The Importance of Regular and Ongoing Training for Congenital CMV in Countries without Routine Screening: A Survey among Pediatricians

Rutin Tarama Yapılmayan Ülkelerde Konjenital CMV İçin Düzenli ve Sürekli Eğitimin Önemi: Pediatristler Arasında Bir Anket

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ABSTRACT

Objective: Although CMV is the most common congenital infection, studies on how its importance is understood by healthcare professionals are limited. This research aims to assess awareness and knowledge of pediatricians regarding congenital CMV infection (cCMVi).

Material and Methods: The target group of the study was pediatricians in Turkey. A 26-item anonymous questionnaire was developed, and implemented online. Participants were grouped by their professional seniority: Group-I, pediatric residents; Group-II, pediatricians; Group-III, specialists in any sub-branches of pediatrics; Group-IV, associate professors/professors in pediatrics.

Results: The questionnaire was completed by 434 respondents. The mean duration of practice was 11.95±7.3 (1-40) years for professionals, and 31.14±13.1 (1-60) months for pediatric residents. Of the participants, 85.9% knew that cCMVi screening is not applied in Turkey and 89.4% had previously followed a patient with suspected cCMVi. Incorrect answers regarding transmission routes and diagnosis methods were significantly more preferred by pediatricians other than residents. Correct answer rates about most common clinical presentation, imaging modalities, common disease-related sequelae, and treatment were generally quite low.

Conclusion: The responses revealed a lack of knowledge and awareness about cCMVi in Turkey among pediatricians, especially in professionals rather than residents. It is important to provide regular and ongoing training about cCMVi in countries where screening is not implemented.

Key Words: Awareness, Congenital Cytomegalovirus infection, Knowledge, Pediatrician, Screening

ÖZ

Amaç: CMV en sık görülen konjenital enfeksiyon olmasına rağmen öneminin sağlık profesyonelleri tarafından nasıl anlaşıldığına dair çalışmalar sınırlıdır. Bu araştırma, çocuk doktorlarının konjenital CMV enfeksiyonu (kCMVe) konusundaki bilgi ve farkındalıklarını değerlendirmeyi amaçlamaktadır.

Gereç ve Yöntemler: Çalışmanın hedef grubu Türkiye'deki çocuk doktorlarıydı. Yirmi altı maddelik anonim bir anket geliştirildi ve çevrimiçi olarak uygulandı. Katılımcılar mesleki kıdemlerine göre gruplandırıldı: Grup-I, pediatri asistanları; Grup-II, çocuk doktorları; Grup-III, pediatrinin herhangi bir yan dal uzmanları; Grup-IV, pediatri doçent/profesörleri.

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Ethics Committee Approval / *Etik Kurul Onayı*: This study was conducted in accordance with the Helsinki Declaration Principles. Ethical approval for the study was obtained from Ankara City Hospital Local Ethics Committee (No: E2-21-942).

Contribution of the Authors / Yazarların katkısı: KANIK YUKSEK S: Constructing the hypothesis or idea of research and/or article, Planning methodology to reach the Conclusions, Organizing, supervising the course of progress and taking the responsibility of the research/study, Taking responsibility in patient follow-up, collection of relevant biological materials, data management and reporting, execution of the experiments, Taking responsibility in logical interpretation and conclusion of the results, Taking responsibility in necessary literature review for the study, Taking responsibility in the writing of the whole or important parts of the study, Reviewing the article before submission scientifically besides spelling and grammar.

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Bulgular: Anket 434 kişi tarafından doldurulmuştur. Ortalama çalışma süresi pediatri asistanları dışındakiler için 11.95±7.3 (1-40) yıl, pediatri asistanları için 31.14±13.1 (1-60) aydı. Katılımcıların %85.9' u Türkiye'de kCMVe taramasının uygulanmadığını biliyordu ve %89.4'ü daha önce kCMVe şüphesi olan bir hastayı takip etmişti. Bulaş yolları ve tanı yöntemleri ile ilgili yanlış cevaplar asistanlar dışındaki pediatristler tarafından anlamlı olarak daha fazla tercih edilmiştir. En yaygın klinik prezentasyon, görüntüleme modaliteleri, yaygın hastalıkla ilgili sekeller ve tedavi hakkında doğru cevap oranları genel olarak oldukça düşüktü.

