Scientific Research Publishing

Open Journal of Pediatrics, 2022, 12, 678-687
https://www.scirp.org/journal/ojped
ISSN Online: 2160-8776
ISSN Print: 2160-8741

Inaugural Seizures Revealing COVID-19 in an Immunocompetent Infant at the University Teaching Hospital (UTH) of Bouaké

Djakaridja Kone[1,2*], Iburaima Alamun Akanji[2,3], Martine Tatiana Yapo[1,2], Kokora Junior Gawa[4], Juliette Kadiane-Oussou[1,2], Leioh Romeo Adou[2,3], Jean Marie Karidioula[1,2], Yapo Thomas Aba[1,2], Kouadio Vincent Asse[3], Ouffoue Kra[1,2]

[1]Department of Infectious and Tropical Diseases, University Teaching Hospital of Bouaké, Bouaké, Côte d'Ivoire
[2]COVID-19 Care Center, University Teaching Hospital of Bouaké, Bouaké, Côte d'Ivoire
[3]Department of Pediatrics, University Teaching Hospital of Bouaké, Bouaké, Côte d'Ivoire
[4]Department of Bacteriology and Virology, University Teaching Hospital of Bouaké, Bouaké, Côte d'Ivoire
Email: *konedjakaridja18@gmail.com, iburaima@yahoo.com, tatianayapo@yahoo.fr, kokorajunior@gmail.com, kadianeoussou14@gmail.com, leioh91@gmail.com, jmkcyclase@yahoo.fr, chefaba@yahoo.fr, assevinc2014@gmail.com, ouffouek@yahoo.com

How to cite this paper: Kone, D., Akanji, I.A., Yapo, M.T., Gawa, K.J., Kadiane-Oussou, J., Adou, L.R., Karidioula, J.M., Aba, Y.T., Asse, K.V. and Kra, O. (2022) Inaugural Seizures Revealing COVID-19 in an Immunocompetent Infant at the University Teaching Hospital (UTH) of Bouaké. *Open Journal of Pediatrics*, **12**, 678-687.
https://doi.org/10.4236/ojped.2022.124070

Received: August 17, 2022
Accepted: September 18, 2022
Published: September 21, 2022

Abstract

Introduction: Children are likely to present with atypical and non-specific clinical manifestations of COVID-19, unlike adults. The aim of this observation is to identify the difficulties related to the diagnosis and the curative and preventive management of SARS-CoV-2 infection in children. **Observation:** This is a 15-month-old infant admitted for febrile seizures. The interrogation revealed signs evolving 48 hours before his admission marked by post-prandial vomiting, wet cough, hypotonia, food refusal, incessant crying, fever, and seizures. His antecedents can be summed up as an uneventful pre- and per-natal period, good eating habits, good psychomotor and staturo-ponderal development, and outdated vaccination. The physical and paraclinical examination made it possible to retain the diagnosis of severe pneumonia. The initial management consisted of oxygenation, hydroelectrolyte intake, antibiotic therapy, and neurosedation. The evolution 3 days later was marked by a worsening of the clinical features, and the hypothesis of infection with SARS-CoV-2 was raised. The nasopharyngeal swab for COVID-19 RT-PCR performed was positive. The infant was isolated in the intensive care unit, where he received oxygen therapy with a mask, enteral nutrition, antibiotic therapy, corticosteroid therapy, and adequate nursing. The evolution was favorable 48 hours later. In addition, his asymptomatic mother and 14-year-old brother were placed in isolation after a positive RT-PCR COVID-19 test. Her father who was very often away from home for professional reasons was negative for COVID-19

RT-PCR. They all four live in the same 3-room house. **Conclusion:** Childhood COVID-19 has many facets. Clinicians should think about it in the face of any infectious manifestation, in order to avoid delays in treatment and improve the prognosis.

