

A cohort study on the risk of hepatectomy and pancreatectomy after history of abdominal surgery on other organs

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Backgrounds/Aims: The present study analyzed the postoperative outcomes in patients who underwent hepatectomy or pancreatectomy, with a history of intra-abdominal surgery involving other organs, to elucidate surgical efficacy. **Methods:** We examined the perioperative parameters in 28 patients who underwent hepatectomy (n=12) and pancreatectomy (n=16) after receiving prior abdominal organ resection (esophagectomy, n=2; gastrectomy, n=5; resection of small intestine, n=2; appendectomy, n=5; colorectal resection, n=9; hepatectomy, n=1; cholecystectomy, n=3; splenectomy, n=2, pancreatectomy, right adrenalectomy, nephrectomy and myoma uteri, n=1 each). **Results:** Age, gender, a history of comorbidities, and primary diseases were not significantly different between the groups. The present operation was predominantly indicated for liver metastases in all patients undergoing hepatectomy. Several diseases were detected in pancreaticoduodenectomy (PD) patients. Laboratory data were not significantly different between groups. Although operating time and blood loss during hepatectomy did not differ significantly between the groups, the operating time was significantly longer in patients undergoing PD compared with distal pancreatectomy ($p < 0.05$). Red cell blood transfusion was most frequently used in patients who underwent major hepatectomy and PD ($p < 0.05$). The prevalence of postoperative complications was not significantly different between groups. Hospital death was not observed and the period of hospital stay did not differ between groups. **Conclusions:** Carefully scheduled hepatectomy or pancreatectomy is safe even in cases with prior abdominal surgery under the present strategy. (*Ann Hepatobiliary Pancreat Surg* 2018;22:344-349)

Key Words: Hepatectomy; Pancreatectomy, Previous history; Abdominal surgeries; Operative difficulties

INTRODUCTION

Repeated operations have been undertaken to enhance curative and survival rates following the initial operation, particularly for colorectal or upper gastrointestinal malignancies. Postoperative adhesion in the digestive tract is the biggest challenge. In cases of hepatectomy or pancreatectomy for malignancies, longer operative time and careful dissection around important organs or vessels are required due to severe adhesion.¹ In the modern era, the dissection devices, and high-quality diathermy or energy devices have been markedly improved to reduce thermal injuries to the surrounding tissue.² In particular, the in-

tra-operative blood loss may be correlated with the severity of adhesion.¹ Thus, the patient position, operative approaches, and the incision site are often selected to avoid the adherent areas.

The present study examined the perioperative parameters and patient outcomes using surgical records of 28 patients who underwent hepatic resection or pancreatectomy for malignancies, in order to elucidate the operative difficulties associated with a retrospective cohort study.

Received: April 27, 2018; **Revised:** June 29, 2018; **Accepted:** July 10, 2018

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Annals of Hepato-Biliary-Pancreatic Surgery • pISSN: 2508-5778 • eISSN: 2508-5859

MATERIALS AND METHODS

Patients

A total of 28 consecutive patients undergoing hepatic or pancreatic resection who had a history of surgeries for other intra-abdominal organs at the Division of Hepatobiliary-pancreatic Surgery of the University Of Miyazaki Faculty Of Medicine between April 2015 and June 2017 were retrieved from the institutional surgical database. Twelve patients undergoing hepatectomy for liver malignancies and 16 undergoing pancreatectomy were reviewed in the present study. Those with combined vascular or other organ resections were excluded as the operative strategies varied. The subjects enrolled in the present analysis comprised 19 males and 9 females, and the median patient age at the time of surgery was 61.8 years (range, 24-77 years) for hepatectomy and 54.4 years (range, 39-81 years) for pancreatectomy. Our protocol for indication of hepatectomy was not influenced by indication for resection of other organs. We examined preoperative clinical parameters, operative procedures, surgical records, postoperative morbidity and mortality, and hospital stay in the present series.