Sonuç: Yanıtlar, Türkiye'de pediatristler arasında, özellikle asistanlardan ziyade diğer pediatristler arasında kCMVe hakkında bilgi ve farkındalık eksikliği olduğunu ortaya koydu. Taramanın uygulanmadığı ülkelerde kCMVe hakkında düzenli ve sürekli eğitim verilmesi önemlidir.

Anahtar Sözcükler: Farkındalık, Konjenital Sitomegalovirüs enfeksiyonu, Bilgi, Çocuk doktoru, Tarama

INTRODUCTION

Congenital Cytomegalovirus infection (cCMVi) is the most common congenital infection worldwide, and is considered to be the most frequent cause of infectious neurological handicaps (1, 2). cCMVi rates vary according to the CMV seroprevalence of the areas; cCMVi rates are between 1-5% in regions with high CMV seroprevalence, and the rate is lower in regions with low CMV seroprevalence as 0.4-2% (3, 4). About 90% of infected infants have no symptoms at birth and early in life, but approximately 10-15% of these infants develop persistent and serious desorders that may have lifelong effects, such as deafness, cognitive and motor impairment, seizures, and microcephaly (1, 5). Among infants with symptomatic cCMVi, treatment with some antiviral drugs showed promising results. They are now used more frequently since they seem safe, although the duration of treatment is uncertain (6, 7). Medical treatment remains the only possibility for this infection, which does not have a chance to be protected with any vaccine yet. Unlike symptomatic disease, there are currently no treatment recommendations or guidelines for asymptomatic cCMVi (7). In newborns and infants who are asymptomatic or without visible signs of disease, cCMVi goes undiagnosed. Screening programmes for pregnant women and newborns are controversial and still being discussed (3, 4). Especially in countries where screening programs are not implemented, it is even more important for healthcare professionals to recognize this congenital infection, which has long-term effects. However, there are limited reports to reveal the level of knowledge of medical professionals about cCMVi and to allow the necessary improvements and interventions to be made (8-13).

According to the limited studies, the seroprevalence of CMV in Turkey is between 94.9%-96.4% in pregnant women (14, 15). Turkey has a high seroprevalence for CMV with these rates, however, the actual frequency for cCMVi is unknown. Considering that newborns are not screened for cCMVi in Turkey, the awareness and knowledge of clinicians on this issue gains more importance in order to diagnose cCMVi in early period and initiate treatment on time when necessary. The objective of this study was to determine the awareness and knowledge of pediatricians about cCMVi, who frequently encounter infants with possibile cCMVi.

MATERIALS and METHODS

Pediatricians working in the hospitals of Turkey were chosen as the target group of the study. Physicians who had completed their education in the pediatrics or any of its sub-branches or who were still in the education process and volunteered to participate in the survey were included in the study. Participants were grouped according to their professional seniority, and comparisons were made over these groups: Group I, residents in pediatrics; Group II, pediatricians; Group III, specialists in any sub-branches of pediatrics; Group IV, associate professors/ professors in pediatrics. A 26-item anonymous questionnaire on cCMVi, which takes 20 min to complete, was developed, and implemented online. The questionnaire was designed with GoogleForm, and the link of the questionnaire was sent by e-mail and Whatsapp application in pediatrician groups of hospitals, from 1 October 2021 to 1 January 2022. The response period was closed after 3 months. Ethical approval for the study was obtained from Ankara City Hospital Local Ethics Committee (No: E2-21-942).