Keywords

COVID-19, Children, Atypical Manifestations, SARS-CoV-2, Bouaké

1. Introduction

The emergence in December 2019 of a new coronavirus responsible for a global pandemic poses a serious threat to public health systems [1]. This new coronavirus (SARS-CoV-2) is usually responsible for severe pneumonia affecting mainly young adults and the elderly with comorbidities [1]. In the literature, in addition to anosmia and ageusia, the most common symptoms in patients with COVID-19 include fever 81.2% (95% CI: 77.9 - 84.4); cough: 58.5% (95% CI: 54.2 - 62.8); asthenia 38.5% (95% CI: 30.6 - 45.3); dyspnoea: 26.1% (95% CI: 20.4 - 31.8); and sputum: 25.8% (95% CI: 21.1 - 30.4) [2]. This historic advent of COVID-19 has not spared children. With the rapid global spread of SARS-CoV-2 infection, the number of pediatric patients with COVID-19 is expected to increase significantly or has already increased significantly [3]. Compared to adults, there are relatively few studies on pediatric COVID-19 due to the high rate of asymptomatic or paucisymptomatic children [4]. However, it is important to note that early routine testing and diagnosis were restricted mainly to symptomatic cases requiring health care in most countries. Therefore, data reported by countries through routine surveillance systems early in the pandemic were likely to significantly underestimate cases amongst those with mild or no symptoms. In addition, children are affected by a mild form, but there are still cases of serious illnesses. In addition, they are also more likely to present with atypical and non-specific clinical manifestations unlike adults [5]. Among symptomatic patients, distinct syndromes occur at varying time points, with severe disease occurring either early or late in an individual child. The clinical presentation of COVID-19 in children varies by age group. Children ≤ 9 years of age are the most commonly present with fever (46%), cough (37%), headache (15%), diarrhea (14%), and sore throat (13%). While older children 10 - 19 years of age are more likely to have symptoms similar to COVID-19 in adults with headache (42%), cough (41%), fever (35%), myalgia (30%), sore throat (29%), and shortness of breath (16%) [6]. A subset of mostly previously healthy children presents 4 to 6 weeks after an initial mild or inapparent infection with a delayed immune response characterized by higher fever, and rising inflammatory markers, with what is now termed multisystem inflammatory syndrome in children (MIS-C) [5] [6]. In some cases, especially in the setting of MIS-C, life-threatening neurologic involvement may occur. We report here an uncommon neurological manifestation, as the re-

velation of SARS-CoV-2 infection that occurred in an infant at the University Teaching Hospital of Bouaké (Côte d'Ivoire). This observation aims to identify the difficulties related to the diagnosis and the curative and preventive management of SARS-CoV-2 infection in children.

2. Observation

This is a 15-month-old infant, female, residing with her parents in Bouaké, admitted to the pediatric emergency for seizures associated with fever. The onset of symptoms dated back to 48 hours before admission with early post-prandial vomiting, wet cough, hypotonia, food refusal, and incessant crying. There was no diarrhea, otorrhea, or rhinorrhea, all evolving in a context of fever at 39˚C - 40˚C. Pre-hospital treatment was done with paracetamol oral solution (1 dose-weight, every 6 hours), Arthemeter + Lumefantrine 20/120mg dispersible tablet (1 tablet, every 12 hours), and Amoxicillin 250 mg (1 dose-weight every 8 hours). The evolution was marked by a worsening of the clinical presentation with the appearance of generalized tonic-clonic seizures, which motivates a consultation in the pediatric emergency. The history of this infant is marked by pre- and intra-natal periods without incident, good food behavior according to WHO recommendations, good psychomotor and staturo-ponderal development, outdated vaccination according to the recommendations of the Expanded Program of Vaccination, and without personal or family pathological history. The physical examination on admission revealed an infant with a poor general impression, temperature 40˚C, heart rate 156 beats/minute, respiratory rate 53 breaths/min, SpO_2 89% on room air. At the neurological level, obnubilation (Blantyre score 4/5), moderate hypotonia, normotensive anterior fontanel, and equal concentric and reactive pupils were noted. At the mucocutaneous level, the colored conjunctivae have a good state of hydration. At the respiratory level, there were signs of respiratory distress (flaring of the nostrils, intercostal indrawing), normal pulmonary sound on percussion, and bilateral crackles on auscultation. At the cardiovascular level, the peripheral pulses were synchronous, and the sounds of the heart were well perceived without added noises. At the digestive level, the oral cavity was clean; the abdomen was supple and depressible without palpable organomegaly. At the otorhinolaryngological level, the false nasals were free, the eardrums were normal, and the throats were non-inflammatory. The lumbar puncture performed revealed a clear cerebrospinal fluid with a "rock water" and normotensive appearance. The cytological, bacteriological, and chemical examination as well as the culture of this liquid were without anomalies. CSF PCR for viruses is not routinely accessible in our context of insufficient technical tables. The blood count showed hyperleukocytosis at 31,770 elements/mm^3 with a predominance of neutrophils in 79.1%, the hemoglobin level was normal at 11.9 g/dl, as well as the number of platelets (152,000 elements/mm^3). Capillary glycaemia and blood ionogram were normal and the thick film was negative. The frontal chest X-ray performed was normal. The hypothesis of severe pneumonia

