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Deferred Primary Anastomosis Versus Diversion in Patients with Severe Secondary Peritonitis Managed with Staged Laparotomies

Carlos A. Ordóñez,
Departamento de Cirugía, Fundación Valle del Lili, Carrera 98 No. 18-49, Cali, Colombia; Departamento de Cirugía, Universidad del Valle, Cali, Colombia

Álvaro I. Sánchez,
Department of Surgery, University of Pittsburgh, Pittsburgh, PA 15213, USA; Universidad del Valle, Instituto CISALVA, Cali, Colombia

Jaime A. Pineda,
Departamento de Cirugía, Fundación Valle del Lili, Carrera 98 No. 18-49, Cali, Colombia

Marisol Badiel,
Fundación Valle del Lili, Instituto de Investigación Clínica, Cali, Colombia

Rafael Mesa,
Fundación Valle del Lili, Instituto de Ciencias de la Salud, Cali, Colombia

Uriel Cardona,
Departamento de Cirugía, Universidad del Valle, Cali, Colombia

Rafael Arias,
Fundación Valle del Lili, Cali, Colombia

Fernando Rosso,
Fundación Valle del Lili, Cali, Colombia

Marcela Granados,
Fundación Valle del Lili, Cali, Colombia

María I. Gutiérrez-Martínez,
Universidad del Valle, Instituto CISALVA, Cali, Colombia

Juan B. Ochoa,
Department of Surgery, University of Pittsburgh, Pittsburgh, PA 15213, USA

Andrew Peitzman, and
Department of Surgery, University of Pittsburgh, Pittsburgh, PA 15213, USA

Juan-Carlos Puyana
Department of Surgery, University of Pittsburgh, Pittsburgh, PA 15213, USA

Carlos A. Ordóñez: carlosordonez@telecom.com.co

Abstract

Correspondence to: Carlos A. Ordóñez, carlosordonez@telecom.com.co.

Conflict of interest None

Background—There is inconclusive data on whether critically ill individuals with severe secondary peritonitis requiring multiple staged laparotomies may became eligible candidates for deferred primary anastomoses (DPA). We sought to compare a protocol for DPA against a protocol for diversion in severely ill critical patients with intra-abdominal sepsis.

Methods—A retrospective cohort study was performed examining 112 patients admitted through an ICU between 2002 and 2006, with diagnosis of secondary peritonitis and managed with staged laparotomies whom required small- or large-bowel segment resections. Patients were categorized and compared according to the surgical treatment necessitated to resolve the secondary peritonitis (DPA versus diversion). Outcome measures were days on mechanical ventilation, days required in ICU, days required in hospital, incidence of fistulas/leakages, acute respiratory distress syndrome (ARDS), and mortality.

Results—There were 34 patients subjected to DPA and 78 to diversion. Fistulas/leakages developed in three patients (8.8%) with DPA and four patients (5.1%) with diversion ($p = 0.359$). ARDS was present in 6 patients (17.6%) with DPA and 24 patients (30.8%) with diversion ($p = 0.149$). There were 30 patients (88.2%) with DPA and 65 patients (83.3%) with diversion discharged alive ($p = 0.51$). There were not statistical significant differences between groups among survivors regarding hospital length of stay, ICU length of stay, and days on mechanical ventilation.

Conclusions—We did not find significant differences in morbidity or mortality when we compared DPA versus diversion surgical treatment. It is feasible to perform a primary anastomosis in critically ill patients with severe secondary peritonitis managed with staged laparotomies.

Keywords

Peritonitis; Anastomosis; Diversion; ICU length of stay; Intra abdominal sepsis

Secondary peritonitis is a systemic manifestation of severe peritoneal inflammation, secondary to a ruptured hollow viscus caused by ischemia and necrosis, previous surgical interventions, or trauma [1]. Secondary peritonitis is associated with in-hospital mortality rates of approximately 30%, long-term morbidity, and lower health-related quality of life at 6 months, resulting in increased health care costs [2–4].