At the top of the questionnaire, a preliminary information was given to the participants explaining the purpose of the study and stating that the participation was on a voluntary basis. In the first part of the questionnaire, questions about demographic variables including age, gender, career duration, professional field, and professional seniority were asked to responders. The remaining part of the questionnaire consisted of multiple-choice questions in which only one or more than one option could be ticked. The contents of the questions were whether cCMVi screening is performed in Turkey, probability of encountering a patient with suspected cCMVi, the transmission routes of CMVi and cCMVi, symptoms and clinical findings, clinical presentation forms, laboratory tests and imaging methods required for diagnosis, the postnatal time for the definitive diagnosis, the indications and duration for cCMVi treatment, antivirals that can be used in the treatment, expected benefit from treatment, and cCMVi-related sequelae.

Power calculation to determine the sample size was not performed for this descriptive survey. Statistical analyzes were performed using SPSS v25.0 (IBM Corp., Armonk, New York, USA) statistical package on the total participants reached during the previously determined three-month study period. The results were expressed as mean±standard deviation,

median and range (smallest value–largest value), and number (%) depending on whether the data were parametric or not. Categorical variables were compared by chi-square or Fisher exact tests, and were summarized with frequencies. All tests were 2-sided with a significance level of 0.05.

RESULTS

The questionnaire was completed by 434 respondents. Of them, 74% (n = 321) were female. The median age of participants was 35 (24-70) years. The distribution of participants by groups was as follows: 104 (24%) participants in group I, 167 (38.5%) participants in group II, 119 (27.4%) participants in group III and 44 (10.1%) participants in group IV. The mean duration of practice was 11.95±7.3 (1-40) years for professionals other than residents, and 31.14±13.1 (1-60) months for residents.

Three hundred and eighty-eight (89.4%) participants stated that they had followed up any patient with suspected cCMVi before. Three hundred and seventy-three participants (85.9%) answered that cCMVi screening is being implemented in Turkey, while 46 (10.6%) participants marked as "not being implemented", and 15 (3.5%) participants did not have any idea. The best-known routes of transmission for CMV were intrauterine transmission (91.2%), blood transfusion (89.6%) and solid organ transplantation (82.9%). However, some participants were unaware of the exact route of CMV transmission with their response of air-borne transmission (49.3%). Additionally, kissing (55.8%), close contact (51.6%), breast feeding (54.4%), changing diapers (53.7%), sexual intercourse (42.2%), and CMV-contaminated food (19.4%) were given as answers to this multiple-choice question. The rate of those who marked at incorrect option was 47.9% (n = 208), and was significantly higher in group II (p = 0.007). Answers to the question about the possible transmission route of cCMVi in a newborn baby were as follows: intrauterine transmission (68.7%), contact with maternal secretions during delivery (31.6%), breast milk (13.6%), kissing by an infected individual (6.9%), all options (27.9%), and have not an idea (1.2%). Incorrect marking to the option of "contact with maternal secretions during delivery" was significantly higher in grup II (p = 0.02) and group III (p = 0.022), but there was no difference between the groups for incorrect ansvers to the other options. The answers of the question about most common maternal CMVi form during pregnancy, are respectively; primary CMVi 74.4% (n = 323), recurrent CMVi 13.6% (n = 59), and no idea 12% (n = 52). The responses and significance levels regarding the symptoms and findings of cCMVi in a newborn infant are summarized in Table I. Answers to the question about the most common clinical presentation of cCMVi by the groups were shown in Figure I.

The answers given to the question about the most appropriate sample for the diagnosis in newborns were "blood" 69.4%, "urine" 48%, "saliva" 10.4%, "breast milk" 1.6%, all options 5.8%, and no idea 2%. While group II did not select urine as the

Table I: The responses and significance levels regarding the symptoms and clinical findings of cCMVi according to the groups.

