Abdominal emergency surgery in patients over 90 years old: is it worthwhile? An Italian multicenter retrospective study

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Abstract

Unlike other surgical fields, such as cardiac surgery, where many trials have been made about safety, feasibility and outcome of surgical procedures in the elderly, there is lack of literature about emergency abdominal surgery in very old patients, especially in people over 90 years of age. The available data reported survival of about 50% one year after the operation.

The aim of the study is to determine the survival rate two years after emergency abdominal surgery in a nonagenarian population and to identify any demographic and surgical parameters that could predict a poor outcome in this type of patient.

The study was a retrospective multicenter trial. Patient inclusion criteria were: age 90 years old or older, urgent abdominal surgery. The medical charts reviewed and data collected were: gender, age, the American Society of Anesthesiologists (ASA) score and comorbidities, diagnosis, time elapsed between arrival to the Emergency Room and admission to the Operatory Room, surgical procedures, open versus laparoscopic procedure, type of anesthesia and outcomes with hospital length of stay. Phone call follow-up was performed for patient discharged alive and Kaplan-Meier analysis was used to evaluate survival.

We identified 72 (20 males and 52 females) nonagenarian patients who underwent abdominal emergency surgery at 6 Italian hospitals (Parma, Bergamo, Bologna, Brescia, Chiari, Adria). Mean age was 92.5 years [range 90-100, standard deviation (SD) 2.6], median ASA score was 3 (range 2-5, mean 3.32) and only 7 patients were without comorbidities. Mean hospital length of stay was 13 days (range 1-60, SD 11.52); 56 patients (77.7%) were discharged alive; 2 years survival rate was 23% [mean follow-up=10 months (range 1-27)]. Among all the parameters analyzed, only ASA score was significantly correlated with survival. Neither the presence of malignancy nor the absence of comorbidities seems to correlate with survival.

Nonagenarian patients undergoing emergent abdominal surgical procedures have a high overall in-hospital mortality rate (23%) and a low 2 years survival rate (51.4%). Except for ASA score, there are no other factors predicting poor outcome. Based on the present study emergency abdominal surgery in frail patients over 90 years of age has to be carefully evaluated: only 1 out 5 patients will be alive after 2 years.

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Introduction

The improvement in living conditions and the achievement of high standards of care during the past two decades resulted in a massive increase in life expectancy, which creates a new set of problems for the field of emergency surgery when treating older patients. According to the Italian National Institute for Statistics (*Istituto Nazionale di Statistica*, ISTAT), the Italian population aged 85 and older will increase from 2.8% of 2011 to 7.8% of 2050,[1] reaching an average life expectancy of 85.3 years for males and 90.5 years for females. With this continuous aging of the population the number of elderly patients requiring emer-

gency surgical intervention will rise dramatically: surgeons must decide whether surgical treatment is justified in these patients, balancing eventual benefits and surgical risks, the latter being markedly increased in an aged population because of their burden of pre-existing illness, and frailty. Another crucial issue is post-operative care: elderly patients frequently demand intensive care, rehabilitation and longer recovery times, even after minor surgery and a solid social support is necessary for full recovery. In this context, it is very hard to predict the outcome in an elderly patent, making it even harder to fully explain benefits and risks to their families or substitute decision-makers.

Furthermore, unlike other surgical fields, such as cardiac surgery, where lots of studies have been made about safety, feasibility and outcome of surgical procedures in the elderly, there is still a lack of consensus whether the available audit tools can be considered accurate in predicting morbidity and mortality in aged segments of the population after emergent abdominal surgery.[2,3]

The aim of the present study is to determine morbidity, mortality and survival rates in nonagenarian patients undergoing emergency abdominal surgery and to identify any demographic or surgical parameter that could predict a poor outcome in this cohort of patients.

Materials and Methods

The study was retrospective and multicenter. We identified all patients aged over 90 years old who underwent abdominal surgery in an emergency setting between January 2012 and December 2013 in six big hospitals in northern Italy (Parma, Adria, Bergamo, Bologna, Brescia, Chiari). Abdominal surgery was defined as any surgery performed in the peritoneal cavity, including abdominal wall hernia repair with or without bowel resection.

