ORIGINAL ARTICLE

Clinical Characteristics and Pattern of Imaging Change of Pediatric COVID-19

Zannat-Ul-Sarmin*[1], Iffat Ara Shamsad [2], Md. Mohidul Islam[3], Jesmin Akter[4],
Sharker Md. Numan[5]

Abstract

Introduction: COVID-19 infection in children is relatively milder and vary from that in adults. Higher fatality rate of children in Bangladesh from COVID-19 infection does not matched with other country may be due to malnutrition, air pollution, poverty, poor parental education about health hygine, inadequate access to high-quality acute healthcare. Chest X-ray is initial imaging technique which is done in children with mild respiratory infections with or without dyspnea. Few studies have reported the radiological findings of COVID-19 in children. **Objective:** In this study, our main goal was to investigate the clinical and imaging features of pediatric COVID-19 patients in child corona unit of Dhaka Medical College Hospital, Bangladesh. **Materials and Methods:** This single center observational study was conducted in Child Corona Unit of Dhaka Medical College Hospital between January 2022 to September 2022. A total of 123 COVID-19 positive pediatric patients detected by RT-PCR were purposively included in the study. Patients with comorbidities were excluded from the study. **Results:** Among 123 children with COVID-19, 43 had no symptoms, 71 had low grade fever and 9 presented with cough, nasal congestion, diarrhea, headache, or fatigue. Normal X-ray findings present in 50(40.6%), unilateral patchy shadowing in 28 (22.8%), bilateral patchy shadowing in 22(17.9%), ground glass opacity in 11(8.9%), consolidation in 7(5.8%) and Interstitial abnormalities in 5(4.0%). **Conclusion:** This study throw light on the cases of COVID-19 in the pediatric population. Children usually have mild or moderate clinical and imaging presentations. Understanding of the clinical and imaging findings helps in reducing misdiagnosis rate for those with concealed and atypical symptoms.

Keywords: COVID-19 infection, Paediatric patients, Clinical characteristics, Radiological features.

Number of Tables: 06; **Number of Figure:** 01; **Number of References:** 28; **Number of Correspondences:** 03.

*1. Corresponding Author:
Dr. Zannat-ul-Sarmin
Registrar
Department of Pediatric Nephrology
DMCH
Email: drsarmin37@gmail.com
Mobile :01714686122

2. Prof. Dr. Iffat Ara Shamsad
Professor and Head
Department of Pediatrics
DMCH

3. Dr. Mohidul Islam
Medical Officer
DMCH
Email:-drhillol35@gmail.com
Mobile no-01712629605

4. Jesmin Akter
Adjunct Faculty
Bangladesh Open University
MPH Program,CMUD.

5. Sharker Md. Numan
Dean, SST
Bangladesh Open University.

Introduction:

Covid-19 infection broke out in December, 2019 has become a pandemic worldwide now[1,2]. The disease has been managed as one of class A infectious diseases. Class A infectious diseases indicate that, the diseases are the most infectious and which will be treated using the most severe measures: detecting and managing the source of infection, cutting off the transmission pathway, and protecting the susceptible population. The epidemic has entered its peak stage and better pathogen detection techniques have been developed, more children have been confirmed to be infected. In children patients infected with this virus with or without symptoms were the primary source of spread through close contact and respiratory droplets as the major person-to-person transmission channels, and a family cluster is the main epidemic spread of COVID-19 in paediatric patients[3]. The incubation period of infection of this virus is 1–14 days with most patients presenting with symptoms between 3–7 days[4,5]. Illness varies in severity from no clinical symptoms or with fever, fatigue, and dry cough, including accompanied upper respiratory symptoms like nasal congestion, runny nose, and sore throat; severe illness occurs in a large proportion of patients with clinically apparent infection[6,7,8]. Anorexia, nausea, vomiting, abdominal pain, and diarrhea may present initially.COVID-19 infection in children is relatively milder and vary from that in adults and a better prognosis with rare mortality in case of children with this disease have been reported[9,10]. Although a large proportion of infected children seems to be asymptomatic,severe pediatric cases of COVID-19 also have been reported[10]. If the COVID-19 infection occur in child who had some diseases, like severe acute malnutrition,

cancer, chronic kidney disease etc. the infection might progress quickly to severe or critically severe type of disease requiring admission to ICU and ventilation[11]. In pediatric patients fatal outcomes of COVID-19 pneumonia are rare, and only a few deaths have been reported[12,13]. Higher fatality rate of children in Bangladesh from COVID-19 infection does not matched with other country may be due to malnutrition, air pollution, poverty, poor parental education about health hygine, inadequate access to high-quality acute healthcare[14]. Chest X-ray is initial imaging technique which is done in children with mild respiratory infections with or without dyspnea[15]. Few studies have reported the radiological findings of COVID-19 in children[16].