Symptoms and findings*	Group I†	Group II†	Group III†	Group IV†	Total†	p
Asymptomatic	62 (59.6)	103 (61.7)	70 (58.9)	17 (38.6)	252 (58.1)	0.049
Rash	78 (75)	139 (83.2)	105 (88.2)	44 (100)	336 (84.3)	0.001
Fever	65 (62.5)	109 (65.2)	88 (73.9)	27 (61.4)	289 (66.6)	0.226
Organomegaly	79 (75.9)	148 (88.7)	106 (89)	42 (95.5)	375 (86.4)	0.003
Microcephaly	102 (98)	164 (98.2)	116 (97.5)	43 (97.7)	425 (97.9)	0.977
Diarrhea	44 (42.3)	69 (41.3)	59 (49.6)	18 (41)	190 (43.8)	0.517
Extremity anomaly	53 (51)	65 (39)	56 (47)	11 (25)	185 (42.6)	0.015
Seizure	84 (81)	130 (78)	92 (77.3)	34 (77.2)	340 (78.3)	0.921
Chorioretinitis	68 (65.4)	99 (59.3)	79 (66.4)	31 (70.5)	277 (63.8)	0.427
Intestinal anomaly	7 (6.7)	7 (4.2)	8 (6.7)	5 (11.4)	27 (6.2)	0.352
Cardiac anomaly	20 (19.2)	30 (18)	22 (18.5)	9 (20.5)	81 (18.7)	0.982
Cytopenia	55 (52.9)	80 (48)	69 (58)	29 (66)	233 (53.7)	0.122
Intracranial calcification	68 (65.4)	92 (55)	72 (60.5)	31 (70.5)	263 (60.6)	0.178
Urinary anomaly	4 (3.8)	1 (0.6)	2 (1.7)	0	7 (1.6)	0.166
High transaminases	54 (52)	86 (51.5)	77 (64.7)	27 (61.4)	244 (56.2)	0.098
Hyperbilirubinemia	40 (38.5)	57 (34.1)	59 (49.6)	21 (47.7)	177 (40.8)	0.046
Hearing loss	64 (61.5)	94 (56.3)	71 (59.6)	25 (56.9)	254 (58.5)	0.837
All options	33 (31.7)	61 (36.5)	39 (32.8)	11 (25)	144 (33.2)	0.517
No idea	0	1 (0.6)	0	1 (2.3)	2 (0.5)	0.236

**Only those who answered "yes" were listed, † n(%)*

Table II: The answers given to the questions about treatment of cCMVi by the groups.

	Group I*	Group II*	Group III*	Group IV*	Total*	p
Is there any drug approved for treatment?						
Yes	89 (85.6)	154 (92.2)	110 (92.4)	37 (84.1)	390 (89.9)	0.138
No	6 (5.8)	10 (6)	5 (4.2)	4 (9.1)	25 (5.8)	
No idea	9 (8.7)	3 (1.8)	4 (3.4)	3 (6.8)	19 (4.4)	
Which drug(s) do you prefer for treatment?						
Cidofovir	1 (1)	3 (1.8)	0	2 (4.5)	6 (1.4)	0.086
Ganciclovir/valganciclovir	91 (87.5)	152 (91)	110 (92.4)	41 (93.2)	394 (90.8)	
Acyclovir/valacyclovir	2 (1.9)	2 (1.2)	1 (0.8)	0	5 (1.2)	
All options	2 (1.9)	8 (4.8)	5 (1.2)	1 (0.2)	16 (3.7)	
No idea	8 (7.7)	2 (1.2)	3 (2.5)	0	13 (3)	
What is the appropriate duration of treatment?						
Oral						0.201
3 weeks	2 (1.9)	4 (2.4)	5 (4.2)	2 (4.5)	13 (3)	
6 weeks	5 (4.8)	17 (10.2)	9 (7.6)	5 (11.4)	36 (8.3)	
3 months	7 (6.7)	26 (15.6)	11 (9.2)	8 (18.2)	52 (12)	
6 months	53 (51)	61 (36.5)	47 (39.5)	14 (31.8)	175 (40.3)	
12 months	2 (1.9)	9 (5.4)	8 (6.7)	3 (6.8)	22 (5.1)	
No idea	35 (33.7)	50 (29.9)	39 (32.8)	12 (27.3)	136 (31.3)	
Parenteral						0.761
3 weeks	24 (23.1)	40 (24)	32 (26.9)	12 (27.3)	108 (24.9)	
6 weeks	36 (34.6)	74 (44.3)	44 (37)	19 (43.2)	173 (39.9)	
3 months	5 (4.8)	8 (4.8)	7 (5.9)	2 (4.5)	22 (5.1)	
6 months	4 (3.8)	9 (5.4)	10 (8.4)	2 (4.5)	25 (5.8)	
12 months	1 (1)	1 (0.6)	0	0	2 (0.5)	
No idea	34 (32.7)	35 (21)	26 (21.8)	9 (20.5)	104 (24)	