Medical charts were reviewed and several parameters were collected in a dedicated database, including age, sex, American Society of Anesthesiologists (ASA) score and comorbidities (heart-disease category included angina, coronary artery disease, myocardial infarction, congestive heart failure, arrhythmia and valvular heart disease; brain-disease category included cerebrovascular accident, Parkinson's disease, Alzheimer's disease, dementia and transient ischemic attacks; chronic renal failure was defined as any pre-existing increase in creatinine serum levels; diabetes included both type 1 and type 2; liver disease was defined as any pre-existing alteration of hepatic function, as demonstrated by altered liver-specific blood-test); diagnosis, time elapsed between hospital admission and emergency laparotomy, primary and secondary surgical procedure, duration of surgery, open versus laparoscopic procedure, type of anesthesia, hospital length of stay and in- hospital mortality were also recorded.

To assess survival a follow-up was performed via phone call to interview relatives of patients who were discharged alive.

Data regarding mortality in the general population over 90 years of age in Italy, during the period of the study, were obtained from ISTAT database.[4]

Statistical analysis was performed using SPSS™ (IBM Corp., Armonk, NY, USA) and using Kaplan-Meier survival estimator for univariate analysis, statistical significance was set at P=0.05.

Results

Seventy-two patients were identified: 20 (27.8%) were males and 52 (72.2%) were females. Mean age was 92.51 years [range 90-100, standard deviation (SD) 2.6] and mean ASA score was 3.32 (range 2-5, median 3) (Table 1).

Comorbidities were extremely common and only 7 patients (9.7%) had no comorbidities (Table 2); hypertension was the most common associated condition, affecting 53 patients (73.6%), followed by chronic heart disease (42 patients, 58.3%), chronic obstructive pulmonary disease (23 patients, 31.9%), chronic renal failure (affecting 21 patients, 29.2%) and diabetes (11 patients, 15.3%).

Gastrointestinal (GI) obstruction was the most common cause of operative intervention (26 cases, 36.1%), followed by presence of a complicated hernia (18 cases, 25%), GI perforation (12 cases, 16.7%) and acute cholecystitis (9 cases, 12.5%).

Table 3 contains a detailed overview of the different etiologies in each diagnostic subset, while Table 4 correlates operative indications and the associated in-hospital mortality: except for a case of massive mesenteric ischemia and a case of Ogilvie syndrome, GI perforation is associated with the highest in-hospital mortality (41.6%) and worst survival.

Table 5 provides an overview of the surgical procedures performed in each diagnostic subset: hernia repair (13 patients, 18.1%), adhesiolysis (10 patients, 13.9%), small bowel resection and anastomosis (10 patients, 13.9%) and cholecystectomy (8 patients, 11.1%) were the most commonly performed procedures, followed by large bowel resection and anastomosis (7 patients, 9.7%), colostomy (6 patients, 8.3%), large bowel resection and stoma (4 patients, 5.6%), appendectomy, peptic ulcer suture and palliative gastrojejunal anastomosis (respectively 3 patients, 4.2%); other procedures included diagnostic laparotomy for massive bowel ischemia, two cases of bleeding gastric neoplasia treat-

Table 1. General results (N=72).

Age (year)	Mean (SD), range	92.51 (2.6)	90-100
Sex	Male, no.	20	27.8%
	Female, no.	52	72.2%
ASA (mean ASA score: 3.32)	I, no.	0	0
	II, no.	5	6.94%
	III, no.	41	56.94%
	IV, no.	24	33.33%
	V, no.	2	2.78%
In-hospital mortality	Patients no., %	16	22.2%
Hospital length of stay	Average days, range	12.97	1-60 (SD 11.52)
Discharge (patients no., %)	Home	35	48.6%
	Nursing facility	21	29.2%

SD, standard deviation; American Society of Anesthesiologists (ASA).

Table 2. Preoperative comorbidities (N=72).

Hypertension, no.	53	73.6%
Heart disease, no.*	42	58.3%
COPD, no.	23	31.9%
Brain disease, no.°	21	29.2%
Chronic renal failure, no.#	21	29.1%
Diabetes, no.§	11	15.2%
Liver disease, no.^	6	8.3%
Chronic steroid use, no.	5	6.9%
No comorbidities	7	9.7%

*Heart-disease category included angina, coronary artery disease, myocardial infarction, congestive heart failure, arrhythmia and alular heart disease; °brain-disease category included cerebrovascular accident, Parkinson's disease, Alzheimer's disease, dementia and transient ischemic attacks; #chronic renal failure was defined as any pre-existing increase in creatinine serum levels; §diabetes included both type 1 and type 2; ^liver disease was defined as any pre-existing alteration of hepatic function, as demonstrated by altered liver-specific blood-test. COPD, chronic obstructive pulmonary disease.

