techniques include: rapid response, does not require live virus for CMV detection and is therefore unaffected by storage and transport conditions, and lower cost. • Available in many hospital and reference laboratories. • False-positive results occasionally occur; we suggest confirming positive tests with repeat PCR testing in urine or saliva, or both. • Newborns with congenital CMV infection release large amounts of CMV in both urine and saliva over prolonged periods; therefore, these tests should be repeatedly positive.
PCR	Bloodstain	34 to 77	99.9	• Detects CMV DNA in blood samples obtained for newborn screening. • It allows for the retrospective diagnosis of congenital CMV infection. • Not all infected babies are viremic at birth, which explains the low sensitivity of this test compared to PCR in urine or saliva samples.
CMV antigenemia	Blood	N/A	N/A	• Detects CMV proteins (pp65) in peripheral blood leukocytes. • Not recommended for the diagnostic evaluation of infants with congenital CMV.
Serology	Blood	N/A	N/A	• Not recommended for routine diagnosis of congenital CMV. • The presence of IgG antibodies against CMV in the newborn may simply reflect the transfer of maternal antibodies; however, their absence makes CMV infection very unlikely. • The IgM antibody against CMV in newborns is insensitive and may be falsely negative in more than half of infected newborns.

* Compared to viral culture in most studies.
**The vial assay or PCR tests have largely replaced viral culture as the methods of choice for diagnosing congenital CMV infection due to more rapidly available results and lower cost. The choice of test used may depend on availability.
Source: Demmler-Harrison GJ.[8]

Next, all mothers who present reactive IgM will have their NB screened with diagnostic and follow-up tests, due to the risk of recent gestational CMV infection.

NB screening will include IgG/IgM tests for CMV, complete blood count, urea, creatinine, AST, ALT, BTF, complete cerebrospinal fluid analysis, fundus examination, cranial CT, echocardiogram, and NHS. The choice of tests was based on the most common manifestations already mentioned, such as visual, cardiac, auditory, renal, hepatic, and neurological abnormalities.

In addition, as previously mentioned, the gold standard for the diagnosis of cCMV consists of saliva culture or PCR with confirmation in urine; however, most public hospitals that provide care through the SUS do not offer this collection service, so the protocol was adapted to the current reality, and therefore the initial screening considered only IgM and IgG serology.

In this regard, we can describe the possibilities in the newborn:

1. IgG+ IgM+, which reflects possible intrauterine infection in the NB.
2. IgG– IgM+, which reflects possible very recent infection, possibly acquired by the mother, with risk of transmission to the NB in the final stage of pregnancy or at the time of delivery.

3. IgG– IgM–, which appears to be extremely unlikely, since the mother is IgM+. In this case, IgM/IgG should be repeated in 7 days. If IgM+, refer for PCR at a Referral Hospital and continue the protocol.
4. IgG+ IgM–, which may reflect a previous intrauterine infection in the NB, but with susceptibility to sequelae. In this case, if the NB presents symptoms or altered tests, they enter screening for PCR.

This last possibility is concerning because, without the pregnant woman's prenatal tests, it is not possible to measure whether it was a very old or relatively recent infection in order to infer possible consequences; thus, this is another example of the importance of performing CMV screening in pregnant women during prenatal care.

Continuing the presentation of the protocol, the NB who presents IgG+ IgM+ or IgG– IgM+, that is, possibly infected, will be referred to a Referral Hospital for PCR collection. Thus, there are four possibilities:

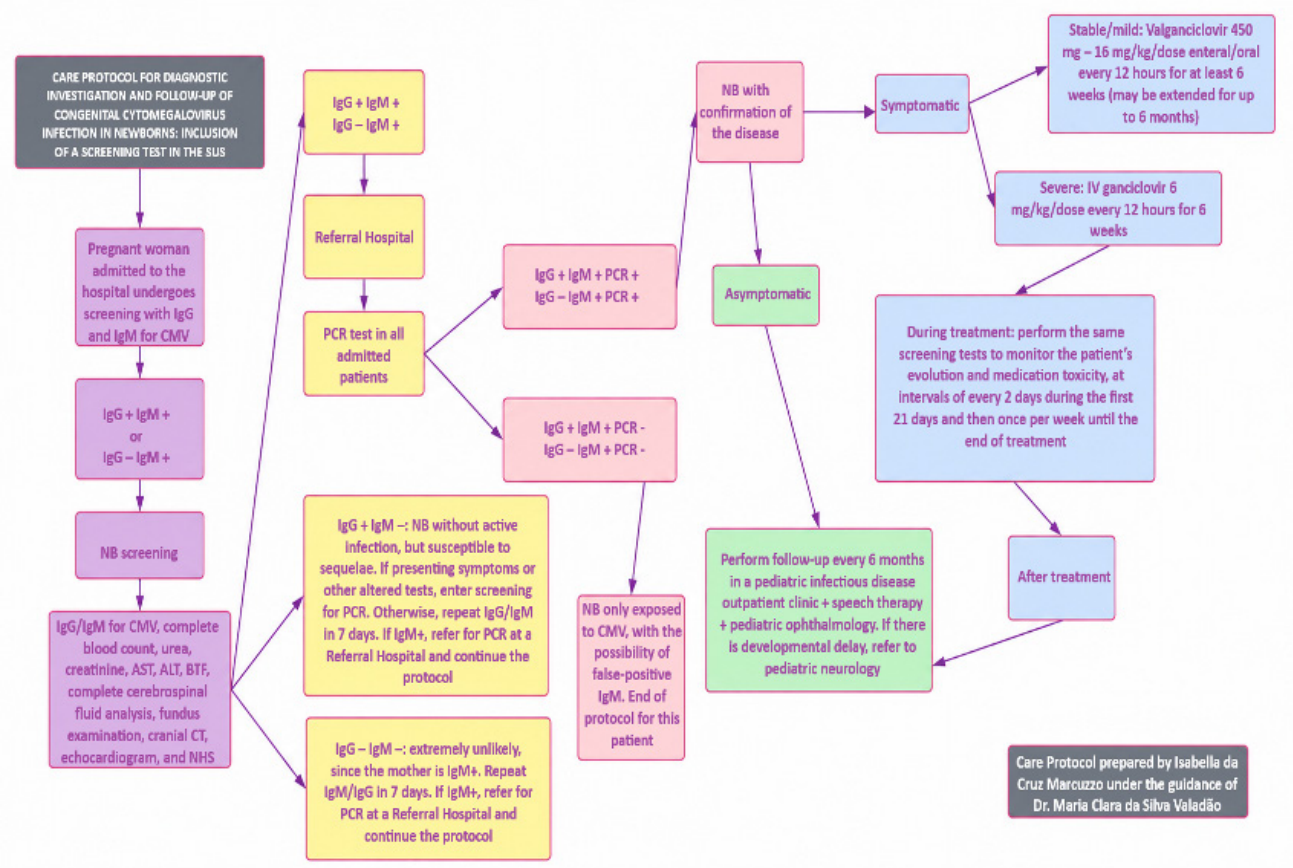
a. IgG+ IgM+ PCR+ or IgG– IgM+ PCR+, confirming cCMV.
b. IgG+ IgM+ PCR– or IgG– IgM+ PCR–, ruling out the disease. In the latter case, this is an NB only exposed to CMV, with the possibility of false-positive IgM, with no need for follow-up in the protocol.

Regarding the first cases (IgG+ IgM+ PCR+ or IgG– IgM+ PCR+), this is an NB who, if symptomatic, should be treated with medications at the inpatient level. In stable patients or those with mild symptoms, treatment with valganciclovir is recommended, whereas ganciclovir is commonly used in severely ill patients. Only ganciclovir is made available by the SUS, and it is necessary to request valganciclovir through the Health Department.

It is important to emphasize that during treatment, the same screening tests should be performed to monitor the patient's evolution and medication toxicity, at intervals of every 2 days during the first 21 days and then weekly until the end of treatment, regardless of case severity.

On the other hand, when referring to patients with the disease who are asymptomatic, pharmacological treatment is not performed, and semiannual follow-up in pediatric infectious disease, speech therapy, and pediatric ophthalmology outpatient clinics is chosen. In cases of delayed developmental milestones, the infant should be referred to a pediatric neurology referral service. This subsequent follow-up also applies to patients who required pharmacological treatment at a Referral Hospital and who, after hospital discharge, should maintain outpatient clinical follow-up.

Below, in an illustrative manner, through Flowchart 1, the description presented above can be evidenced:



Flowchart 1: Care Protocol for diagnostic investigation and follow-up of congenital cytomegalovirus infection in newborns: inclusion of a screening test in the SUS

