Clinical Notes

Liver injury and cytopenia after BNT162b2 COVID-19 vaccination in an adolescent

Yu Kawasaki, Kousaku Matsubara, Masayuki Hori and Kenichi Isome
Department of Pediatrics, Kobe City Nishi-Kobe Medical Center, Kobe, Japan

Key words adolescent, COVID-19, cytopenia, liver injury, vaccine.

COVID-19, which is caused by severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2), is an ongoing global pandemic of major concern. Recently, two novel mRNA-based vaccinations against SARS-CoV-2, BNT162b2 and mRNA-1273, have become available for adolescents in Japan. Although these vaccines have excellent safety and efficacy profiles in adults and adolescents,1,2 healthcare providers must remain attentive to new adverse reactions. Herein, we present the first adolescent case of liver injury and cytopenia after receiving the BNT162b2 vaccine.

A previously healthy 15-year-old female received the first dose of the BNT162b2 vaccine from a primary care physician. Approximately 8 h after vaccination, the patient complained of fever and headache. She revisited the physician and was treated with acetaminophen (400 mg, 1–3 times daily). Three days later, the fever and headache had not subsided and she visited the physician for the third time. A nasopharyngeal swab was negative for the SARS-CoV-2 antigen. On the fifth clinical day, the patient was referred to our hospital and was hospitalized because of persistent fever (up to 38.8°C) and severe headache.

She had a history of receiving the recommended vaccinations with no adverse reactions. There was no family history of similar diseases, including any viral, hereditary, or metabolitic liver diseases. Moreover, none of her classmates had similar symptoms. On admission, her temperature was 37.7°C, heart rate 104 per minute, and blood pressure 106/74 mmHg. On physical examination, she did not have tonsillar swelling, cervical lymphadenopathy, hepatosplenomegaly, edema, or jaundice. The remainder of the examinations were unremarkable. Laboratory results were as follows: white blood cells (WBC), 1.5 × 10^9/L with neutrophils of 0.88 × 10^9/L and no atypical lymphocytes; red blood cells, 4.68 × 10^12/L; hemoglobin, 12.8 g/dL; platelet counts (Plt), 112 × 10^9/L; C-reactive protein, 1.9 mg/dL; total bilirubin, 0.9 mg/dL; aspartate aminotransferase (AST), 104 IU/L; alanine aminotransferase (ALT), 66 IU/L; and lactate dehydrogenase (LDH), 306 IU/L.

The patient was administered fluids after admission. The next day, the fever and headache subsided. On the seventh clinical day, leukopenia (1.6 × 10^9/L) and thrombocytopenia (135 × 10^9/L) were persistent, and AST (539 IU/L), ALT (419 IU/L), and LDH (636 IU/L) increased. Serum albumin, prothrombin time, and plasma ammonia levels were normal. Serological tests for hepatitis A, B, and C, Epstein Barr virus, parvovirus B19, and cytomegalovirus were all negative. Abdominal ultrasonography showed no abnormal findings. Drug-induced hepatotoxicity due to acetaminophen was considered unlikely because of the patient’s history of taking this medication repeatedly without any side effects. Thus, we made a diagnosis of liver injury and cytopenia related to the vaccination. On the 10th clinical day, cytopenia was normalized to WBC, 4.2 × 10^9/L and Plt, 258 × 10^9/L; moreover, AST, ALT, and LDH spontaneously declined to 113 IU/L, 246 IU/L, and 241 IU/L, respectively. She was discharged on the same day. On the 14th clinical day, laboratory findings showed remarkable improvement, as AST, ALT, and LDH were 28 IU/L, 68 IU/L, and 165 IU/L, respectively.

Reported cases of hepatotoxicity following COVID-19 vaccination with or without a history of chronic liver disease in patients ranging in age between 25 and 74 years are rare.3,4 All patients recovered with or without specific treatment. Due to the small number of recorded cases, the exact incidence of this phenomenon is undetermined. Hines et al. described a 26-year-old female who developed liver injury and immune thrombocytopenic purpura secondary to the mRNA-1273 vaccination,4 which was the only reported case of liver injury and cytopenia following COVID-19 vaccination. To the best of our knowledge, this is the first case of an adolescent who experienced liver injury concomitant with cytopenia following COVID-19 vaccination.

Our patient developed leukopenia and thrombocytopenia. Several cases of immune-mediated thrombocytopenia and thrombotic thrombocytopenic purpura following mRNA
COVID-19 vaccination have been reported. In the present case, cytopenia in two lineages occurred simultaneously and was presumed to be different from these conditions.

In conclusion, this is the first description of liver injury concomitant with cytopenia following the BNT162b2 vaccination in an adolescent without any underlying disease. Although the safety of this vaccine has been reported in studies among adolescents, the safety of the vaccine in large-scale hematological tests has not yet been confirmed. Our study raises concern about the possibility of hepatotoxicity and hematotoxicity after the BNT162b2 vaccination. Additional information on the potential toxicity of COVID-19 vaccines for adolescents is critical before their widespread use, to benefit public health.

Disclosure

The authors declare no conflict of interest.

Author contributions

K.Y. designed the study and drafted the manuscript. M.K. critically reviewed the manuscript and supervised the whole study process. H.M. and I.K. gave technical support and conceptual advice. All authors read and approved the final manuscript.

Informed consent

The patient’s family provided informed consent for the publication of this case report.

References

1 Frenck RW Jr, Klein NP, Kitchin N et al. Safety, immunogenicity, and efficacy of the BNT162b2 Covid-19 vaccine in adolescents. N. Engl. J. Med. 2021; 385: 239–50.
2 Ali K, Berman G, Zhou H et al. Evaluation of mRNA-1273 SARS-CoV-2 vaccine in adolescents. N. Engl. J. Med. 2021; 385: 2241–51.
3 Shroff H, Satapathy SK, Crawford JM, Todd NJ, VanWagner LB. Liver injury following SARS-CoV-2 vaccination: a multicenter case series. J. Hepatol. 2022; 76: 211–4.
4 Hines A, Shen JG, Olazagasti C, Shams S. Immune thrombocytopenic purpura and acute liver injury after COVID-19 vaccine. BMJ Case Rep. 2021; 14: e242678.
5 Welsh KJ, Baumbatt J, Chege W, Goud R, Nair N. Thrombocytopenia including immune thrombocytopenia after receipt of mRNA COVID-19 vaccines reported to the vaccine adverse event reporting system (VAERS). Vaccine 2021; 39: 3329–32.
6 Kirpalani A, Garabon J, Amos K et al. Thrombotic thrombocytopenic purpura temporally associated with BNT162b2 vaccination in an adolescent successfully treated with caplacizumab. Br. J. Haematol. 2022; 196: e11–4.