Table 3. Different diagnosis subsets.

Diagnosis	Specific diagnosis		Cases, no.
GI obstruction (26 cases)	Small bowel obstruction	Ileal volvulus	11
		Adhesive obstruction	5
		Peritoneal carcinosis	1
	Large bowel obstruction	Colon neoplasia	5
		Sigmoid volvulus	1
	Gastro-duodenal obstruction	Hepatic cyst	1
		Infiltrating gallbladder neoplasia	1
		Infiltrating hepatic neoplasia	1
GI perforation (12 cases)	Gastric perforation	Perforated gastric ulcer	1
		Perforated gastric neoplasia	1
	Duodenal perforation	Iatrogenic duodenal perforation post ERCP	1
	Small bowel perforation	Foreign body perforation	1
	Large bowel perforation	Perforated colonic neoplasia	3
		Traumatic laceration	2
		Diverticular disease	1
		Ischemic colitis	1
		Unknown nature colonic perforation	1
GI bleeding (2 cases)	Bleeding gastric neoplasia		2

GI, gastrointestinal; ERCP, endoscopic retrograde cholangiopancreatography.

ed respectively with a total and a partial gastrectomy and fenestration of a huge liver cyst causing duodenal obstruction.

Table 4 correlates surgical procedures and the associated in-hospital mortality: it is interesting to highlight how different kinds of surgical procedures (*i.e.*, cholecystectomy, small bowel resection and anastomosis even when associated with hernia repair, appendectomy, Hartmann procedure and palliative gastro-jejunal anastomosis) have in-hospital mortality rates of 0%.

Out of the 72 procedures, 12 were laparoscopic and 61 were performed with general anesthesia; none of these factors has significant impact on survival.

Mean time between hospital admission and surgical procedure was 26.6 hours (range 1-168, SD±36.52); mean surgical length was 90.7 min (range 30-280, SD±47.19).

Mean hospital length of stay was 13 days (range 1-60, SD±11.52) (Table 1).

Of the 56 survivors, 21 (29.2%) were discharged from the hospital to a nursing home, while 35 patients (48.6%) went back home (Table 1).

Overall in-hospital mortality was 23.3% (17 patients) and global 2 year survival was 51.4% (mean follow-up time was 10 months (range 1-27) (Table 1).

Although life expectancy is higher for female population, no significant difference in mortality between males and females was found (P=0.688) (Figure 1).

Only ASA score was significantly correlated with survival (P<0.001) (Figure 2).

None of the comorbidities, when considered alone, significantly affected survival. Interestingly, also the absence of all the examined comorbidities was not correlated with survival (Figure 3).

Presence of malignancy as cause of the surgical procedure (15 cases, 20.8%) was also not associated with a worse survival (Figure 4).

Type of surgery and general anesthesia did no impact on survival (respectively P=0.869 and P=0.574).

There was also not a difference in survival between patients undergoing surgery within 12 h from hospital admission and those who had surgery performed after 12 h (P=0.289, Figure 5).

No statistical analysis correlating diagnosis or surgical procedure with mortality could be made, because subgroups were too small to perform a reliable Kaplan-Meier survival estimator (Table 4).

Table 4. Mortality according to diseases and procedures.

	Cases, no.	In-hospital mortality (%)
Disease		
Mesenteric ischemia	1	1 (100)
Ogilvie syndrome	1	1 (100)
GI perforation	12	5 (41.6)
GI obstruction	26	6 (23)
Complicated hernias	18	3 (16.7)
Acute cholecystitis	9	0 (0)
Acute appendicitis	3	0 (0)
GI bleeding	2	0 (0)
Procedure		
Explorative laparotomy	1	1 (100)
Hepatic cyst fenestration	1	1 (100)
Peptic ulcer repair	1	1 (100)
Duodenal perforation repair + GEA	1	1 (100)
Hernia repair + large bowel resection	1	1 (100)
Adesiolysis + ileostoma	1	1 (100)
Colostomy	4	2 (50)
Partial/total gastrectomy	2	1 (50)
Caecostomy	2	1 (50)
Adesiolysis	10	3 (30.0)
Large bowel resection and anastomosis	6	1 (16.6)
Hernia repair	13	2 (15.4)
Cholecystectomy	9	0 (0)
Small bowel resection and anastomosis	6	0 (0)
Hernia repair + small bowel resection	4	0 (0)
Appendectomy	3	0 (0)
Palliative GEA	3	0 (0)
Hartmann procedure	3	0 (0)
Large bowel resection and stoma	1	0 (0)

GI, gastrointestinal; GEA, gastroenteroanastomosis.

