

The successful management of Thirty-six hepatopancreatobiliary surgeries under the intensive protective arrangements during the COVID-19 pandemic

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Summary. *Background:* During the pandemic of COVID-19, the overwhelm of infected patients created an exponential surge for ICU and ward beds. As a result, a major proportion of elective surgeries was postponed. However, various emergency and urgent procedures were allowed. Due to the mortality complications of hepatopancreatobiliary issues, we decided to afford urgent procedures under intensive protective arrangements. *Method and results:* In our ward (liver transplant), 4 ICU beds and 16 ward beds were allocated to non-COVID-19 patients. A total of 36 hepatopancreatobiliary procedures were managed for one month. All the surgeries were afforded under personal protective equipment and other intensive protective arrangements for personnel and patients. During 6 weeks following the surgery, all patients were followed up through telemedicine and no new case of COVID-19 was detected. *Conclusion:* In general, it appears that intensive protections could significantly reduce the number of COVID-19 incidence among patients with co-morbidities who undergo invasive procedures. (www.actabiomedica.it)

Key words: Liver Transplantation, Hepatopancreatobiliary Procedures, Operative, COVID-19

Introduction

In December 2019, the first case infected with SARS-COV2 was reported in China. After a while, this virus swept china, spread worldwide, and caused thousands of deaths all over the world (1). On 19 February 2020, the first case of COVID-19 was reported in Iran and thus the urgent situation was announced. As of July 4, 2020, more than 11,125,245 confirmed cases and 528 204 deaths were recorded in worldwide according to the 167th situation report published by WHO. Therefore, most of the transplant centers, including liver transplant centers, faced many problems and decided to postpone their surgery and transplantation during this pandemic (2). Although postponing

elective surgeries could help to decrease the number of exposed cases in hospital settings, the prolongation of waiting time could increase the risk of COVID-19 infection in patients with several co-morbidities (3). Besides, this prolongation increases the risk of death due to mortal complications of liver failure. So, there is the question that whether the suspension of surgery in these high-risk populations is cost-beneficial or not. Also, there is no definite perspective on the eradication of this virus. However, a successfully accepted organ transplantation (especially the liver) needs sufficient equipment and staff, including the available ICU beds, an expert team of specialists, and enough protective equipment in the pandemic situation (4). In the present study, we share our experience of hepato-

pancreatobiliary surgeries, including transplantation and hepatobiliary surgery under the intensive prevention arrangements at this pandemic time, in a referral center of COVID-19.

Method and study designs

Imam Khomeini hospital Complex was introduced as one of the tertiary centers of Tehran for admission of patients infected with COVID-19 on 18 February 2020. Most of the floors were allocated to COVID-19 and all elective admissions were stopped. Although, this complex includes different, separated blocks, but most of the blocks, including our block received COVID-19 patients. So, the surgical patients in our department were exposed to COVID-19 infected patients. Between February 18 and March 18, 1164 cases confirmed based on CT-scan findings were admitted in wards and 208 cases with the severe presentation were admitted in ICU. Unfortunately, 128 patients died during this month due to COVID-19. In hepatobiliary and liver transplant division, with 16 ward beds and 4 ICU beds were preserved for essential surgeries. However, the liver transplant group in this hospital decided to proceed with their elective category 1 and emergent surgeries according to the ministry of health guidelines. For achieving the optimal prevention against COVID-19, the following curricula were determined.

1. Providing surgical masks to staff, physicians, and patients
2. Learning the correct way of washing hands to personnel
4. Cleaning and disinfecting surfaces
5. Severe restriction of traffic to the transplant ward
6. Separating patients with respiratory manifestation and postponing the surgery of patients with respiratory manifestation
7. Separating and isolating patients with COVID-19 suspected presentations
8. Discharge in early days after surgery and rehabilitation and follow-up via telemedicine
9. The separation of the liver surgery operation room from other surgical rooms
10. Quarantine the personnel with suspicious signs or symptoms
11. CT scanning after surgery in patients with dry cough with or without fever
12. Checking the laboratory data during the admission before and after surgery regularly and with more frequency
13. Furthermore, our supervisor was dedicated to check the accurate performance of protocols by personnel.

In this month, 36 liver surgeries, including 8 liver transplants and 28 hepatobiliary procedures, were afforded. All patients were followed up for 6 weeks after surgery every day in terms of signs and symptoms of COVID-19 via telemedicine. The patients with suspicious symptoms were investigated using CT-scan and RT-PCR. Moreover, among 14 specialists of our transplant team, 2 of them presented with related symptoms of COVID-19. These physicians were isolated for more than 2 weeks and were not allowed to come back to work unless showing two times of negative RT-PCR.

