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Impact of Covid-19 on Hepato-Pancreato-Biliary Surgery

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Abstract

Background: The coronavirus 2019 disease (COVID-19) pandemic has significantly impacted hospital systems and surgical departments globally. There is however a knowledge gap on its impact on the Hepato-pancreato-biliary (HPB) unit of surgical departments.

Objective: Our study aims to review the impact of COVID-19 on hepato-pancreato-biliary surgery.

Design: Narrative review

Materials and Methods: This is a study that aimed to understand the effect of the COVID-19 pandemic on hepatic, biliary, and pancreatic surgery. In this narrative review, we performed literature search using PubMed, Science Direct, and Google Scholar using the following MeSh terms ('COVID-19' OR 'coronavirus' AND 'hepatic' OR 'liver' AND 'biliary' AND 'pancreatic' AND 'surgery' AND 'impact').

Results: The study found a delay in surgical procedures in various centers due to the unavailability of resources to the HPB unit of their centers. We found increased mortality in patients with COVID-19 infections and an increased risk of postoperative mortality following infection with COVID-19. The study similarly found a significant decrease in screening for HPB diseases. Most units reported a change in management protocol of HPB surgical patients with the adoption of non-surgical procedures for pathologies that were normally managed surgically. Similarly, there was an increase in neoadjuvant chemotherapy for HBP cancer.

Conclusion: This study demonstrates that hepato-pancreato-biliary surgical services were disrupted by the COVID-19 pandemic. The findings demonstrate the importance of emergency preparedness in the misevent of a future outbreak of diseases of public health emergency.

Keywords: COVID-19; Pancreatic; Gallbladder; Liver; Hepatobiliary; Surgery; Impact; Coronavirus

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Introduction & Background

Coronavirus disease 2019 (COVID-19) is an infectious and highly contagious disease caused by the novel Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) [1]. COVID-19 was first reported in December 2019 when several pneumonia cases with an unclear etiology were discovered in Wuhan, Hubei Province, China. Globally, over six million deaths have been recorded [2]. While COVID-19 is predominantly a viral pulmonary illness, extra-pulmonary features have been reported in literature [3-6]. The Liver and Pancreatobiliary systems are among the numerous systems affected by COVID-19 with patients presenting with elevated liver injury and biochemistries, and immune-mediated inflammatory damages to the pancreas and biliary system [7-9].

Declared as a global pandemic on March 11, 2020, COVID-19 has had

a crippling effect on health systems across the world [3]. The worldwide reaction to the COVID19 epidemic showed weaknesses in our emergency healthcare preparedness and response. All units of the healthcare system came under extreme strain with both human and capital resources channeled toward the care and treatment of patients with the coronavirus lowering the ability to treat other critical illnesses, such as those requiring surgical care [10].

There have been deficits in surgical services across many countries with a "backlog" of patients whose surgical procedures were postponed during the height of the epidemic. Lockdowns had a negative impact on cancer surgical systems all around the world, with one in seven patients in areas that had full lockdowns not having their planned operation and enduring lengthier preoperative delays. Hepatopancreato-biliary (HPB) surgery units all over the world were presented with similar challenges that led to the provision of new protocols and treatment strategies [11].

Review

Impact of Covid-19 on Hepatic Surgery

HPB malignancies are termed surgical emergencies due to their aggressive nature require urgent operation and should be prioritized with the patient informed about the perioperative risk as a result of the coronavirus disease 2019 (COVID-19) infection which has a high mortality rate in surgical patients [12,13]. This disagrees with the findings of a retrospective study performed by An, et al. it was found that the median tumor volume doubling time of hepatocellular carcinoma (HCC) is on average 85.7 days (with a range of 11 to 851.2 days). An, et al., therefore, recommended that surgical procedures be delayed surgical procedures until after the peak of the pandemic since a short-term delay in resection of HCC is not life-threatening, particularly at an early stage [14,15].