was therefore raised on the basis of epidemiological, clinical, and biological arguments (Figure 1). The infant's initial care consisted of maintaining the major vital functions by positioning the back at 30˚, head in slight extension and oxygenation with glasses, correcting hydroelectrolyte disorders by slow intravenous infusion of isotonic glucose serum enriched with electrolytes (Na^+, K^+, Ca^{2+}), antibiotic therapy based on amoxicillin + clavulanic acid 100 mg/kg/day in 3 direct intravenous injections, paracetamol at a dose of 15 mg/kg/6h by slow direct intravenous injection, diazepam 0.5 mg/kg by slow direct intravenous in the event of seizures. Then, neurological and cardiorespiratory monitoring has been instituted. After 3 days of hospitalization, the evolution was marked by an alteration of the neurological state with a Blantyre score which went from 4 to 3/5, and repeated convulsive attacks, associated with an accentuation of the signs of respiratory distress. Faced with this worsening of the clinical features, the hypothesis of infection with SARS-CoV-2 has been raised. The nasopharyngeal swab for COVID-19 RT-PCR performed was positive. The infant was isolated in the intensive care unit, where he received oxygen therapy with a mask, enteral nutrition of 30 kcal/kg/d based on infant cereals, antibiotic therapy, corticosteroid therapy (dexamethasone) 2 mg in one dose intravenously direct and adequate nursing. The evolution was favorable 48 hours later marked by a good neurological state (Blantyre score 5/5) and respiratory state (SpO_2 99% in ambient air). In addition, his asymptomatic mother and 14-year-old brother were placed in isolation after a positive RT-PCR COVID-19 test. Her father who was very often away from home for professional reasons was negative for COVID-19 RT-PCR. They all 4 live in the same 3-room house.

3. Discussion

This case report allowed us to see the difficulties related to the early diagnosis and prevention of COVID-19.

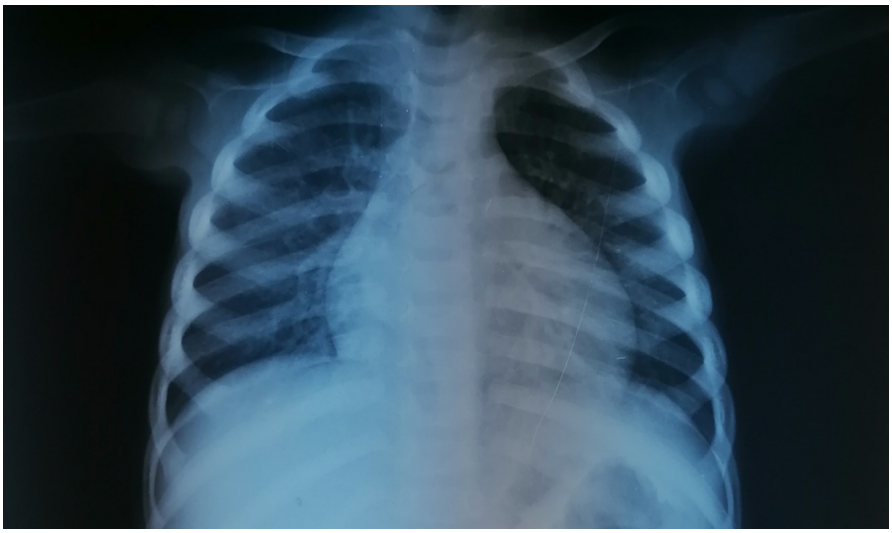

Figure 1. Frontal chest X-ray of 15 months old child.