The surgical option for the management of patients with compromised bowel in secondary peritonitis has been usually the resection of the perforated viscus followed by primary anastomosis or a diversion [5]. The determinants that dictate whether a patient should undergo primary anastomosis or undergo exteriorization of the bowel are hemodynamic stability, extent of inflammation of the peritoneal cavity, and viability of the bowel. Clinical scenarios in which primary anastomoses are viable alternatives include cases where the peritonitis is exclusively due to small-bowel pathology or selected cases of perforated diverticulitis with limited contamination [5–9]. However, in patients with severe secondary peritonitis and with significant hemodynamic instability and compromised tissue perfusion, the use of primary anastomosis has been limited because of the high risk of suture/anastomosis failure, leakage, and increased surgical mortality [1]. In these patients it is advisable to control the source of peritoneal contamination and to perform an exteriorization of the compromised intestinal segment. In patients with critical physiologic conditions, diversion may be a safer and more viable alternative.

The morbidity associated with the creation of an ostomy is not trivial, however [10,11]. Complications associated with the creation of ostomies include fluid and electrolyte imbalance, skin damage, stomal retraction, herniation, stenosis, and bleeding [12,13]. There is little data about whether some of these patients managed with staged laparotomies may at

some point became better candidates for a definitive deferred primary anastomosis (DPA). In this series, we describe our experience in the management of this particular group of severe critically ill patients with complicated secondary peritonitis. The objective of this study was to compare outcomes of a protocol for DPA against a protocol for diversion, in patients with severe secondary peritonitis admitted to the intensive care unit of our institution and managed with staged laparotomies.

Patients and methods

This retrospective cohort study examined patients admitted between November 2000 and December 2006 to the intensive care unit (ICU) of the Fundación Valle del Lili in Cali, Colombia, with diagnosis of secondary peritonitis. Averages of 2,000 patients per year were admitted to the ICU of our institution between 2000 and 2006. During the same time period, 3,360 operations were performed in ICU patients. We identified a total of 254 patients with the diagnosis of secondary peritonitis by a chart review. Patients admitted through the ICU were considered eligible for the study if they were older than 18 years of age, if they presented with hemodynamic instability, or signs of systemic inflammatory response syndrome (SIRS) or severe sepsis, and if they required a resection of an involved segment of the small or large bowel.

Hemodynamic instability was defined as initial systolic blood pressure <90 mmHg, or a mean arterial pressure <60 mmHg, or a reduction in systolic blood pressure ≥40 mmHg from baseline, despite adequate volume resuscitation, in the absence of other causes for hypotension [14]. SIRS was determined as the presence of an inflammatory state of the whole body without a proven source of infection, when two or more of the following were present: heart rate >90 beats per minute, body temperature <36°C or >38°C, respiratory rate >20 breaths per minute, blood gas $PaCO_2$ <32 mmHg, or white blood cell count $<4 \times 10^9$ or $> 12 \times 10^9$ cells/L, or the presence of >10% immature neutrophils [15]. We defined severe sepsis as SIRS plus one or more organ dysfunction [16]. Patients who did not survive more than 24 hours after admission to the ICU were not included. Patients who underwent initial primary anastomosis before admission to the ICU were not included because they may alter the results in favor of the primary anastomosis group. Of the 254 patients, 112 patients met the inclusion criteria of our study.

Surgical management

The decision to perform a DPA versus a diversion was based on individual surgeon opinion. The surgeons from the division of trauma at the Fundacion Valle de Lili established the policy of damage control plus deferred primary anastomosis approach to the patients with severe secondary peritonitis managed with staged laparotomies, in the same manner as done with trauma patients. However, based on the patient's conditions, sometimes the surgeons from the division of trauma preferred to perform a diversion of the compromised bowel rather than a deferred primary anastomosis. In contrast, surgeons of the department of surgery at the same institution, not involved in the care of trauma patients, continued to manage patients with severe secondary peritonitis with diversion of the compromised bowel and staged laparotomies. In this study we performed a comparison between these two groups of patients (patients with DPA versus patients with diversion).

In the DPA group, a temporally ligature of proximal and distal ends of the bowel was performed in the first laparotomy after patients developed secondary peritonitis. Then, after adequate physiologic stabilization in the ICU, peritoneal washes were performed in the ICU or in the operating room until the septic source was controlled, and a definitive anastomosis was created. All anastomoses were created using a functional end-to-end anastomosis with a continuous single layer Vicryl® 3-0 suture (handsewn anastomoses) [17]. Successful

anastomoses were defined as those that healed with resumption of the normal enteric transit. Patients who failed to resume normal enteric transit in subsequent laparotomies were diverted and considered as a failure of the treatment. Nonetheless, they were analyzed in the DPA group.