Materials and Methods:
This cross-sectional observational study was conducted in the Paediatric COVID-19 unit, DMCH, Dhaka, Bangladesh. The only Government Paediatric Covid Unit in Bangladesh situated in Old Plastic and Burn Surgery Building of Dhaka Medical College. A total of 123 children diagnosed with COVID-19 infection detected by real-time reverse transcription-polymerase chain reaction (RT-PCR) and those underwent a chest X-ray due to symptoms of respiratory infection with at least one of the following symptoms: fever, nasal discharge, cough or respiratory distress were included in the study. Patients were excluded who had any comorbidities like Bronchial asthma, cystic fibrosis, tuberculosis, congenital heart disease, lymphoproliferative disorder, chronic kidney disease, chronic liver disease, hemoglobinopathies, rheumatological condition, chronic neurological disorder, immunosuppressive condition such as malignancy, immunosuppressive drug. Informed written consent was taken from patient's attendant. Patient's socio-demographic data were collected which include age, sex, contact history. The clinical features, laboratory parameters and radiological features were collected. Collected data were entered into SPSS and was checked. Data were analyzed and presented in tabulated form. The data collected from the patients were analyzed. The statistical analysis was conducted using SPSS (statistical package for the social science) version 26 statistical software. The findings of the study were presented by frequency, percentage in tables. Means and standard deviations for continuous variables and frequency distributions for categorical variables were used to describe the characteristics of the total sample. Association between qualitative data were assessed by Chi-Square and Fisher Exact tests. P value of <0.05 was considered as significant.
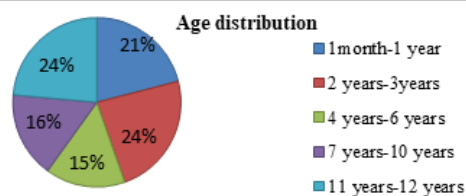
Results:

Figure-1: Characteristics of patients

Table- I: Characteristics of patients (N=123)

Total number of patients	123
Female	48 (39.02)
Male	75 (61)
Positive epidemiological environment	
Positive	37 (30)
Negative	86 (70)
Comorbidity	36 (29)
Infection with other organism	16 (13)
Hospitalisation	25 (20.3)
Duration of hospitalisation, days (median [IQR])	3 [2.4]

Table- II: Clinical features and investigations

Type of symptom	
Fever	71(57.7)
Nasal congestion	9 (7.3)
Exanthema	3 (2.4)
Myalgia	9 (7.3)
Headache	9 (7.3)
Cough	99(80.4)
Chest pain	3 (2.4)
Dyspnoea	24 (19.5)
Bronchospasm	1(0.8)
Abdominal pain	8 (6.5)
Vomiting	4 (3.2)
Diarrhoea	9 (7.3)

Table - III: Distribution of patients by laboratory findings (N=123)

Laboratory findings	Frequency	Percentage
Leucocyte count (× 1000 cell/ mm³) (n=87)		
Normal	21	24.1
Lower	66	75.9
Median [IQR]	3,970.0 [3,800.0, 5,940.0]	
Lymphocyte count (in %) (n=87)		
Normal	20	22.9
Lower	67	77.1
Median [IQR]	24.0 [22.0, 28.0]	
Platelet count (in /mm³)(n=87)		
Below	12	13.8
Normal	41	47.0
Higher	34	39.0
Median [IQR]	3,59,000.0 [247,000.0, 49,0000.0]	
C-Reactive Protein (CRP)mg/L (n=71)		
Normal	28	39.4
Higher	43	60.6
D-dimer, mg/L (n=46)		
Normal	8	17.4
Higher	38	82.6
Median [IQR]	2.5 [0.7, 4.4]	
Serum ferritin (in ng/mL)(n=48)		
Below	2	4.2
Normal	12	25.0
Higher	34	70.8
Median [IQR]	204.5 [91.0, 445.5]	
Lactate dehydrogenase (in U/L) (n=47)		
Below	2	4.3
Normal	20	42.6
Higher	25	53.2
Median [IQR]	500.0 [266.0, 740.0]	

Laboratory findings	Frequency	Percentage
Lactate dehydrogenase (in U/L) (n=47)		
Below	2	4.3
Normal	20	42.6
Higher	25	53.2
Median [IQR]	500.0 [266.0, 740.0]	

Table-IV Shows that 50 (40.6%) had no Chest X-ray abnormality. However, 28 (22.8%) had unilateral patchy opacity, 22 (17.9%) had bilateral patchy opacity. Ground-glass opacity (GGO) was present in 11 (8.9%) patients, consolidation was present in 7 (5.8%) patients and interstitial abnormalities was observed in 5 (4.0%) patients.