- **Difficulties linked to the early diagnosis of SARS-CoV-2 infection**

Since its appearance, the SARS-CoV-2 infection has created a global pandemic where the pediatric population seems to be less impacted, as revealed by numerous studies [3] [4]. During the SARS-CoV-1 outbreaks in Hong Kong and MERS CoV, very few pediatric patients were reported, despite a high mortality rate in adults [7]. Children appear to have a milder form of the disease caused by coronaviruses, including in SARS-CoV-2 infection. In one of the largest cohort studies conducted by the Chinese Center for Disease Prevention and Control (CDC) collecting 72,314 patients diagnosed positive for COVID-19, only 1% concerned patients under 10 years old and no deaths occurred in this age group [8]. This lower sensitivity would be due to a more trained innate immunity or to cross-reactions with other coronaviruses that naturally colonize the respiratory mucous membranes of children. They are often asymptomatic or have mild clinical manifestations such as fever, dry cough and fatigue. Some patients present with misleading gastrointestinal (nausea, vomiting, abdominal pain and diarrhea), neurological (convulsion, torpor, coma) symptoms [9]. Thus, the diagnosis of COVID-19 in children is difficult as the signs are non-specific, unlike adults who can present compatible symptoms such as the classic anosmia-ageusia [2]. The search for SARS-CoV-2 infection is therefore not carried out in first intention by the pediatrician who will direct his investigations towards the search for commonly encountered pathologies. RT-PCR COVID-19 will only be prescribed in the event of a poor evolution of respiratory signs, as was the case in our patient. On admission the child was explored for malaria, meningitis and pneumonia (which are pathologies frequently encountered in developing countries and responsible for many deaths). It is the deterioration of the neurological state and especially the worsening of the respiratory distress in the context of a pandemic which motivated the prescription of the COVID-19 test which came back positive in the child as well as in his brother and his mother. Several cases of atypical revelation of COVID-19 in children have been described in the literature. Khaskour *et al.* [10] in Iran in 2020 presented a case series with atypical manifestation of COVID-19 infection as acute abdomen in children. In the study by Dominiguez *et al.* [11] in Europe, the atypical manifestations of COVID-19 in children were lymphadenopathy (17%), pleurisy (7%), atelectasis (2%) and pneumothorax (2%). These studies show how often COVID-19 is a multi-faceted disease. Seizures in COVID-19 patients were first documented by Moriguchi *et al.* [12]. In the study by Hogan *et al.* [13], neurological manifestations of COVID-19 were found in 25% of patients, but seizures were reported in only 0.5%. Also, Keshavarzi *et al.* [14] noted a 0.8% proportion of seizures as a manifestation of COVID-19. These studies demonstrate that convulsive seizures are rare manifestations of COVID-19 infection, which would be the cause of diagnostic error and the delay in management, as was the case in this observation. On the other hand, Sayed *et al.* [15] in his study on typical and atypical forms of COVID-19 in children highlighted seizures (18.2%) and encephalopathy (9.1%). Neurological