Demographics

Chronic hepatitis was observed in three patients (25%) in the hepatectomy group. While the liver was normal in eight patients chemotherapy-associated chronic liver injury was observed in three cases. The Child-Pugh classification A was observed in all patients and Liver Damage Grade B was observed in three cases (15%). Diseases included hepatocellular carcinoma (HCC) in two patients, intrahepatic cholangiocarcinoma (ICC) in none, and metastatic liver tumor in nine patients. Hepatectomy included hemi-hepatectomy or greater (n=3), sectionectomy (n=1), segmentectomy (n=3), and limited resection (n=4, including laparoscopic resection in 2). Radical hepatectomy was performed to remove the hepatic tumor without leaving any residual tumor. The volume of resectable liver was estimated based on the indocyanine green retention rate at 15 min (ICGR15) using Takasaki's formula. Furthermore, the acceptable hepatic function for hepatectomy was limited to ICGR15 <40%, Child-Pugh classification A or B, and total bilirubin level of <2 mg/dL. The expected liver volume for resection, excluding the tumor,

was measured by computed tomography (CT) volumetry.

Pancreatitis accompanying hepatic disease was observed in two patients (13%) in the pancreatectomy group, while the liver was normal in eight patients and chemotherapy-associated chronic liver injury was observed in three cases. Diseases included pancreatic ductal adenocarcinoma (PDAC) in six patients, intraductal papillary mucin producing neoplasm (IPMN) in three, distal bile duct carcinoma (BDC) in two, ampullar adenocarcinoma in three, and duodenal adenocarcinoma in two cases. Hepatectomy included pancreatoduodenectomy (PD) in nine (including pylorus-preserving PD in four patients) and distal pancreatectomy (DP) in seven cases. Radical hepatectomy was performed to remove the hepatic tumor without leaving any residual tumor in all. Laparoscopic history was not found in this study. Anesthesia and patient data were retrieved from the institutional database. The institutional ethics committee approved the present study on 2017/10/20 (reference number O-0203) and the study was accomplished by March 2018.

Statistical analysis

All continuous data were expressed as the mean±standard deviation. Data for different groups were compared using one-way analysis of variance and examined by the Student's *t*-test. A two-tailed *p*-value <0.05 was considered significant. The linear regression formula was used to correlate the parameters. The PASW Statistics for Windows version 18.0.0 software (SPSS, an IBM Company, Chicago, IL) was used for all statistical analyses.

RESULTS

Surgical history

Among the 28 patients included in the present study, hepatic resection was performed in 12 cases (limited resection in 5, segmentectomy or sectionectomy in 4, and major hepatectomy in 3) and pancreatectomy in 16 (PD in 12 and distal pancreatectomy in 4). Prior abdominal surgeries consisted of esophagectomy in 2, gastrectomy in 5, resection of the small intestine in 2, appendectomy in 5, colorectal resection in 9, hepatectomy in 1, cholecystectomy in 3, splenectomy in 2, and pancreatectomy, right adrenalectomy, nephrectomy, and removal of uterine

Table 1. Demographics of patients who underwent hepatectomy or pancreatectomy after prior abdominal surgeries

