Risk factors and predictors of mortality in cases of on-demand re-laparotomy due to complicated intraperitoneal Sepsis: a prospective study

Original Article

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ABSTRACT

Background: Relaparotomy patients burden healthcare systems, especially in low-income centers. With over occupying ICU beds at the hospital, numerous patients were not admitted to the ICU despite multiple surgeries and adverse events requiring strict supervision, so in this study we aimed to determine the risk factors and predictors of mortality in patients who underwent on-demand re-laparotomy (OD) due to complicated intraperitoneal sepsis.

Methods: A total of 113 patients who needed re-laparotomy for complicated intraperitoneal sepsis were included in the study. Patients who underwent planned re-laparotomy (PR) or were re-explored laparoscopically were excluded. We followed with laboratory and radiological investigations to evaluate improvement, wound infection, anastomotic leakage, hemorrhage, burst abdomen, surgical re-exploration and mortality.

Results: Mortality was greater in males (87.9 %), patients with chronic kidney disease (12.1 %), patients with coronavirus disease 2019 (27.3 %), patients with a negative surgical history of previous abdominal surgery, and patients with a presentation of acute abdomen (60.6 %). There were statistically significant differences between survived and mortality cases in terms of the procedure, operative findings, surgical site, preoperative shock, surgical procedure, admission to the ICU, and outcome of the intervention.

Multi-organ failure Conclusion: Our study revealed the following factors are predictors of mortality in patients who needed OD due to complicated intraperitoneal sepsis: , pre-re-exploration shock, a time since primary surgery 7 days or more, the operative finding of mesenteric vascular occlusion and intestinal gangrene, intestinal leakage, postoperative ICU admission, postoperative burst abdomen, and postoperative chest infection.

Key Words: Burst abdomen, complicated intraperitoneal sepsis, on-demand relaparotomy, planned relaparotomy.

Received: 7 January 2024, **Accepted:** 29 January 2024, **Publish:** 07 July 2024

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ISSN: 1110-1121, July 2024, Vol. 43, No. 3: 256–264 © The Egyptian Journal of Surgery

INTRODUCTION

Intra-abdominal infections involve many pathological conditions and are frequently classified as uncomplicated or complicated. In the context of complicated intra-abdominal infections, such infection spreads beyond the organ and induces localized or diffuse peritonitis. Complicated intra-abdominal infections are an essential etiology of morbimortality and may be accompanied by poor prognosis; therefore, the treatment of these patients involves both control of the source of infection and administering antibiotics[1].

Surgical adaptation is recorded to persist for two months, during which the body reacts to surgical stress. As a result, re-laparotomy (RL) occurs within the onset of adaptation. There are two kinds of RL: planned re-laparotomy (PR) and on-demand re-laparotomy (OD). Repeated surgeries can be described as operations performed outside this adaptation[2].

The PR procedure requires all patients with complicated sepsis to return to the operating room every two days until proper source control is achieved. With the OD procedure, all patients are managed expectantly and only patients manifesting signs of unresolved intra-abdominal sepsis are exposed to repeat surgery[3].

Problems in developing nations include patient delay to initial manifestations and resource limitations, particularly intensive care resources and limitations in the postsurgical supervision of such patients[4]. Such limitations make an OD plan more challenging, as any delay in reoperation has been demonstrated to increase morbimortality[5].

DOI: 10.21608/EJSUR.2024.274050.1002

The factors that affect the outcomes of patients who undergo RL include patient demographic features, the indication for the first surgery, the urgency of the first surgery and the duration between the first surgery and the RL. RL performed for dehiscence and early obstruction has been demonstrated to be accompanied by minimal risk; on the other hand, RL for bleeding and infection entails moderate risk. The highest rate of mortality occurs when RL is performed for anastomotic leakage. The mortality rate is greater in older age groups and those with multiple RL[6].

A previous study with multivariate analyses recognized age, disease severity and adverse events as prognostic factors for survival, but therapeutic plans were not evaluated. It might be argued that the surgeon's choice for an individual patient, according to the ability to predict disease severity rather than the therapeutic plan, correlated with the outcome[7].