Results

From 18th February to 18th March 2020, 36 cases underwent liver surgery or transplantation. The mean age of our study population was 48.64 ± 14.16 , with 69.44% of them being female. The mean days of ward admission and ICU admission were estimated 6.63 ± 4.90 and 1.91 ± 2.08 days, respectively. Moreover, 47.21% of the study population presented comorbidities (Table 2). During this month, 22.22% of our patients underwent liver transplantation due to chronic or acute liver failure. And, all of them received the immunosuppression treatment after the surgery. Liver metastasis was another highly prevalent reason for hepatobiliary surgery in this time (22.22%) (Table 1). Among the cancerous patients, two cases had positive history of radiation therapy and nine of them received chemotherapy. One of the patients due to transplant rejection received three dose of methyl prednisolone. Another one underwent liver resection due to cholangiocarcinoma, but passed away due to sepsis and liver failure. During the follow-up period,

Table 1. The reason and type of procedures and their prevalences among study population

| Disease | Operation type | Frequency | Prevalence (%) |
|---------------------------------------------------|----------------------------------------------------------------|-----------|----------------|
| Acute or chronic liver failure | Transplantation | 8 | 22.22% |
| Liver Metastasis | Hepatectomy/Matastatectomy/ segmentectomy | 8 | 22.22% |
| Complicated Hydatid cyst | Drainage and hepatotomy | 5 | 13.88% |
| CBD injury/stricture | hepaticojeojenostomy | 4 | 11.11% |
| Extrahepatic cancers and hepatocellular carcinoma | nephrectomy,adrenalectomy, ampulectomy and liver segmentectomy | 4 | 11.11% |
| Pancreas tumors | Whipple procedure | 4 | 11.11% |
| Complicated cholecystites and gallbladder cancer | Drainage-cholecystectomy, Extended cholecystectomy | 3 | 8.33% |
| Total | - | 36 | 100% |

Table 2. Demographic characteristics among study population

| | Total population (N=32) |
|-----------------------------------|-------------------------|
| Age (years) | |
| Mean±SD | 48.64±14.16 |
| Sex | |
| Male | 11(30.55%) |
| Female | 25(69.44%) |
| Duration of hospitalization (day) | |
| Ward admission(Mean±SD) | 6.63±4.90 |
| ICU admission(Mean±SD) | 1.91±2.08 |
| Neoadjuvant Treatment | |
| Chemotherapy | 9(28.12%) |
| Radiotherapy | 2(6.25%) |
| Co-morbidity | |
| Diabetes mellitus | 7(19.44 %) |
| Hypertension | 7(19.44%) |
| Coronary heart disease | 3(8.33%) |
| Positive PCR test | 0(0%) |
| Laboratory data | |
| Creatinine | 1.01±0.41 |
| Hemoglobin | 11.59±2 |

two of the patients confessed mild fever and myalgia, although CT-scan was clear in both of them as the manifestations diminished quickly. Another one of the patients undergoing liver transplantation presented fever (temperature=39°C) on the day 19 post-transplantation. She was admitted in an isolated room. The CT-scan showed a ground glass view in the base of the lung. The patient was treated with Hydroxychloroquine 200 mg twice a day, Meropenem 1 gr every eight hours, and Vancomycin 1 gr twice a day. The PCR-test of nasopharynx specimen in this patient was negative, twice. However, the anti-viral treatment was continued for two weeks. Then, the patient was discharged symptom-free.

Discussion

In this study, 36 hepatopancreatobiliary procedures were managed for one month. All the surgeries were afforded under personal protective equipment and other intensive protective arrangements. During the six weeks of following up of the patients after discharge, no positive history of COVID-19 was reported. Also, the outcome of surgeries was acceptable.

In the current study, according to recommended protocols (5), all the patients were tested via PCR. The complete exposure history was taken. The operation schedule was arranged as the lowest number of procedures in each day to afford. All the staff who involved in each operation were tested via PCR. Before and after operation, the patients were isolated.

This virus is transmitted by respiratory droplets, and the clarified transmission routes are aerosol and the digestive tract (6). In elderly patients with comorbidities, or immunocompromised patients, the infection rapidly develops and presents the severe form. Thus, these groups of people are considered as the high-risk population (7).

