

Effects of distal pancreatectomy and splenectomy on outcomes in patients undergoing cytoreductive surgery and hyperthermic intraperitoneal chemotherapy with CC/0 resection

Sitoredüktif cerrahi ve CC/0 rezeksiyonla hipertermik intraperitoneal kemoterapi uygulanan hastalarda distal pankreatektomi ve splenektominin sonuçlara etkisi

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Background and Aims: This study aims to determine the early and late postoperative effects of distal pancreatectomy plus splenectomy in patients who underwent cytoreductive surgery and hyperthermic intraperitoneal chemotherapy and achieved CC0 resection due to peritoneal carcinomatosis. **Materials and Method:** All patients who underwent a cytoreductive surgery and hyperthermic intraperitoneal chemotherapy procedure due to peritoneal carcinomatosis of various tumors in our clinic between 2014 and 2020 were included in the study. Data from all patients who underwent additional distal pancreatectomy plus splenectomy were analyzed retrospectively. **Results:** The cytoreductive surgery and hyperthermic intraperitoneal chemotherapy procedure with CC/0 resection was performed on 85 of 136 patients diagnosed with peritoneal carcinomatosis. Of these patients, 13 (15.3%) had undergone distal pancreatectomy plus splenectomy together with the main procedure. The mean hospital stay was 15 (range, 5–50) days in patients who underwent distal pancreatectomy plus splenectomy, whereas it was 13 (range, 4–109) days in those who did not, and the difference was statistically insignificant. The most common major complications seen in the distal pancreatectomy plus splenectomy group were an anastomotic leak, enterocutaneous fistula, and intraabdominal abscess. The 30-day mortality was two (15.38%) and one (1.38%) in the group with and the group without distal pancreatectomy plus splenectomy, respectively. When the groups were evaluated, the median survival time was 19 months in the cytoreductive surgery and hyperthermic intraperitoneal chemotherapy group and 18 months in the cytoreductive surgery and hyperthermic intraperitoneal chemotherapy + distal pancreatectomy plus splenectomy group. This difference was statistically insignificant ($p = 0.382$). **Conclusion:** The addition of distal pancreatectomy plus splenectomy increased major postoperative complications in patients undergoing cytoreductive surgery and hyperthermic intraperitoneal chemotherapy but did not affect overall survival. We think distal pancreatectomy plus splenectomy can be performed for a complete cytoreduction if necessary. However, it increases major postoperative complications, and patient follow-up should be done accordingly.

Key words: Hyperthermic intraperitoneal chemotherapy, cytoreductive surgery, distal pancreatectomy, splenectomy

Giriş ve Amaç: Bu çalışmanın amacı, peritoneal karsinomatozis nedeniyle sitoredüktif cerrahi ve hipertermik intraperitoneal kemoterapi uygulanan ve komplet sitoredüksiyon sağlanan hastalarda distal pankreatektomi+splenektominin erken ve geç postoperatif etkilerini belirlemektir. **Gereç ve Yöntem:** Kliniğimizde 2014-2020 yılları arasında çeşitli tümörlerin peritoneal karsinomatozisi nedeniyle sitoredüktif cerrahi ve hipertermik intraperitoneal kemoterapi işlemi yapılan tüm hastalar çalışmaya dahil edildi. Ek distal pankreatektomi ve splenektomi yapılan tüm hastaların verileri retrospektif olarak analiz edildi. **Bulgular:** Peritoneal karsinomatozis tanısıyla ameliyat edilen 136 hastanın 85'ine (komplet sitoredüksiyon rezeksiyonla) sitoredüktif cerrahi ve hipertermik intraperitoneal kemoterapi işlemi uygulandı. Bu hastaların 13'ünün (%15.3) ana işleme ek olarak distal pankreatektomi + splenektomi uygulandı. Distal pankreatektomi ve splenektomi yapılan hastalarda ortalama yatış süresi 15 (5-50) gün iken, yapılmayanlarda 13 (4-109) gündü ve aradaki fark istatistiksel olarak anlamsızdı. Distal pankreatektomi ve splenektomi yapılan grupta en sık görülen majör komplikasyon anastomoz kaçağı, enterokutanöz fistül ve intraabdominal apse idi. 30 günlük mortalite distal pankreatektomi ve splenektomi eklenen ve eklenmeyen gruplarda sırası ile 2 (%15.38) ve 1 (%1.38) idi. Gruplar değerlendirildiğinde; medyan sağkalım süresi sitoredüktif cerrahi ve hipertermik intraperitoneal kemoterapi grubunda 19 ay, sitoredüktif cerrahi ve hipertermik intraperitoneal kemoterapi + distal pankreatektomi ve splenektomili grupta 18 aydı ve istatistiksel olarak anlamlı değildi ($p = 0.382$). **Sonuç:** Distal pankreatektomi ve splenektomi eklenmesi, sitoredüktif cerrahi ve hipertermik intraperitoneal kemoterapi uygulanan hastalarda postoperatif majör komplikasyonları arttırmaktadır, fakat genel ortalama sağkalımı etkilememiştir. Tam bir sitoredüksiyon için gerekirse distal pankreatektomi ve splenektomi yapılabileceğini düşünüyoruz ancak bu işlemin postoperatif majör komplikasyonların gelişimini arttırdığı bilinmeli ve buna göre hasta takibi yapılmalıdır.