* *n(%)*

Table III: The responses about the indications for initiating treatment, expectations from the treatment, and the most common disease-related sequelae.

	Group I*	Group II*	Group III*	Group IV*	Total*	p
Indications for initiating treatment						
All infants diagnosed with cCMVi	45 (43.3)	52 (31.1)	29 (24.4)	10 (22.7)	136 (31.3)	0.003
Infants with symptomatic cCMVi	49 (47.1)	88 (52.7)	64 (53.8)	28 (63.6)	229 (52.8)	
Infants with hearing loss	2 (1.9)	1 (0.6)	0	0	3 (0.7)	
Infants with chorioretinitis and neurological signs	2 (1.9)	23 (13.8)	20 (16.8)	6 (13.6)	51 (11.8)	
No idea	6 (5.8)	3 (1.8)	6 (5)	0	15 (3.5)	
Expectations from the treatment						
Negativity in CMV viremia	11 (10.6)	16 (9.6)	17 (14.3)	12 (27.3)	56 (12.9)	0.015
Preventing an asymptomatic infection from transformation to a symptomatic infection	14 (13.5)	19 (11.4)	13 (10.9)	6 (13.6)	52 (12)	0.713
Preventing CMV reactivations	12 (11.5)	18 (10.8)	13 (10.9)	4 (9.1)	47 (10.8)	0.978
Long-term improvement in audiological and neurodevelopmental findings	29 (27.9)	64 (38.3)	55 (46.2)	13 (29.5)	161 (37.1)	0.027
All options	45 (43.3)	61 (36.5)	41 (34.5)	16 (36.4)	163 (37.6)	0.565
No idea	8 (7.7)	13 (7.8)	5 (4.2)	5 (11.4)	31 (7.1)	0.410
Most common disease-related sequelae						
Neuromuscular problems	11 (10.6)	7 (4.2)	5 (4.2)	0	23 (5.3)	0.051
Loss of vision	7 (6.7)	10 (6)	9 (7.6)	4 (9.1)	30 (6.9)	
Hearing loss	62 (59.6)	118 (70.7)	73 (61.3)	32 (72.7)	285 (65.7)	
Intellectual disability and delay in psychomotor development	19 (18.3)	24 (14.4)	23 (19.3)	2 (4.5)	68 (15.7)	
Behavioral problems	1 (1)	0	0	0	1 (0.2)	
No idea	4 (3.8)	8 (4.8)	9 (7.6)	6 (13.6)	27 (6.2)	

*****n(%)*

most appropriate sample significantly (p = 0.010), there was no difference between groups in other sample choices. The order of preference for the laboratory test(s) to diagnose if cCMVi is suspected was as follows: polymerase chain reaction (PCR) in blood from baby (72.4%), serological tests of blood from baby (54.4%), PCR in urine from baby (48.4%), PCR in breast milk (5.1%), serological tests of blood from mother (35.5%), all options (15.9%), and no idea (0.2%). Group IV preferred the