Various mechanisms for COVID-19 have been suspected. One major pathophysiology of COVID-19 organ damage is Angiotensin Converting Enzyme 2 receptors (8). The evidence has indicated that COVID-19 could infect endothelial cells of several organs, including lung, heart, and even liver, via ACE2 receptors (9). The presence of inflammatory and endothelial

death cells in target organs of COVID-19 has led to the hypothesis that the virus can simultaneously trigger inflammatory responses and directly infect host cells. Thus, these two mechanisms cause endothelialitis in the target organ (10). According to, most of our study procedures, including hepatopancreatobiliary and liver transplantation operations have been categorized as Tier 2a, 2b, and some of them like acute liver failures, and chronic liver diseases have been categorized as Tier 3. In Tier2 category, the surgeons as their recommendation could postpone procedures, or not. In Tier 3 category, the operation is recommended (11, 12). A solid organ transplant recipient is exposed to a greater risk of infection due to immunosuppression therapy in comparison with other groups. Moreover, this group of patients usually comprises elderly people with underlying diseases (13). Different ways have been considered as the transmission routes among perioperative times, including suction, endotracheal intubation, and endoscopy. Furthermore, the fecal-oral transmission is another common route in hospital settings. All of these routes could significantly increase the risk of transmission of COVID-19 infection among liver transplant candidates. Therefore, the postpone or canceling the operative procedure in these patients has been recommended (14). However, there is a major lack of information about the impact of SARS-CoV on new liver transplant recipients. So far, few studies have estimated the risk of COVID-19 infection among transplant candidates during the invasive procedures, and their results are surprisingly conflicting. According to AASLD/AST, Acute liver failure, complicated cirrhosis, metabolic liver diseases, and chronic liver disease have been introduced the indications of liver transplant in era of COVID-19 pandemic (15). One study in China evaluated 87 patients who underwent heart transplantation after 2015 and were categorized as an immunocompromised group of patients. They reported that although the immunocompromised group with solid organ transplantation was at a greater risk of severe form of the disease and mortality, it appeared that the use of protective strategies could significantly decrease the risk of infection in this high-risk group (13).

To decrease the risk of transmission to the lowest level, several protective guidelines during trauma inju-

ries and the first or second level of surgeries, including neoplasia, have been recommended. The healthcare workforce must follow the defined protective protocol. These protective guidelines include facial masks with filters, eye protection, double non-sterile gloves, gown, and caps. Moreover, it is necessary to provide different separated physical places for suspected patients from non-COVID-19 patients. The staff with full protection should provide inter-hospital patient transfer to the operation room after admission. The room should be sensitized with sensitizers before and after each surgery. Moreover, the ICU and wards should be frequently sensitized carefully (16, 17). The delay of surgery in patients with hepatopancreatobiliary could decrease the survival rate in these patients, especially in primary cancers and metastasis could increase the risk of development. Furthermore, in patients with liver failure, the prolongation of waiting time for transplantation could reduce the survival rate due to mortal complications. Moreover, these patients are around 50 years old and present several comorbidities due to their liver issues or adjuvant therapies for metastasis, or as a result of masses which could lead to higher risk of COVID-19 infection in these patients. The immune system in cancerous patients is suppressed due to weight loss and lack of nutrition (18). The threat to these patients is not only limited to COVID-19, and they could be at the risk of other co-infections, including bacterial and fungal infections (19). Therefore, the postponement of invasive procedures could lead to the increased risk of serious health problems in these patients. It appears that hepatopancreatobiliary surgeries under intensive protective arrangements could be cost-beneficial. However, patients with positive history of organ transplant are treated with immunosuppressant agents. These treatments make this group of patients at high risk of COVID-19 infection. Therefore, we should take into consideration the increased risk of COVID-19 infection after transplantation. Overall, in this large center, we decided to continue hepatopancreatobiliary surgeries with more urgency. The candidates were evaluated individually, and a decision was made according to their situations. In more emergent cases, all the procedures were performed under intensive protection. According to previous studies, in patients with multiple comorbidities and also in im-

munocompromised cases, unspecific symptoms were more common and these patients had longer duration of shedding in comparison with the normal population (20). These patients usually need more intensive care (21). Therefore, we decided to follow-up our patients daily for about six weeks after discharge via telemedicine. Furthermore, after surgery, the treatment started in all suspicious cases before the PCR-test confirmation. Fortunately, no patient showed positive PCR-test results. Finally, we successfully carried out the procedures in 36 patients and had follow-up for six weeks. We believe that hepatopancreatobiliary procedures as semi-elective surgeries should be carried out in sterile situations with intensive protection. However, the procedure could be different according to each individual case.

Conclusion

Hepatobiliary surgeries could be regarded as semi-elective based on degree of emergency. Thus, based on the situation of each individual, surgeons should decide whether to have invasive procedures in pandemic time. According to our findings, in the patients who underwent hepatopancreatobiliary surgeries with serious underlying reasons, intensive protection and special arrangements could significantly contribute to implementation of a safe hepatobiliary procedure during pandemic time.

Conflict of interest: Each author declares that he or she has no commercial associations (e.g. consultancies, stock ownership, equity interest, patent/licensing arrangement etc.) that might pose a conflict of interest in connection with the submitted article

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