Table IV: Distribution of patients by Chest X-ray findings (N=89)

Radiographic findings	Frequency	Percentage
No abnormality detected	50	40.6
Unilateral patchy opacity	28	22.8
Bilateral patchy opacity	22	17.9
Ground - glass opacity (GGO)	11	8.9
Consolidation	7	5.8
Interstitial abnormalities	5	4.0
Total	**123**	**100.0**

Table-V shows that most of the patients (86.8%) in severe group had lower leucocyte count while majority of the patients (67.3%) in mild to moderate group had lower leucocyte count (p=0.035). Lymphocyte count was significantly lower in severe patients compared to mild to moderate patients (P=0.009). Out of 71 patients, 6 (21.4%) patients with CRP <6 had severe illness while 27 (62.8%) patients with CRP ≥6 CRP had severe illness (P=0.001). No significant statistical difference was observed between the groups regarding Platelet count (P=0.166), Hemoglobin (P=0.352), D-dimer (P=0.440), Ferritin (P=0.118).

Table V: Association between laboratory findings and severity of disease

Laboratory findings	Severity of disease		P value
	Mild to moderate	Severe	
Leucocyte count (N=87)			
Normal	16 (32.7%)	5 (13.2%)	0.035
Lower	33 (67.3%)	33 (86.8%)	
Lymphocyte count (N=87)			
Normal	16 (32.7%)	4 (10.5%)	0.009
Lower	33 (67.3%)	34 (89.5%)	
Platelet count (N=87)			
Below	7 (58.3%)	5 (41.7%)	0.166
Normal	27 (65.9%)	14 (34.1%)	
Higher	15 (41.1%)	9 (59.9%)	
Hemoglobin (N=87)			
Below	43 (51.1%)	31 (41.9%)	0.352*
Normal	5 (41.7%)	7 (58.3%)	
Higher	1 (100.0%)	0 (0.0%)	
D-dimer (n=46)			
Normal	6 (75.0%)	2 (25.0%)	0.440*
Higher	21 (55.3%)	17 (44.7%)	
CRP (n=71)			
<6	22 (78.6%)	6 (21.4%)	**0.001**
≥6	16 (37.2%)	27 (62.8%)	
Ferritin (n=48)			
Below	0 (0.0%)	2 (100.0%)	0.118*
Normal	9 (75.0%)	3 (25.0%)	
Higher	21 (61.8%)	13 (38.2%)	

*Fisher Exact test

Table-VI Show that all patients with no abnormality in radiographic finding had mild illness while 22(80.0%) patients with unilateral patchy opacity had severe illness and 5(71.5%) with consolidation had severe illness. Fisher Exact test showed that there were significant statistical difference between radiographic findings and severity of disease as P<0.001.

Table VI: Association between Chest X-ray findings and severity of disease (N=123)

Chest-X ray findings	Severity of disease		P value
	Mild to moderate	Severe	
No abnormality detected	50 (100.0%)	0 (0.0%)	<0.001
Unilateral patchy opacity	6 (20.0%)	22 (80.0%)	
Bilateral patchy opacity	5 (23.0%)	17 (77.0%)	
Ground-glass opacity (GGO)	3 (27.3%)	8 (72.7%)	
Consolidation	2 (28.5%)	5 (71.50%)	
Interstitial abnormalities	5 (100.0%)	0 (0.0%)	

Discussion:

Coronavirus disease-19 (COVID-19) is a global health crisis. Clinical symptoms are similar to any acute respiratory viral infection with less pronounced nasal symptoms. Disease seems to be milder in children but situation appear to be changing. While children experienced less severe illness than adults, young children specially infants are more vulnerable to disease and experienced more severe illness than older children[17]. The present cross sectional study had been conducted to find out the clinical characteristics and radiological features in children with COVID-19 infection. A total of 123 patients diagnosed with COVID-19 infection confirmed by real-time reverse transcription-polymerase chain reaction (RT-PCR) were purposively included in the study. Majority children had mild to moderate symptoms and majority children infected with COVID-19 were exposed through family clusters. Fever and cough were the most common symptoms where diarrhea and vomiting were also found in many patients. Leucocyte and lymphocyte counts are often below the normal range in children with COVID-19. Abnormalities in radio-imaging were found in majority of the patients, the most common being unilateral or bilateral patchy opacity. Infants and patients with lung abnormalities, lower leukocyte and lower lymphocyte count and elevated CRP had significantly more in severe form of disease than others. Among the 123 patients, 21.0% were from 1month-1 year age group, 24% patients were from 2-3 years age group,15% patients were from 4-6 years age group,16% patients were from 7-10 years age group, while 21% patients were from >10 years age group. The study of Ghosh, et al. (2020) found that one fifth were infant, more than one third patients were from 1-5 years age group, another one fifth were from 5-10 years age group while 12.7% patients were from >10 years age group. However, the single center observational study of Anwar, et al. (2021) showed that maximum patients were in the group of 11-15 years. A meta-analysis reported that 60.1% of the children were older than 5 years[19]. This difference might be due to the fact that the present study dealt with RT-PCR confirmed case and patients with up to 12 while those study included patients up to 18 years of age. Majority patients of this study were

male. The study conducted in Child Corona Unit of Dhaka Medical College Hospital (DMCH) also found that the proportion of male patients were higher compared to female patients[14]. Other **studies also supported this results[22].** Pediatric patients are more likely to show upper respiratory symptoms, such as sore throat, pharyngeal congestion, and rhinorrhea. (Ding et al., 2020) Cough and fever and were most common symptom (80.4% and 57.7%) among the patients of the present study followed dyspoena (19.5%). Others had diarrhea (7.3%), myalgia (7.3%), vomiting (3.2%), headache (7.3%), runny nose (7.3%) and abdominal pain (6.5%)28. The clinical profile of all patients of a study showed that fever, nasal congestion, cough, myalgia were very common symptoms.(Anwar et al., 2021)Again, the clinical profile of patients of a study showed that fever, cough, sore throat, runny nose, anorexia, convulsion, respiratory distress & acute diarrhea were the common symptoms[22,23,24]. Some atypical findings were presented in few patients of the current study which was later diagnosed as MIS-C. Multisystem Inflammatory Syndrome in Children (MIS-C) is a new phenomenon reported worldwide with temporal association with COVID-19[18,20]. Majority of the patients 50(40.6%) had no radiological abnormality where 28 (22.8%) had unilateral patchy opacity, another 22 (17.9%) had bilateral patchy opacity. Interstitial abnormalities was observed in 5 (4.0%) patients, consolidation was present in 7 (5.8%) patients and Ground-glass opacity (GGO) was present in 11 (8.9%) patients. Relatively similar results were reported by one study which found 38% were undergone local patchy shadowing, 31.8% patients were undergone bilateral patchy shadowing and 27.9% patients had interstitial abnormalities and only 2.1% patients were undergone Ground-glass opacity.(Anwar et al., 2021) A study reported that unilateral pneumonia is common in children with COVID-19 and the main change in imaging is ground-glass opacity[27]. Leukocyte and Lymphocyte count were lower in majority (>75.0%) patients. According to the Diagnosis and Treatment Program of Novel Coronavirus Infected Pneumonia, the leucocyte count usually remains normal or decreases, and the lymphocyte count decreases.(Lu et al., 2020) Majority patients had higher Lactate dehydrogenase (53.2%), serum ferritin (70.0%), C-Reactive Protein level (70.5%) and D-dimer (82.6%). Higher inflammatory markers (Lactate dehydrogenase and C-Reactive Protein) were also observed in other studies[10,19]. Leucocyte and Lymphocyte count were significantly lower in severe patients compared to mild to moderate patients (P=0.035, P=0.009 respectively). This finding was supported by the meta-analysis of Ding et al. (2020). Huang, et al. (2020) reported that leucocyte and Lymphocyte count were significantly lower in ICU patients compared to non-ICU patients. Lymphopenia is considered a remarkable feature of SARS and MERS because of apoptosis and viral particle-induced cytoplasmic damage[20,25,26]. All patients with no abnormality in radiographic finding had mild illness while 22(80.0%) patients with unilateral patchy opacity had severe illness and 5(71.5%) with consolidation had severe illness.