manifestations during COVID-19 could be due to invasion of the central nervous system by the virus. This cerebral penetration can take place either directly through the olfactory tract [16] or indirectly through the Converting Enzyme (CE) receptors present in the cerebral vascular endothelium [17]. Indeed, CE is known as a receptor for SARS-CoV. Since SARS-CoV-2 has similar amino acids to SARS-CoV, recent evidence indicates that the EC is probably the cellular receptor for the new coronavirus [18]. Moreover, the virus can enter the central nervous system either by infecting sensory or motor neurons or by an anterograde transport machinery, using kinesin and dynein [19]. Whatever the mechanism of cerebral penetration of the virus, the consequence will be a release of pro-inflammatory cytokines (TNF-α, IL-6, IL-1B) [20]. Under normal conditions, cytokines play vital roles in various aspects of normal CNS function, including sleep regulation and neuronal development. However, elevated levels of cytokines during an infection have been shown to play a major role in generating fever when generating febrile seizures [21]. Also, laboratory and clinical observations have shown that pro-inflammatory cytokines have a very important role in the onset and maintenance of seizures independently of fever. TNF-α stimulates astrocytes. Through the mechanism of endocytosis, TNF-α will not only increase the number of glutamate receptors, but also decrease the number of GABA receptors, thus increasing neuronal excitability [22]. Then, this astrocytic stimulation of TNF-α can lead to an increase in the production of IL-6, which thus contributes to initiating and increasing the severity of neurological disorders [23]. Additionally, COVID-19 infection can degrade the integrity of the blood-brain barrier resulting in the migration of blood cells and proteins, such as albumin, that disrupt the osmotic balance of the central nervous system (CNS) and cause seizures [24]. Aside from cerebral invasion of the virus, studies have reported that COVID-19 infection is associated with decreased serum concentrations of sodium, potassium, magnesium, and calcium. Seizures are the most important clinical symptoms of electrolyte disturbances and are more common in patients with hyponatremia, hypocalcemia and hypomagnesemia [25].

- **Intra-family transmission of SARS-CoV-2 infection in children**

Several studies have shown that the carriage of the virus in children was less important due to a low expression of ACE2 receptors on the surface of the respiratory mucosa [26]. Thus children are less virus carriers and less contaminating those around them. Indeed, the multiplication of cluster analyzes has made it possible to better understand the risk carried by children, including the most fragile adults [25]. After confinement, the reopening of schools confirmed the determining role of adults in school clusters [26]. The analysis of family cases went in the same direction and made children collateral victims more than active spreaders of the virus [27] [28]. In addition, no significant link was found between the opening of nursery and the spread of the virus [29] [30]. When large population surveys focused on children, it became clear that symptomatic child-

ren were more frequently infected at home the younger they were, adolescents being more at risk of contracting the virus outside [31]. This trend was also confirmed by the study by Cao *et al.* [32] which, in nine hospitalized infants diagnosed with COVID-19 in China, found at least one family member infected with SARS-CoV-2. Pediatric forms thus raise the issue of compliance with barrier measures between adults and children.

- **Difficulties related to the prevention of SARS-CoV-2 infection in breastfed children**

In the literature currently, no cases of vertical transmission of SARS-CoV-2 and during breastfeeding have been described [33] [34]. SARS-CoV-2 is transmitted via the projection of respiratory droplets less than one meter by infected people, when they cough, sneeze or sputter. Transmission can also be hand-held, by simple contact with contaminated surfaces, on which the virus would survive from four hours to three days [35]. In the context of the breastfed child, contamination of the newborn can occur via droplets exhaled by the mother, in the event of close contact during latching, emotional gestures, and routine care, or in the event of formula feeding [36]. Given the benefits of breastfeeding on infant health, the World Health Organization (WHO) therefore recommends continuing breastfeeding even in the event of SARS-CoV-2 infection in the mother. This breastfeeding must be carried out in compliance with preventive measures, washing your hands frequently with clean water and soap, or with a hydroalcoholic solution, in particular before touching the baby; wear a medical mask while breastfeeding. Change the mask as soon as it becomes damp; throw it away immediately after use do not reuse it; do not touch the front of the mask but remove it from the back sneeze or cough into a tissue, throw it away immediately and rub your hands with a hydroalcoholic solution or wash your hands again with soap and clean water; clean and disinfect surfaces regularly [37]. However, these measures seem difficult to apply to most households in our countries with limited resources where promiscuity is very present.