Anahtar kelimeler: Hipertermik intraperitoneal kemoterapi, sitoredüktif cerrahi, distal pankreatektomi, splenektomi

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Özgün YM, Öter V, Pişkin E, et al. Effects of distal pancreatectomy and splenectomy on outcomes in patients undergoing cytoreductive surgery and hyperthermic intraperitoneal chemotherapy with CC/0 resection. The Turkish Journal of Academic Gastroenterology 2021;20:104-111. DOI: 10.17941/agd.978955

Manuscript received: 28.04.2021 • Accepted: 03.06.2021

INTRODUCTION

Peritoneal carcinomatosis (PC) was previously considered as a terminal stage disease and was tried to be treated with palliative surgical procedures and systemic chemotherapy (1). Today, PC is accepted as a locoregional disease limited to the abdomen, and selected patients are effectively treated with cytoreductive surgery and hyperthermic intraperitoneal chemotherapy (CRS + HIPEC) treatment (2). Compared to systemic chemotherapy, very good results are obtained and long-term survival can be achieved especially in the treatment of colorectal malignancies, gastric cancers, pseudomyxoma peritonei, peritoneal metastases of ovarian carcinoma and malignant mesothelioma (3-5). In this complex and aggressive surgery, it is emphasized that the experience and learning curve of the center are very important in terms of postoperative outcomes (6). In addition, the completeness of cytoreduction (CC) score is better in experienced centers. The purpose of CC is to clear peritoneal metastases, to perform necessary organ resections and peritonectomies. Afterwards, HIPEC treatment can be performed with open or closed methods (7). After this procedure, 0.9% - 5.8% mortality and 12% - 52% morbidity rates can be observed (8). Studies have shown that postoperative serious complications (serious adverse events) increase early recurrences (9).

One of the dilemmas that arises when performing cytoreductive surgery and HIPEC procedure is pancreatic involvement of the tumor. While pancreaticoduodenectomy procedure, which may be necessary in pancreatic head and neck involvement, creates an obstacle for resection due to its additional high morbidity and mortality risk, resection appears as an option in front of the surgeon in distal pancreatic involvement. Distal pancreatectomy is a procedure that has postoperative complications and therefore may affect early and late results, but it does not prevent resectability as in peritoneal carcinomatosis with pancreatic head and neck involvement.

To our knowledge, there is insufficient data in the English literature regarding patients who underwent CRS + HIPEC with additional distal pancreatic and splenic resection (DPS), and the management to this issue is still unclear. The aim of this study is to determine the early and late postoperative effects of distal pancreatectomy plus splenectomy in patients who underwent CRS + HIPEC and achieved CC0 resection due to peritoneal carcinomatosis.

MATERIALS and METHOD

This retrospective study is evaluated and approved by the ethics board of our center (Ankara City Hospital; Ethics board number: 24.03.2021, E2-21-353).