In the other group of patients, during the first laparotomy, a diversion of proximal and distal ends rather than temporally ligature was performed. Then, after adequate physiologic stabilization in the ICU, peritoneal washes were performed in the ICU or operating room until the septic source was controlled and it was considered safe to close the abdomen.

In both groups, open abdomens were managed similarly initially using a Velcro system and later a vacuum pack [1]. All patients received broad-spectrum antibiotics. Most patients received a combination of third-generation cephalosporin plus metronidazole as the initial antibiotic scheme. During laparotomies, samples of peritoneal exudates were collected for microbiologic analyses. On microbiologic identification of organisms, the antibiotic therapy was narrowed to cover those organisms present on culture based on its sensitivity. Mechanical ventilation and hemodynamic support were provided in the ICU as needed. Parenteral nutritional support, enteral nutritional support, or combinations of both were started as soon as feasible. Clinical follow-up was continued until hospital discharge.

Data collection

Data were collected and entered into an electronic database. The following variables were collected: sex, age, Acute Physiology and Chronic Health Evaluation (APACHE) II score [18] obtained at last 24 hours after ICU admission, and cause of peritonitis. Collected information of cause of peritonitis was categorized in postoperative, traumatic, and primary intra-abdominal pathology. Postoperative cause of peritonitis means a failure of any surgical procedure different of primary anastomosis or diversion, either by on-demand or planned surgery implemented as a treatment for a specific pathology, affecting the continuity of the bowel and generating perforations, leaks, and severe peritonitis. Traumatic cause of peritonitis was defined as peritonitis caused by external causes of injury at the abdominal cavity that perforated or compromised the continuity of the bowel. Primary intra-abdominal pathology cause of peritonitis was defined as a systemic or localized disease, affecting the continuity of the bowel and generating perforations, leaks, and severe peritonitis.

In addition, we recorded multiple organ dysfunction syndrome (MODS) [19] obtained during ICU stay, and presence or development during hospitalization of septic shock defined as a state of acute circulatory failure characterized by persistent arterial hypotension unexplained by other causes and without response to crystalloids and the use of vassopresors [14,15].

Regarding the surgical management we recorded the type of the anatomical resection (small bowel or colon), culture of peritoneal exudates performed at index laparotomy and in subsequent laparotomies, and number of laparotomies needed to ensure cleanness of the abdominal cavity.

The following outcomes measures were collected: days required of mechanical ventilation, days required in the ICU, days required in hospital, development of fistulas and leaks after surgical treatment, presence of acute respiratory distress syndrome (ARDS) [20], and mortality.

Fistulas and leaks after surgical treatment was collected in our database as an event that is identified at any time after temporally ligature of proximal and distal ends of the bowel or diversion was performed and during the hospital course until hospital discharge. This

definition of fistula and leaks did not include cases with fistulas and leakages from previous surgeries before the development of secondary peritonitis and fistulas that were not related to the anastomosis or diversion procedures as pancreatic fistulas or fistulas from different etiologies. Mortality was defined as death from any cause during the follow-up.

Statistical analysis

Patients were categorized and analyzed according to the surgical treatment provided during first laparotomy (DPA or diversion) to resolve the severe secondary peritonitis. Comparisons of all variables were performed between the two treatment groups (patients with DPA versus patients with diversion). To determine differences, unpaired *t* test or Mann–Whitney test in quantitative variables, and chi-square test and two-tailed Fisher's exact test in qualitative variables, were used as appropriate. A value of $p < 0.05$ was considered statistically significant. In survivors, hospital and ICU length of stay and days of required mechanical ventilation were analyzed by the Kaplan–Meier method and compared using the log-rank test for equality of survivor function [21]. Subgroup analyses of the outcome variables and the hospital course in survivors were performed by type of anatomic resection (small bowel and colon). Statistical analyses were performed with STATA (version 9.1) software.

This was a retrospective chart review and therefore was considered a low-risk study according to the scientific, technical, and administrative rules for research in health in Colombia (Res. No. 8430/1993 of Colombian's Health Department). Personal identification variables from the subjects under the study were removed to preserve patient confidentiality. Ethics committee of the Fundación Valle del Lili approved the methodology of this study.