4. Conclusion

SARS-CoV-2 disease, although affecting children less frequently, can be responsible for serious forms with an atypical revelation. Clinicians should be aware of the myriad of atypical extrapulmonary manifestations of SARS-CoV-2 infection in children, and consider this in the face of any infectious manifestation. This will allow tests to be carried out for rapid diagnosis, and the early initiation of treatments as well as appropriate public health measures. Compliance with barrier measures remains the only way to date to avoid contamination of a mother breastfeeding her child, hence the need to increase awareness campaigns to promote support for breastfeeding during the COVID-19 pandemic.

Authors' Contribution

All the authors participated intellectually in the preparation and revision of the

manuscript before its submission.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

[1] Wu, F., Zhao, S., Yu, B., Chen, Y.M., Wang, W., Song, Z.G., *et al.* (2020) A New Coronavirus Associated with Human Respiratory Disease in China. *Nature*, **579**, 265-269. https://doi.org/10.1038/s41586-020-2008-3

[2] Alimohamadi, Y., Sepandi, M., Taghdir, M. and Hosamirudsari, H. (2020) Determine the Most Common Clinical Symptoms in COVID-19 Patients: A Systematic Review and Meta-Analysis. *Journal of Preventive Medicine and Hygiene*, **61**, E304-E312.

[3] Guo, C.-X, He, L., Yin, J.-Y., Meng, X.-G., Tan, W., Yang, G.-P., *et al.* (2020) Epidemiological and Clinical Features of Pediatric COVID-19. *BMC Medicine*, **18**, Article No. 250. https://doi.org/10.1186/s12916-020-01719-2

[4] Zimmermann, P. and Curtis, N. (2020) COVID-19 in Children, Pregnancy and Neonates: A Review of Epidemiologic and Clinical Features. *The Pediatric Infectious Disease Journal*, **39**, 469-477. https://doi.org/10.1097/INF.0000000000002700

[5] Ludvigsson, J.F. (2020) Systematic Review of COVID-19 in Children Shows Milder Cases and a Better Prognosis than Adults. *Acta Paediatrica*, **109**, 1088-1095. https://doi.org/10.1111/apa.15270

[6] Alsohime, F., *et al.* (2020) COVID-19 Infection Prevalence in Pediatric Population: Etiology, Clinical Presentation, and Outcome. *Journal of Infection and Public Health*, **13**, 1791-1796. https://doi.org/10.1016/j.jiph.2020.10.008

[7] Lahfaoui, M., Azizi, M., Elbakkaoui, M., Amrani, R., Kamaoui, I. and Benhaddou, H. (2020) Acute Respiratory Distress Syndrome Secondary to SARS-CoV-2 Infection in an Infant. *Revue des Maladies Respiratoires*, **37**, 502-504. https://doi.org/10.1016/j.rmr.2020.04.009

[8] Wu, Z. and Mcgoogan, J.M. (2020) Characteristics of and Important Lessons from the Coronavirus Disease 2019 (COVID-19) Outbreak in China: Summary of a Report of 72 314 Cases from the Chinese Center for Disease Control and Prevention. *JAMA*, **323**, 1239-1242. https://doi.org/10.1001/jama.2020.2648

[9] Hong, H., Wang, Y., Chung, H.T. and Chen, C.J. (2020) Clinical Characteristics of Novel Coronavirus Disease 2019 (COVID-19) in Newborns, Infants and Children. *Pediatrics & Neonatology*, **61**, 131-132. https://doi.org/10.1016/j.pedneo.2020.03.001

[10] Khakshour, A., Saeidinia, A. and Ghanbari, G. (2021) Atypical Presentation of COVID-19 Infection as Acute Abdomen in Children: A Case Series. *Clinical Case Reports*, **9**, e05030. https://doi.org/10.1002/ccr3.5030

[11] Caro-Dominguez, P., Shelmerdine, S.C., Toso, S., Secinaro, A., Toma, P., Damasio, M.B., *et al.* (2020) Thoracic Imaging of Coronavirus Disease 2019 (COVID-19) in Children: A Series of 91 Cases. *Pediatric Radiology*, **50**, 1354-1368. https://doi.org/10.1007/s00247-020-04747-5