All patients who underwent CRS + HIPEC procedure due to peritoneal carcinomatosis of various tumors in our clinic between 2014 and 2020 were included in the study. Data of all patients who underwent additional distal pancreatectomy and splenectomy were found and analyzed retrospectively.

In the preoperative staging, the patients were evaluated according to their computed tomography (CT), magnetic resonance imaging (MRI), upper and lower gastrointestinal endoscopy (if necessary), blood tests and performance status and prepared for the operation. All patients for whom CRS+HIPEC procedure was planned were discussed at the multidisciplinary tumor council before surgery and their treatment was decided. Patients who were not suitable for surgery or had palliative procedures were excluded from the study. HIPEC was performed to all patients after CRS. Degree of resection is reported as; CC/0: no macroscopic visible tumor, CC/1: < 2.5 mm residual tumoral implants, CC/2: residual tumoral implants between 2.5 mm and 2.5 cm and CC/3: implants over > 2.5 cm (7,10).

In CC/1, CC/2 and CC/3 resections, millimetric or macroscopic tumor is left behind, and therefore aggressive interventions such as distal pancreatectomy, splenectomy or diaphragm stripping may not be performed. Considering that the patients who underwent CC/1, CC/2 and CC/3 resections would affect the early and late results, only patients with CC/0 complete resection were included in the study. The Eastern Cooperative Oncology Group (ECOG) score (11) was used in the preoperative evaluation of the patients, and patients with an ECOG value above 3 due to comorbid diseases were not operated and excluded from the study. Patients with extraabdominal metastases in the preoperative evaluation were also excluded from the study. The nutritional status of the patients was determined according to NRS 2002 (12), and patients in need were given adequate nutritional support preoperatively.

Surgical Procedure (CRS + HIPEC)

All operations were performed in the same center and by the same experienced surgical team. A midline incision between the xiphoid process and pubic tubercle was used in all operations. After a full abdominal exploration, peritoneal carcinomatosis index (PCI) was determined as defined by Sugarbaker (13). According to the spread of the tumor, patients were performed cytoreductive surgery, five-zone peritonectomy and necessary multi-organ resections as described by Sugarbaker (10,13). In all operations, total surgical time, amount of blood replace-

ments, organ and peritoneal resections and urine output were recorded. When it was ensured that there was no visible tumor, the abdomen was washed with five liters of warm saline. For HIPEC, two inflow and two outflow drains were placed in the abdomen, and abdomen was temporarily closed for the closed system HIPEC treatment. All patients were administered HIPEC as Oxaliplatin 350 mg/m² in 5% dextrose solution at 42-42.5 degrees for 30-60 minutes. In 15 patients, 15 mg/m² Mitomycin-C was administered intraperitoneally, once for 60 minutes. After HIPEC treatment, the abdomen was washed again with five liters of warm saline and anastomoses, if any, were performed after this stage.

Surgical Procedure (Distal pancreatectomy + splenectomy)

In all patients, the distal pancreas was resected en bloc with the spleen. Since all patients were operated for non-pancreatic malignancies, radical anterograde modular pancreaticosplenectomy (RAMPS) was not performed in any case. Resection was performed until the surgical margin of the pancreas was thought to be tumor free (Figure 1). In suspicious cases, frozen section was studied to make sure of the negative margin. The pancreatic stump was closed manually with eight-shaped sutures using 3/0 silk suture, in all cases. Stapler and / or adhesive material such as fibrin glue was not performed in any of the cases. In cases without distal pancreatic involvement, only splenectomy was performed. These patients were not included in the study.

Postoperative Stage and Data Analysis

All patients were followed up in the intensive care unit after the operation. Patients were recorded in terms of gastrointestinal, hematological, urinary, respiratory and neurological complications and were followed up daily.



Figure 1. A case with total omentectomy, diaphragmatic stripping, and DPS.

Complications were reviewed retrospectively for the first 30 days. Complication grading was done according to the National Cancer Institute Common Terminology Criteria for Adverse Events (NCICTCAE) version 3.0 (14).

