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ORIGINAL ARTICLE

Medicine Science International Medical Journal

Medicine Science 2021;10(4):1392-7

Hepatopancreaticobiliary injuries during the COVID-19 pandemic

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Received 23 May 2021; Accepted 29 June 2021
Available online 24.11.2021 with doi: 10.5455/medscience.2021.05.185

Abstract

The purpose of this study was to evaluate the results of conservatively or surgically treated patients with hepatopancreaticobiliary (HPB) injuries during the novel coronavirus (COVID-19) pandemic. The medical records of 360 patients who were asked for consultation from the emergency department between March 11, 2020 and March 31, 2021 and evaluated by a single surgeon during this period were retrospectively reviewed. Twenty-three patients with HPB injuries were included in the study. Blunt abdominal trauma (47.8%) was the most common etiology of HPB injuries and the most frequently affected organ was the liver (69.6%). Eleven (47.8%) of the patients with HPB injuries were operated and 12 (52.2%) were followed conservatively. The hemoglobin value was significantly lower in the operated group ($p<0.05$). The World Society of Emergency Surgery (WSES) stage IV liver trauma was higher in the operated group. All of the ERCP-related perforations were Stapfer Type 4 and only one patient required surgery. Only 1 (4.3%) patients was COVID-19 positive at the time of first admission. No patients contracted COVID-19 during the hospitalization. Morbidity rate was 26.1% and mortality rate was 8.7% after HPB injury. Further studies are needed to reveal the relationship between HPB surgery and COVID-19 pandemic. We would like to emphasize that compliance with isolation conditions and vaccination are very important for both patients and us healthcare professionals.

Keywords: COVID-19 pandemic, hepatopancreaticobiliary injury, emergency surgery

Introduction

The novel coronavirus (COVID-19) pandemic was first reported in December 2019 in Wuhan, Hubei Province of China, and spread rapidly all over the World [1]. As of May 2021, 158 million confirmed cases were detected worldwide, causing 3.2 million deaths. One of the indispensable cornerstones of the healthcare system that contributes to public health is elective and emergency surgical procedures [2]. As the COVID-19 outbreak spread, hospitals became areas at high risk of transmission. Although some elective surgeries could be delayed, emergency operations continued. There is little evidence of emergency surgical care in the COVID-19 pandemic. A study conducted in a tertiary hospital in Wuhan showed that the vast majority of patients with COVID-19 pneumonia underwent gastrointestinal and thoracic operations [3].

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Hepatopancreaticobiliary (HPB) injuries are a condition with high morbidity and mortality rates, requiring rapid intervention, long-term hospital stay and resuscitation with a multidisciplinary approach, despite advances in surgical skills, anesthesia and intensive care. The aim of this study was to evaluate the results of conservatively or surgically treated patients with HPB injuries during the COVID-19 pandemic.

Materials and Methods

This study was carried out in the General Surgery Clinic of Ondokuz Mayıs University Medical Faculty Hospital. Ethical approval was obtained from the local ethics committee for the study (IRB approval number OMU: 194/2021). The medical records of 360 patients who were asked for consultation from the emergency department between March 11, 2020 (The first COVID-19 case in Turkey was announced on March 11) and March 31, 2021 and evaluated by a single surgeon during this period were retrospectively reviewed. Twenty-three patients who were found to be consulted for hepatopancreatobiliary injury were included in the study. Age, gender, patient management, The American Society of Anesthesiology (ASA) score, hemodynamic status at first admission, type of trauma, affected organ, laboratory

values, coexisting intraabdominal and extraabdominal injury, COVID-19 status, length of hospital stay (LOS), morbidity and mortality rates were determined as parameters to be investigated. Evaluation of liver damage was made according to the World Society of Emergency Surgery (WSES) liver trauma classification [4]. Stapfer classification was used in endoscopic retrograde cholangiopancreatography (ERCP) related perforations and Strasberg-Bismuth classification was used in iatrogenic bile duct injuries [5, 6]. Pancreatic injuries were classified according to the American Society of Trauma Surgery (AAST) pancreatic organ injury scale [7].

