



Measles epidemic outbreak: A challenge to the medical biochemistry laboratory in a tertiary hospital

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Dear Editor,

Measles, as a highly contagious and infectious disease, unfortunately still represents a public health challenge. It was already known that measles was an eradicated disease with the use of the measles, mumps, and rubella vaccine. However, due to the distrust of some people and parents in experts and rejection of vaccination of children, this disease can still flare up in unvaccinated people and immunocompromised people (1). Patients infected with the measles virus develop symptoms of classical viral infection (fever, cough, sore throat) with the appearance of characteristic Koplik's spots inside the mouth and rashes on the body. As such, this virus often has a good prognosis, but serious complications (pneumonia and encephalitis) may occur in a certain part of patients, requiring their hospitalization and hospital treatment (2).

Bosnia and Herzegovina, as a developing country, has already encountered measles epidemics in the past, which required a quick and efficient response from health institutions to diagnose new cases, treat them, and primarily prevent the spread of the infection among the population (3-8). At this moment, Bosnia and Herzegovina and its health system are facing a measles epidemic that was declared in December 2023 in Tuzla Canton and from January 2024 in Sarajevo Canton. Since then, the number of sick and hospitalized patients has been increasing and our public health institutions are focused on controlling the epidemic, among other things, by quickly and properly vaccinating unvaccinated children. According to the current data from the Institute of Public Health of the Federation of Bosnia and Herzegovina, 3371 measles patients were reported until the beginning of June 2024 (9) and more than 250 patients including children and adults were hospitalized at the Clinic of Infectious Diseases in our tertiary hospital.

The Clinic for Infectious Diseases of the Clinical Center of the University of Sarajevo treats patients with measles every day, and to monitor their disease, it delivers patient samples for analysis to our unit – Clinical Biochemistry and Laboratory Medicine. Therefore, below, we will present and describe the challenges of our laboratory in a tertiary hospital in a measles epidemic.

To monitor the patient's clinical picture, our colleagues and infectologists order various biochemical and hematological analyses, which indicate the improvement or deterioration of the clinical picture. Complete and differential blood counts are of great importance because many viral infections are characterized by changes in the leukocyte lineage. Therefore, in addition to the differential blood count, it would be significant to determine the hemogram-derived indices, examine their possible use in decision-making in the diagnostic algorithm through specificity and sensitivity, and correlate them with other inflammatory parameters in these patients. Depending on the general condition of the patient, other parameters of the blood count may also be changed. Biochemical parameters such as electrolytes, blood sugar, kidney function parameters, C-reactive protein (CRP), and enzymes (aspartate aminotransferase, alanine aminotransferase, creatine kinase, lactate dehydrogenase) are the most ordered. Basic minerals (sodium, potassium, calcium, and chloride) and blood sugar can give an insight into the general state of an organism due to the body's efforts in the fight against the virus. CRP is an indispensable part of diagnostics because it is a very sensitive and specific parameter of inflammation in the body (10). The mentioned enzymes are mostly increased, as already proven in previous studies, but with their decrease during the recovery of the patient (11). Coagulation tests (activated partial thromboplastin time, international normalized ratio, fibrinogen, and D-dimer) are also ordered and their increased values are expected in the acute, febrile phase of the disease (12). In addition to basic analyses, procalcitonin, as a good indicator of sepsis, is also required in patients with worsening disease (13).

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All of these routine tests are processed in our laboratory and delivered to the infectologists in a timely manner. The pre-analytical phase of these samples is at a high level, because there is no possibility of losing the referral or lack of basic data, because the doctor electronically orders all analyses for the patient, which has already been entered into the hospital information system. Hemolyzed samples, of which there are very few, are rejected, and instructions for re-sampling and transport are indicated on the findings, according to good laboratory practice (GLP) guidelines. In a very small number of samples, pseudothrombocytopenia was observed when determining the blood count on the hematology analyzer, and a peripheral blood smear was prepared from these blood samples in the Hematology Laboratory, which showed platelet aggregates during microscopic examination. Following GLP guidelines, all patient blood samples flagged/noted by the hematology analyzer were also double evaluated on a peripheral blood smear. Extremely high analysis results were not observed in these patients. The total turn-around time for all mentioned laboratory parameters was <30 min.

Given the fact that measles is a disease that mainly affects the pediatric population and immunocompromised people, the role of the medical biochemical laboratory is very important for this sensitive population. Receiving, processing, validating, verifying, and issuing findings are necessary for timely action with the fact that 70% of clinical decisions depend on laboratory analyses (14). Adhering to standard operating procedures, GLP and the guidelines of other standards, we provide accurate and precise analysis results with the aim of optimal patient outcomes.