- **Group 0:** No complications
- **Group 1:** Patients with Grade 1, 2; minor complications
- **Group 2:** Patients with Grade 3, 4, 5; major complications

The patients were evaluated in three categories: no postoperative complications, minor complications, and major complications. Major complications were evaluated as grade 3 for endoscopic or CT/Ultrasound (USG) guided interventions, grade 4 for reoperation, and grade 5 for postoperative death. Complications were divided into three groups according to their grades. Patients with and without DPS were compared according to their demographic characteristics and development of complications.

Statistical Analysis

The data were evaluated with IBM SPSS Statistics program v. 21 for analysis. In evaluation process; frequency as number and percentages were used for categorical variables. Descriptive data were used as median, minimum, and maximum for numerical variables. Continuous variables were evaluated as mean value \pm standard deviation or median value (minimum-maximum) where applicable. Mann-Whitney U-test was applied for comparing median values, and the mean differences were evaluated by student's t-test. A p value < 0.05 was considered statistically significant.

RESULTS

CRS + HIPEC procedure with CC/0 resection was performed on 85 patients out of 136 who were operated with the diagnosis of peritoneal carcinomatosis. It was evaluated that 13 of these patients (15.3%) had undergone distal pancreatectomy + splenectomy together with the main procedure. While 46 (54.1%) of the 85 patients who were operated were women, the mean age was 54.3 \pm 11.8 years. There was no significant difference in terms of age and gender between patients who underwent DPS or not.

Considering the causes of peritoneal carcinomatosis, both groups were operated mostly for colorectal and gastric malignancies. Other causes were pseudomyxoma peritonei (PMP), ovarian cancer, intestinal adenocarcinoma, mesothelioma and neuroendocrine tumor (NET) of small intestine, in order of frequency. There was no

statistical difference between the two groups in terms of primary tumor origin. While the mean PCI score of all operated patients was 7 (0-30), this number was 7 in patients who underwent DPS and 6 in patients who did not, and there was no statistically significant difference between the two groups ($p=0.598$). The patients with a PCI score of 0 were those who underwent prophylactic HIPEC or were operated for perforated appendix mucocele in an external center and who were performed complementary HIPEC by us. There were 12 (16.6%) patients in CRS + HIPEC group and 2 (15.3%) patients in DPS group who received prophylactic HIPEC. Median operation time was 7 (2-15) hours in all patients. This period was 7 (3-12) hours in patients with DPS, while it was 6.5 (2-15) hours in the group that did not, and there was no statistical difference. The need for perioperative blood transfusion occurred in 21 (25.3%) patients while 2 of these 21 patients who received blood transfusion were in the CRS + HIPEC + DPS group, the remaining 19 patients were in CRS + HIPEC group but this difference was not statistically significant ($p = 0.397$). The preoperative mean albumin value of the patients was 4.2 ± 0.4 gr/L. The average number of resected organs was found to be 2 (0-6), and the average number of peritonectomy areas described by Sugarbaker was found to be 2 (0-5). The numbers and p values of both groups are presented in Table 1.

Postoperative complications were observed in 11 (84.61%) patients in the DPS group, while in 37 (51.38) patients in the group without DPS, and the difference was statistically significant ($p = 0.026$). When we examined in terms of major and minor complications, major complications were seen in 7 (53.84%) and 17 (23.61%) patients, respectively, between the group that underwent DPS and the group that did not, and the difference was also statistically significant ($p = 0.02$). Ostomy was performed in 21 (24.7%) patients in total, and no difference was found between the groups in terms of ostomy ($p: 0.397$). The differences observed between the groups in terms of complications are presented in Table 1 and all complications observed are presented in Table 2.

