Short Communication

COVID-19 Vaccines-Induced Thrombosis and Thromboembolism

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Due to concerns about thrombosis or thromboembolism, the European Union's top pharmaceutical regulators concluded on April 18, 2021 after more than 12 European countries **[**1**]**, including Bulgaria, Denmark and Norway **[**2**]** stopped distribution of the AstraZeneca/Oxford COVID-19 vaccine that the AstraZeneca/Oxford COVID-19 vaccine, the particularly important vaccine accounting for more than 90 % of distributed COVAX's vaccines **[**3**]** was safe **[**1**]**. The European Medicines Agency (EMA) stated that the vaccine was not associated with an increase in the overall risk of thromboembolic events or blood clots **[**1, 2**]**.

The vaccine's benefits in protecting persons from COVID-19 with the associated risks of deaths and hospital admissions outweigh the possible risks, supported by the World Health Organization (WHO)' s announcement on April 17, 2021 and recommended the continuation of the vaccine **[**1-3**]**, according to its own global database of safety report and data from 27 million doses of AstraZeneca/Oxford COVID-19 vaccine administered in India **[**3**]**.

The rate of clotting conditions after COVID-19 vaccination are fewer than expected **[**3**]**. Bulgaria, Denmark, Iceland, Norway, Italy, Austria, and Thailand (temporary stopped using the vaccine) have stopped using certain batches of the vaccine as a precautionary measure **[**2**]**. Following the

announcements on April 18, 2021 from the EMA and the United kingdom (UK) regulators that the AstraZeneca/Oxford COVID-19 vaccine is safe and immunization should continue, more than 12 countries restarted their AstraZeneca/Oxford COVID-19 vaccination programs, including Indonesia, Italy, Germany, UK, Australia, and Mexico **[**2-4**]**. In the UK, more than 11 million individuals have already received at least one dose of the AstraZeneca/Oxford COVID-19 vaccine and there has been no evidences of excess blood clots or deaths occurring, whereas Germany had signed a deal for 30 million doses with Pfizer/BioNTech in September 2020 **[**2**]**. Europe's drug regulator also has backed the AstraZeneca/Oxford COVID-19 vaccine and promotes the campaign "COVID-19 can be deadly and vaccination saves lives " **[**2**]**. France also restarted AstraZeneca/Oxford COVID-19 vaccination program, but only for those older than 55 years following an EMA's finding that it could not exclude and increased thromboembolism risk in individuals younger than 55 years, based on a background rates of blood clotting and a review of cases in those who are and are not vaccinated **[**3**]**. Nevertheless, Norway, Sweden, and Denmark are continuing their pauses, whereas they collect more information **[**3**]**. Due to being about to receive shipments of the COVAX's vaccine, Cameroon suspended use of the AstraZeneca/Oxford COVID-19 vaccine **[**3**]**.

In Europe, there have been around 30 cases with thromboembolic events, including a report that a 50-year-old man had died in Italy with the development of deep vein thrombosis (DVT), whereas approximately 5 million Europeans have already received the AstraZeneca/Oxford COVID-19 vaccine **[**2**]**. In Norway, in early March 2021, four persons developed blood clots a few days after having the AstraZeneca/Oxford COVID-19 vaccine **[**4**]**. Later, another individual in Austria was hospitalized with a clot on the lung and finally died, 10 days after vaccination **[**4**]**. In Denmark, a death of vaccinated person involving a blood clot has been reported **[**4**]**. The medical researchers in Germany had demonstrated an association between the AstraZeneca/Oxford COVID-19 vaccine and one especially rare type of blood clot hypothesized to have occurred in a "very small number" of persons who have received the vaccine **[**4**]**. The incidence of this type of blood clot is 3 to 4 persons per million persons in the general unvaccinated population **[**4**]**. There is no associated increase in cases in the vaccinated group **[**4**]**. Schultz et al demonstrated five healthcare workers, 32-54 years of age developed venous thrombosis and thrombocytopenia 7 to 10 days after receiving the first dose of adenoviral vector vaccine (AstraZeneca/Oxford COVID-19 vaccine) **[**5**]**. All these patients had high levels of antibodies to platelet factor 4-polyanion complexes and they had no previous exposure to heparin **[**5**]**. Hypothetically, they represent a rare vaccinated-associated variant of spontaneous heparin-induced thrombocytopenia that refers to as vaccine-induced immune thrombotic thrombocytopenia due to these five cases occurred in a population of more than 130,000 vaccinated individuals **[**5**]**.

Nevertheless, AstraZeneca stated that there was no evidence of an increase risk of thrombocytopenia, deep vein thrombosis (DVT), or pulmonary thromboembolism in any defined age group (particularly in

patients ages 20 to 50 years **[**1**]**), gender, batch or in any particular country **[**4**]**. The type of found blood clots included cerebral venous sinus thrombosis and disseminated intravascular coagulation (DIC) **[**1**]**. Blood clots occur in approximately one in 1,000 persons **[**4**]**. Pulmonary thromboembolism and deep vein thrombosis are estimated one to two adults per 1,000 adults per year in the United States **[**1**]**.

This order of magnitude is higher than Europe's 37 such events out of 17 million AstraZeneca/Oxford COVID-19 vaccine recipients **[**1**]**. Several vaccinated persons also presented with thrombocytopenia and having blood schistocytes **[**1**]**. These complications occurred 7 to 14 days after vaccination **[**1**]**. In the European Union countries, there were 7 cases of DIC and 18 cases of cerebral venous sinus thrombosis (presenting with headache, blurred vision, and weakness of part of the face or limbs **[**4**]**) suspected of association with the AstraZeneca/Oxford COVID-19 vaccine, as of March 18, 2021 **[**1**]**.

In conclusion, the scare causes understandable anxiety for those who have already had their AstraZeneca/Oxford COVID-19 vaccine, or who may be waiting for their second dose of vaccination. Further studies are urgently needed to identify an exact association between thrombosis or thromboembolism events and the COVID-19 vaccination.

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