Discussion

Several studies have addressed the outcomes of elderly patients undergoing a variety of elective surgical procedure, such as colorectal cancer resection, carotid endarterectomy, coronary artery by-pass grafting and laparoscopic colectomy.[5-8] These studies concluded that, for elective procedure, this cohort of patients have morbidity and mortality rates comparable to those of younger cohorts; but what happens when elderly patients suffer an abdominal surgical problem requiring an emergency operation?

These patients may present for surgery with acute fluid and electrolyte imbalance due to the combined effects of inadequate intake relative to fluid loss, which may be superimposed on reduced renal

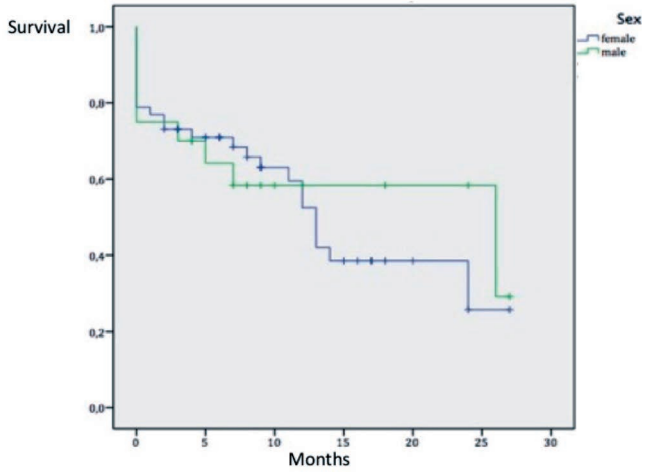

Figure 1. Sex and survival (P=0.688).

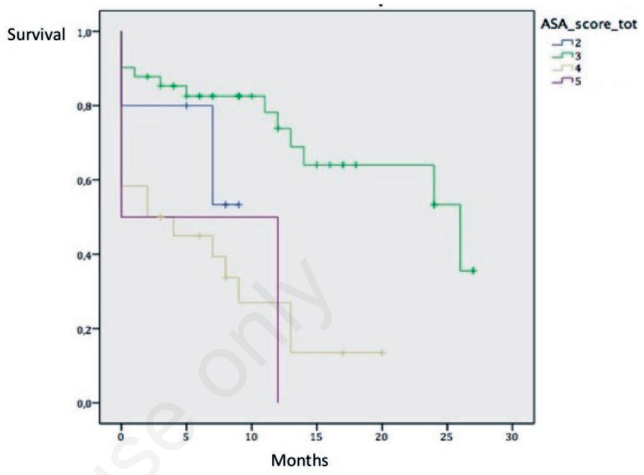

Figure 2. American Society of Anesthesiologists (ASA) score and survival (P<0.001).

Table 5. Procedures according to the diagnosis.

Diagnosis	Procedures	Cases, no.
GI obstruction (26 cases)	Adhesiolysis	10
	Small bowel resection and anastomosis	5
	Large bowel resection and anastomosis	4
	Hartmann procedure	2
	GEA (palliative gastrojejunoanastomosis)	2
	Hepatic cyst fenestration	1
	Colostomy	1
	Adhesiolysis and ileostomy	1
Complicated hernias (18 cases)	Hernia repair	13
	Small bowel resection and anastomosis	4
	Large bowel resection and anastomosis	1
GI perforation (12 cases)	Colostomy	3
	Large bowel resection and anastomosis	2
	Hartmann procedure	1
	Small bowel resection and anastomosis	1
	Large bowel resection and stoma	1
	Peptic ulcer repair	1
	Subtotal gastrectomy	1
	Duodenal perforation repair + GEA	1
	colostomy	1
Acute cholecystitis (9 cases)	Cholecystectomy	8
	Cholecystectomy + duodenal fistula repair	1
Acute appendicitis (3 cases)	Appendectomy	3
GI bleeding (2 cases)	Total gastrectomy	1
	GEA (palliative gastrojejunoanastomosis)	1
Mesenteric ischemia	Explorative laparotomy	1
Ogilvie syndrome	Colostomy	1

GI, gastrointestinal; GEA, gastroenteroanastomosis.

reserve and sepsis and third space losses. Moreover, neurologic decline resulting in dementia further complicate the diagnosis of intra-abdominal sepsis, often resulting in delays in presentation and diagnosis and surgical treatment. They require skilled resuscitation, careful peri-operative monitoring of cardiovascular parameters and fluid balance.

