Vaccine-Induced Prothrombotic Immune Thrombocytopenia following AstraZeneca COVID-19 Vaccination in Younger Adults: A Preliminary Harm-benefit Analysis for British Columbia

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03/04/2021

Background

Recently, NACI recommended against using AstraZeneca COVID-19 Vaccine for Canadians under the age 55, due to concerns about the incidence of Vaccine-Induced Prothrombotic Immune Thrombocytopenia (VIPIT) based on European reports [1]. On Match 18, 2021, the European Medicines Agency estimated the incidence of VIPID at approximately 1 per 1,000,000 people vaccinated with the AstraZeneca vaccine [2]. A higher estimated rate of 1 per 100,000 by the Paul-Ehrlich Institut in Germany was published on March 19th [3]. It was this higher rate reported by the Paul-Ehrlich Institut that led NACI to recommend against using this vaccine in adults under 55 years old [1]. On April 1st, the UK Medicines & Healthcare Products Regulatory Agency updated its own previously reported data to report a total of 22 cerebral venous sinus thrombosis (CVST) and 8 other clot-related events from 18.1 million doses of the AstraZeneca Vaccine.

Harm-Benefit Analysis

We need to assess whether mortality risk due to AstraZeneca is larger than or comparable to the risk of mortality due to COVID-19. We limit our analysis to 20 to 50 years old British Columbians and focus on the time period between April 1st, 2021 and July 1st, 2021, when all BCers are expected to have received at least their first dose of a COVID-19 vaccine.

Mortality Risk due to AstraZeneca Vaccine

$$P(death)_{astrazeneca} = P(AZ) \times P(VIPIT|AZ) \times P(death|VIPIT)$$

To err on the side of caution, we will follow NACI's lead and assume the highest reported rate of VIPIT, which is 1 in 100,000 recipients, so $P(VIPIT|AZ) = \frac{1}{100,000}$. On the other hand, as reported by NACI, case fatality due to VIPID is currently estimated at 40%, but is likely to decrease as there will be more awareness and better early treatment. Again to err on the side of caution, we'll keep the estimate at 40%, so

$$P(death)_{astrazeneca} = P(AZ) \times \frac{1}{100,000} \times \frac{40}{100}$$
$$= P(AZ) \times \frac{4}{1,000,000}$$

So, the risk of death due to AstraZeneca COVID-19 vaccine is approximately 2 in 1 million vaccine eligible population. The population of BC under 50 years old is approximately 2 million. Assuming an 80% uptake for all COVID-19 vaccines combined and that half of vaccine recipients will receive the AstraZeneca vaccine, we can estimate the expected number of deaths in BC

$$E(death)_{astrazeneca} = 2,000,000 \text{ persons} \times \frac{80 \text{ vaccinated}}{100 \text{ persons}} \times \frac{1 \text{ vaccinated with AZ}}{2 \text{ vaccinated}} \times \frac{4 \text{ deaths}}{1,000,000 \text{ vaccinated with AZ}}$$

$$= 3.2 \text{ deaths}$$

Mortality Risk due to COVID-19

Now let's estimate the mortality risk of COVID-19 and expected number of deaths due to COVID-19 among 20 to 50 years old British Columbians.

$$P(death)_{COVID19} = P(COVID19) \times P(death|COVID19)$$

where $P(death|COVID19)$ is the case fatality rate of COVID-19 in the age groups of interest.

Table 1: COVID-19 cases (n=944,491) and deaths (n=22,655) for cases with case reports reported to PHAC in Canada as of March 26, 2021, 9 am EDT

Age	Cases	Deaths
0-19	163514	6
20-29	176525	38
30-39	151419	81
40-49	138255	192
50-59	126242	624
60-69	79769	1772
70-79	45540	4362
80+	63227	15580

Using this table, we can calculate a case fatality rate of 667 per million cases for those who are over 20 and under 50. For simplicity, we assume this value to be constant among provinces.

We now have to estimate the probability of contracting COVID between April 1st and July 1st, 2021. Proper estimation of this risk requires transmission modelling using a SEIR model. Here, for simplicity we assume the

References

1.   National Advisory Committee on Immunization (NACI). NACI rapid response: Recommended use of AstraZeneca COVID-19 vaccine in younger adults [Internet]. National Advisory Committee on Immunization (NACI); 2021 Mar [cited 2021 Apr 3]. Available from: https://www.canada.ca/en/public-health/services/immunization/national-advisory-committee-on-immunization-naci/rapid-response-recommended-use-astrazeneca-covid-19-vaccine-younger-adults.html

2.   European Medicines Agency. COVID-19 Vaccine AstraZeneca: Benefits still outweigh the risks despite possible link to rare blood clots with low blood platelets [Internet]. European Medicines Agency; 2021 Mar [cited 2021 Apr 2]. Available from: https://www.ema.europa.eu/en/news/covid-19-vaccine-astrazeneca-benefits-still-outweigh-risks-despite-possible-link-rare-blood-clots

3.   Paul-Ehrlich-Institut (PEI). COVID-19 Vaccine AstraZeneca - Safety assessment result: The vaccine is safe and effective in the fight against COVID-19 [Internet]. Federal Institute for Vaccines; Biomedicine; 2021 Mar [cited 2021 Apr 2]. Available from: https://www.pei.de/EN/newsroom/hp-news/2021/210319-covid-19-vaccine-astrazeneca-safety-assessment-result-vaccine-safe-and-effective.html