	Limited hepatectomy (n=5)	Segmental or sectional hepatectomy (n=4)	Major hepatec- tomy (n=3)	Pancreatico- duodenec- tomy (n=12)	Distal pancreatec- tomy (n=4)	<i>p</i>
Age (years)	59±21	67±11	59±17	69±9	61±15	
Gender						
Male/Female	4/1	2/2	3/0	9/3	2/2	0.52
Background liver						
Normal/Chronic hepatitis	3/2	2/2	3/0			0.35
None/Pancreatitis				10/2	4/0	1.0
Prior surgery on other organs						
Esophagus			1	1		
Stomach		2		2	1	
Small intestine				2		
Appendectomy				3	2	
Colorectum	2	2	1	4		
Hepatectomy	1					
Cholecystectomy	1			2		
Spenectomy				1	1	
Pancreatectomy		1				
Retroperitoneum	1			1		
Others					1	
Diseases						
MLC/HCC	4/1	4/0	2/1			0.49
PDAC/IPMN/BDC/AC/DC				4/1/2/3/2	2/2/0/0	-
Child-Pugh classification						
A/B	5/0	4/0	3/0	-	-	
Laboratory data						
Total bilirubin (mg/dL)	0.8±0.5	0.8±0.9	0.3±0.6	3.0±3.5	0.5±0.6	
Prothrombin activity (%)	90±2	84±45	89±15	98±15	101±27	
Platelet count (/mm ³)	18±9	27±7	25±11	27±15	24±17	
Indocyanine green retention rate at 15 min (%)	23±15	15±10	12±9			
Surgeons						
Chief/Fellow and Resident	0/5	2/2	2/1	8/4	3/1	0.24
Incision						
Median/Transverse/J-shape/Oblique/others	1/0/1/1/2	3/0/1/0/0	0/0/3/0/0	12/0/0/0/0	4/0/0/0/0	-
Surgical records						
Operating time (min)	215±117	348±115	505±117	625±115*	379±98	
Blood loss (ml)	173±219	655±522	2000±879	1591±1700	275±200	
Transfusion (No/Yes)	5/0	3/1	0/3	5/7	4/0	0.033
Postoperative complications						
No/Yes	2/3	2/2	2/1	7/5	1/3	0.56
Systemic and wound infection				2		
Gastric stasis				2	2	
Hepatectomy-associated complication						
No/Yes	5/0	1/3	2/1			-
Hepatic failure			1			-
Intraabdominal infection						
Uncontrolled ascites						
Bile leakage		1	1			
Hospital death	nil	nil	nil	nil	nil	-
Hospital stay (days)	7±9	25±9	29±9	34±26	31±25	

No significant difference in continuous parameters between groups

*; $p < 0.05$ vs. Distal pancreatectomy, #; $p = 0.75$ vs. Distal pancreatectomy

MLC, metastatic liver carcinoma; HCC, hepatocellular carcinoma PDAC, pancreatic ductal adenocarcinoma; IPMN, intraductal papillary mucin-producing neoplasm; BDC, bile duct carcinoma; AC, ampullar carcinoma; DC, duodenal carcinoma

myoma in 1 each.

Clinicopathological parameters

The demographics of patients who underwent hepatectomy or pancreatectomy after prior abdominal surgery are shown in Table 1. Age and gender did not differ significantly between groups. The incidence of chronic hepatic injury was not significantly different between the hepatectomy groups, and that of pancreatitis did not significantly vary between the pancreatectomy groups. Patients who underwent hepatectomy, showed a history of different abdominal surgeries, without any significant trends, and in those who underwent pancreatectomy, colectomy was predominantly performed. The present operation was primarily conducted for metastatic liver disease in all patients undergoing hepatectomy. Several diseases were observed in PD patients, but only pancreatic carcinoma and intraductal papillary neoplasm were observed in distal pancreatectomy patients. Child-Pugh A was the predominant class in all hepatectomy patients. Laboratory data of total bilirubin level, ICGR15, prothrombin activity, and platelet count were not significantly different between the groups. The prevalence of chief operators among surgeons with varying levels of experience did not differ significantly between the groups.

Surgical outcomes

The median incision was predominantly performed for pancreatectomy patients. Although operating time and blood loss did not vary significantly between groups undergoing hepatectomy, the operating time was significantly longer in patients undergoing PD in comparison with distal pancreatectomy ($p=0.033$). Red blood cell transfusion was most frequently used in patients who underwent major hepatectomy and PD ($p<0.05$). The prevalence of postoperative complications did not vary significantly between groups, and hepatectomy-associated complications in patients were not significantly different between groups. Hospital death was not observed and the length of hospital stay did not vary significantly between groups.