Notably, PR yielded negative findings in 66 % of the patients and, as a result, had no therapeutic effect on these patients. Improving patient selection for RL in the OD plan however, is important as 31 % of such patients also had a negative RL[8].

RL patients place enormous demands on healthcare systems, especially in low-income centers. With over occupying ICU beds at the hospital, numerous patients were not admitted to the ICU despite multiple surgeries and adverse events requiring strict supervision. Management of patients with severe electrolyte disturbance and metabolic effects outside the ICU could be accompanied by a high mortality rate[9]. Hence we aimed to determine the risk factors and predictors of mortality in cases of OD due to complicated intraperitoneal sepsis.

PATIENTS AND METHODS:

This was a prospective study, conducted at Mansoura University Hospital from August 2021 to August 2023. This study included 113 patients who needed RL for complicated intraperitoneal sepsis.

Inclusion criteria

We included patients who had previous operations either inside or outside Mansoura University Hospitals and needed RL at the General Surgery Department, Mansoura University Hospital. We excluded patients who underwent PR and re-explored laparoscopically.

Methods

The enrolled patients were subjected to full history taken from the patient himself or his relatives if they presented with altered mental status; personal history including name, age, sex, occupation, marital status and smoking history; present history including details about the complaints' onset, course, duration and medications used to relieve this complaint before attending to the emergency hospital; associated symptoms such as (fever, diffuse abdominal pain, vomiting, constipation and urine output); past medical history including major illnesses, any previous surgery and any concurrent illness such as chronic kidney disease (CKD) and diabetes and detailed history of the previous operation including the timing of intervention, cause of intervention and intraoperative findings.

The examination included a general examination that assessed the level of consciousness according to the GCS score, special decubitus status, blood pressure, pulse and urine output, while the local examination included an abdominal examination: (inspection, palpation, percussion and auscultation).

Investigations

The laboratory investigations included complete blood count, arterial blood gas analysis, serum creatinine level, liver function test and international normalized ratio (INR). The radiological findings included abdominal radiography, chest radiography, pelvic-abdominal ultrasound and computed tomography (CT) images of the abdomen and pelvis.

Preoperative preparation

Before the operation, we used a Ryle tube if indicated. A urinary catheter, central venous catheter, good resuscitation and correction of fluids and electrolyte imbalance were done. We administrated thromboprophylaxis measures and triple antibiotics for full coverage.

Operative technique

The patients were generally anesthetized and in the supine position and a midline abdominal incision was made. We fully explored all quadrants of the abdominal cavity and examined all intraperitoneal organs. We performed irrigation and suction of any intra-abdominal collection to detect the source of sepsis and deal with it. Afterward, we inserted wide pore drains pelvic, hepatorenal, lienorenal and closure was started by the closure of the linea alba. Afterwards, the skin was closed.

Data collection

We collected data about shock state, abdominal pain, wound infection and drains (amount and color of drained fluid). Operative findings that included the source of infection, intra-abdominal free fluid and collections, affected organs and surgical procedures. Postoperative findings included medical complications inform of cardiological complications (congestive heart failure, atrial fibrillation), respiratory complications (pneumonia, pulmonary embolism), renal complications

(acute renal failure),and infection (septic shock). Surgical complications included infection (wound infection, abdominal collection), leak (anastomotic leak, suture leak), hemorrhagic (gastrointestinal bleeding) and others (mechanical ileus, mesenteric ischemia).

Follow-up

We followed-up with laboratory and radiological investigations to evaluate the patients' improvement, wound infection, anastomotic leakage, hemorrhage, burst abdomen, nutritional state, state of stoma if present (functioning, prolapsed and slipped stoma), surgical re-exploration (intestinal fistula, intra-abdominal collection, repositioning of stoma if present) and death.