The mean hospitalization period of all patients was 14 (4-109) days. The mean was 15 (5-50) days in patients who underwent DPS, while it was 13 (4-109) days in those who did not, and the difference was statistically insignificant. When 85 patients were evaluated, 30-day mortality was observed in 3 (3.5%) patients. One of them was in the CRS group and two were in the CRS + DPS group. As these two groups were compared in terms of 30-day mortality, no statistically significant difference was found

($p = 0.06$). One of these patients died due to anastomotic leak and septic shock, one due to pulmonary embolism and the other due to pancytopenia. Two of these patients were in the group which DPS was performed. One patient died 60 days after operation at the CRS + HIPEC group. When both groups were evaluated in terms of overall survival after excluding patients who died in 30 days the median survival time was 18 months (range; 1 - 80 months) in all patients, when groups were evaluated; the median survival time was 19 months (range; 1 - 80 months) in the CRS + HIPEC group and 18 months (range; 1-47) in the group with CRS + HIPEC + DPS, and this difference was found to be statistically insignificant ($p = 0.382$).

DISCUSSION

Peritoneal carcinomatosis, which was previously considered to be inoperable, is now recognized as a locoregional disease with treatment, thanks to the innovations and developments in surgery and oncology in the last two decades (15). Cytoreductive surgery (SRC) and intraperitoneal chemotherapy treatment described by Spratt in cases of Pseudomyxoma peritonei in 1980 was developed by Sugarbaker and has taken the form applied today (16). Today, CRS + HIPEC treatment is used for curative purposes for gastric cancers, malignant mesothelioma and peritoneal metastases of some rare tumors, although it is especially used for appendix mucinous tumors, colorectal and ovarian malignancies (16-17). The purpose of this treatment modality is to surgically resect all visible tumoral implants and to perform HIPEC in the same session for malignant cells that are not seen at the cellular level (18). Cytoreduction should be done without leaving any visible tumor, and HIPEC can only be effective in this case (19). Systematic CRS, defined and standardized by Sugarbaker, includes peritonectomy and visceral organ resections (10,19). According to this standardization, peritonectomy is divided into five regions: right and left diaphragmatic, anterolateral abdominal wall, subhepatic and bursa omentalis, and pelvic peritonectomy. Distal pancreas and spleen can be resected en bloc or separately by left upper quadrant diaphragmatic peritonectomy. Splenectomy is usually performed with large omentum resection or left diaphragm stripping. If there is no tumoral infiltration in the spleen, splenectomy is not performed (20). At this stage, if the tail of the pancreas is involved, distal pancreatectomy should be resected en bloc with omentectomy and splenectomy. Figure 2 and Figure 3 shows the patient who was operated on for PMP before and after resection.

Table 1. Comparison of patients with and without distal pancreatectomy + splenectomy (DPS) in all patients who underwent CRS + HIPEC

