# COVID-19 vaccine (mRNA BNT162b2) and COVID-19 Infection-Induced Thrombotic Thrombocytopenic Purpura in Adolescents

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**Abstract**

The mRNA COVID-19 vaccine and COVID-19 infection caused by the SARS-CoV-2 virus may be immunologic triggers for the development of thrombotic thrombocytopenic purpura (TTP). There is not yet literature that discusses TTP induced by COVID-19 vaccination or infection in pediatric or adolescent patients. We describe 4 adolescents presenting with TTP (both de novo and relapsed disease) following administration of the Pfizer COVID-19 vaccine or after COVID-19 infection. Our observations demonstrate that the Pfizer-BioNTech mRNA vaccine and COVID-19 infection can act as triggers for the development/relapse of both congenital and acquired TTP.

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`TTP Covid PBC_SES.pdf` available at https://authorea.com/users/447851/articles/546773-covid-19-vaccine-mrna-bnt162b2-and-covid-19-infection-induced-thrombotic-thrombocytopenic-purpura-in-adolescents

**TABLE 1: Patient Characteristics and Summary of COVID-19 Vaccination or Infection-induced TTP Course**

| Patient | Age (years) | Sex | Medical history | Vaccine status | Prior COVID infection | TTP symptoms | Treatment | Treatment Side Effects | Current clinical status |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 19 | F | TTP | Pfizer-BioNTech mRNA vaccine dose 1 | Not reported; SARS-CoV-2 PCR not detected at time of relapse | Bruising, hematuria | TPE x 4 days Methylprednisolone, rituximab, caplacizumab | None to-date | In remission |
| 2 | 15 | F | Arrhythmia of unknown etiology, previously on metoprolol | Pfizer-BioNTech mRNA vaccine dose 1 | Not reported; SARS-CoV-2 Anti-Spike IgM positive after vaccination | Fatigue, bruising | TPE x 4 days, Methylprednisolone, rituximab, FFP infusion | Herpes zoster infection, weight gain | In remission |
| 3 | 17 | F | Asthma, NAFLD | Unvaccinated | No clinical history; SARS-CoV-2 IgG antibodies positive on presentation | Hemiparesis, headache, fatigue, jaundice, hematuria | TPE x 5 days, rituximab, caplacizumab | Steroid induced hyperglycemia requiring insulin, extremity tremors | In remission |
| 4 | 17 | M | ASD/VSD repaired; precocious puberty treated with hormone suppression | Unvaccinated | 3 weeks prior to presentation with symptomatic infection; COVID antibodies negative ~3 months after initial presentation | Initial hematuria; representation with jaundice, pallor, neurologic abnormalities; refractory | TPE x 5 days, rituximab, prednisone, cyclosporine, caplacizumab, FFP infusion | Hypertension during steroid course | Receiving Koate-DVI infusions biweekly |

TTP=thrombotic thrombocytopenic purpura
TPE=therapeutic plasma exchange
FFP=fresh frozen plasma
NAFLD= nonalcoholic fatty liver disease
ASD=atrial septal defect
VSD=ventricular septal defect

**TABLE 2: Laboratory Results on Presentation of COVID-19 Vaccination or Infection-induced TTP**

| Patient | Labs on presentation* | ADAMTS13 | Comments |
|---|---|---|---|
| 1 | Hgb:12.4 gm/dL<br>Plt: $7x10^3$/uL<br>Abs retic: $0.103x10^6$/uL<br>BiliU: 5.3 mg/dL<br>LDH: 836 U/L<br>C3: 129 mg/dL<br>C4: 30 mg/dL | Activity < 5%, inhibitor 55% [ref range < 30%] | Schistocytes on peripheral smear |
| 2 | Hgb: 6.5 gm/dL<br>Plt: $33x10^3$/uL<br>Abs retic: $0.286x10^6$/uL<br>BiliU: 1.4 mg/dL<br>LDH: 354 U/L<br>C3: 130 mg/dL<br>C4: not obtained | Activity < 5%, inhibitor 25% [ref range <30%] | Schistocytes on peripheral smear |
| 3 | Hgb: 8.1 gm/dL<br>Plt: $5x10^3$/uL<br>Abs retic: $0.522x10^6$/uL<br>BiliU: 4.9 mg/dL<br>LDH: 2824 U/L<br>C3: 106 mg/dL<br>C4: 15 mg/dL | Activity < 5%, inhibitor 54 % [ref range <30%] | Schistocytes on peripheral smear |
| 4 | Hgb:11.9 gm/dL<br>Plt: $352x10^3$/uL<br>Abs retic: $0.082x10^6$/uL<br>BiliU:0.3 mg/dL<br>LDH:465 U/L<br>C3: 147 mg/dL<br>C4: 21 mg/dL | Activity < 5%, inhibitor 0.4 [ref range <0.4]; novel homozygous variant in the *ADAMTS13* gene, NM_139025.4:c.1584+5G>A | Note: labs from initial encounter with TCH Hematology; had already received treatment at prior hospital |

Hgb=hemoglobin
Plt=platelets
Abs retic=absolute reticulocyte
BiliU=unconjugated bilirubin
LDH=lactate dehydrogenase
TCH=Texas Children's Hospital
TCH institutional reference ranges: Hgb 10.6-13.5 gm/dL, Plt 186-353 $x10^3$/uL; Abs retic 0.039-0.057 $x10^6$/uL; BiliU < 1.0 mg/dL, LDH 151-298 U/L, C3 86-182 mg/dL, C4 17-51 mg/dL.