DISCUSSION

Recent advances in major hepatectomy and pan-

createctomy have ensured patient safety via adequate preoperative evaluation of the functional liver reserve and improved postoperative management.^{1,3} Although patient prognosis has been improved with increased survival,¹ further malignancies or other diseases require surgical intervention. Prior abdominal surgeries may influence subsequent abdominal surgeries and patient outcomes. Furthermore, increased surgical stress is anticipated preoperatively and decisions related to resection depend on patient condition or organ function. In particular, hepatic or pancreatic resections are relatively complicated and invasive in comparison with other digestive tract surgeries. Additional adverse complications associated with these operations may lead to systemic damage or lethal conditions. The present series of 28 patients involved those who underwent scheduled hepatic or pancreatic resections. Our aim in this study was to elucidate whether prior abdominal surgeries influenced adversely the subsequent hepatectomy or pancreatectomy.

The number of subgroups was limited, particularly for hepatectomy. The prevalence of sectionectomy or major hepatectomy tended to be lower in our series. After prior abdominal surgery, manipulation of adhesive parts around the major vessels may be difficult; however, such manipulations are usually required for hepatectomy or pancreatectomy, except in partial resections. Preoperatively, surgeons may hesitate and alter the indication for the operation. Although surgery was conducted in all patients in the present series, the indications and surgical decisions were unclear based on patient charts. The second or third operation was performed in elderly patients in previous reports;⁴ however, the patient age in our study ranged around 60 years, which was not different from other studies involving patients without prior abdominal operations.⁵⁻⁸ Considering this selective bias, secondary surgeries for elderly patients and high-risk surgical candidates were likely avoided at our institute. Even in younger patients, a greater risk of intraoperative (bowel injury) and postoperative adverse events (surgical site infections) was previously reported.^{9,10} In our study, the prevalence of background diseases, such as cirrhosis and chronic pancreatitis, was lower, and organ function was well preserved.

Although the prior surgeries varied, gastrectomy and colorectal surgery accounted for 45% of all the surgeries,

and were carried out via median incision laparotomy leaving behind possible intra-abdominal adhesions. Kim et al. and Yamamoto et al. reported that these laparotomies exhibited a high degree of adhesion and increased the severity.^{11,12} Hepatectomy and pancreatectomy usually require laparotomy on the upper median line, and the operative time may be prolonged in order to perform adhesiolysis. Furthermore, following gastrectomy, lymphadenectomy and reconstructed intestines led to adhesions. In cases where severe adhesion was expected, we preferred to perform thoraco-abdominal laparotomy with an oblique incision, which uses a different part of the initial wound, in patients undergoing hepatic resections involving the subphrenic lesion of the right liver.¹³⁻¹⁶ The author performed hepatectomy using this incision safely at this stage.¹⁶ This incision was selected in one hepatectomy in the present series. Although, fewer hepatectomies and pancreatectomies occurred during this period, reoperation after hepatectomy was common.¹⁷

Surgical skills involving dissection of postoperative adhesions are important, and 46% of trainee residents and fellows performed this operation. According to the author's previous study and other similar reports, surgical records and patient outcomes involving hepatectomy or pancreatectomy did not differ between instructors and trainees following adequate instruction supported by experienced surgeons.¹⁸⁻²¹ The difference in surgical experience may not have influenced surgical records and outcomes in the present study (data not shown). In the present study, operating time, blood loss, and red cell transfusion increased with the extent of hepatectomy and PD, and this was consistent with previous reports.^{22,23} Blood loss related to transfusion was minor under limited hepatectomy and distal pancreatectomy, suggesting that intra-abdominal adhesion may not influence such operations. Operating time and blood loss were greatly increased in major hepatectomy and PD, especially in patients without prior operation.²³ Therefore, it is necessary to fully consider the indications for major operations based on patient status and prepare adequately for blood transfusions.

Postoperative complications were not severe and only a single patient undergoing major hepatectomy developed transient hepatic failure, without any death in the present series. The hospital stay was not extended. Sepsis and sur-

gical site infection were observed only in two cases (8%); therefore, the selected patients may not have been affected by severe surgical stress due to prior operations and adhesion, as reported previously.^{7,8}

We investigated hepatectomy or pancreatectomy in patients who underwent prior abdominal surgeries. The present study demonstrated good postoperative outcomes following careful pre- and perioperative management based on our usual indications. The current strategy ensures operative safety for hepatectomy or pancreatectomy in patients with prior abdominal surgery.

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