Results

A total of 112 patients, operated between November 2000 and December 2006, were found eligible for the study. DPA was performed in 34 patients (30.3%), and a diversion was performed in 78 patients (69.7%). Initial patient characteristics are depicted in Table 1. On admission, both groups were comparable with regard to age, gender distribution, APACHE II scores, and cause of peritonitis. Twenty-three patients (68%) of the DPA group and 45 (58%) patients of the diversion group were men. The mean age of patients was 57.2 years in the DPA group and 55.4 years in the diversion group. The causes of peritonitis in the DPA group were: postoperative in 18 patients (53%), primary intra-abdominal pathology in 12 patients (35%), and traumatic in 4 patients (12%). The causes in the diversion group were postoperative in 35 patients (45%), primary intra-abdominal pathology in 24 patients (31%) and traumatic in 19 patients (24%). The mean APACHE II score for patients in the DPA group was 16.1 and for patients in the diversion group was 14.5. The percentage of patients who developed septic shock before the surgery or during hospitalization was 73.5% (25 patients) in the DPA group and 60.2% (47 patients) in the diversion group. MODS score was measured during first 48 hours in the ICU. Patients in the DPA group had higher initial MODS scores compared with patients in the diversion group (4.7 vs. 3.5 respectively, $p = 0.003$; Table 1).

Surgical management

In the DPA group, small-bowel resections were performed in 18 patients (52.9%) and colon resections in 16 patients (47.1%). In the diversion group, small-bowel resections were performed in 16 patients (20.5%) and colon resections in 62 patients (79.5%). The difference in proportions of type of anatomical resection between groups was statistically significant ($p = 0.001$) and this is shown in Table 1.

In the DPA group, ileo-ileo anastomoses were performed in 16 patients with small-bowel resections. In two patients with small-bowel resection it was technically impossible to restore the normal enteric transit creating an anastomosis and, therefore, a diverting procedure was performed. Colon-colonic anastomoses were performed in ten patients with colon resection and ileo-colon anastomoses in three patients who underwent ileo-colonic resections. In three patients with colon resection it was technically impossible to restore the normal enteric transit creating an anastomosis and, therefore, a diverting procedure was performed. The overall successful rate of DPA procedures was 85.3%. The successful rate of DPA in patients with a small-bowel resection was 88.9% (16 patients). The successful rate of DPA in patients with colon resections was 81.2% (13 patients). When we compared the successful rate of DPA in patients with small-bowel resections versus the successful rate of DPA in patients with colon resections, the difference did not reach statistical significance ($p = 0.648$).

The average number of staged laparotomies was equal in DPA and diversion patients (4 laparotomies). Three patients in the diversion group did not need relaparotomy. No statistically significantly difference between groups was observed (Table 1).

Data on cultures from peritoneal exudates are depicted in Table 2. During the first intervention, 31 patients (91.2%) in the DPA group were positive for bacteria. The most frequent isolated microorganisms were *Escherichia coli* (11 patients) and *Enterococcus fecalis* (5 patients). In subsequent laparotomies, 22 patients (64.7%) were positive. The three patients who were negative during the first intervention remained negative in subsequent laparotomies. The predominant organisms isolated during subsequent laparotomies were *Pseudomona aureginosa* (6 patients) and *E. fecalis* (5 patients). There were 17 patients (50%) in the DPA group in whom the first peritoneal exudates during the first laparotomy reported bacteria resistance to the initial antibiotic scheme and, hence, antibiotic scheme was switched to carbapenems. Thirteen patients (38.2%) with evidence of fungus received treatment.

In the diversion group, 65 patients (83.3%) were positive for bacteria during the first laparotomy. The most frequent isolated microorganisms were *E. coli* (26 patients), *E. fecalis* (9 patients), and *P. aureginosa* (7 patients). In subsequent laparotomies 50 patients (64.1%) were positive. From the 13 patients who were negative in the first laparotomy, 1 patient became positive in subsequent laparotomies. The predominant microorganism isolated during subsequent laparotomies were *E. fecalis* (13 patients), *P. aureginosa* (9 patients), and *E. coli* (8 patients). There were 33 patients (42.3%) in the diversion group in whom the first peritoneal exudates during the first laparotomy reported bacteria resistant to the initial antibiotic scheme, and hence, the antibiotic scheme was switched to carbapenems. Twenty patients (25.6%) with evidence of fungus received treatment.