This needs to commence preoperatively, and to be continued into the intra-operative and postoperative period. Several works report a significant increase in mortality for elder patients undergoing emergency surgery, when compared to elective surgery.[2,9,10] This is easy to understand: unlike elective surgery, many risk factors are not amenable to modification at the time a patient requires emergency surgery; Shih-Chi Wu *et al*.[11] recently confirmed this by demonstrating how hypoalbuminemia was associated with higher rate of morbidity and mortality after emergent abdominal surgery in geriatric critically ill patients. Furthermore, comorbidities are very common in elderly patients: even though none of the comorbidities analyzed in this study independently showed a correlation with survival, two or more comorbidities could have a synergic effect impairing the ability of the organism to adapt to stressful situations; this is demonstrated by the huge impact that an increased ASA score has on survival.[12]

Louis and colleagues,[10] confirmed emergency status and comorbid conditions as the strongest determinants of outcome in octogenarians undergoing major intestinal surgery.

Overall in-hospital mortality in our series was 22.2%, which is similar to that reported in previous studies, ranging from 15% to 33.3%.[2,9,10,13-18] Two years survival was 51.4%, similar to that reported from Racz *et al*.[2] According to the 2011-2012 life tables for Italian population, men and women who reach the age of 92 (the mean and median age of this study) have a 1-year survival of 80%.[4] This data, compared to our cohort survival, outline a 2.5-fold increase in mortality for patients undergoing abdominal emergent surgery, which represents a relatively high increase beyond that expected for general population in this age group.

Our opinion is that, given the acceptable mortality rates for elective surgery in this cohort of patients, when needed a well planned, elective abdominal procedure should not be denied only because of the age of the patient, thus avoiding the need for emergency surgery.

It is interesting to highlight how the presence of malignancy as an underlining cause of the emergency surgical procedure is not correlated with a variation of survival: this could mean that elder patients are more likely to die for causes related to their age and comorbidities rather than for tumor progression; should this be the case, implications would be very important for surgical approach, thus giving the priority to a quick procedure aiming to control the emergent problem and minimizing the importance of a proper oncological approach.

Louis and colleagues compared cancer and non-cancer operations in patients over 80 years-old and found that there were no significant difference in length of stay and mortality:[10] they identified 138 octogenarians undergoing 157 operations between 1995 and 2005 at a single institution and cancer comprised for 63 percent of the cases; the most common causes of death were sepsis and multiorgan failure. When emergency operations were excluded, there where no significant difference in mortality between cancer versus non-cancer cases. This study support our statement that a proper management of the physiological derangement typical of the emergency setting could be even more important than a meticulous oncologic approach in the oldest older.

Of all demographic characteristics, only ASA score was significantly correlated with survival (Figure 2): even if ASA score was the most predictive factor analyzed and was strongly correlated with survival, it lacks of resolution and can be used only as a gross guide.

Mean time between hospital admission and surgical procedure was 26.6 h: in contrast to what is generally reported in literature,[19,20] there is no significant difference in survival between patients undergoing

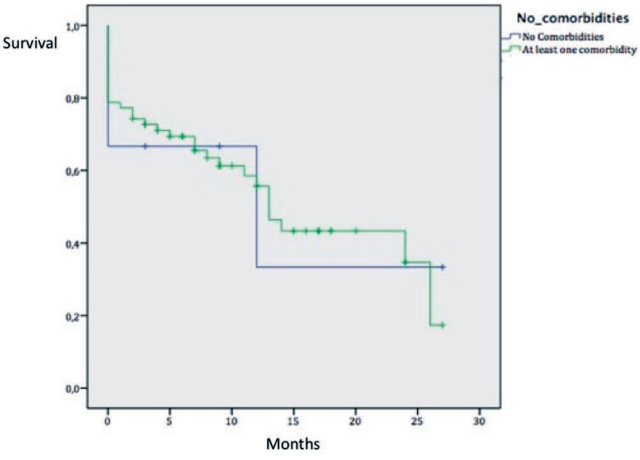

Figure 3. Absence of any comorbidity and survival (P=0.966).