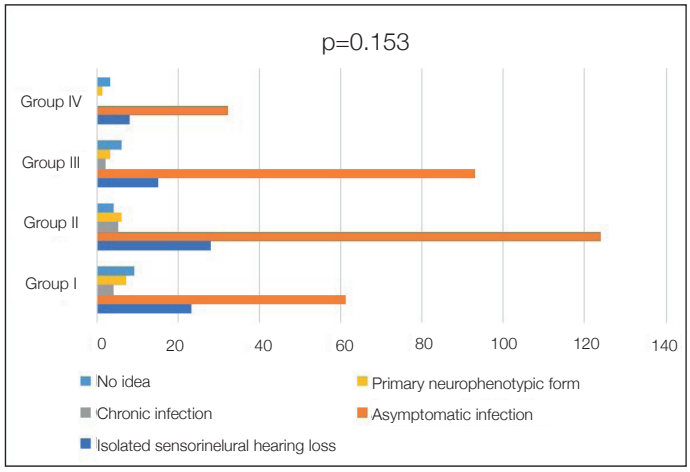

Figure I: Responses (n) about the most common clinical presentation of cCMVi by groups.

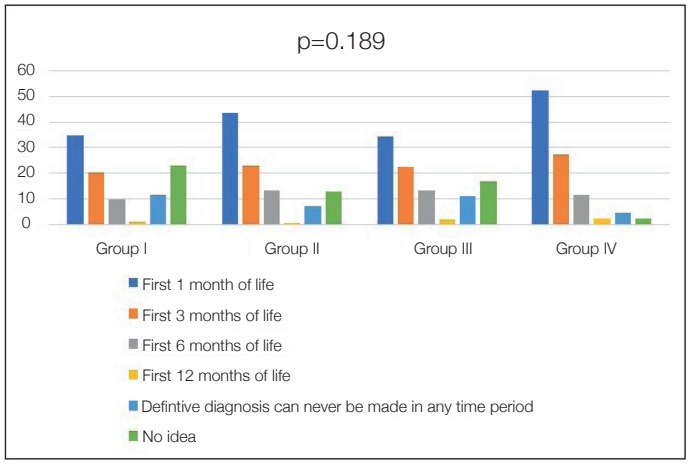

Figure II: Responses (%) of the groups about the period in which the diagnosis of cCMVi can be made definitively with the tests performed (Percentages are indicated separately for each group).

CMV PCR in urine for diagnosis significantly less (p = 0.048). However, there was not any difference between the groups for other test options. Preferences by the groups about the period in which the diagnosis of cCMVi can be made definitively with the tests performed were shown in Figure II.

Bone radiographic surveys (65.9%), echocardiography (30.9%), cranial imaging (23.7%), hearing test (21.4%), and eye examination (19.8%) options were preferred as unnecessary imaging methods or examinations during the diagnosis, respectively. Of the participants, 2.8% had no idea about this approach. Any statistical difference was not detected between the groups in terms of preferences (p = 0.404). The answers of the questions about treatment options and duration of treatment in oral and parenteral administration according to the groups and their significance levels were summarized in Table II. The responses reflecting the level of knowledge about the indications for initiating treatment, expectations from the treatment, and the most common disease-related sequelae were summarized in Table III.

DISCUSSION

Although cCMVi is the most common congenital infection, studies on how the importance of cCMVi, its transmission routes, clinical findings and treatment approaches are understood by healthcare professionals are limited (9-13, 16, 17). Awareness studies on medical professionals, who are more likely to encounter cCMVi patients such as pediatricians, obstetricians and audiologists, will enable to reveal level of knowledge about cCMVi and make necessary improvements and interventions. The knowledge and awareness about the cCMVi among pediatricians in Turkey was investigated in this study. This report is the first survey conducted among only pediatricians in this context, and several remarkable results were obtained. The vast majority (89.4%) of the responders stated that they had followed any patient with suspected cCMVi before. However, the responses revealed that there is a significant lack of knowledge about cCMVi, which is not parallel to the high rate of this cCMVi experience.