Conclusion:
Children with COVID-19 had mild to moderate symptoms. Fever and cough were the main symptoms of COVID-19 while vomiting and diarrhea occurring less frequently in children. Few patients presented with MIS-C. Patchy opacity was the most common radiographic findings of children. Leucocyte and lymphocyte counts were often in below the normal range in children with COVID-19. Infants, patients with lung abnormalities, lower leucocyte, lymphocyte count and elevated CRP had significantly more severe form of disease than others. Clinical practitioners should pay attention on the specific characteristics of children to improve the accuracy of diagnosis and treatment of COVID-19.

References:
1. Coronaviridae Study Group of the International Committee on Taxonomy of V. The species severe acute respiratory syndrome-related coronavirus: classifying 2019-nCoV and naming it SARS-CoV-2. Nat Microbiol. 2020;5:536-44.
https://doi.org/10.1038/s41564-020-0695-z
PMid:32123347 PMCid:PMC7095448
2. Huang C, Wang Y, Li X, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan. China Lancet. 2020.
https://doi.org/10.1016/S0140-6736(20)30183-5
PMid:31986264
3. Chan JF, Yuan S, Kok KH, et al. A familial cluster of pneumonia associated with the 2019 novel coronavirus indicating person-to-person transmission: a study of a family cluster. Lancet. 2020;395:514-23.
https://doi.org/10.1016/S0140-6736(20)30154-9
PMid:31986261
4. Backer JA, Klinkenberg D, Wallinga J. Incubation period of 2019 novel coronavirus (2019-nCoV) infections among travellers from Wuhan, China, 20-28 January 2020. Euro Surveill. 2020;25
https://doi.org/10.2807/1560-7917.ES.2020.25.5.2000062
PMid:32046819 PMCid:PMC7014672
5. Xu YH, Dong JH, An WM, et al. Clinical and computed tomographic imaging features of novel coronavirus pneumonia caused by SARS-CoV-2. JInf Secur. 2020;80:394-400.
https://doi.org/10.1016/j.jinf.2020.02.017
PMid:32109443 PMCid:PMC7102535
6. Du W, Yu J, Wang H, et al. Clinical characteristics of COVID-19 in children compared with adults in Shandong Province. China Infection. 2020.
https://doi.org/10.1007/s15010-020-01427-2
PMid:32301099 PMCid:PMC7161094
7. Tan YP, Tan BY, Pan J, Wu J, Zeng SZ, Wei HY. Epidemiologic and clinical characteristics of 10 children with coronavirus disease 2019 in Changsha, China. J Clin Virol. 2020;127:104353.
https://doi.org/10.1016/j.jcv.2020.104353

PMid:32302953 PMCid:PMC7195108

8. Yang P, Wang X, Liu P, et al. Clinical characteristics and risk assessment of newborns born to mothers with COVID-19.J Clin Virol. 2020;127:104356.
https://doi.org/10.1016/j.jcv.2020.104356
PMid:32302955 PMCid:PMC7194834

9. Balasubramanian SRN, Goenka A, Roderick M, Ramanan AV. Coronavirus disease (COVID-19) in children - what we know so far and what we Do not? Indian Pediatr. 2020; [Epub ahead of print].
https://doi.org/10.1007/s13312-020-1819-5
PMid:32273490 PMCid:PMC7240240

10. Sun DLH, Lu XX, Xiao H, Ren J, Zhang FR, Liu ZS. Clinical features of severe pediatric patients with coronavirus disease 2019 in Wuhan: a single center's observational study. World J Pediatr. 2020; [Epub ahead of print]
https://doi.org/10.1007/s12519-020-00354-4
PMid:32193831 PMCid:PMC7091225

11. Chen F, Liu ZS, Zhang FR, et al. First case of severe childhood novel coronavirus pneumonia in China. Zhonghua er ke za zhi. 2020;58:179-82.

12. Gotzinger F, Santiago-Garcia B, Noguera-Julian A, et al. COVID-19 in children and adolescents in Europe: a multinational, multicentre cohort study. Lancet Child Adolesc Health. 2020.
https://doi.org/10.1016/S2352-4642(20)30177-2
PMid:32593339

13. Ludvigsson JF. Systematic review of COVID-19 in children shows milder cases and a better prognosis than adults. Acta Paediatr. 2020;109:1088-95.
https://doi.org/10.1111/apa.15270
PMid:32202343 PMCid:PMC7228328

14. Anwar S, Shamsad AI, Morshed AKM,Farzana F. Clinical Profile of Child COVID-19 Patients of Bangladesh. American Journal of Pediatrics.2021;7(1): 5-8 .
https://doi.org/10.11648/j.ajp.20210701.12