During the pandemic, chest computed tomography (CT) was performed and COVID-19 test was applied to all patients who were asked for surgical consultation in the emergency department. Patients with suspicious lesions showing COVID-19 pneumonia on chest CT were approached as positive for COVID-19, and optimum isolation conditions were attempted to be provided in these patients. PCR test results of the patients were followed. Patients with positive PCR tests were admitted to COVID-19 isolation wards. In the presence of symptoms such as shortness of breath, cough, fever, or worsening of vital signs, COVID-19 tests and chest CT were repeated, even if this was due to any other medical reason.

Statistical analysis

SPSS (Statistical Package for Social Sciences) for Windows 15.0 program was used for statistical analysis. Descriptive statistics were used for demographic and clinical features. Data were presented as mean ± standard deviation or median (min – max). Normality analysis of the quantitative data was performed using the Shapiro-Wilk test. The data that did not conform to normal distribution were compared using the Mann-Whitney U test. Statistical significance value was accepted as $p < 0.05$.

Results

Twenty three (6.4%) of the 360 consultations requested from the emergency department were HPB injuries. The mean age was 45.6 ± 16.5 years and 60.9% of the patients were male. While 11 (47.8%) of the patients had hemodynamic instability at the first examination in the emergency department, 12 (52.2%) patients were stable (Table 1). Blunt abdominal trauma (47.8%) was the most common etiology of HPB injuries and the most frequently affected organ was the liver (69.6%). Coexisting intra-abdominal and extra abdominal injuries were presented in table 1. Eleven (47.8%) of the patients with HPB injuries were operated and 12 (52.2%) patients were followed conservatively. When the operative and non-operative management groups were compared in terms of laboratory values, the hemoglobin value was significantly lower in the group that underwent surgery ($p<0.05$), (Table 2). Classification of types and degrees of HPB injuries were summarized in Table 3. WSES grade IV liver trauma was higher in the operated group as expected. All the ERCP-related perforations were Stapfer Type 4 and only one patient required surgery. Demographic data, clinical features and surgical outcomes were shown in Table 4. Left hepatectomy was performed in a patient with cryptogenic liver cirrhosis who had liver segments 2, 3 and 4 injuries due to blunt abdominal trauma. Two patients who underwent hepatorraphy also had an inferior vena cava injury. Four patients who were referred to our center with perihepatic packing had hemodynamic instability and damage-control surgery was performed quickly on the same day. Liver segmentectomy was performed in three of these patients and Whipple procedure was performed in one. In addition, we performed perihepatic packing and right nephrectomy to a patient whose first evaluation was made in our center, and we performed the damage control surgery 36 hours later.

Only 1 (4.3%) of the patients was COVID-19 positive at the time of first admission. This patient, who had no pneumonic involvement on preoperative chest CT, was operated due to a gunshot wound. No patient was diagnosed with COVID-19 during conservative or postoperative follow-up and 10 days after discharge. Morbidity rate was calculated as 26.1% and mortality rate was 8.7% in all patients after HPB injury (Table 1). ERCP and endobiliary stenting were used to eliminate postoperative biliary leakage in two patients who were operated due to liver injury. The patient, who underwent Whipple procedure due to pancreatic injury and developed postoperative grade B pancreatic fistula, was treated with parenteral nutrition, percutaneous abscess drainage (PAD) and antibiotics. CT-guided retroperitoneal abscess drainage was performed in two patients who were followed up conservatively after ERCP perforation. Percutaneous transhepatic biliary drainage (PTBD) and PAD were applied to a patient referred to our center due to iatrogenic bile duct injury in the second postoperative week. The patient died of sepsis during the follow-up. Another patient with WSES grade IV liver injury secondary to blunt abdominal trauma died while trying to be resuscitated in the emergency department.