Comparisons on cultures from peritoneal exudates indicated no statistically significantly differences between the DPA and the diversion groups (Table 2).

Outcomes

Outcome variables according to treatment are depicted in Table 3. After DPA, three (8.8%) patients developed fistulas and leaks. Two patients developed a small-bowel fistula; one resolved without surgical intervention and the other required deferred surgical repair. One patient developed a colonic fistula and was successfully managed conservatively.

After diversion, four patients (5.1%) developed fistulas or leaks. One patient developed a small-bowel fistula from a small-bowel repair performed during the damage control laparotomy in which the ostomy was performed. Although this leak was not from the

ostomy itself, we considered it as part of the protocol for diversion and included as a complication of the diversion procedure. One patient developed a colonic fistula from the distal end, and two patients developed a colonic leakage from invaginating stoma, which subsequently leaked into the peritoneum.

The percentage of patients who developed ARDS after surgical intervention and during ICU was 17.6% in the DPA group and 30.1% in the diversion group ($p = 0.149$). Mortality was approximately 11.8% in the DPA group and approximately 16.7% in the diversion group. Mortality between groups did not reach statistical significance ($p = 0.51$).

Hospital course outcomes for survivors

Comparison of hospital courses between groups among survivors is shown in Table 4. The log-rank test for equality of survivor function indicated that time to discharge from hospitalization in DPA and diversion patients was not statistically significantly different ($p = 0.975$). The Kaplan-Meier method for equality of survivor function showed that DPA patients' discharged from ICU earlier than diversion patients; however, the log-rank test indicated that this difference was not statistically significant ($p = 0.914$). In the diversion group, one patient required mechanical ventilation for 53 days. The log-rank test for equality of survivor function indicated that days on mechanical ventilation between groups were not statistically significantly different ($p = 0.971$).

Subgroup analysis by anatomical resection

We conducted a subgroup analysis of the outcome variables separately in patients with small-bowel resections and in patients with colon resections (Table 3). Also, we compared hospital courses between groups among survivors separately in patients with small-bowel resections and in patients with colon resections (Table 4). Comparison of outcomes and hospital courses among survivors in patients with small-bowel and colon resection did not reach statistically significantly differences.

Discussion

The implementation of an aggressive surgical control of the infecting source of peritonitis managed with staged laparotomies plus deferred primary anastomosis has complication rates, mortality rates, and hospital courses equal to those reported in the diversion group, in critically ill patients with severe secondary peritonitis managed in our institution. These results were consistent in global and subgroup analyses.

Some limitations have to be acknowledged. Bias selection resulting from the fact that the patients' management was based on individual surgeon opinion cannot be completely ruled out. Because of the retrospective nature of this review, differences in management could not be determined. It is possible that other differences in management might have occurred in addition to that of the surgical creation of an anastomosis versus a diverting ostomy. It is not possible always, especially in surgical treatments, to randomize interventions, and less possible to blind and conceal from the investigator team. However, the support of internal validity of this study is that patients' characteristics on both groups were comparable. They were seemingly equal in demographic characteristics and patients in the DPA group were seemingly sicker as defined by the initial MODS score.

Generalizability might be a concern in this study. Demographic characteristics and comorbidity profiles of our population may vary the incidence of the disease, the mortality, and the morbidity outcomes that we have evaluated. Applicability of this surgical procedure in our critically ill patients with secondary peritonitis, for both small bowel and colon, might

be valid and feasible. Nevertheless, reproducibility and validation of this data will be required in patients from other populations.

The paucity of a randomized, controlled trial comparing primary anastomoses versus diversions and the fear of anastomotic breakdown are some reasons why surgeons are reluctant to perform a primary anastomosis, especially in patients with hemodynamic instability accompanied by purulent or fecal peritonitis, presence of fecal loading, bowel wall edema, and ischemia. Furthermore, these patients usually present with associated conditions, such as, malnutrition, and other concomitant diseases [22]. The clinical characteristics of these patients and the details of the surgical strategies implemented during staged laparotomies are not fully described nor can they be systematically analyzed. Perhaps for these reasons, it is challenging when and how a DPA may be a better alternative in these complicated patients.