Statistical analysis and data interpretation

Data analysis was carried out by SPSS software, version 25 (PASW statistics version 25 Chicago: SPSS Inc.). Qualitative data were described using numbers and percentages. Quantitative data were described using median for non-normally distributed data and mean±SD for normally distributed data after testing normality using Kolmogrov–Smirnov test. The significance of the obtained results was judged at the (≤ 0.05) level. χ^2, Fischer exact test and Monte Carlo tests were utilized for comparison of qualitative data between groups as appropriate. The Mann–Whitney U test was utilized for comparison between two groups for non-normally distributed data.

RESULTS:

This was a prospective study that included 113 patients who needed OD for complicated intraperitoneal sepsis. Table 1 shows that median age of the studied cases is 39 years ranging from 17 to 86 years, of them 58.4 % are males, 28.3 % have a history of diabetes, 22.1 % are hypertensive, 5.3 % cardiac, 4.4 % coagulopathy, 3.5 % CKD, 14.2 % coronavirus disease 2019 (COVID-19), 31.9 % obese, 1.8 % hepatic and 23 % surgical history of previous abdominal surgery.

Table 2 shows that there were no statistically significant differences between survived and mortality cases as regards the age of the studied cases, diabetes, hypertension, coagulopathy, obesity and hepatic affection ($P > 0.05$). A statistically significant difference between survived and mortality cases was detected for sex, cardiac, CKD, COVID-19, surgical history of previous abdominal surgery and clinical presentation.

Table 3 shows that there was a statistically significant difference between survived and mortality cases as regards a procedure, operative findings and surgical site ($P < 0.05$). Among the patients who died, 75.8 % underwent midline surgery, 15.2 % underwent grid iron surgery and 9.1 % underwent laparoscopy. The operative findings in the patients who died were as follows: 24.2 % had perforated viscus, 21.2 % had MVO and 18.2 % had cancer in the colon.

Table 1: Demographic characteristics and Comorbidities of the studied patients:

	N = 113 (%)
Age/years	39 (17–86)
Sex	
Male	66 (58.4)
Female	47 (41.6)
Medical History	
DM	
–ve	81 (71.7)
+ve	32 (28.3)
Hypertension	
–ve	88 (77.9)
+ve	25 (22.1)
Cardiac	
–ve	107 (94.7)
+ve	6 (5.3)
Coagulopathy	
–ve	108 (95.6)
+ve	5 (4.4)
CKD	
–ve	109 (96.5)
+ve	4 (3.5)
COVID-19	
–ve	97 (85.8)
+ve	16 (14.2)
Obesity	
–ve	77 (68.1)
+ve	36 (31.9)
Hepatic	
–ve	111 (98.2)
+ve	2 (1.8)
Surgical history previous abdominal surgery	
–ve	87 (77.0)
+ve	26 (23.0)

Table 2: Comparison of sociodemographic data and comorbidities between survived and mortality cases:

	Survived n = 80 (%)	Mortality n = 33 (%)	Test of significance
Age/years	43.73 ± 16.63	45.15 ± 17.61	t = 0.408 *P* = 0.684
Sex			
Male	37 (46.2)	29 (87.9)	χ^2 = 16.67
Female	43 (53.8)	4 (12.1)	*P* < 0.001*
DM			
–ve	57 (71.2)	24 (72.7)	χ^2 = 0.025
+ve	23 (28.8)	9 (27.3)	*P* = 1.0
Hypertension			
–ve	61 (76.2)	27 (81.8)	χ^2 = 0.420
+ve	19 (23.8)	6 (18.2)	*P* = 0.517
Cardiac			
–ve	78 (97.5)	29 (87.9)	χ^2 = 4.30
+ve	2 (2.5)	4 (12.1)	*P* = 0.038*
Coagulopathy			
–ve	78 (97.5)	30 (90.9)	FET = 2.4
+ve	2 (2.5)	3 (9.1)	*P* = 0.148
CKD			
–ve	80 (100)	29 (87.9)	FET = 10.05
+ve	0	4 (12.1)	*P* = 0.006*
COVID-19			
–ve	73 (91.2)	24 (72.7)	χ^2 = 6.59
+ve	7 (8.8)	9 (27.3)	*P* = 0.01*
Obesity			
–ve	51 (63.8)	26 (78.8)	χ^2 = 2.43
+ve	29 (36.2)	7 (21.2)	*P* = 0.119
Hepatic			
–ve	78 (97.5)	33 (100)	FET = 0.840
+ve	2 (2.5)	0	*P* = 1.0
Surgical history previous abdominal surgery			
–ve	56 (70)	31 (93.9)	χ^2 = 7.56
+ve	24 (30)	2 (6.1)	*P* = 0.006*
Clinical presentation			
Abdominal trauma	6 (7.5)	6 (18.2)	MC = 27.16
Acute abdomen	37 (46.2)	20 (60.6)	*P* < 0.001*
Delivery	7 (8.8)	0	
Intestinal obstruction	15 (18.8)	2 (6.1)	
Morbid obesity	0	3 (9.1)	
Stoma closure	2 (2.5)	0	
Vaginal bleeding	13 (16.2)	0	
Rectosigmoid cancer	0	2 (6.1)	