Furthermore, a need to delay hepatobiliary oncological surgery was seen particularly in countries with high COVID-19 cases due to limited availability of critical care management as well as based on directives issued by the hospital to halt elective surgeries. The operating capacity was decreased with elective surgeries not being carried out due to the redeployment of operating theatre staff and anesthetists to the critical care unit [13,16]. Also, due to the risk of possible dissemination of COVID-19 by aerosol, there was a decline in laparoscopic surgeries being performed [13]. The risk of dissemination arises from the presence of the pathogen in the peritoneal cavity. The aerosol can be released into the room during the surgical procedure. Various strategies have been suggested if laparoscopic procedures must be performed which included creating a precise opening to introduce trocars to prevent leakage and the use of an aspirator for surgical smoke evacuation [15].

In a survey amongst surgeons in Italy, a decrease in inpatient referrals was noted among 90% of surgeons [17]. There was also a 5-fold decline in the number of elective and emergency surgeries in a study performed in turkey when comparing the number of cases in 2019 and 2020 [18], due to decreased availability of ventilators and increased COVID-19-related admission. There was a need for the adoption of telemedicine amongst surgeons but this was not widely adopted for outpatient appointments [17], this could be due to out-of-pocket payment by both the physician and patient and lack of suitable training among surgeons [19,20].

Preoperative testing was conducted as a routine in countries with a high number of cases. Patients with positive test results had their procedures canceled. Delayed surgical procedures resulted in the increased need for alternatives such as neoadjuvant therapy to be adopted particularly in metastatic liver cancers [13]. This agrees with the findings of a study performed at the University Hospital of Leicester, it was found that there was increased adoption of nonsurgical procedures for pathologies that were normally managed surgically [12].

Nosocomial Exposure on the Rise Among Patients and Doctors

A small sample size of research was performed in China and there was an increased need for intensive care unit (ICU) care among postoperative patients as compared to those nonsurgical patients hospitalized for COVID-19. The case fatality was also higher among surgical patients infected with COVID-19. This finding is attributable to increased immune impairment and an early severe inflammatory response [21].

The unavailability of full personal protective equipment (PPE) including respirator masks and eye protectors in the operating theatre, increased the risk of contracting COVID-19 among health workers. In a snapshot study performed in Italy, the incidence of infection among surgeons was as high as 30% [22]. A study performed by Alsaoudi, et al. this study shows that if required precautions are put in place the spread of COVID-19 will be negligible and the need for delay will not be necessary [12].

Blood Donation

In a survey performed on the impact of COVID-19 on blood donation in the World Health Organization (WHO) African region, a reduction in blood donation and regularly conducted blood drives was noted due to the closure of most schools and non-essential businesses making it impossible to recruit donors. In most countries, there was a drop in the amount of blood issued due to the decreased availability of blood as well as decreased demands. The demand for

blood decreased due to the suspension of surgeries and outpatient department closure [12].

Also, other countries such as the United States, Canada, Malaysia, and Saudi Arabia experienced this drop in the amount of blood donation due to lockdown implementation and fear of contracting COVID-19 at the site of donation [23-24].

Liver Transplantation

In a prospective study performed by Maggi, et al. in Italy, there was a decrease in the amount of liver donation as well as liver transplantation due to concerns of infection among staff and patients, and a lack of ICU beds. In this study, there was a death of one of the liver transplant patients infected with COVID-19 which raised some questions about the facilitation of liver transplantation during a COVID-19 outbreak. Therefore, it was suggested that only end-stage liver disease patients and those with an extremely poor prognosis should undergo liver transplants as the benefit outweighs the complications arising from COVID-19 [25].

This is similar to the finding of Merola, et al. who reported a substantial impact of COVID-19 on transplantation due to concerns of viral transmission from the donor to the recipient and health care workers. There was deferment of liver transplantation until after the incidence peak subsides and a significant drop in the number of cases in the United States by over 25% between February and April 2020 [26].

Impact of Covid-19 on Biliary Surgery

According to a publication on the Impact of COVID-19 on management, and outcomes of acute care surgery for gallbladder disease which was a retrospective review of patients diagnosed with acute cholecystitis, and symptomatic cholelithiasis, in two emergency departments in Northern California between March and June 2019 and 2020. They found that COVID-19 has ensured various healthcare systems alter their management guidelines in a bid to preserve hospital resources, continue to discharge duties at optimum capacity, and reduce the risk of COVID-19 infection to their staff [27,28].