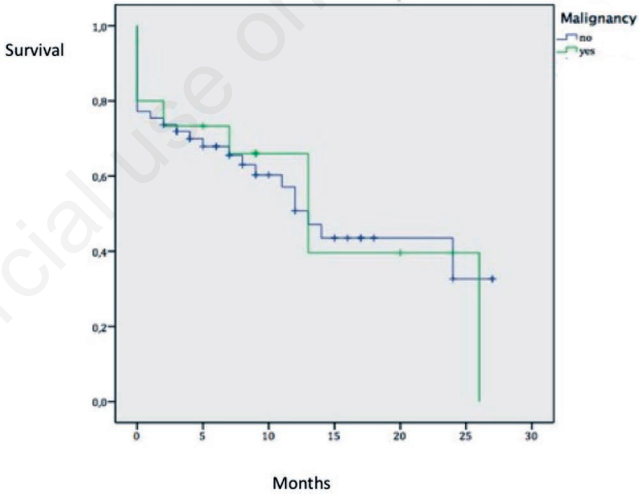

Figure 4. Presence of malignancy and survival (P=0.998).

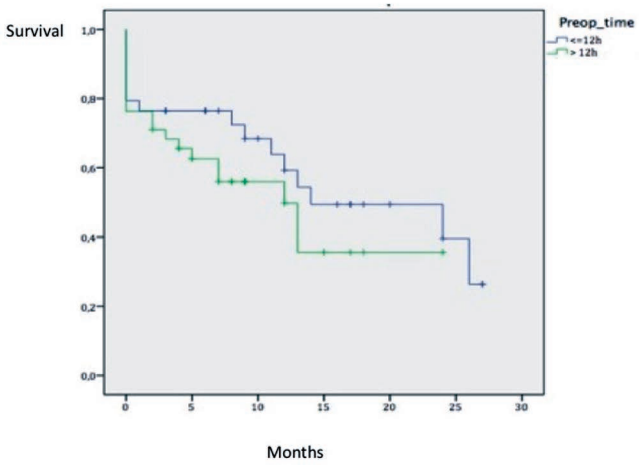

Figure 5. Time to surgery and survival (P=0.289).

surgery within the first 12 h of hospitalization (Figure 5); even considering a pre-operative delay of more than 24 h no difference was found in survival. This parameter includes a bias, because patients with longer times elapsed before surgery were either very compromised patients, where the first attempt was a medical therapy, or patients usually admitted first to a medical ward and brought to surgical theater later, because of worsening of their clinical conditions.

Excluding one case of massive bowel ischemia, GI perforation was associated with the highest in-hospital mortality (41.6%). It is interesting to highlight how cholecystectomy, small bowel resection and anastomosis and appendectomy were correlated with no in-hospital mortality (Table 4).

When measuring outcome, quality of life after surgery needs to be carefully considered: of the 56 survivors, 21 (29.9%) were discharged from the hospital to a nursing home, while 35 patients (48.6%) went back to their homes (Table 1). It is important to highlight how one out of three nonagenarians will not return to his home after major abdominal surgery.

There are several limitations to this study, including its retrospective nature that limits the data available for analysis. Furthermore, we intentionally considered only patients with acute conditions undergoing urgent surgery, excluding those elderly patients with acute surgical conditions who were treated conservatively. Another limitation is the small size of the population considered in this study that does not allow obtaining strict statistical significance. On the other hand, the strength of this study dwells into its multicenter basis, that allows to generalize our results to a wider reality: the results we obtained are a snapshot of surgical practice in Italy and are not strictly related to a single center or a single surgeon.

Conclusions

Overall in-hospital mortality is acceptable for nonagenarian undergoing emergent abdominal surgical procedures, however survival sits around 50%. Except for ASA score, there are no known factors predicting poor outcome. Further studies are needed to adequately investigate post-operative quality-of-life and daily living impairment. Based on the present study and other recent works, emergent abdominal surgery in frail patients over 90 years of age is a worthwhile enterprise, but an elective and carefully planned surgery is preferable and should not be precluded exclusively on an age basis.

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