χ^2, Chi-Square test; FET, Fischer exact test; MC, Monte Carlo test.
*Statistically significant.

Table 3: Comparison of primary surgery data between survived and mortality cases:

	Survived n = 80 (%)	Mortality n = 33 (%)	Test of significance
Procedure			
Trans vaginal	2 (2.5)	0	MC = 18.11
Right paramedian	3 (3.8)	0	*P* = 0.005*
Pfannenstiel	15 (18.8)	0	
Mid line	46 (57.5)	25 (75.8)	
Laparoscope	2 (2.5)	3 (9.1)	
Grid iron	4 (5.0)	5 (15.2)	
Local exploration	8 (10.0)	0	
Shock			
–ve	63 (78.8)	23 (69.7)	χ^2 = 1.05
+ve	17 (21.2)	10 (30.3)	*P* = 0.337
Operative findings			
Obstructed hernia	4 (5.0)	1 (3.0)	MC = 25.6
Perforated viscus	23 (28.8)	8 (24.2)	*P* = 0.02*
Cancer colon	3 (3.8)	6 (18.2)	
Appendicitis	11 (13.8)	3 (9.0)	
Acute necrotizing pancreatitis	1 (1.25)	2 (6.1)	
Ischemic colitis	0	2 (6.1)	
Sigmoid volvulus	2 (2.5)	0	
MVO	10 (12.5)	7 (21.2)	
Fibroid	6 (7.5)	2 (6.1)	
Adhesive IO	3 (3.8)	0	
Endometrial hyperplasia	2 (2.5)	0	
Splenic injury	2 (2.5)	0	
Gravid uterus	6 (5.3)	1 (3.0)	
Morbid obesity for lap sleeve	2 (2.5)	1 (3.0)	
DB ileostomy	3 (3.8)	0	
Hartman colostomy	2 (2.5)	0	

MC, Monte Carlo test; χ^2, Chi-Square test.

*statistically significant.

Table 4 shows a statistically significant difference between survived and mortality cases as regards preoperative shock and preoperative presentation ($P < 0.05$). For died cases, 69.7 % have a history of preoperative shock, 45.5 % have acute abdomen, 33.3 % have an intestinal leak and 9.1 % have duodenal fistula. Median time since first surgery is higher among died cases 7 days versus 5 days for survived cases.

Table 4: Comparison of preoperative re-exploration data between survived and died case:

	Survived n = 80 (%)	Died n = 33 (%)	Test of significance
ICU			
–ve	57 (71.2)	19 (57.6)	$\chi^2 = 1.98$
+ve	23 (28.8)	14 (42.4)	$P = 0.159$
Pre operative shock			
–ve	50 (62.5)	10 (30.3)	$\chi^2 = 9.73$
+ve	30 (37.5)	23 (69.7)	$P = 0.002$*
Pre operative presentation			
Urine leak and necrotizing fasciitis	3 (3.8)	0	MC = 23.44
Slipped stoma	6 (7.5)	2 (6.1)	$P < 0.0001$*
Intestinal leak	50 (62.5)	11 (33.3)	
Fecal fistula	4 (5.0)	2 (6.1)	
Duodenal fistula	0	3 (9.1)	
Bile leak	5 (6.2)	0	
Acute Abdomen	12 (15.0)	15 (45.5)	
Time since 1ry surgery/days			Z = 2.49
Median (min–max)	5 (1–21)	7 (1–28)	$P = 0.013$*
Early	59 (73.8)	19 (57.6)	$\chi 2 = 2.86$
Late	21 (26.2)	14 (42.4)	$P = 0.09$