15. Tezer H, Bedir Demirdag T, disease Ncoronavirus. COVID-19) in children. Turk J Med Sci 2020; 50(SI-1): 592-603.
https://doi.org/10.3906/sag-2004-174
PMid:32304191 PMCid:PMC7195991

16. Lu Y, Wen H, Rong D, Zhou Z, Liu H.Clinical characteristics and radiological features of children infected with the 2019 novel coronavirus. Clin Radiol 2020; 75. https://doi.org/10.1016/j.crad.2020.04.010 PMid:32389373 PMCid:PMC7252054

17. Management guideline for paediatric COVID-19.(2020). Bangladesh Pediatric Association.

18. Radia T, Williams N, Agrawal P, Harman K, Weale J, Cook J and Gupta A. Multi-system inflammatory syndrome in children & adolescents (MIS-C): A systematic review of clinical features and presentation. Paediatric Respiratory Reviews.2021;38:51-57. https://doi.org/10.1016/j.prrv.2020.08.001 PMid:32891582 PMCid:PMC7417920

19. Ding Y, Yan H & Guo W.Clinical characteristics of children with COVID-19: a meta-analysis. Frontiers in pediatrics.2020; 8:431.
https://doi.org/10.3389/fped.2020.00431
PMid:32719759 PMCid:PMC7350605

20. Chu H, Zhou J, Wong B.H.Y, Li, C, Chan J.F.W, et al. Middle East respiratory syndrome coronavirus efficiently infects human primary T lymphocytes and activates the extrinsic and intrinsic apoptosis pathways. The Journal of infectious diseases. 2016; 213(6): 904-914.
https://doi.org/10.1093/infdis/jiv380
PMid:26203058 PMCid:PMC7107330

21. Feldstein L.R, Rose E.B, Horwitz S.M, Collins J.P, Newhams M.M, Son M.B.F, et al. Multisystem inflammatory syndrome in US children and adolescents. New England Journal of Medicine.2020;383(4): 334-346.
https://doi.org/10.1056/NEJMoa2021680 PMid:32598831
PMCid:PMC7346765

22. Ghosh U.K, Sultana A. Ghosh N.K, Akram A, Ahmed E, Rana I.H, et al. Clinico-demographic Profile of Coronavirus Infection among Bangladeshi Children: A Tertiary Care Hospital Study. Bangladesh Journal of Infectious Diseases. 2020:S16-S21.
https://doi.org/10.3329/bjid.v7i00.50157

23. Heimdal I, Moe N, Krokstad S, Christensen A, Skanke L.H, Nordbø S.A, et al. Human Coronavirus in Hospitalized Children with Respiratory Tract Infections: A 9-Year Population-Based Study From Norway. The Journal of infectious diseases. 2019; 219(8):1198-1206.
https://doi.org/10.1093/infdis/jiy646
PMid:30418633 PMCid:PMC7107437

24. Ksiazek T.G, Erdman D, Goldsmith C.S, Zaki S.R, Peret T, Emery S, et al. A novel coronavirus associated with severe acute respiratory syndrome. New England journal of medicine. 2003; 348(20):1953-1966.
https://doi.org/10.1056/NEJMoa030781 PMid:12690092

25. Liu WJ, Zhao M, Liu K, Xu K, Wong, TanW, et al. T-cell immunity of SARS-CoV: Implications for vaccine development against MERS-CoV. Antiviral research.2017;137:82-92.
https://doi.org/10.1016/j.antiviral.2016.11.006 PMid:27840203
PMCid:PMC7113894

26. Lifen Y, Dai Zhenyuan D.M, Yang Z, Wanqiu D, Li P, Yating L, et al . Suggestions for medical staff from department of pediatrics during the treatment of 2019-nCoV infection/pneumonia. Journal of New Medicine. 2020;51(2):77.

27. Wang D, Hu B, Hu C, Zhu F, Liu X, Zhang J, et al. Clinical characteristics of 138 hospitalized patients with 2019 novel coronavirus-infected pneumonia in Wuhan,China. Journal of American Medical Association.2020;323(11):1061-1069.
https://doi.org/10.1001/jama.2020.1585 PMid:32031570
PMCid:PMC7042881

28. Xiao F, Tang M, Zheng X, Liu Y, Li X and Shan H. Evidence for gastrointestinal infection of SARS-CoV-2. Gastroenterology. 2020;158(6):1831-1833.
https://doi.org/10.1053/j.gastro.2020.02.055
PMid:32142773 PMCid:PMC7130181