

Impact of COVID-19 pandemic on surgical outcomes after hepatopancreatobiliary (HPB) surgery

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Abstract: COVID-19 pandemic has disrupted healthcare systems worldwide, causing the postponement or cancellation of millions of elective surgeries. It is essential for hepatopancreatobiliary (HPB) surgeons to well understand the perioperative risk and management of HPB surgery during the COVID-19 pandemic, including the impact of preoperative COVID-19 infection and timing of surgery, the impact of COVID-19 infection on postoperative mortality, the postoperative pulmonary complications in patients with perioperative COVID-19 infection, and the postoperative complications without pulmonary involvement. Perioperative COVID-19 infection increases the risk of postoperative mortality and pulmonary complications in patients undergoing abdominal surgery. Furthermore, in some regions, the COVID-19 vaccine's availability is still limited, leading to an increase in the number of cases and potential medical collapse, which could hinder the improvement of HPB postoperative mortality rates. The timing of surgery for COVID-19 positive patients should be carefully considered, balancing the potential risks of delay with the risks of surgery during the infection.

Keywords: COVID-19, SARS-COV-2, pandemic, hepatopancreatobiliary surgery, complication

The COVID-19 pandemic, which started in December 2019, has caused significant disruption in healthcare systems worldwide by creating enormous pressure on hospital capacity (1). This situation has impacted surgical patients both with and without COVID-19. Research conducted by the COVIDSurg collaborative has revealed that 28.4 million elective surgeries, including 2.3 million cancer surgeries, were cancelled or postponed due to a shortage of intensive care capacity over a 12-week period of peak disruption to hospital services in 2020 (2-4). Another issue is that the fear of perioperative mortality in patients undergoing major surgery for hepatopancreatobiliary (HPB) cancer, related to COVID-19, also affected the allocation of surgery. It is therefore essential for HPB surgeons to well understand the perioperative risk and management of HPB surgery during the pandemic.

Impact of preoperative COVID-19 infection and timing of surgery

Patients who preoperatively test positive for COVID-19 should delay their surgery until they have fully recovered from the virus due to its negative impact for patients undergoing surgery. As a result of an international study by COVIDSurg Collaborative and GlobalSurg Collaborative, it was proposed that surgeries should be

postponed for patients confirmed positive for COVID-19 preoperatively, for at least 7 weeks after diagnosis and if persistent symptoms of COVID-19 infection have subsided (5). However, for some emergency surgeries, such as resection of advanced cancers, delaying surgery has the potential risk of oncology, and timing of surgery should be tailored for each patient (5). Advantages of delaying surgery should be balanced against the potential risks of delay for patients with HPB cancer, which can be rapidly progressive.

Impact of COVID-19 infection on postoperative mortality

COVIDSurg Collaborative has reported a mortality of 23.8% for patients with perioperative COVID-19 infection (26.1% preoperative infection and 71.5 % postoperative infection), compared to a 4% mortality for patients without perioperative COVID-19 infection between January and March 2020 (6). A meta-analysis of 2,947 patients with perioperative COVID-19 infection has demonstrated a 20% postoperative mortality rate although these were a mixture of different surgical specialties (7). For elective liver and pancreas cancer surgery, an international study conducted by McKay SC, *et al.* reported that perioperative COVID-19 infection was associated with significantly higher mortality

(patients with COVID-19; 9.4% vs. patients without COVID-19; 2.6%) during the first 3 months of the COVID-19 epidemic (8). Martinez-Mier G, *et al.* have performed a comparative analysis of two periods (pre-COVID-19 and COVID-19 period) and demonstrated a negative impact of COVID-19 period (2020–2021) on HPB surgical outcomes with a higher mortality in Mexico (9,10). However, in Italy, there was no significant difference in 30-day postoperative mortality after liver and pancreas surgery between the pre-COVID-19 and COVID-19 periods (11,12).

Postoperative pulmonary complications in patients with perioperative COVID-19 infection

Patients undergoing abdominal surgery during the pandemic may be at increased risk of postoperative pulmonary complications due to the effects of the virus on the respiratory system. Several studies have investigated this issue, providing valuable insights into the impact of COVID-19 on surgical outcomes. One study by the COVIDSurg Collaborative examined mortality and pulmonary complications in patients undergoing surgery with perioperative SARS-CoV-2 infection (6). The study included over 1,100 patients from 235 hospitals across 24 countries. The results showed that postoperative pulmonary complications occur in 50% of patients with perioperative COVID-19 infection and are associated with high mortality (23.8%) (6). Another study by the STARSurg Collaborative and COVIDSurg Collaborative investigated the impact of the pandemic on postoperative pulmonary complications in patients undergoing surgery. The results showed that COVID-19 infection showed a significant association with the development of postoperative pulmonary complications (13). A third study by the COVIDSurg Collaborative and GlobalSurg Collaborative examined the effects of preoperative isolation on postoperative pulmonary complications after elective surgery. The study found that preoperative isolation did not reduce the incidence of postoperative pulmonary complications after elective surgery. In fact, the incidence of pulmonary complications was slightly higher in patients who were isolated preoperatively compared to those who were not isolated (14). The COVID-19 pandemic has posed significant challenges to the management of patients undergoing abdominal surgery, with an increased risk of postoperative pulmonary complications.

Postoperative complications without pulmonary involvement

An international cohort study has revealed that COVID-19 was associated with late postoperative bleeding, bile leakage, and grade B/C pancreatic fistula (8). However, their study lacks data around the

time of COVID-19 infection to definitively attribute complications to COVID-19 infection. Therefore, no definitive relationship between factors has been mentioned. They suggested that patients sustaining complications were more likely to require longer hospital stays, increasing the risk of developing nosocomial COVID-19 infection, thus potentially giving the appearance of a higher rate of surgical complications (8).

There is limited data available on whether complications without pulmonary involvement have increased after HPB surgery during the COVID-19 pandemic. However, it is important to carefully consider potential impacts of the pandemic on postoperative care and to take appropriate measures to minimize risk of complications and ensure optimal outcomes for patients.

Did COVID-19 vaccinations improve outcomes after HPB surgery?

In 2021 and 2022, the availability of COVID-19 vaccinations has increased (15,16), which could be effective to reduce the number of infections and severity of cases (17). A retrospective study published in 2023 found that mortality rates among patients undergoing liver transplantation during vaccination period (September 2021 to March 2022) have equalized with pre-COVID-19 (18). On the other hand, Fu N, *et al.* suggested that the vaccination itself did not influence survival prognoses in patients undergoing pancreatectomy for pancreatic adenocarcinoma (19). Furthermore, in some regions, the COVID-19 vaccine's availability is still limited (20), leading to an increase in the number of cases and potential medical collapse, which could hinder improvement of HPB postoperative mortality rates. Additionally, other factors may still impact HPB postoperative mortality rates despite widespread use of COVID-19 vaccines. Therefore, it is not yet entirely clear whether COVID-19 vaccinations directly contribute to improvement of HPB postoperative mortality rates. Nevertheless, widespread use of COVID-19 vaccines is expected to significantly contribute to an improvement of patient health.

In summary, the COVID-19 pandemic has disrupted healthcare systems worldwide, causing postponement or cancellation of millions of elective surgeries. Perioperative COVID-19 infection increases risk of postoperative mortality and pulmonary complications in patients undergoing abdominal surgery. There is limited data on the impact of COVID-19 on postoperative outcomes in HPB surgery. The timing of surgery for COVID-19 positive patients should be carefully considered, balancing the potential risks of delay with risks of surgery during the infection. The impact of COVID-19 vaccination on the outcomes after HPB surgery has not yet been clarified.

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