χ^2, Chi-Square test; MC, Monte Carlo test; Z, Mann–Whitney U test.

*statistically significant.

Table 5 shows that there was a statistically significant difference between survived and mortality cases in terms of operative findings, surgical procedure and surgeon experience ($P < 0.05$). Among the patients who died, 24.2 % had anastomotic leakage, 21.2 % had MVO and 15.2 % had intra-abdominal collection. Surgical procedures for patients who died cases, were 45.5 % resection and stoma, 33.3 % repair and stoma ileostomy/colostomy.

Table 6 shows a statistically significant difference between survived and mortality cases about admission to the ICU and outcome of intervention ($P < 0.05$). Among the patients who died, 90.9 % were admitted to the ICU, 57.6 % had chest infections, 24.2 % had burst abdomen and 6.1 % had ree-fistula and ree-leak.

Table 5: Comparison of operative re-exploration data between survived and mortality cases:

Operative data	Total n = 113	Survived n = 80 (%)	Mortality n = 33 (%)	Test of
Findings				
Intra-abdominal collection	17	12 (15.0)	5 (15.2)	Mc = 21.69
Necrotizing fasciitis	3	2 (2.5)	1 (3.0)	$P = 0.007$*
Slipped stoma	18	16 (20.0)	2 (6.1)	
Duodenal fistula	5	3 (3.8)	2 (6.1)	
MVO	13	6 (7.5)	7 (21.2)	
Anastomotic leakage	20	12 (15.0)	8 (24.2)	
Bile leakage	2	2 (2.5)	0	
Fecal fistula	6	3 (3.8)	3 (9.0)	
Missed or Iatrogenic injury	29	24 (30)	5 (15.2)	
Surgical procedure				
Toilet and drainage	19	14 (17.5)	5 (15.2)	MC = 35.2
Stoma refashioning	16	15 (18.8)	0	$P = 0.002$*
Resection and stoma	33	18 (22.5)	15 (45.5)	
Resection anastomosis	3	2 (2.5)	1 (3.0)	
Repair, stoma ileostomy/colostomy	36	25 (31.3)	11 (33.3)	
Pyloric exclusion and drainage	3	3 (3.8)	0	
Debridement and nephrostomy tube	3	2 (2.5)	1 (3.0)	

MC, Monte Carlo test; $\chi 2$, Chi-Square test.

*statistically significant.

Table 6: Comparison of postoperative data between survived and died case:

Postoperative Data	Survived n = 80 (%)	Mortality n = 33 (%)	Test of
Wound			
Normal	16 (20)	4 (12.1)	MC=2.89
Infected	54 (67.5)	21 (63.6)	$P = 0.235$
Burst	10 (12.5)	8 (24.2)	
ICU			
–ve	49 (61.2)	3 (9.1)	$\chi^2 = 25.59$
+ve	31 (38.8)	30 (90.9)	$P < 0.001$*
Hospital stay (days)	10 (2–25)	12 (2–45)	Z = 0.548 $P = 0.583$
Complications			
Re-leak	6 (7.5)	2 (6.1)	MC = 34.92
Re-fistula	2 (2.5)	2 (6.1)	$P < 0.001$*
Chest infection	18 (22.5)	19 (57.6)	

χ^2, Chi-Square test; MC, Monte Carlo test; Z, Mann–Whitney U test.

*statistically significant.