	CRS+ HIPEC	CRS + HIPEC + DPS	Total	p Value
Total	72 (84.7%)	13 (15.3%)	85	
Gender				
Women	40 (55.55%)	6 (46.15%)	46 (54.11)	0.531
Men	32 (44.44%)	7 (53.84%)	39 (45.88)	
Age	55.05 ± 1.14	50.23 ± 1.35		0.264
Location of primary tumor				
Colon	25 (34.72%)	7 (53.84%)	32 (37.64%)	0.535
Stomach	15 (20.83%)	4 (30.76%)	19 (22.35%)	
PMP	15 (20.83%)	1 (7.69%)	16 (18.82%)	
Ovary	11 (15.27%)	1 (7.69%)	12 (14.11%)	
Small intestine	4 (5.55%)	0	4 (4.70%)	
Mesothelioma	2 (2.77%)	0	2 (2.35%)	
ECOG				
ECOG0	11 (15.27%)	2 (15.38%)	13 (15.3%)	0.54
ECOG1	41 (56.94%)	6 (46.15%)	47 (55.3%)	
ECOG2	16 (22.22%)	5 (38.46%)	21 (24.7%)	
ECOG3	4 (5.55%)	0	4 (4.7%)	
Primary	28 (38.88%)	4 (30.76%)	32 (37.64%)	0.578
Recurrence	44 (61.11%)	9 (69.23%)	53 (62.35%)	
Peritonectomy				
Yes	27 (37.5%)	5 (38.46%)	32 (37.64%)	0.94
No	45 (62.5%)	8 (61.53%)	53 (62.35%)	
Ostomy				
Yes	19 (26.38%)	2 (15.38%)	21 (24.7%)	0.397
No	53 (73.62%)	11 (84.62%)	64 (75.3%)	
Length of stay (day)	13 (4-109)	15 (5-50)	14 (4-109)	0.222
PCI	6 (0-30)	7 (0-26)	7 (0-30)	0.598
Operation time (hour)	6.5 (2-15)	7 (3-12)	7 (2-15)	0.130
Peroperative blood transfusion	19 (26.38%)	2 (15.38%)	21 (24.7%)	0.397
Postoperative complication				
No	35 (48.61%)	2 (15.38%)	37 (43.52%)	0.026
Yes	37 (51.38%)	11 (84.61%)	48 (56.47%)	
Complication grade				
None	36 (50%)	2 (15.38%)	38 (44.70%)	0.05
Minor1	8 (11.11%)	1 (7.69%)	9 (10.58%)	
Minor2	11 (15.27%)	3 (23.07%)	14 (16.47%)	
Major3	11 (15.27%)	5 (38.46%)	16 (18.8%)	
Major4	4 (5.55%)	0	4 (4.70%)	
Major5	2 (2.77%)	2 (15.38%)	4 (4.70%)	
Complication grade				
Grade 0, 1, 2 (none and minor)	55 (76.38%)	6 (46.15%)	61 (71.76%)	0.02
Grade 3, 4, 5 (major)	17 (23.61%)	7 (53.84%)	24 (28.23%)	
Survival				
Ex	27 (37.5%)	8 (61.5%)	35 (41.2%)	0.268
Living	45 (62.5%)	5 (38.5%)	50 (58.8%)	
Median survival time (months)	18 (1 - 47 months)	19 (1-80 months)	18 (1-80 months)	0.382
Multiorgan resection				
≤ 3 organs	56	6	62	0.018
> 3 organs	16	7	23	
Albumin (gr/L) (Mean, SD)	4.249 ± 0.509	4.232 ± 0.423	4.247 ± 0.496	0.92

CRS + HIPEC: Cytoreductive surgery and hyperthermic intraperitoneal chemotherapy, DPS: Distal pancreatectomy plus splenectomy, PMP: Pseudomyxoma peritonei, ECOG: The Eastern Cooperative Oncology Group Score, PCI: Peritoneal carcinomatosis index.

Table 2. Postoperative complications in all patients who underwent CRS + HIPEC

	Total (85 patients)
Postoperative complications	
None (grade 0) + Minor (grade 1, 2)	61 (71.7%)
Major (grade 3, 4, 5)	24 (28.3%)
Gastrointestinal complications	
Anastomotic leak	5
Enterocutan fistula	5
Intraabdominal collection, abscess	5
Intraabdominal bleeding	2
Ileus	3
Liver abscess, cholangitis	2
Pancreatic fistula	1
Reoperation	1
Pulmonary complications	
Atelectasis	1
Pneumonia	2
Pleural effusion	2
Re-Intubation	2
Neurological complications	
	2
Hematological complications	
	1
Nephrotoxicity and acute renal failure	
	5
Gastrocnemius compartment syndrome	
	1
Mortality	
	3

Morbidity and mortality rates are also high after such aggressive and long-lasting surgeries, and they increase in correlation with the size of the resection (21). This procedure, which was given 52% morbidity and 17% mortality rates in the first meta-analyses, has been shown to be performed with 33% morbidity and 2.8% mortality in recent meta-analyses with the completion of the learning curve (8,22). When all patients were evaluated in our series, major morbidity was observed in 24 patients (28.2%) and mortality in 3 patients (3.5%) in total.

Piso et al. published the retrospective data of 2149 CRS + HIPEC patients from 52 hospitals, and reported the splenectomy rate as 20.1% and the pancreatectomy rate as 5.3%. In their series, they showed that while pancreatectomy is the most effective factor on morbidity, it does not affect mortality. When these patients were examined, the CC/0 + CC/1 rate was found to be 65.89% (22). In our series, DPS was performed to 13 (15.3%) patients. We think that the reason for this high rate in our series is due to the possibility of providing CC/0 by pancreatectomy in all patients. More aggressive and long-lasting CRS is required to reach CC/0. The linear relationship between high PCI, long operation time, the number of peritonectomy areas, the number of resected organs and postoperative major morbidity has been shown in various studies (23,24). In our series, no difference was found between the groups in terms of the number of peritonectomy areas, PCI, and operation time when the DPS group



Figure 2.
Diffuse PMP involving colon spleen and distal pancreas.