Discussion

The liver is the most frequently injured solid organ after the spleen in blunt abdominal trauma. Liver damage has been reported in 40% of patients undergoing laparotomy for stab wounds and 30% of patients with gunshot wounds [8]. Diagnosis and treatment of liver trauma has improved with the use of modern diagnostic and treatment tools [9, 10]. Various innovative multimodal approaches such as endovascular intervention protocols have greatly increased the possibility of nonoperative treatment (NOM) for selected patients. Most patients presenting with liver injury have minor or moderate injuries (WSES I, II, III) and are successfully treated by NOM. In contrast, the vast majority of severe injuries (WSES IV, V) require surgery [11]. Bilgic [12] et al reported that hemodynamic instability was noted in 40% of patients with liver trauma and the mortality rate was higher in patients with systolic blood pressure below 90 mmHg. Uncontrolled bleeding secondary to high-grade liver damage is one of the main factors associated with an increased risk of death in the early (within 24 hours) and perioperative period in patients with abdominal trauma [13]. In present study, the majority of patients who underwent surgery had WSES stage IV liver damage, and the hemodynamic status was unstable in 47.8% of the patients. Hemoglobin levels were significantly lower in operative management group. Mortality occurred in only 1 patient due to liver injury during the resuscitation in the emergency department.

Pancreatic trauma accounts for 5% of severe abdominal injuries. Despite this low percentage, it has high mortality rates [14, 15]. The proximity of the pancreatic head to the major abdominal vascular vessels explains the high instability risk in pancreatic trauma after

Table 1. Demographic and clinical characteristics of patients

	n	%
Number of patients	23	100
Age (years)	45.6 ± 16.5	
Gender		
Female	9	39.1
Male	14	60.9
ASA		
I	9	39.1
II	7	30.5
III	3	13
IV	2	8.7
V	2	8.7
Hemodynamic status at first admission		
Stable	12	52.2
Unstable	11	47.8
Type of Trauma		
Blunt trauma	11	47.8
ERCP related perforation	5	21.9
Gunshot wounds	3	13
Stab wounds	3	13
Iatrogenic bile duct injury	1	4.3
Affected organ		
Liver	16	69.6
Bile duct	6	26.1
Pancreas	1	4.3
Coexisting intra-abdominal injury		
Kidney	4	17.4
Spleen	2	8.7
Intra-abdominal vascular injury	2	8.7
Small intestine	1	4.3
Coexisting extra abdominal injury		
Chest trauma	11	47.8
Musculoskeletal system	11	47.8
Cranial injury	3	13
Maxillofacial injury	3	13
Management		
Operative	11	47.8
Non-operative	12	52.2
COVID 19		
Positive at the time of diagnosis	1	4.3
Positive on follow-up time	-	-
Length of hospital stay (days)	17.1 ± 14.9	
Morbidity	6	26.1
Mortality	2	8.7

ASA: American Society of Anesthesiologists, ERCP: Endoscopic Retrograde Cholangiopancreatography, HPB: Hepato Pancreato Biliary

Table 2. Significant laboratory findings in HPB injury between operative and non-operative managed groups

	Nonoperative Management	Operative Management	P value
Hemoglobin (gr/dL)	12.7 (8.2-15.5)	8.2 (4-13.9)	0.009
White blood cell (/uL)	16610 (5760-25770)	11892 (7380-19010)	0.151
Platelet (/mm^3)	233000 (119000-408000)	192090 (70000-291000)	0.260
Creatinine (mg/dL)	0.84 (0.41-2.38)	0.85 (0.49-1.69)	0.880
Aspartate aminotransferase (U/L)	173 (16-2123)	113 (10-352)	0.260
Alanine aminotransferase (U/L)	172 (36-2583)	153 (14-417)	0.260
Total bilirubin (mg/dL)	0.48 (0.15-14.4)	0.5 (0.15-1.22)	0.740
Direkt bilirubin (mg/dL)	0.19 (0.09-12.6)	0.22 (0.09-0.70)	0.608
INR*	1.06 (0.92-1.98)	1.18 (0.88-1.92)	0.379