The gallbladder cohort of the study reported an increase in patients diagnosed with acute cholecystitis, and a decrease in patients with symptomatic cholelithiasis during the pandemic, however, the overall rates of gallbladder disease remained unaffected [29].

Patients diagnosed with cholecystitis were found to have had a severe disease during the pandemic which was evidenced by a higher mean Tokyo Criteria scores. Even though the difference in symptom duration prior to presentation was not statistically significant, it makes sense that presentation delays could have contributed to the observed severity increase given that symptoms lasting longer than three days cause the severity score to move from Grade I to Grade II of the Tokyo Criteria scores [29].

To safeguard themselves while treating patients who could have COVID-19 infections, surgeons worldwide confronted new hurdles. Concern has been raised about the significance and accessibility of PPE for healthcare personnel during the pandemic after certain facilities in Italy with early experience with COVID-19 reported rates of infection among surgeons of as high as 30% [29-30].

Several European surgical societies recommended laparoscopic cholecystectomy as the preferred treatment choice for acute cholecystitis during the pandemic [3132]. According to a population-based study conducted in Sweden, the number of biliary colic patients under the age of 65 has decreased while the number of patients undergoing surgery has increased among those over the age of 80. During the initial wave of the pandemic, they saw a sharp drop in the quantity of treatments carried out for uncomplicated gallstone disease. However, there was a modest rise in complicated gallstone-related diseases, which was probably brought on by postponing surgical treatment [33].

According to another study, the rate of gallstones-related surgery among males remained constant while it fell among women. This was driven by the fact that women were more likely than males to have uncomplicated gallstone disease [34].

Concerns regarding the possibility of transmission of SARS-CoV-2 via aerosols produced in operating rooms during laparoscopic operations surfaced during the peak of the pandemic in 2020. Given concerns that have been mentioned in the literature regarding possible aerosol dissemination of COVID-19 via laparoscopic surgery. 23% of those who responded reported laparoscopic surgery continuing for both essential and non-essential cases, 58% for essential cases only, and 19% reported a halt to laparoscopic surgery in their units during the pandemic [35-38].

Impact of Covid-19 on Pancreatic Surgery

Surveys and literature on the impact of the COVID-19 pandemic on pancreatic surgery revealed varying findings and outcomes. Some literature reported no significant impact of the pandemic on the surgical capacity others stated a notable effect on the surgical capacity. This section of the article summarizes the findings from literature.

Guidelines and recommendations published during the first phase of the pandemic suggested scaling down on elective surgeries due to concerns of limited healthcare resources and the risk of adverse postoperative complications [39]. A study carried out in Argentina that analyzed the impact of the COVID-19 pandemic on pancreatic surgeries in private

and public institutions concluded that the pandemic did not reduce the number of pancreatic surgeries performed in private institutions and can be safely performed while public institutions saw a decline in pancreatic surgeries because most of the resources were channeled into the care of patients with COVID-19 [40].

A study performed by European-African-Hepato-Pancreato-Biliary Association (EAHPBA) showed that surgeons were still able to perform hepato-pacreato-biliary surgeries even during the peak of the pandemic with the use of local private hospitals and ICU (intensive care unit facilities) in the UK. The study also reported a more than 50% drop in utilization of the operating theatres by A majority of the respondents and non-essential surgeries were no longer performed by 83% of the respondents while 13% performed these surgeries due to recurrent or significant symptoms [41].

This aligns with the recommendation of the Society of American Gastrointestinal and Endoscopic Surgeons (SAGES) and the European Association of Endoscopic Surgery that all elective cases be postponed except for surgical treatment needed for progressive and life-threatening health conditions like malignancies [42].

Similarly, a survey done in the UK stated that about one-fifth of the centers that took part in the study had no capacity for resectional pancreatic surgery in the first one and half months of the pandemic [43]. The global survey on pancreatic surgeries carried out by Oba, et al. also states that 62% of the participants perform less pancreatic surgery as a result of COVID-19 [42].

Informing the patient about the possible risks such as contracting COVID-19 during hospitalization, inadequate post-op care (lack of bed space in the ICU), increased risk of COVID-19-related deaths due to surgery or cancer, etc [42], Pergolini et explored the perception of the patient and it was found out that more than half of the patients refused surgery or request that their surgery is postponed due to fear of COVID-19 and its consequences [39], this may also account for the reason why the number of cases operated upon reduced.

