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ASO RESEARCH LETTER

Vaccination Against SARS-CoV-2 Decreases Risk of Adverse Events in Patients who Develop COVID-19 Following Cancer Surgery

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Early in the COVID-19 pandemic, mortality rates were observed to exceed 25% in patients who developed postoperative SARS-CoV-2 infections.[1] This prompted numerous perioperative structural and process changes to mitigate this risk.[2,3] As the pandemic has progressed, the emergence of novel therapeutic and preventative measures have proven effective in decreasing the overall burden of SARS-CoV-2 infection. These advances likely reduce the risk in surgical patients; however, this has not been reexamined at a population level. This study reports 30-day adverse postoperative event rates in patients who develop postoperative COVID-19 and measures the impact of vaccination on these outcomes.

METHODS

This was a retrospective cohort study using the National COVID Cohort Collaborative (N3C) Data Enclave. The study cohort included patients who underwent surgical resection for cancer. Patients positive for COVID-19 were identified based on a positive lab measurement (PCR or antigen) or a positive COVID-19 diagnosis (ICD10-CM code U07.1). Postoperative COVID-19 was defined as a new SARS-CoV-2 infection that occurred within 30 days of surgery. Fully vaccinated patients were characterized as having at least two COVID-19 vaccines 14 days or more before surgery. This analysis included patients from January 2020 to August 2022.

Construction of the study cohort was executed using Observational Health Data Science and Informatics' (OHDSI) ATLAS tool. Patients with cancer were identified using the Malignant Neoplastic Disease standard concept and benign concepts were excluded.[4] Major oncologic surgery concepts were created using standard codes obtained from ATLAS. Exclusion criteria included (1) endoscopic or natural orifice procedures; (2) percutaneous approaches; (3) diagnostic procedures (unless performed open); (4) cosmetic procedures; (5) nononcologic procedures; and (6) transplants.

The primary outcome of the study was composite adverse event that occurred within 30 days of surgery. Adverse events included mortality, hospital readmission, pneumonia, respiratory failure, pulmonary embolism, sepsis, cardiac arrhythmia, renal failure, urinary tract infection, and deep vein thrombosis. SNOMED concepts were used for defining surgical morbidity, because there is not a validated crosswalk to other surgical classification frameworks presently available in the N3C Data Enclave (i.e., Clavien-Dindo). Multivariable logistic regression models assessing postoperative outcomes were adjusted for relative surgical risk, comorbidities, age, sex, and race. All analyses were performed within the N3C Data Enclave.

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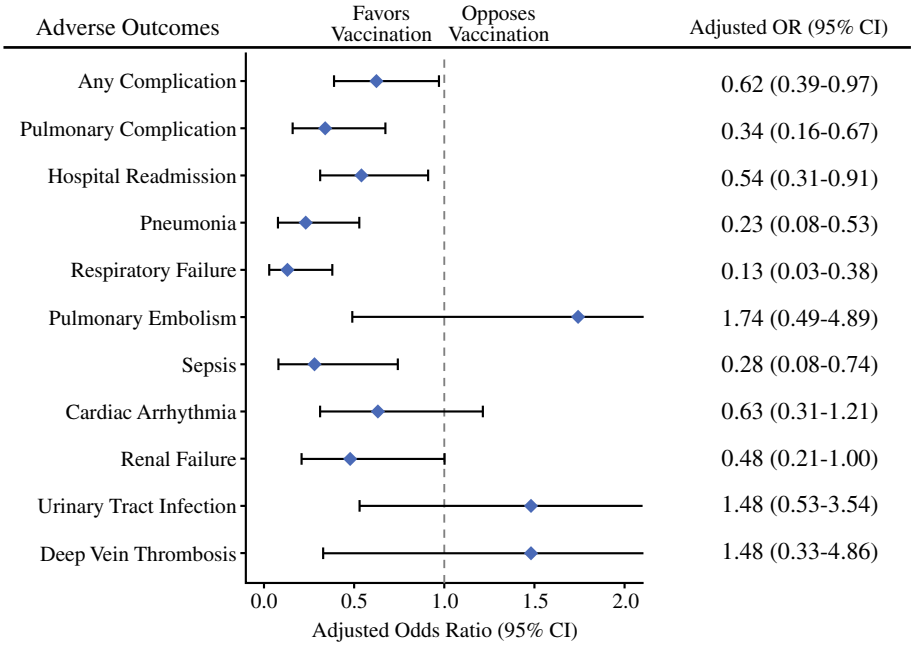