Figure 3.
Same case after resection with total gastrectomy + DPS + diaphragmatic stripping. White arrow shows pancreatic stump.

was compared with the non-DPS group. From these results, we saw that the postoperative major complication rates increased in the same patient group only with the addition of DPS. The most common major complications after DPS were intra-abdominal abscess requiring percutaneous drainage and intestinal fistulae. Pancreatic fistula developed in only one patient and early mortality was observed in two patients.

In the series published by Deraco *et al.*, they found a rate of 8.8% pancreatic fistula in patients who underwent only splenectomy. They reported that this rate is higher than fistulas that develop splenectomies due to hematological malignancies (1-2%), and they argued that the possible reasons for this may be due to pancreatic trauma, more thermal injury during cytoreduction, and the negative effects of hyperthermic chemotherapy (25). In this series they published, they gave the number of patients who underwent distal pancreatectomy with splenectomy as two. Canner *et al.* compared patients who underwent CRS + HIPEC with patients who underwent DPS for pancreatic adenocarcinoma and showed that the rates of postoperative pancreatic fistula (POPF) were the same, but the fistula was more severe in the HIPEC group (26). In the same study, they showed that PCI had no effect on the development of pancreatic fistula in patients who underwent distal pancreatectomy. In our series, POPF developed in only one patient in the DPS group. When we look at the patients who underwent splenectomy in the group that underwent only CRS + HIPEC, no POPF was observed, although there were 11 patients who had splenectomy.

In our study, we showed that DPS can be performed to achieve CC0 resection, but it has statistically increased major complication rates compared to other patients. In a multicenter study published by Schwartz *et al.*, DPS was performed with CRS + HIPEC in 105 patients. The first 30-day mortality was found 5.9% and the major complication rate 44% (27). The authors argued that DPS is not a contraindication to the operation and that it can be performed with acceptable morbidity and mortality. Similarly, Doud *et al.* showed that the addition of DPS (6.5%) in a series of 63 patients had increased major morbidity and similar mortality rates, and emphasized that this procedure should not be avoided in cases where CC0 resection could be achieved (28).

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When the long-term follow-up of the patients were examined, no statistically significant difference was found between the two groups in terms of survival. Simkens *et al.* stated in their study that complications seen in the early period increased recurrences and therefore shortened survival (9). In our study, the addition of DPS increases early complications but does not affect life expectancy. This let us to think that both groups benefit from CC0 resection and although it increases early complications, the addition of DPS should have the same survival time as peritoneal carcinomatosis without distal pancreatic invasion. Sullivan *et al.* performed distal pancreatectomy in 37 patients who underwent CRS + HIPEC and reported that progression free survival (PFS) was low in the DPS group (29). Considering this group, it was seen that only 69% of the patients who underwent DPS could have CC/0 with CC/1 and this rate was 90% in the other group, and this difference was significantly lower. Considering that the CC/0 rate will be even lower, it comes to mind that the PFS may be low for this reason. The reason for the lack of difference in terms of survival in our series can be explained by the fact that all patients are comprised of patients with CC/0 resection, which is the main determinant of survival.

The addition of DPS increases postoperative major complications in patients undergoing CRS + HIPEC, but has no effect on survival. We think that the reason for its ineffectiveness on survival is the achievement of CC0 resection, which is the goal of CRS + HIPEC surgery in both groups. We think that DPS can be performed if necessary for a complete cytoreduction, but it should be known that it increases the development of postoperative major complications and patient follow-up should be done accordingly.

Acknowledgements: None

Funding: No funding was received from any source for the article.

Conflicts of interest: All authors declare no conflicts of interest.

Ethics: This study was conducted in accordance with the Declaration of Helsinki. Ethics committee approval was received from Ministry of Health, Ankara City Hospital (24.03.2021/E2-21-353).

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