A UK study found that about a third of the respondents used chemotherapy and chemoradiotherapy in place of surgery as the first line for the management of resectable pancreatic cancer [43]. Some of the reasons given for this change include the need to reduce peri-operative complications in COVID-19-positive patients and associated morbidity and mortality as well as relieving strain on the already busy intensive care units (ICU) and high dependency units (HDU). The downside to the use of neo-adjuvant treatment is that by the time surgical capacity is restored, there would be have been a lot of patients who have completed the course of their neo-adjuvant treatment and will be competing with newly diagnosed patients with resectable tumors for the operating list, bearing in mind that there is window period in which surgery has to be done following neo-adjuvant treatment. The ideal average wait time post-chemotherapy for pancreatic tumors is 3 weeks [43], while post-radiotherapy averages between 6-8 weeks [44]. If the surgery becomes delayed in either of the two categories, it becomes more challenging and dangerous to proceed with the surgery. There is a need for surgical capacity to be expanded to mitigate the delay in access to surgery in these groups of patients [43]. The alternative treatment options were not free of harm for instance radiation-induced fibrosis can distort the anatomical planes and make the surgery more difficult [44], while chemotherapy can cause immunosuppression which is a risk factor for COVID-19 infection while lack of chemotherapy will lead to progression of the cancers [41]. Conversely, Jee, et al. stated that cytotoxic chemotherapy was not associated with adverse COVID-19 outcomes but patients with peri-COVID-19 lymphopenia and neutropenia had adverse COVID-19 outcomes [45], However, a Chinese study reports that oncologic patients treated with either chemotherapy or surgery have a significantly higher risk of developing severe COVID-19 infection following completion of their treatment [46].

In contrast, a study from Singapore demonstrated an increase in the volume of HBP cases operated upon during the COVID-19 pandemic, and this was attributed to triaging mechanism that resulted in a relative increase in resources for HPB oncology patients even though the resources were scarce [47]. Other contributing factors that led to the increase include the fact that HPB oncologic patients were prioritized because of the aggressive biologic nature of these cancers and no effective neoadjuvant therapy when compared to other surgical malignancies e.g., breast cancer. Hence urgent surgery is crucial for the survival of these patients. Delay in surgery for pancreatic cancer could result in a greater than 30% reduction in survival at 6 months and a greater than 17% reduction in survival at 3 months according to a study done by Sud, et al. [48].

According to a report by the European-African Hepato-Pancreato-Biliary Association (E-AHPBA), pre-operative COVID-19 testing was crucial in assuring the safety of medical professionals. [41]. 82% of the respondents canceled the surgeries in patients who tested positive pre-operatively while 17% went ahead with the procedures with appropriate precaution. PPE was more readily available in operating theatres where COVID-19 positive patients were operated upon compared to theatres where unconfirmed cases were being treated [41]. The use of personal protective equipment is highly recommended due to the increased risk of contracting the infection during surgery [42].

In absence of full hospital capabilities for respiratory support, patients with increased risk for postoperative respiratory failure should not be prioritized for surgery [42]. This corroborates the American College of Surgeons (ACS) consensus on the issue of triage that in elective cases with a high chance that there might be a need for ICU admission that the risk of delaying the surgery be balanced against the imminent availability of healthcare resources for patients with COVID-19 [42].

According to the consensus patients who have completed the course of neoadjuvant chemotherapy for pancreatic cancer should undergo surgery. However, in case of limited resources patients should be prioritized based on objective prognostic factors and co-morbidities. Should the surgery be postponed patients should continue their neo-adjuvant chemotherapy [42].

High-volume centers are recommended for pancreatic surgery to reduce the risk of prolonged hospital stay and severe complications requiring ICU admission hence, their activity is maintained during the pandemic, while low-volume centers should not perform high-risk pancreatic surgeries during the COVID-19 pandemic [42].

