

Short Note

Neurological Complications of SARS-CoV-2 Vaccinations: A Community Based Observational Study in Germany

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After the start of anti-Sars-CoV-2 vaccinations at the beginning of the year 2021 an increasing number of patients presented with vaccination side effects to our emergency departments. The Neurological University Hospital is the only provider for neurological patient care in the district of Bielefeld and runs two neurological emergency departments at two different sites. Between the 8th of February and the 24th of May 2021, 26.435 doses of ChAdOx1nCov-19, 90.252 doses of BNT162b2, 3064 doses of mRNA-1273 and 328 doses of Ad26.COV2.S vaccines have been administered within the district of Bielefeld comprising approximately 500.000 inhabitants.

204 patients had neurological symptoms after ChAdOx1nCov-19 vaccination and 86 patients after BNT162b2 vaccination.

Neurological symptoms occurred in 14 patients after mRNA-1273 vaccination and in 7 patients after Ad26.COV2.S in this time period. In 13 patients having been vaccinated against Sars-CoV-2, the type of vaccine applied remained unknown (Table 1).

The most common side effects were headaches, independent of the vaccine used. After ChAdOx1nCov-19 immunization 0,77% neurological complications per dose were observed. The most severe vaccine induced neurological complication was observed in three patients suffering from vaccine-induced immune thrombotic thrombocytopenia (VITT) with cerebral sinus-venous thromboses and in one patient with thrombotic thrombocytopenic purpura with VITT-associated antibodies [1,2]. VITT was only observed after ChAdOx1nCov-19 immunization. The risk of VITT and TTP with documented anti-PF4 antibodies was 0.015% (Table 1). Seventy-five % of these patients were woman with a mean age of sixty.

In 116 other German departments of neurology, a total of 45 VITT-cases with cerebral sinus- venous thromboses were reported of which 75% affected patients were female (report of

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the German Society of Neurology DGN, date Mai 2021; Schulz et al., [3]).

In BNT162b2 vaccinated patients, only 0,095% neurological symptoms per dose were documented. Facial palsy, Guillain-Barré's- (GBS) or Miller-Fisher's-Syndrom (MFS), meningitis or meningoencephalitis, and epileptic seizures, strokes or transient ischemic attacks were reported in ChAdOx1nCov-19 as well as in BNT162b2 immunized patients. In addition, zoster ophthalmicus was observed in 2 of the ChAdOx1nCov-19 vaccinated patients. Seventy-five % of patients with GBS, MFS and facial palsy were male with a mean age of sixty.

To study whether apart from VITT these neurological diagnoses were significantly increased among patients in our emergency departments in association to the Sars-CoV-2 vaccination in the reported time period in 2021, we compared the number of patients with these diagnoses in the same periods of the two previous years, based on the total number of patients presented (Table 2). The diagnoses meningitis/encephalitis were increased approximately two-fold in 2021 as compared to two previous years, respectively, whereas the diagnoses GBS and MFS clustered in 2020, the first year of the Sars-CoV-2 pandemic (Table 2). In patients with meningoencephalitis in temporal association to ChAdOx1nCov-19 vaccination, pathogen- inducement was excluded and response to steroids was shown [4].

Here we demonstrate that, in addition to VITT as a specific severe complication after Sars-CoV-2 vaccination with ChAdOx1nCov-19, aseptic meningoencephalitis without antineuronal antibody detection occurred approximately two-fold increased after Sars-CoV-2 vaccination in the district of Bielefeld, Germany, irrespective of the type of vaccine used. In contrast, strokes, transient ischemic attacks and epileptic seizures occurred in similar frequencies in the three years studied.

In line with our results, excess cases of GBS after Covid-19 infection nearly 4 times higher as compared to cases after anti-

Table 1: Different numbers of anti-Sars-CoV-2 vaccination doses and reported neurological complications after vaccination.

2021	doses	number of patients with VINC in ED	Neurological symptoms (%) per dose	VITT/ TTP	facial palsy	GBS/ MFS	meningitis/ encephalitis	zoster ophthalmicus	epileptic seizures	stroke/ TIA
ChAdOx1n Cov-19	26.435	204	0,77	4	1	1	3	2	2	4
mRNA-1273	3064	14	0,457						2	1
BNT162b2	90252	86	0,095		1	1	1		4	8
Ad26.COV2.S	328	7	2,13						0	0
type of vaccination unknown		13	n.a.				1		0	5
n =				4	2	2	5	2	8	18

Abbreviations: VINC: Vaccine Induced Neurological Complication; ED: Emergency Department; VITT: Vaccine Induced Immune-Thrombotic Thrombocytopenia; TTP: Thrombotic Thrombocytopenic Purpura; GBS: Guillain-Barré Syndrome; MFS Miller-Fisher’s Syndrome

Table 2: Incidence of different neurological diagnoses compared in the identical period of time (from the eighth of February to the sixteenth of June) in the year before the COVID-19 pandemic started (2019), the year the pandemic was ongoing (2020) and the year in which the anti-Sars-CoV-2 vaccination just started in the central vaccination center of our city (8.2.2021). 4 weeks past the last day of the vaccination report, the end of the survey was determined.

8.2.- 16.06.	facial palsy n (%)	GBS/MFS/ polyradiculitis n (%)	meningitis/encephalitis n (%)	epileptic seizure n (%)	TIA n (%)	stroke n (%)	total number of cases
2019	41 (1,41)	4 (0,14)	3 (0,10)	159 (5,4)	219 (7,6)	508 (17,5)	2900
2020	42 (1,64)	8 (0,31)	3 (0,12)	158 (6,2)	226 (8,8)	481 (18,8)	2555
2021	25 (1,11)	3 (0,13)	6 (0,26)	172 (7,5)	240 (10,6)	485 (21,3)	2274

SARS-Cov-2 vaccination were reported in a large case study from the University of Oxford [5]. However, we did not observe a higher incidence of stroke after a first dose of BNT162b2 vaccination in our study.

Ethics declaration: All procedures performed in the study were in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. The study was approved by the local ethics committee (file reference 2022-506-f-S).

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