Published data suggest that in complicated peritonitis secondary to small bowel and colonic pathologies, primary anastomosis is a safe procedure. This is more accepted for pathologies located in the small bowel and, based on risk assessment, is becoming more accepted in pathologies located in the colon [6,23].

In postoperative peritonitis after colonoscopic perforations, primary repair is performed in more than half of the cases, usually the same day when the perforation occurred. Resection with anastomosis was performed in 25% of the cases and a colonic diversion in 19% of the cases [24]. Other series reported a 29% rate of primary repair, 33% of intestinal resection with primary anastomosis, and 38% of diversion procedures. In these cases morbidity was associated with factor, such as time to diagnosis and age, rather than the type of the procedure performed to resolve the peritonitis [25].

In studies examined, the management of abdominal wounds that resulted in destructive colon injuries, clinical judgment often is used in deciding the type of operative management in these injuries—the same approach described in our study. The results supported primary anastomosis for destructive colon injuries regardless of the presence of previously identified risk factors and avoiding the need for a diverting procedure [26,27]. Nonetheless, resection and primary anastomosis may not be the optimal treatment for all colonic wounds. In penetrating colon injuries that have high rates of infectious morbidity, the development of infectious complications have to be more with the injury severity and the hemodynamic status, rather than the type of operation performed [28–30].

After diversion, stoma-related complications are estimated to be 10%, which requires a meticulous technique when they are being constructed [10]. It is because of this added morbidity that patients prefer to live without stomas and primary anastomosis has been subsequently suggested in the management of peritonitis secondary to a ruptured hollow viscus, with less morbidity and similar mortality [5,6]. Reestablishing bowel continuity should translate into additional months with better quality of life, diminished morbidity, and resource utilizations related to subsequent procedures needed for the takedown of bowel ostomies.

Conclusions

We did not find differences in morbidity or mortality in patients with small bowel and colon pathologies when we compared a protocol for DPA versus a protocol for diversion. In critically ill patients in our institution, DPA is as safe a surgical procedure as diversion for the treatment of severe secondary peritonitis managed with staged laparotomies. This study demonstrates that DPA can be performed safely in patients with severe peritonitis as long as the clinical criteria for improved sepsis and adequate control of the septic focci is achieved

during the staged laparotomy strategy. This paper can add to the growing database on this subject in the literature—that it is feasible to perform a definitive DPA in critically ill patients with severe peritonitis secondary to bowel perforation.

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Table 1

Patient and surgical management characteristics according to treatment

Variable	DPA (*n* = 34)	Diversion (*n* = 78)	*p* Value
Gender			
Male	23 (67.6)	45 (57.7)	0.32[a]
Female	11 (32.3)	33 (42.3)	
Age (yr)			
Mean (SD)	57.2 (21.6)	55.4 (19.3)	0.67[b]
Median (PR)	60 (24–87)	59 (20–83)	
Range	18–91	18–86	
Causes of peritonitis			
Postoperative	18 (52.9)	35 (44.9)	0.32[a]
Intra-abdominal pathology	12 (35.3)	24 (30.8)	
Trauma	4 (11.8)	19 (24.4)	
APACHE II score			
<11	8 (23.5)	18 (23.1)	0.87[c]
11–25	24 (70.6)	57 (73.1)	
>25	2. (5.9)	3 (3.8)	
Mean (SD)	16.1 (7.1)	14.5 (5.4)	0.24[b]
Median (PR)	16 (7–24)	14 (7–25)	
Range	3–29	1–28	
Septic shock	25 (73.5)	47 (60.3)	0.25[a]
MOD score			
Mean (SD)	4.7 (2.5)	3.5 (4.2)	0.003[d]
Median (PR)	4.5 (1–8)	2 (0–13)	
Range	0–11	0–15	
Anatomic resection			
Small bowel	18 (52.9)	16 (20.5)	0.001[a]
Colon	16 (47.1)	62 (79.5)	
No. of laparotomies			
Mean (SD)	4.0 (2.7)	4.1 (3.1)	0.78[d]
Median (PR)	3.5 (2–6)	3 (1–11)	
Range	1–13	0–14	

Data are numbers with percentages in parentheses unless otherwise indicated

DPA deferred primary anastomosis, *SD* standard deviation, *PR* percentile range

[a] Chi-square test;