[12] Moriguchi, T., Harii, N., Goto, J., Harada, D., Sugawara, H., Takamino, J., *et al.* (2020) A first Case of Meningitis/Encephalitis Associated with SARS-Coronavirus-2. *International Journal of Infectious Diseases*, **94**, 55-58.

https://doi.org/10.1016/j.ijid.2020.03.062

[13] Hogan, R.E., Grinspan, Z., Axeen, E., Marquis, B. and Day, B.K. (2020) COVID-19 in Patients with Seizures and Epilepsy: Interpretation of Relevant Knowledge of Presenting Signs and Symptoms. *Epilepsy Currents*, **20**, 312-315. https://doi.org/10.1177/1535759720948549

[14] Keshavarzi, A., Janbabaei, G., Kheyrati, L., Ghavamabad, L.H. and Asadi-Pooya, A.A. (2021) Seizure Is a Rare Presenting Manifestation of COVID-19. *Seizure: European Journal of Epilepsy*, **86**, 16-18. https://doi.org/10.1016/j.seizure.2021.01.009

[15] Sayed, M.A. and Abdelhakeem, M. (2022) Typical and Atypical Clinical Presentation of COVID-19 Infection in Children in the Top of Pandemic in EL-Minia Governorate (Two Center Experience). *The Mediterranean Journal of Hematology and Infectious Diseases*, **14**, e2022002. https://doi.org/10.4084/MJHID.2022.002

[16] Steardo, L. (2020) Neuroinfection May Contribute to Pathophysiology and Clinical Manifestations of COVID-19. *Acta Physiologica*, **2020**, e13473. https://doi.org/10.1111/apha.13473

[17] Jiang, T., Gao, L., Lu, J. and Zhang, Y.D. (2013) ACE2-Ang-(1-7)-Mas Axis in Brain: A Potential Target for Prevention and Treatment of Ischemic Stroke. *Current Neuropharmacology*, **11**, 209-217. https://doi.org/10.2174/1570159X11311020007

[18] Zhou, P., Yang, X.L., Wang, X.G., Hu, B., Zhang, L., Zhang, W., *et al.* (2020) A Pneumonia Outbreak Associated with a New Coronavirus of Probable Bat Origin. *Nature*, **579**, 270-273.

[19] Wu, Y., Xu, X., Chen, Z., Duan, J., Hashimoto, K., Yang, L., *et al.* (2020) Nervous System Involvement after Infection with COVID-19 and Other Coronaviruses. *Brain Behavior and Immunity*, **87**, 18-22. https://doi.org/10.1016/j.bbi.2020.03.031

[20] Tufan, A., Avanoğlu, G.A. and Matucci-Cerinic, M. (2020) COVID-19, Immune System Response, Hyperinflammation and Repurposing Antirheumatic Drugs. *Turkish Journal of Medical Sciences*, **50**, 620-632. https://doi.org/10.3906/sag-2004-168

[21] Galic, M.A., Riazi, K. and Pittman, Q.J. (2012) Cytokines and Brain Excitability. *Frontiers in Neuroendocrinology*, **33**, 116-125. https://doi.org/10.1016/j.yfrne.2011.12.002

[22] Levin, S. and Godukhin, O. (2017) Modulating Effect of Cytokines on Mechanisms of Synaptic Plasticity in the Brain. *Biochemistry*, **82**, 264-274. https://doi.org/10.1134/S000629791703004X

[23] Van Vliet, E. (2007) Blood-Brain Barrier Leakage May Lead to Progression of Temporal Lobe Epilepsy. *Brain*, **130**, 521-534. https://doi.org/10.1093/brain/awl318

[24] Mabillard, H. and Sayer, J.A. (2020) Electrolyte Disturbances in SARS-CoV-2 Infection. *F*1000*Research*, **9**, Article No. 587.