FIG. 1 Association between preoperative vaccination and adverse surgical outcomes in patients with postoperative COVID-19

RESULTS

Of 126,216 patients who underwent oncologic surgery, 1,091 (0.9%) developed a SARS-CoV-2 infection within 30 days after surgery. Patients who developed postoperative COVID-19 were at increased risk for 30-day readmission (47% vs. 15%, $P < 0.001$), pulmonary complications (20% vs. 4.4%, $P < 0.001$), nonfatal adverse events (47% vs. 20%, $P < 0.001$), and mortality (5.3% vs. 1.0%, $P < 0.001$). Following adjustment, postoperative COVID-19 was an independent risk factor and noted to increase the odds of all observed adverse events (Table 1).

At the time of surgery, 12,220 (9.7%) patients were fully vaccinated. Patients who were fully vaccinated did not have a decreased risk of developing postoperative COVID-19 (adjusted odds ratio [aOR] 1.12 [0.91–1.37]). Of patients with postoperative SARS-CoV-2 infection, 112 (10.2%) were fully vaccinated. These patients were observed to be at a decreased risk for 30-day readmission (aOR 0.54 [0.31–0.91]), pulmonary complications (aOR

TABLE 1 Risk of adverse 30-day outcomes following surgery in patients with and without postoperative SARS-CoV-2

Outcomes	No postoperative COVID-19 (N = 125,125)	Postoperative COVID-19 (N = 1,091)	*P* value	Adjusted OR (95% CI)
Mortality	1,239 (1.0%)	58 (5.3%)	< 0.001	5.73 (4.20-7.66)
Any complication	24,987 (20%)	510 (47%)	< 0.001	3.64 (3.18-4.17)
Pulmonary complication	5,474 (4.4%)	220 (20%)	< 0.001	5.99 (5.05-7.08)
Hospital readmission	14,767 (15%)	396 (47%)	< 0.001	5.17 (4.44-6.02)
Pneumonia	2,010 (1.6%)	168 (15%)	< 0.001	12.1 (9.99-14.6)
Respiratory failure	3,154 (2.5%)	145 (13%)	< 0.001	6.52 (5.33-7.92)
Pulmonary embolism	1,571 (1.3%)	30 (2.7%)	< 0.001	2.00 (1.30-2.93)
Sepsis	2,625 (2.1%)	118 (11%)	< 0.001	5.56 (4.46-6.88)
Cardiac arrhythmia	9,395 (7.5%)	168 (15%)	< 0.001	2.37 (1.96-2.85)
Renal failure	5,520 (4.4%)	149 (14%)	< 0.001	3.60 (2.95-4.37)
Urinary tract infection	2,819 (2.3%)	43 (3.9%)	< 0.001	1.81 (1.29-2.47)
Deep vein thrombosis	1,044 (0.8%)	21 (1.9%)	< 0.001	2.30 (1.42-3.50)

OR odds ratio; *CI* confidence interval

0.34 [0.16–0.67]), and nonfatal adverse events (aOR 0.62 [0.39–0.97]) compared with those who were not fully vaccinated. Notably, patients that were fully vaccinated and developed COVID-19 after surgery did not have any 30-day mortality.

DISCUSSION

In this study of cancer patients undergoing surgical resection, postoperative SARS-CoV-2 infection remains a significant risk factor for mortality and morbidity. Vaccination decreases the risk of adverse postoperative events, however, does not prevent developing COVID-19 after surgery. While the incidence of postoperative COVID-19 infection is low, it remains a devastating complication in patients undergoing oncologic resection. Vaccination against SARS- CoV-2 provides a powerful, widely available measure to mitigate this risk and should be a mandatory part of preoperative optimization.

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1245/s10434-022-12916-z.

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