According to the E-AHPBA survey, laparoscopic surgeries were performed by 23% of the respondents for both essential and non-essential surgeries, while essential surgeries only were carried by 58% of the participants and 19% stopped performing laparoscopic surgeries all through the pandemic. The need to reduce total operating time thereby limiting the exposure of the medical and nursing staff to the risk of contracting the infection has also been stated as part of the reason for the drop in the use of minimally invasive surgery [49]. Reduction in the surgical management of the more benign pancreatic conditions in which laparoscopy is a more favored technique of surgical intervention could have also accounted for the drop in minimally invasive surgeries during the pandemic [49]. However, the Society of American Gastrointestinal and Endoscopic Surgeons (SAGES) suggested the continuation of minimally invasive surgery by their risk-reducing procedural guide [39]. Reduced post-op morbidity and hospital stay following surgery is a proven benefit of minimally invasive surgery hence should be encouraged in these high-risk patients [42].

Pergolini, et al. in their study found that most participants routinely admitted their post-op patients to the ICU for observation for a night or 2 nights. However, during the pandemic they found that despite the increase in ICU capacity in 94% of the centers included in the study, 20% of the participants changed their approach to postoperative management due to difficulty in keeping patients in an already strained ICU, resulting in the need to transfer patients to normal ward earlier. Discharging patients earlier to their homes, another, hospital or rehabilitation center was another strategy employed by 32% of the participants. While 40% did not operate at all on high-risk patients [39].

Increased use of unconventional destinations rather than the ICU for immediate post-op management of patients was also reported by McKay, et al. and may be a result of younger and less co-morbid patients in whom the need for ICU is less anticipated were operated upon more frequently conversely patient needing more complex procedures avoided reducing the need for ICU care [43].

Quero, et al. did not find any difference in the ICU of post-operative care patients who underwent surgery during the pandemic and this was attributed to the lower number of surgeries performed during that period as well as the use of specialized ICU for management of COVID-19 positive patients [49].

Pergolini also assessed the perception of the pancreatic surgeons and it was found that the pandemic negatively impacted their practices in that they sense a more stressful environment than usual [39]. The surgeons recommended that in the future if faced with another pandemic, the already pre-established hospitals should be dedicated to handling the pandemic while referral centers for oncological care should continue to work without restrictions there maintaining the high standard of care for oncology patients [39]. Virtual tumor boards in addition to Telemedicine could assist in outpatient care and follow-up.

Pancreatic Transplant

Online-based research that focused more on the delivery of pancreatic transplant services during the COVID-19 pandemic was carried out amongst members of the World Pancreas Transplant Guidelines Group between May 2020 and July 2020 and showed that there was a major drop in pancreatic transplant referrals by over 75% in nearly 40% of the 28 centers that participated in the survey [50].

Results from the study also stated that the pancreas of the donors who tested positive for COVID-19 was never used in 10 centers (36%), while the rest of the 18 centers used the pancreas at varying days post positive test results as follows; at 14 days (1 center, 4 percent), 14-28 days (2 centers, 7 percent), or more than 28 days (15 centers, 54 percent) [50].

Large proportions of the centers (21) performed pancreatic transplant surgeries in their usual theatre while the rest did their surgeries in different theatres but in the same hospital [50]. McKay, et al. also stated that there was a moderate increase in alternate clean sites for surgery during the pandemic [43].

Conclusion

In summary, this study shows the significant impact of COVID-19 on hepatopancreato-biliary surgical units around the world. Across the world, many organizations created guidelines to assist in the triaging of HPB surgical care during the pandemic. It was evident that there were a decline in the volume of elective hepato-pancreato-biliary (HPB) surgeries in most healthcare facilities across the world, particularly in countries with high COVID-19 patients. Some of the reasons include hospital policies which vary between public and private institutions, redeployment of resources, personnel, and anesthetists to care for patients infected with COVID-19, and fear of dissemination of aerosols from minimal access surgeries. Certain patients also failed to give consent due to fear of postoperative complications which were evidently higher during the pandemic. The study also reveals the importance of strengthening health systems globally to ensure preparedness to tackle global pandemics without a significant negative effect on other units.

Contributions

All authors contributed equally to in study conception and design, literature survey, data analysis, writing of the paper, and revision. All authors reviewed the results and approved the final version of the manuscript.

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Conflict of Interest

The authors declare no potential conflicts of interest concerning the research, authorship, and/or publication of this article.

Declaration of Competing Interest

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