HPB: Hepato Pancreato Biliary, INR: International Normalized Ratio. Bold value indicates statistically significant finding

Table 3. Classification of types and degrees of HPB injury

	Nonoperative Management (n=12)	Operative Management (n=11)
WSES liver trauma classification		
Grade I	3	3
Grade II	3	-
Grade IV	1	6
Stapfer Type IV ERCP related perforation	4	1
Strasberg E2 bile duct injury	1	-
Pancreas Grade V trauma	-	1

HPB: Hepato Pancreato Biliary, WSES: World Society of Emergency Surgery

knife and gunshot injuries. Penetrating trauma is observed in the majority of unstable patients [16, 17]. According to the American Society of Trauma Surgery (AAST), duodenopancreatic injury is divided into 5 stages and pancreaticoduodenectomy (PD) is the recommended procedure for IV and V grades. It is difficult to decide on PD in pancreatic injury, and there is still no consensus on the timing of the operation. There are different opinions advocating one-stage or two-stage surgery [18, 19]. In our study, an emergency PD was performed in a patient who was referred to us due to a pancreatic injury that was operated on in a hospital 3 hours away from our clinic after a gunshot injury.

ERCP-related perforation is a rare but serious complication. The mortality rate of ERCP-related perforations ranges from 4.2% to 37%, and delay in treatment for more than 24 hours after perforation can lead to a doubling of mortality [20, 21]. Emergency surgical treatment gives the best results in lateral or medial wall perforations (Type I). Conservative treatment should be planned in Type 2 lesions where contaminated fluid is not collected in intraperitoneal and retroperitoneal areas on CT, and surgical treatment is recommended if there is fluid accumulation on CT. It has been reported that most patients with small retroperitoneal Type III and IV perforations requiring rare emergency surgery can be treated with conservative medical treatment. If the patient with ERCP-related perforation scheduled for conservative treatment does not improve within 48 hours and signs of intra-abdominal sepsis develop rapidly, surgery should be considered immediately [22, 23]. In our study, all the ERCP-related perforations were Type 4, and surgery was performed in only one patient due to deterioration of vital signs and development of acute abdominal findings at the 48th hour of the follow-up. No perforation was identified at laparotomy.

Although bile duct injury is rare after cholecystectomy, it is the most feared major complication due to the high risk of morbidity (9.3%−43%) and early mortality (0%−1.7%) [24, 25]. The presence of acute cholecystitis attacks, anatomical variations, male gender, abdominal surgery history, obesity and lack of experience of the surgeon are important risk factors for biliary tract injury [26, 27]. It is very important to recognize and treat this complication early before peritonitis develops. Late diagnosis will result in large amounts of bile accumulation in the abdomen, which will lead to the more severe clinical manifestation of biliary peritonitis. Most bile duct injuries (especially Type A and Type D injuries) can be treated with sphincterotomy and stents. Surgical treatment is required when the endoscopic procedure is unsuccessful or bile duct was cut completely (Type E). In patients with widespread peritonitis in which bile leakage is diagnosed late, urgent interventions are primarily recommended reducing inflammation and it is emphasized that the definitive surgery should be performed

doi: 10.5455/medscience.2021.05.185

Table 4. Clinical characteristics and outcomes of patients undergoing surgery for HPB trauma