The well-known transmission routes of CMV by the participants were intrauterine transmission, blood transfusion and solid organ transplantation. Other possible transmission routes, such as kissing, close contact, breast feeding, changing diapers, sexual intercourse, and CMV-contaminated food were marked at lower rates. However air-borne transmission which is not a exact route of transmission, was marked at a rate that was not at all low. The rates of correct answers about the possible transmission route of cCMVi in a newborn were found to be quite low compared to the rates of the answers given to CMV transmission routes. It is important to know the possible transmission route of cCMVi in order to consider the cCMVi infection that may occur in the babies of women who are exposed to the risk of maternal infection during pregnancy and to examine the patient in this direction. It is also interesting that inappropriate answers were detected at a higher rate among professionals in group II and group III, rather than residents who are in education processes. This data may bring on the agenda the additional information programs on cCMVi after the pediatric education process. The risk of inutero transmission to the fetus is far higher with primary maternal infection than with recurrent infection (1). Three quarters of the participants in this study stated that the most common maternal CMVi form was primary maternal infection.

While most newborn infants with cCMVi are asymptomatic at birth, 10-15% of infants born symptomatically may have clinical signs and symptoms that affect many systems and organs, often including neurological abnormalities, petechiae, hepatosplenomegaly, and jaundice (1, 5). Of the participants, 58.1% marked that the infection could be asymptomatic, but the rate was considered low. Among the groups, group II marked this option with the highest rate (61.7%), while group IV marked this option at the lowest rate (38.6%, p = 0.049). It is worrying that this rate is not high; because some asymptomatic

newborns who cannot be diagnosed will develop long-term sequelae, and the ignorance of this fact by pediatricians may result in delayed diagnosis of possible sequelae that may occur after the neonatal period, since cCMVi screening is not performed in Turkey. Correct options marked in order of frequency were microcephaly, organomegaly, rash, seizure, fever, chorioretinitis, intracranial calcification, hearing loss, high transaminases, cytopenia, and hyperbilirubinemia. It was observed that the neurologic findings, which are often expected in symptomatic newborns, were frequently marked by the participants. However, it was remarkable that unexpected or rarely reported clinical manifestations such as extremity anomaly, intestinal anomaly, diarrhea, cardiac anomaly, and urinary anomaly were also chosen by some participants at a substantial rate. Frequent marking of unexpected clinical findings may result in unnecessary investigation of possible cCMVi cases by the physician and prolongation of diagnosis time. Nearly all respondents had an opinion on this question, with a third of professionals ticking “all options”. Infants with congenital CMV infection are classified according to the symptoms at the time of birth, and are divided into four groups according to this classification: asymptomatic, symptomatic, primary neurophenotype, and asymptomatic with isolated hearing loss (1). The most common clinical presentation is asymptomatic infection as mentioned above. Asymptomatic form was the most marked option by all groups of this study with no statistical difference, followed by the “isolated sensorineural hearing loss”. It is also interesting that the “chronic infection”, a form not included in the classification, is also marked by some professionals.

Clinical findings in the symptomatic neonate with cCMVi can be similar to those in other congenital infections (1, 5). Therefore, additional diagnostic procedures are required for definitive diagnosis. The diagnosis can be established by detection of the virus in body fluids within the first 3 weeks of life, and urine and saliva are the preferred specimens for diagnosis (1). Blood samples is not recommended as a first-line test because not all infected infants are viremic. Viral cultures and PCR are the preferred methods of testing. However, PCR is widely applied due to its high sensitivity and rapid results compared to culture (18). In this report, participants preferred “blood” sample most frequently, but less preferred “urine” and “saliva” samples, which are primarily recommended samples. Interestingly, pediatricians preferred urine significantly less than other groups. Although not primarily recommended, PCR and serological tests from blood were also the most preferred laboratory tests by the responders. Group IV professionals, the most qualified physician group, preferred the CMV PCR in urine for diagnosis significantly less than the others. In addition, although the “First 1 month of life” was preferred by most of the participants as the period in which the diagnosis of cCMVi can be made definitively, it was noticed that there was a lack of information about the period of diagnosis and a variety of answers. It is also very thought-provoking that almost a quarter of the participants prefer cranial imaging, hearing test, and eye examination for unnecessary imaging methods for diagnosis. With these results, possible cases of cCMVi seems to be at risk of underdiagnosis due to not using the appropriate test samples and examination methods for definitive diagnosis by pediatricians.

