Case report

Journal of INDEPENDENT MEDICINE

Measles-Mumps-Rubella Vaccination-Induced Immunothrombocytopenia Purpura: A Case Report

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Abstract

Immune thrombocytopenic purpura (ITP) is an acquired autoimmune disorder characterized by isolated thrombocytopenia. Although uncommon, it may occur following certain vaccinations, particularly the measles, mumps, and rubella (MMR) vaccine. We report a 13-month-old previously healthy male infant who developed diffuse purpura and oromucosal bleeding shortly after receiving a single dose of the MMR vaccine. Laboratory evaluation revealed severe thrombocytopenia, and extensive investigations excluded all other secondary causes. With full clinical recovery, the child responded favourably to oral corticosteroids and intravenous immunoglobulin. This case emphasises the need for clinicians to take into account ITP in infants who present with bleeding symptoms following live-attenuated vaccination. It also highlights a rare but significant vaccine-associated adverse event.

Keywords: Immune thrombocytopenic purpura, single-dose MMR-vaccine, vaccine

Introduction

Thrombocytopenia is defined as a platelet count below 100 × 10^9/L. It is classified as primary when no identifiable underlying disorder is present, often immune-mediated, and as secondary when associated with systemic illnesses such as infections, autoimmune diseases, or medication exposures. (1) The annual incidence of ITP in children varies by region, ranging from 1.9 to 6.4 per 100,000 children. (2)

Several infectious agents have been implicated in secondary ITP, including HIV, hepatitis C virus, Helicobacter pylori, influenza, Epstein–Barr virus, and varicella zoster virus. Autoimmune disorders such as rheumatoid arthritis, systemic lupus erythematosus, and antiphospholipid syndrome, as well as certain drugs, may also trigger ITP. (3)

Among vaccines, the measles, mumps, and rubella (MMR) vaccine and, to a lesser extent, the varicella, hepatitis A, and Tdap vaccines have been linked to ITP. (4) The MMR vaccine is the only immunization with a well-established association, with an estimated incidence of 0.087, 4 cases per 100,000 administered doses. Most reported cases occur in children. More recently, COVID-19 vaccines have also been associated with transient thrombocytopenia, typically appearing within weeks of vaccination. (5)

Despite the extremely low risk, clinicians should remain aware of vaccine-associated ITP. To date, no case of MMR-related ITP has been reported from Pakistan. This case contributes to the limited global

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literature by presenting a rare immunogenic response to a live-attenuated vaccine, manifesting as acute, severe thrombocytopenia. The report aims to increase clinical awareness and provide comparative evidence for physicians encountering similar presentations.

Case presentation

A well-nourished 13-month-old boy weighing 11 kg from the Swabi District of Khyber Pakhtunkhwa, Pakistan, presented with extensive purpura over the body, multiple petechiae, dry lips, and pallor. Two days prior to admission, he had received a single dose of the live-attenuated measles, mumps, and rubella (MMR) vaccine at a local vaccination center in Shagai, Maneri (Swabi). On presentation, his vital signs included a systolic blood pressure of 120 mmHg and a pulse rate of 122 beats per minute. Neurological, respiratory, and cardiovascular examinations were unremarkable. There was no hepatosplenomegaly or lymphadenopathy (**Figures 1–3**).

Initial laboratory evaluation revealed a haemoglobin level of 10.2 g/dL, haematocrit of 32.2%, and a white cell count of 11.8 × 10^9/L (47.2% neutrophils, 43.2% lymphocytes, and 6% monocytes). Platelet count was markedly reduced at 11 × 10^9/L. Peripheral smear demonstrated mild anisopoikilocytosis, hypochromic microcytosis, reduced platelets, and normal white blood cells with neutrophil predominance; no schistocytes were observed. Coagulation profile, including PT and APTT, was within normal limits. Liver and renal function tests were also normal. Viral screening, including HIV serology, dengue NS1 antigen, and IgM/IgG panel, was negative. No secondary cause of thrombocytopenia was identified.

The MMR vaccine-induced immune thrombocytopenic purpura (ITP) was identified as the cause of the thrombocytopenia based on temporal correlation with vaccination and exclusion of alternative causes. The child was given intravenous immunoglobulin (IVIG) at 0.8 g/kg/day for two days and oral prednisolone at 2 mg/kg/day due to severe thrombocytopenia with oromucosal bleeding. His platelet count increased to 31 × 10^9/L after 48 hours, but his haematocrit dropped to 26.0%, most likely due to haemodilution from IV fluids given with IVIG. By the third day of hospitalisation, there was a noticeable improvement in the patient's condition, including the resolution of pallor and a significant decrease in petechiae and purpura. To treat gastric irritation brought on by steroids, antacids were prescribed. After a three-day stay, he was discharged with prophylactic cefixime for possible hospital-acquired infections, oral prednisolone, and antacids.

The child looked healthy at the one-week follow-up, with the bruises significantly faded and the platelet count increased to 83 × 10^1/L. For a week, oral prednisolone was tapered to 1 mg/kg/day; additional tapering was recommended every week. The tapering schedule and recurrence monitoring were discussed with the parents.

