**Hospital course and outcomes of emergency general surgery patients admitted during the COVID era**

**Background and Significance**

On December 31, 2019, Chinese authorities reported a cluster of cases of pneumonia. 55% of the cases reported prior to January 1st of 2020 were linked to the Huanan Seafood Wholesale Market in the Chinese province of Wuhan, Hubei, as compared to only 8.6% of future cases. This suggested rapid and consistent human to human transmission requiring strong and swift isolation measures (1). Now known as Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) or coronavirus disease 2019 (COVID-19), the virus has spread rapidly within China and across the globe, creating large outbreaks on all 6 continents. The World Health Organization designated COVID-19 a global pandemic on March 16, 2020 (2). As of May 19th, 2020, the United States has reported over 1.5 million total cases and 91,000 deaths. The U.S. is advocating its residents to work from home, avoid discretionary travel, and avoid social gatherings (3). Due to the rapid surge in patients requiring testing and inpatient care and despite the efforts of the federal and local governments, hospitals across the U.S. are starting to experience shortages in vital supplies and devices such as personal protective equipment, ventilators, and ICU beds (4). The consequences of these shortages will not only affect the quality of care provided for COVID-19 patients but will also impact care provided across the entire healthcare system.

Since the beginning of March, hospitals around the world started implementing various administrative and clinical policies to help prepare for the anticipated surge in patients requiring inpatient care. Many hospitals have replaced all outpatient visits with telemedicine, relocated all non-essential staff to work from home, restricted the number of providers present at any time, postponed elective procedures, and restructured some of the clinical units to accommodate the expected surge. Although much research and efforts are currently being directed towards understanding and optimizing the care for and treatment of subjects infected with COVID-19, there has been no study yet examining the impact this will have on the clinical outcomes of emergency general surgical (EGS) patients. EGS constitutes 11% of surgical admissions and 50% of surgical mortality in the United States. Approximately 50% of EGS patients develop a postoperative complication. The large burden imposed by EGS issues makes it necessary to understand how these patients are affected by the ongoing pandemic. Given that hospitals may be under increased resource strain, and that patients are avoiding hospitals out of fear of getting infected, we expect that this will have a detrimental impact on the disease course of EGS patients. We hypothesize that patients presenting later in their disease course and having to experience delays in care will experience a higher morbidity and mortality.

**Objectives**

1. Describe the complications and mortality of EGS patients admitted during the COVID pandemic
2. Compare the complication and mortality rates to a control admitted during the same period, one year prior
3. Compare changes in mortality and complications across institutions with varying resource strain

**Hypothesis**

EGS patients admitted during the COVID-19 pandemic will have a higher complication rate.

**Outcomes**

1. Primary outcome: Complications
2. Secondary outcomes: Mortality, Length of Stay (LOS), Discharge Disposition

**Methodology**

Study design: Retrospective multi-institutional study of EGS patients. The study period begins on the day the first COVID case was reported in the institution’s state and will run for 6 months. Data will be collected using REDCap.

Inclusion criteria:

1. EGS patients that belong to the following diagnostic groups (ICD-10-CM):
   1. Acute Appendicitis (K35.X)
   2. Acute Cholecystitis (K81.0)
   3. Perforated Diverticulitis (K57.0X, K57.2X, K57.4X, K57.8X)
   4. Perforated Intestine (K63.1)
   5. Perforated Peptic Ulcer (K25.1, K25.2, K25.5, K25.6, K26.1, K26.2, K26.5, K26.6, K27.1, K27.2, K27.5, K27.6)
   6. Intestinal obstruction (K56.X)
   7. Necrotizing soft tissue infection (M72.6)
2. Admitted after January 1, 2019 (or date of first reported case in respective state)
3. ≥ 18 years of age

Exclusion criteria: None

Data collection and analysis: Patients more than 18 years of age belonging to any of the predetermined EGS codes will be included. Complication rate, LOS, discharge disposition, and mortality rate will be examined. We will then compare these outcomes to a historical control group (admitted 1 year prior during the same period) using propensity score matching based on age, gender, institution, and admission diagnosis. We will then perform a subgroup analysis, grouping institutions having a high, medium, and low COVID resource strain to verify whether any change in complication and mortality remains evident. Resource strain will be estimated using total hospital COVID occupancy: ≤10% = Low strain, 11-20% = Medium Strain, ≥21% = High strain. Student’s t-test and the Mann Whitney U test will be used to compare continuous variables. Chi-squared tests or Fisher’s exact test will be used to compare categorical variables. Statistical significance is set at p<0.05.

**Appendix**

* **Hospital Variables**
  + Hospital Size (Number of Beds)
  + Hospital Type (Public vs Private, Teaching vs Non-Teaching)
  + Monthly COVID-19 Occupancy Rate
* **Demographics**
  + Date of admission
  + Age
  + Sex
  + Race
  + Ethnicity
* **Preop COVID Status**
  + Positive, Negative, No Preop Testing, Unknown
* **Surgical Information**
  + Date of OR
  + CPT Codes
* **Hospital course**
  + Peri/Postoperative Complications
    - Surgical site infection
    - Sepsis
    - Stroke
    - Myocardial Infarction
    - Cardiac arrest
    - ARDS
    - Wound dehiscence
    - Pneumonia
    - Deep vein thrombosis
    - Pulmonary embolism
    - Acute renal injury
    - Postoperative Ileus/Nausea/Vomiting
    - Surgical bleeding
  + SOFA Score
  + AAST disease score
  + ICU Length of Stay
  + Hospital Length of Stay
  + Mortality
* **Discharge Disposition**
  + Home
  + Home with nursing services
  + Rehabilitation
  + Long term acute care facility
  + Nursing Home
  + Referral to other hospital
  + Hospice
  + Morgue

**References:**

1. Li, Q., Guan, X., Wu, P., Wang, X., Zhou, L., Tong, Y., ... & Xing, X. (2020). Early transmission dynamics in Wuhan, China, of novel coronavirus–infected pneumonia. *New England Journal of Medicine*.

2. World Health Organization (2020, March 11). *Press briefing by WHO Director General*. Retrieved from <https://www.who.int/dg/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19---11-march-2020>

3. U.S. Office of the President. (2020, March 16). *Press briefing by President Donald J. Trump*. Retrieved from <https://www.whitehouse.gov/briefings-statements/coronavirus-guidelines-america/>

4. Ranney, M. L., Griffeth, V., & Jha, A. K. (2020). Critical Supply Shortages—The Need for Ventilators and Personal Protective Equipment during the Covid-19 Pandemic. *New England Journal of Medicine*.

5. Scott, J. W., Olufajo, O. A., Brat, G. A., Rose, J. A., Zogg, C. K., Haider, A. H., ... & Havens, J. M. (2016). Use of national burden to define operative emergency general surgery. *JAMA Surgery*.