Although there is more than one effective agents against CMV, treatment of cCMVi with intravenous ganciclovir or oral valganciclovir therapy has been shown to reduce the risk of long-term sequelae of hearing loss and neurodevelopmental delay in symptomatic newborns (6, 7). Although there are uncertainties regarding the duration of treatment, there is a trend to use 6 months of oral therapy and 6 weeks of parenteral therapy (1, 6, 7). In this study, 90% of the participants stated that there is an approved drug for cCMVi, and the level of knowledge about the use of ganciclovir/valganciclovir in treatment was found to be quite high in all groups and in total (87.5%-93.2%). However, the lack of knowledge about the duration of treatment approachs is remarkable. Although pediatric residents were the group that most accurately stated the oral 6-month treatment period, the rate (51%) was quite low even in this group, while the overall rate remained at 40%. The rate of those not express any opinion is relatively high with 31.3%. The lack of knowledge on the duration of parenteral treatment is also quite evident, the rate of those who chose 6 weeks (39.9%) was higher than those who chose the other options, however it was similar with the rate of those who chose 3 weeks (24.9%) or did not express an opinion (24%), and there was no prominent group. The indication for initiating cCMVi treatment is currently considered all newborns with symptomatic cCMVi (19). In this study, this indication was marked with a significantly higher rate by the participants ($p = 0.003$), but it was still found to be proportionally low (52.8%). In this study, this indication was marked with a significantly higher rate by the participants ($p = 0.003$), but it was still found to be proportionally low (52.8%), the highest rate of correct answers is in group IV professionals (63.6%). It is also significant that one third of the participants marked the option “All infants diagnosed with cCMVi”, and it is a misinformation that can cause problems in the approach. In the answers about the expectations from the treatment, the “Long-term improvement in audiological and neurodevelopmental findings” option was marked more than the other options, but it is quite low (37.1%). Group III professionals were significantly higher among those who marked this option ($p = 0.027$). Group IV professionals are significantly higher in those who marked “Negativity in CMV viremia” (27.3%, $p = 0.015$). It is noteworthy that the rate of those who chose the “All option” was similar to those who chose the correct option (37.1% vs. 37.6%), but no difference was found between the groups. These results suggest that the exact expectation from cCMVi treatment among pediatricians is not understood.

The answer to the question about the most common disease-related sequelae was “hearing loss” with the highest rate

(65.7%). Other options are marked low. It is important that pediatricians know the most common disease-related sequelae, because the main benefit expected from treatment is shaped by targeting the sequelae.

This study has some limitations. Completing the questionnaire may have been subject to response bias, as respondents who were unsure of their knowledge of cCMVi may refuse to respond. For this reason, the actual results may be lower than the results presented in this report. Additionally, the participant ratio could have been higher to better reflect the country in general. As a shortcoming, the time elapsed from the baseline training on cCMVi and the additional training received after completing the pediatric training were not questioned.

The most significant knowledge gaps identified in this study werein the areas of cCMVi transmission, clinical findings, diagnostic tests and methods, and treatment of cCMVi. Wrong answers are notable not only in the group of residents who are in the education process, but also in the groups that are in the advanced stages of the pediatrics profession. In fact, it has been observed that the level of knowledge of residents in pediatrics is better in some areas. This seem to indicate that further educational efforts about cCMVi should target all levels of the pediatric profession not only during assistant training. In countries where cCMVi screening is not available like Turkey, it would be realistic to support clinicians' training on cCMVi and to be repeated at intervals to keep the information up-to-date.

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