Patient ID Age / Sex	Type of injury	Hemodynamic status on admission	Type of HPB trauma	Coexisting intraabdominal injury	Coexisting extraabdominal injury	Operative procedure	COVID-19 status at first admission	LOS (days) / Prognosis
1 **37 / Female**	Stab wounds	Unstable	Liver segment 4, 5 and 8 laceration	Infrarenal vena cava	None	Hepatorrhaphy Primary IVC repair	Negative	7 / Healing
2 **39 / Male**	Gunshot wounds	Stable	Pancreatic head injury	Small intestine	None	Depacking Whipple Primary repair of the small intestine	Negative	38 / Healing
3 **33 / Female**	Blunt trauma	Unstable	Liver segment 5, 6 and 7 laceration	None	Chest trauma Left elbow dislocation	Depacking Segmentectomy Chest tube Open reduction for ED	Negative	25 / Healing
4 **39 / Male**	Gunshot wounds	Unstable	Liver segment 5, 6 laceration	Kidney	None	Depacking Segmentectomy	Negative	23 / Healing
5 **35 / Male**	Blunt trauma	Unstable	Liver segment 2, 3 and 4 laceration	None	Chest trauma Spinal fractures	Left hepatectomy	Negative	24 / Healing
6 **53 / Male**	Blunt trauma	Unstable	Liver segment 1 laceration	Spleen	Chest trauma Pelvic fracture	Depacking Segmentectomy Splenectomy Chest tube External fixator	Negative	16 / Healing
7 **67 / Female**	ERCP perforation	Unstable	Retro-peritoneal gas	None	None	Surgical drainage of retroperitoneal and peritoneal spaces	Negative	60 / Healing
8 **21 / Female**	Blunt trauma	Unstable	Liver segment 2, 4, 5, 6 and 7 laceration	Kidney	Chest trauma Pelvic fracture Spinal fractures Cranial injury	Packing Right nephrectomy Chest tube Depacking	Negative	35 / Healing
9 **51 / Female**	Gunshot wounds	Stable	Liver segment 5 laceration	None	None	Hepatorrhaphy	Positive	3 / Healing
10 **38 / Male**	Stab wounds	Unstable	Liver segment 2 laceration	None	None	Hepatorrhaphy	Negative	5 / Healing
11 **56 / Male**	Stab wounds	Stable	Liver segment 4 laceration	Gallbladder Infrarenal vena cava	None	Hepatorrhaphy Primary IVC repair Cholecystectomy	Negative	7 / Healing

ERCP: Endoscopic Retrograde Cholangiopancreatography, HPB: Hepato Pancreato Biliary, ED: elbow dislocation, IVC: inferior vena cava

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3 months later [28]. In present study, Strasberg E2 bile duct injury was detected in one patient in the second postoperative week after laparoscopic cholecystectomy. The patient who underwent PTBD and PAD died of sepsis during the follow-up.

HPB injuries are a health problem with high morbidity and mortality rate, requiring long-term hospital stay and intense contact with hospitals and healthcare professionals. The ongoing pandemic period has made it even more difficult for surgeons to manage their patients [29]. There is literature information indicating that the vast majority of patients diagnosed with COVID-19 pneumonia during the treatment process underwent gastrointestinal and thoracic operations [3]. Based on this information, we shared the treatment processes and results of patients with HPB injuries during the pandemic period. Only one patient was COVID-19 positive at the time of first admission, and no patient was infected with COVID-19 during hospitalization. The COVID-19 positive patient had an uneventful recovery and was discharged. Although the small number of patients is a limitation of the study, this study may be a pioneer in the literature.

Conclusion

HPB injuries are a health problem with high morbidity and mortality rates, requiring long-term hospitalization and trying to be solved with a multidisciplinary approach. During the pandemic process, the workload of this patient group has increased and patient management has become more complex. Further studies are needed to reveal the relationship between HPB surgery and COVID-19 pandemic. We would like to emphasize that compliance with isolation conditions and vaccination are very important for both patients and us healthcare professionals.

Conflict of interests
The authors declare that they have no competing interests.

Financial Disclosure
All authors declare no financial support.

Ethical approval
This article was approved by the Ondokuz Mayis University Ethics Committee on 04/05/2021 (no. 194).

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