And finally, the experience of our laboratory has shown that we can adequately respond to the measles epidemic in addition to the other clinics that we serve with analyses. Laboratory parameters important for monitoring the course of the disease have already been mentioned above and amount to 19 analyses per patient. Our journey is still ongoing, and with our own efforts, knowledge, and experience, we are facing the challenges of the new epidemic of measles.

REFERENCES

1. Wilder-Smith AB, Qureshi K. Resurgence of measles in Europe: A systematic review on parental attitudes and beliefs of measles vaccine. *J Epidemiol Glob Health* 2020;10(1):46-58.

2. Said EA, Al-Balushi MS. Measles on the rise: The importance of vaccination. *Sultan Qaboos Univ Med J* 2019;19(2):e89-90.
<https://doi.org/10.18295/squmj.2019.19.02.001>
3. Jahić R, Porobić-Jahić H, Žepić D. Epidemiological and clinical characteristics of children with measles hospitalized at the department for infectious diseases in Tuzla during the 2014-2015 measles epidemic. *Central Eur J Paediatr* 2017;13:62-8.
<https://doi.org/10.5457/p2005-114.171>
4. Salimović-Bešić I, Šeremet M, Hübschen JM, Hukić M, Tihic N, Ahmetagić S, et al. Epidemiologic and laboratory surveillance of the measles outbreak in the federation of Bosnia and Herzegovina, February 2014-April 2015. *Clin Microbiol Infect* 2016;22:563.e1-7.
<https://doi.org/10.1016/j.cmi.2016.02.005>
5. Hukić M, Ravlija J, Karakas S, Mulaomerovic M, Dedeic Ljubovic A, Salimović-Besic I, et al. An ongoing measles outbreak in the federation of Bosnia and Herzegovina, 2014 to 2015. *Euro Surveill* 2015;20:21047.
<https://doi.org/10.2807/1560-7917.es2015.20.9.21047>
6. Salimović-Bešić I, Musa S, Tihic N, Arapović J, Hukić M, Šeremet M, et al. Epidemiology of measles cases and phylogenetic analysis of the virus circulated in the federation of Bosnia and Herzegovina during 2018: Implications for elimination efforts. *Med Glas (Zenica)* 2020;17(1):98-105.
<https://doi.org/10.17392/1054-20>
7. Arapović J, Sulaver Ž, Rajić B, Pilav A. The 2019 measles epidemic in Bosnia and Herzegovina: What is wrong with the mandatory vaccination program? *Bosn J Basic Med Sci* 2019;19(3):210-2.
<https://doi.org/10.17305/bjbm.2019.4266>
8. Musa S, Salimović-Bešić I, Džambić JB, Tihic N, Bajramović A, Arapčić S, et al. Ongoing measles outbreak, the federation of Bosnia and Herzegovina, December 2023 to February 2024. *Euro Surveill* 2024;29(9):2400107.
<https://doi.org/10.2807/1560-7917.ES.2024.29.9.2400107>
9. Institute for Public Health of Sarajevo of Bosnia and Herzegovina. Bilten o Kretanju Zaraznih Bolesti 21/24. [Bulletin on Trends in Infectious Diseases 21/24]. Sarajevo, Bosnia and Herzegovina; 2024. Available from: <https://zzjzks.ba/bilteni-o-kretanju-zaraznih-bolesti-na-podrucju-kantona-sarajevo> [Last accessed on 2024 Jul 01].
10. Vecchio AL, Krzysztofak A, Montagnani C, Valentini P, Rossi N, Garazzino S, et al. Complications and risk factors for severe outcome in children with measles. *Arch Dis Child* 2020;105(9):896-9.
<https://doi.org/10.1136/archdischild-2018-315290>
11. Satoh A, Kobayashi H, Yoshida T, Tanaka A, Kawajiri T, Oki Y, et al. Clinicopathological study on liver dysfunction in measles. *Intern Med* 1999;38(5):454-7.
<https://doi.org/10.2169/internalmedicine.38.454>
12. Ohnishi K, Kato Y. Circulating D-dimer and thrombomodulin levels in acute febrile phase of measles. *J Infect* 2002;45:180-3.
[https://doi.org/10.1016/s0163-4453\(02\)91048-0](https://doi.org/10.1016/s0163-4453(02)91048-0)
13. Turaiche M, Grigoras ML, Bratosin F, Bogdan I, Bota AV, Cerbu B, et al. Disease progression, clinical features, and risk factors for pneumonia in unvaccinated children and adolescents with measles: A re-emerging disease in Romania. *Int J Environ Res Public Health* 2022;19(20):13165.
<https://doi.org/10.3390/ijerph192013165>
14. Sikaris KA. Enhancing the clinical value of medical laboratory testing. *Clin Biochem Rev* 2017;38(3):107-14.