[b] Unpaired *t* test;

[c] Fisher's exact test;

[d] Mann–Whitney test

Table 2

Data on cultures from peritoneal exudates according to treatment

Peritoneal exudates	DPA (*n* = 34)	Diversion (*n* = 78)	*p* Value
Culture positive for bacteria during first laparotomy	31 (91.2)	65 (83.3)	0.22[a]
Culture positive for bacteria during subsequent laparotomies	22 (64.7)	50 (64.1)	0.95[b]
Bacteria resistance to initial antibiotic scheme	17 (50.0)	33 (42.3)	0.45[b]
Culture positive for fungus at any laparotomy	13 (38.2)	20 (25.6)	0.18[b]

Data are numbers with percentages in parentheses unless otherwise indicated

DPA deferred primary anastomosis

[a] Fisher's exact test;

[b] chi-square test

Table 3

Outcome variables according to treatment

Variable	DPA	Diversion	*p* Value
All patients	*n* = 34	*n* = 78	
Fistulas or leaks	3 (8.8)	4 (5.1)	0.36[a]
ADRS	6 (17.6)	24 (30.8)	0.15[b]
Mortality	4 (11.8)	13 (16.7)	0.51[b]
Patients with small-bowel resection	*n* = 18	*n* = 16	
Fistulas or leaks	2 (11.1)	1 (6.2)	0.55[a]
ADRS	4 (22.2)	5 (31.3)	0.42[a]
Mortality	2 (11.1)	1 (6.3)	0.55[a]
Patients with colon resection	*n* = 16	*n* = 62	
Fistulas or leaks	1 (6.2)	3 (4.8)	0.61[a]
ADRS	2 (12.5)	19 (30.6)	0.12[a]
Mortality	2 (12.5)	12 (19.3)	0.41[a]

Data are numbers with percentages in parentheses unless otherwise indicated

DPA deferred primary anastomosis, *ADRS* acute respiratory distress syndrome, *SD* standard deviation

[a] Fisher's exact test;

[b] chi-square test

Table 4

Hospital course outcomes according to treatment for patients discharged alive

Variable	DPA	Diversion	*p* Value[a]
All survivors	*n* = 30	*n* = 65	
Days of hospitalization			
Mean (SD)	29.3 (19.1)	29.5 (18.6)	0.90
Median (PR)	22.5 (15–39)	24 (19–35)	
Range	8–82	6–82	
Days of ICU			
Mean (SD)	17.9 (10.2)	16.7 (12.2)	0.32
Median (PR)	16 (10–25)	14 (7–23)	
Range	4–38	0–61	
Days of mechanical ventilation			
Mean (SD)	9.3 (7.2)	9 (9.6)	0.35
Median (PR)	7.5 (4–12)	5 (4–12)	
Range	1–29	0–53	
Survivors with small-bowel resection	*n* = 16	*n* = 15	
Days of hospitalization			
Mean (SD)	30.7 (17.1)	34.7 (23.4)	0.89
Median (PR)	30 (15–39)	26 (19–52)	
Range	8–63	8–82	
Days of ICU			
Mean (SD)	18.6 (9.6)	16.7 (8.9)	0.57
Median (PR)	18 (10–25)	14 (10–24)	
Range	6–38	5–36	
Days of mechanical ventilation			
Mean (SD)	8.9 (6.9)	8.1 (6.9)	0.68
Median (PR)	8 (4–11)	5 (4–12)	
Range	1–24	1–26	
Survivors with colon resection	*n* = 14	*n* = 50	
Days of hospitalization			
Mean (SD)	27.4 (22)	27.9 (16.9)	0.30
Median (PR)	18 (15–24)	22.5 (19–34)	
Range	8–82	6–75	
Days of ICU			
Mean (SD)	17.1 (11.1)	16.7 (13.1)	0.81
Median (PR)	12 (11–25)	13.5 (6–23)	
Range	4–36	0–61	
Days of mechanical ventilation			
Mean (SD)	9.8 (7.9)	9.2 (10.3)	0.41
Median (PR)	7 (6–12)	6 (2–12)	
Range	1–29	0–53	

DPA deferred primary anastomosis, *SD* standard deviation, *PR* percentile range

[a] Mann–Whitney test