DISCUSSION

Despite improvements in antimicrobial therapies, surgical approaches and adequate care, the mortality of patients with extensive intra-abdominal infection is still high ranging from 22 % to 70 %[10] and this percentage is also higher among patients with multi-organ failure (MOF) at the onset of initial surgery[11]. The currently used therapy for extensive peritonitis relies on many principles, including early administration of antibiotics, efficient surgical control of infections and supportive care to maintain organ function and restrict the development of MOF[12].

Once surgery is needed, two factors must be considered. First, a single initial surgery is often inadequate for managing the infection and re-explorations are occasionally needed. Second, patients with extensive intra-abdominal infections could develop intra-abdominal hypertension which ultimately results in abdominal compartment syndrome. In the past, various surgical procedures were developed to improve the outcomes of patients with severe abdominal infections. The most commonly used approaches are OD ('wait and see' approach), continuous postoperative peritoneal lavage, open drainage and PR[13].

Accurately comparing the outcomes of different surgical procedures utilized in the context of peritonitis management is difficult as different studies have compared cases of different disease severities. The management of patients with different stages of abdominal infection could require an individualized surgical approach. This was best demonstrated by Holzheimer and Gathof[14] reported that the overall mortality in patients with diffuse peritonitis was ~30 %.

Once abdominal closure was accomplished at the termination of the PR, mortality was 18 %, but when closure was not feasible, mortality was 100 %. After initial abdominal closure, some patients continued to demonstrate features of abdominal sepsis; mortality was 38 % in patients who were re-explored and 67 % in those without re-exploration[15]. We aimed to determine the risk factors and predictors of mortality in patients who underwent OD due to complicated intraperitoneal sepsis.

Our study was a prospective study conducted at Mansoura University Hospital from August 2021 to August 2023. This study included 113 patients who needed OD for complicated intraperitoneal sepsis, to determine the risk factors and predictors of mortality.

A comparison of sociodemographic data and comorbidities between the surviving and mortality patients revealed nonsignificant differences between the surviving and mortality patients with regard to age, diabetes status, hypertension status, coagulopathy status, obesity status and hepatic manifestations ($P > 0.05$). Our study was consistent with the literature in identifying age as an independent variable predictive of mortality[10, 16, 17]. In contrast, according to a review of the literature, age[18, 19] and diabetes mellitus status[11, 18, 20] are considered important prognostic factors.

This study demonstrated a statistically significant difference between survived and mortality cases in terms of sex, cardiac status, chronic kidney disease, COVID-19 incidence, surgical history of previous abdominal surgery and clinical presentation. The mortality rates were greater for males (87.9 %), patients with CKD (12.1 %), patients with COVID-19 (27.3 %), patients with a negative surgical history of previous abdominal surgery and patients with acute abdomen (60.6 %). Similarly, several studies have shown that any severe organ failure and, more importantly, initial cardiac, renal, or hepatic, failure at the initiation of therapy also have a considerable impact on survival [11, 18, 20, 21].

In contrast, Torer *et al.*[22]. reported a 32 % mortality rate. Malignancy, MOF, lack of source control and the period between manifestation and the second surgery were found to be independent predisposing factors for mortality.

Preoperative findings of the studied patients revealed that 32.7 % of cases were admitted to the

ICU before the second operation and 46.9 % had preoperative shock. Preoperative presentation of the studied patients included 54 % intestinal leakage, 23.9 % acute abdomen, 7.1 % slipped stoma, 5.3 % fecal fistula, 4.4 % bile leakage and 2.7 % duodenal fistula. The median time since primary surgery was 5 days ranging from 1 to 28 days as 69 % of patients presented early in the 1st week after the primary surgery.

Our study revealed a statistically significant difference between survived and mortality cases about preoperative shock and preoperative presentation. Among the patients who died, 69.7 % had a history of preoperative shock, 45.5 % had acute abdomen, 33.3 % had intestinal leakage and 9.1 % had a duodenal fistula. The median time since the first surgery was greater among patients who died (7 days versus 5 days for surviving patients).