Source: the authors

REFERENCES

1. Leruez-Ville M, et al. Cytomegalovirus infection during pregnancy: state of the science. Am J Obstet Gynecol. 2020;222(6):589-605. doi: http://www.doi.org/10.1016/j.ajog.2020.02.018
2. Ross SA, Kimberlin D. Clinical outcome and the role of antivirals in congenital cytomegalovirus infection. Antiviral Res. 2021 Jul;191:105083. doi: 10.1016/j.antiviral.2021.105083.
3. Bezerra F. Aspectos epidemiológicos e clínicos da infecção por citomegalovírus no Brasil: uma revisão [trabalho de conclusão de curso]. Natal (RN): Universidade Federal do Rio Grande do Norte; 2021.
4. Nascimento A. Transmissão perinatal do citomegalovírus em recém-nascidos pré-termo através do leite materno [dissertação]. Natal (RN): Universidade Federal do Rio Grande do Norte; 2022.
5. Boppana SB. Cytomegalovirus infection in pregnancy. In: Hirsch MS, editor. UpToDate [Internet]. Waltham (MA): UpToDate Inc.; 2024 [cited 2024 Aug 25]. Available from: https://www.uptodate.com/contents/cytomegalovirus-infection-in-pregnancy
6. Ssentongo P, et al. Congenital cytomegalovirus infection burden and epidemiologic risk factors in countries with universal screening: a systematic review and meta-analysis. JAMA Netw Open. 2021;4(8):e2121734. doi: http://www.doi.org/10.1001/jamanetworkopen.2021.21734
7. Lino J. Prevalência de infecção congênita por citomegalovírus e perfil de citocinas nos pacientes prematuros, pequenos para idade gestacional ou baixo peso [dissertação]. Belo Horizonte (MG): Universidade Federal de Minas Gerais; 2021[cited 2024 Oct 5].. Available from: https://hdl.handle.net/1843/45170
8. Demmler-Harrison G. Congenital cytomegalovirus infection: management and outcome. In: Kapadia S, editor. UpToDate [Internet]. Waltham (MA): UpToDate Inc.; 2024a [cited 2024 Oct 5]. Available from: https://www.uptodate.com/contents/congenital-cytomegalovirus-ccmv-infection-management-and-outcome
9. Chiopris G, et al. Congenital cytomegalovirus infection: update on diagnosis and treatment. Microorganisms. 2020;8(12):1847. doi: http://www.doi.org/10.3390/microorganisms8121847
10. Morioka I, et al. Efficacy and safety of valganciclovir in patients with symptomatic congenital cytomegalovirus disease: study protocol clinical trial (SPIRIT compliant). Medicine (Baltimore). 2020;99(20):e20234. doi: http://www.doi.org/10.1097/MD.0000000000020234
11. Demmler-Harrison G. Overview of cytomegalovirus infections in children. In: Kapadia S, editor. UpToDate [Internet]. Waltham (MA): UpToDate Inc.; 2024b [cited 2024 Oct 11]. Available from: https://www.uptodate.com/contents/overview-of-cytomegalovirus-cmv-infections-in-children
12. Boronat E, et al. Actualización sobre citomegalovirus congénito. Rev Sanit Investig [Internet]. 2021 [cited 2024 Sep 10]. Available from: https://dialnet.unirioja.es/servlet/articulo?codigo=8067438
13. Tesini B. Congenital and perinatal cytomegalovirus (CMV) infection. In: MSD Manual Professional Version [Internet]. Rahway (NJ): Merck & Co., Inc.; 2022 [cited 2024 Nov 28]. Available from: https://www.msdmanuals.com/professional/pediatrics/infections-in-neonates/congenital-and-perinatal-cytomegalovirus-infection-cmv
14. Solís J. Citomegalovirus congénito. In: Guías Clínicas de Neonatología [Internet]. San José: Asociación Costarricense de Neonatología; 2020 [cited 2024 Nov 25]. p. 3-4. Available from: https://aconecr.com/wp-content/uploads/2020/08/CITOMEGALOVIRUS-CONGENITO-.pdf
15. Ishi P, et al. Protocolo citomegalovírus congênito [Internet]. Aracaju (SE): Clínica Santa Helena; 2021 [cited 2024 Oct 18]. Available from: https://hmsantahelena.com.br/wp-content/uploads/2024/09/PROT.DT_.049.01-CITOMEGALOVIRUS-CONGENITO.pdf
16. Brasil. Ministério da Saúde. Secretaria de Atenção Primária à Saúde. Manual de gestação de alto risco [Internet]. 1. ed. Brasília (DF): Ministério da Saúde; 2022 [cited 2024 Nov 3]. Available from: https://bvsms.saude.gov.br/bvs/publicacoes/manual_gestacao_alto_risco.pdf
17. Caliendo AM. Overview of diagnostic tests for cytomegalovirus infection. In: Hirsch MS, editor. UpToDate [Internet]. Waltham (MA): UpToDate Inc.; 2022 [cited 2024 Sep 15]. Available from: https://www.uptodate.com/contents/overview-of-diagnostic-tests-for-cytomegalovirus-infection
18. Cherry JD, Harrison GJ, Kaplan SL, Steinbach WJ, Hotez PJ, editors. Feigin and Cherry's textbook of pediatric infectious diseases. 8th ed. Philadelphia (PA): Elsevier; 2019.