Discussion

Our 13-month-old patient presented with a single episode of oromucosal bleeding and widespread purpura, predominantly affecting the limbs, for the preceding 24 hours. After ruling out traumatic causes, infectious etiologies, and inherited bleeding disorders through appropriate investigations, and considering the recent history of MMR vaccination, a diagnosis of vaccine-associated thrombocytopenia was established.

There is strong evidence that some vaccines, most notably the MMR vaccine, may infrequently cause thrombocytopenia as an adverse immunogenic event. MMR-associated immune thrombocytopenic purpura (ITP) is rare but thought to be caused by an abnormal immune response targeting host platelets. Unless the child has chronic ITP and is scheduled to receive the MMR vaccine, ITP itself is not regarded as a contraindication to routine vaccination. (6) Despite the rarity of MMR-associated ITP, epidemiologic studies in large paediatric cohorts have found a slightly elevated risk of ITP in the 1–6 weeks after MMR vaccination in children aged 12–19 months. In contrast, other common early childhood vaccines have not demonstrated a significant association with ITP. The protective benefit of the MMR vaccine is supported by the fact that the incidence of ITP after a natural measles or rubella infection is significantly higher than after vaccination. (12)

The pathogenesis is believed to involve either molecular mimicry, in which structural similarities between vaccine antigens and platelet antigens cause cross-reactive antibodies in susceptible individuals, or immunological stimulation by viral antigens. (7) Vaccine-associated thrombocytopenia may be mediated by autoantibodies directed against platelet glycoproteins such as GPIb/IX or GPIIb/IIIa following antigen exposure, with cross-reactive immune responses triggering rapid platelet destruction. (13) Despite this mechanism, children should continue to receive the MMR vaccination at recommended ages because MMR-associated ITP is usually mild, self-limited, and non-fatal. (8) In a prior

study, 93% of children who experienced acute ITP following MMR vaccination recovered completely within 6 months. (8)

For management, oral prednisolone at 2 mg/kg/day for 3–4 weeks remains a widely used protocol. Higher doses may produce faster platelet recovery, but may also cause side effects. In emergency presentations, particularly with bleeding, intravenous immunoglobulin (IVIG) is considered first-line therapy. IVIG acts by blocking Fc receptors on macrophages of the reticuloendothelial system, thereby reducing platelet destruction, and is most effective at 1–2 g/kg. (9) According to international practice guidelines, bone marrow biopsy is not routinely recommended in typical pediatric ITP, and children with newly diagnosed or vaccine-associated ITP can often be managed with first-line therapies such as corticosteroids and IVIG. Furthermore, guidelines support continued vaccination schedules in children with a history of ITP, as re-vaccination does not generally lead to recurrence when immunity status is assessed. (14) In addition, current consensus recommendations suggest that children with acute ITP, including vaccine-associated cases, can be effectively managed with first-line therapies such as corticosteroids or intravenous immunoglobulin, with treatment tailored to bleeding severity and platelet counts. (15) Follow-up studies have shown that most cases of vaccine-associated ITP resolve completely, and re-vaccination with MMR after recovery does not typically result in recurrence, with sustained remission observed in multiple cohorts. (13)

In Pakistan, two doses of the MMR vaccine are recommended, as a single dose provides only approximately 75% efficacy against measles infection. (10) A common concern is whether children who develop vaccine-associated ITP can safely receive subsequent doses. A systematic review reported that none of the 37 children who developed ITP after the first MMR dose experienced recurrence after the second dose. Based on these findings, the American Society of Hematology advises that children with prior ITP should still receive future vaccinations, including MMR, unless serologic testing already confirms immunity. (11) It is important to emphasize that natural measles and rubella infections carry a substantially higher risk of ITP compared with the rare vaccine-associated cases, and that the benefits of vaccination consistently outweigh the risks. (16)

While clinicians should be aware of MMR-associated ITP as a possible cause of acute thrombocytopenia in children, it is critical to emphasize that vaccine-induced ITP is significantly rarer than thrombocytopenia resulting from the natural infections the vaccine prevents. Therefore, MMR vaccination programs should continue without restriction, even in light of rare post-vaccination immunogenic events.

Although existing case reports and retrospective studies have helped highlight the association between MMR vaccination and ITP, they offer only a limited understanding of why certain children develop this rare reaction. There is a clear need for well-designed prospective studies to identify which host factors may predispose individuals to vaccine-related immune responses and to clarify the precise immunological mechanisms involved. Furthermore, more robust data on follow-up strategies and long-term outcomes would greatly enhance clinical decision-making and help guide future vaccination practices with greater confidence.

Conclusion

Immune thrombocytopenic purpura (ITP) can happen after receiving the MMR vaccination, but it is far less common than the risk of ITP from the natural infections that the vaccine prevents. Therefore, the MMR immunization program should not be restricted or limited due to concerns about post-MMR vaccine immunogenicity.

Author Contributions

Burhan Ali: Conceptualisation, methodology, investigation, writing original draft.

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Conflict of Interest: No Conflict of Interest.

Source of Funding: None.

Ethical Consent

Informed written consent was obtained from parents, and the ethical review board of the institute granted approval.

Figure 1. Photograph of the patient's abdomen showing extensive, non-blanching purpuric lesions



Figure 2. Photograph of the patient's back demonstrating widespread petechiae and confluent purpura



Figure 3. Photograph of the patient's thigh revealing a dense distribution of purpuric spots and patches



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