[25] Davies, N.G., Klepac, P., Liu, Y., Prem. K., Jit, M., CMMID COVID-19 Working Group and Eggo, R.M. (2020) Age-Dependent Effects in the Transmission and Control of COVID-19 Epidemics. *Nature Medicine*, **26**, 1205-1211. https://doi.org/10.1038/s41591-020-0962-9

[26] Ismail, S.A., Saliba, V., Bernal, J.A.L., Ramsay, M.E. and Ladhani, S.N. (2021) SARS-CoV-2 Infection and Transmission in Educational Settings: Cross-Sectional Analysis of Clusters and Outbreaks in England. *The Lancet Infectious Disease*, **21**, 353-344. https://doi.org/10.1016/S1473-3099(20)30882-3

[27] Jin, X., Lian, J.S., Hu, J.H., Gao, J., Zheng, L. and Zhang, Y.M. (2019) Epidemiological, Clinical and Virological Characteristics of 74 Cases of Coronavirus-Infected Disease 2019 (COVID-19) with Gastrointestinal Symptoms. *Gut*, **69**, 1002-1009. https://doi.org/10.1136/gutjnl-2020-320926

[28] Lee, B. and Raszka, W.V. (2020) COVID-19 Transmission and Children: The Child Is Not to Blame. *Pediatrics*, **146**, e2020004879. https://doi.org/10.1542/peds.2020-004879

[29] Danis, K., Epaulard, O., Bénet, T., Gaymard, A., Campoy, S., *et al.* (2020) Cluster of Coronavirus Disease 2019 (COVID-19) in the French Alps, February 2020. *Clinical Infectious Diseases*, **71**, 825-832. https://doi.org/10.1093/cid/ciaa424

[30] Park, S., Choi, G.J. and Ko, H. (2020) Information Technology-Based Tracing Strategy in Response to COVID-19 in South Korea—Privacy Controversies. *JAMA*, **323**, 2129-2130. https://doi.org/10.1001/jama.2020.6602

[31] Goldstein, E., Lipsitch, M. and Cevik, M. (2021) On the Effect of Age on the Transmission of SARS-CoV-2 in Households, Schools and the Community. *The Journal of Infectious Diseases*, **223**, 362-369. https://doi.org/10.1093/infdis/jiaa691

[32] Cao, Q., Chen, Y.C., Chen, C.L. and Chiu, C.H. (2020) SARS-CoV-2 Infection in Children: Transmission Dynamics and Clinical Characteristics. *Journal of the Formosan Medical Association*, **119**, 670-673. https://doi.org/10.1016/j.jfma.2020.02.009

[33] Fakari, F.R. and Simbar, M. (2020) Coronavirus Pandemic and Worries during Pregnancy; a Letter to the Editor. *Archives of Academic Emergency Medicine*, **8**, e21.

[34] Chen, H., Guo, J., Wang, C., Luo, F., Yu, X., *et al.* (2020) Clinical Characteristics and Intrauterine Vertical Transmission Potential of Covid-19 Infection in Nine Pregnant Women: A Retrospective Review of Medical Records. *Lancet*, **395**, 809-815. https://doi.org/10.1016/S0140-6736(20)30360-3

[35] van Doremalen, N., Bushmaker, T., Morris, D.H., Holbrook, M.G., Gamble, A., Williamson, B.N., *et al.* (2020) Aerosol and Surface Stability of SARS-CoV-2 as Compared with SARS-CoV-1. *New England Journal of Medicine*, **382**, 1564-1567. https://doi.org/10.1056/NEJMc2004973

[36] Walker, K.F., O'Donoghue, K., Grace, N., Dorling, J., Comeau, J.L., Li, W., *et al.* (2020) Maternal Transmission of SARS-COV-2 to the Neonate, and Possible Routes for Such Transmission: A Systematic Review and Critical Analysis. *BJOG,* **127**, 1324-1336. https://doi.org/10.1111/1471-0528.16362

[37] World Health Organization (2021) Breastfeeding Advice during the COVID-19 Outbreak. http://www.emro.who.int/nutrition/nutrition-infocus/breastfeeding-advice-during-covid-19-outbreak.html