In agreement with the findings of Martínez-Ordaz *et al.*[23] who reported a statistically significant difference in mortality and the development of generalized peritonitis after the primary surgery, urgent primary laparotomy and the development of multiple organ failure. Moreover, Bensignor *et al.*[24] stated preoperative shock as a predictor of mortality.

In context, Koperna *et al.*[11] found that the mortality rate was significantly lower (9 %) in patients who underwent OD within two days after the initial operation and that the interval between the initial operation and the first reoperation affected patient survival.

Apparently, early RL resulted in better infection control and thus increased survival. On the other hand, this is not generally true because the severity of the patient's general condition, as indicated by the number of affected organs, has an essential role determining patient outcomes[10]. In contrast, Kiewiet *et al.*[25] stated that the length of ICU admission differed significantly between patients who needed a RL and those who did not.

Our study demonstrated a statistically significant difference between survived and mortality cases concerning the procedure and operative findings of primary surgery ($P < 0.05$). Among the patients who died, 75.8 % underwent midline surgery, 15.2 % underwent grid iron surgery and 9.1 % underwent laparoscopy. The operative findings were as follows: 24.2 % perforated viscus, 21.2 % MVO and 18.2 % cancer colon. Operative findings at re-exploration demonstrated that 25.7 % of the studied patients had missed or iatrogenic injury, 17.7 % had anastomotic leakage, 15 % had a collection, 11.5 % had MVO, 16 % had a slipped stoma, 5.3 % had a fecal fistula, 4.4 % had a duodenal blowout and 1.8% had bile leakage. The most common surgical procedures were resection and stoma (29.2 %), repair (29.2 %) and stoma ileostomy/colostomy.

Bensignor *et al.*[24] stated that conservative treatment was conducted in 65 % of patients. The remaining patients had generalized peritonitis, abnormal leakage through a drain, or abdominal scar with manifestations of sepsis or MOF that could not delay intervention.

Comparison of operative data between survived and died cases demonstrated a statistically significant difference between survived and mortality cases as regards operative findings and surgical procedures ($P < 0.05$). Among the patients who died, 24.2 % had anastomotic leakage, 21.2 % had mesoscopic vascular occlusion and 15.2 % had intra-abdominal collection. Surgical procedures for mortality were 45.5 % resection and stoma, 33.3 % repair and stoma ileostomy/colostomy.

In context, Martínez-Ordaz *et al.*[23] found a statistically significant association between mortality and the development of an intestinal fistula, wound infection and respiratory insufficiency. Likewise, acute mesenteric ischemia, intestinal obstruction, obstructed hernia and visceral perforation are the main etiologies of lethal outcomes in patients receiving re-laparotomies[26].

Comparison of postoperative data between survived and mortality cases showed a statistically significant difference between survived and mortality cases as regards admission to the ICU and outcome of intervention ($P < 0.05$ Among the patients who died, 90.9 % were admitted to the ICU, 57.6 % had chest infection, 24.2 % had burst abdomen and 6.1 % had re-fistula and re-leak.

Our results were in line with those of Bensignor *et al.*[24], who reported that ICU admission and delayed extubating were also predisposing factors for morbidity, as mechanical ventilation is known to be a predisposing factor for pneumonia. The literature recommends that extensive or persistent organ failure in the early postsurgical phase be considered the best indicator of positive findings and ongoing infection[7, 8].

CONCLUSION

According to our study, the predictors of mortality in patients who underwent on-demand RL due to complicated intra-abdominal sepsis were as follows: patient with multiorgan failure, prereexploration shock, time since primary surgery 7 days or more, operative finding of mesenteric vascular occlusion and intestinal

gangrene, the operative finding of intestinal leakage, postoperative ICU admission, postoperative burst of the abdomen and postoperative chest infection.

ABBREVIATION:

MVO: Mesentric Vascular Occlusion.

ACKNOWLEDGMENTS

Sources of funding: None.

All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2008 (5) reference number: MD.21.08.511.R1

Informed consent: informed consent was obtained from all patients for being included in the study.

CONFLICT OF INTEREST

There are no conflicts of interest.

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