

## Open versus laparoscopic approach in the treatment of abdominal emergencies in elderly population

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**SUMMARY: Open versus laparoscopic approach in the treatment of abdominal emergencies in elderly population.**

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*Aim. To evaluate the role of laparoscopy in the treatment of surgical emergency in old population.*

*Patients and Methods. Over-70 years-old patients submitted to emergency abdominal surgery from January 2013 to December 2014 were collected and grouped according to admission diagnoses. These accounted small bowel obstruction, colonic acute disease, appendicitis, ventral hernia, gastro-duodenal perforation, biliary disease.*

*In each group it was analyzed the operation time (OT), the morbidity rate and the mortality rate comparing open and laparoscopic management using T-test and Chi-square test.*

*Results. 159 over 70-years-old patients underwent emergency surgery in the General and Emergency surgery Operative Unit (O.U.) of the Policlinic of Palermo. 75 patients were managed by a laparoscopic approach and 84 underwent traditional open emergency surgery.*

*T-Test for OT and Chi-square test for morbidity rate and mortality rate showed no differences in small bowel emergencies ( $p=0,4$ ;  $0,25 < p < 0,9$ ;  $0,25 < p < 0,9$ ), in colonic acute diseases ( $p=0,35$ ;  $0,25 < p < 0,9$ ;  $0,25 < p < 0,9$ ), in appendicitis ( $p=0,22$ ;  $0,05 < p < 0,1$ ;  $0,25 < p < 0,9$ ), in complicated ventral hernia ( $p=0,12$ ;  $p > 0,9$ ;  $p > 0,95$ ) and in gastro-duodenal perforation ( $p=0,9$ ;  $p > 0,9$ ;  $p > 0,95$ ). In cholecystitis, laparoscopy group showed lower OT (T-Test:  $p=0,0002$ ) while Chi-square test for morbidity rate ( $0,1 < p < 0,25$ ) and mortality rate ( $0,25 < p < 0,9$ ) showed no differences.*

*Conclusions. The collected data showed the feasibility of laparoscopic management as an alternative to open surgery in surgical emergencies in elderly population.*

KEY WORDS: Surgery - Laparoscopy - Elderly - Emergency.

### Introduction

Laparoscopy (lap) has gained an important role in many surgical specialties since the last decade, becoming the gold standard in the treatment of some surgical problems (1-4).

The role of lap in abdominal emergencies it was analyzed showing good results in the treatment of acute cholecystitis, appendicitis and gynaecological diseases. In the management of cholecystitis, laparoscopy is considered already the gold standard while in the suspicious of appendicitis laparoscopic abdominal ex-

ploration is recommended in young female allowing differential diagnosis with ovarian disease (1-3).

In literature there are only few reports that describe the role of laparoscopy in emergency surgery in elderly people.

It was showed that in over 65-years-old patients, laparoscopy when feasible decreases wound complications, post-operative ileus and intraoperative blood loss, reducing also the need of post-operative rehabilitation. However, it was highlight that laparoscopy could be contraindicated due to its physiological alteration in patients with comorbidities (5).

The aim of this study is to analyze the minimal invasive approach in the management of surgical emergencies in over 70-years-old patients.

### Patients and methods

From January 2013 to December 2014, 159 over 70-years-old patients underwent abdominal emergency

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surgery at the General and Emergency Surgery O.U. of the Policlinic of Palermo. Among those, 75 patients were managed by a laparoscopic approach and 84 underwent traditional open surgery.

Data were collected from the hospital database and from patients' schedules.

Patients were grouped according to the admission diagnosis and for each disease it was analyzed the average operative time (OT), the conversion rate, the morbidity rate according to Clavien score 3-4 and the mortality rate for patients managed by open surgery and by laparoscopy.

These data were compared using Chi-square test to verify statistical significance in mortality rate and morbidity rate between open and laparoscopic groups (E0: there aren't difference in mortality /morbidity rate between the open and laparoscopic group) and using the T-test for OT (E0: to prove that there is no difference between the groups).

The exclusion criteria to laparoscopy were presence of hemodynamic instability, patient's performance status, anesthesiologist contraindications, technical contraindications and surgeons' skill.

## Results

From January 2013 to December 2014, 159 over 70-years-old patients underwent emergency surgery in the General and Emergency surgery O.U. of the Policlinic of Palermo

Among those 75 patients were managed by a laparoscopic approach and 84 underwent traditional open emergency surgery.

There were 29 small bowel emergencies; 67 colonic acute diseases or obstruction; 17 appendicitis; 4 complicated ventral or groin hernia; 6 gastro-duodenal ulcer diseases; 36 acute cholecystitis.

Data on OT, morbidity and mortality rates for the several diagnoses are showed in Tables 1, 2, and 3.

13 patients underwent emergency lap for small bowel

emergency while in 16 patients open operations were performed. Only a procedure was converted to open surgery. T-Test to compare OT verify that there wasn't difference between the groups ( $p=0,4$ ) (Table 1). Chi-square test for morbidity rate ( $0,25 < p < 0,9$ ) and for mortality rate ( $0,25 < p < 0,9$ ) demonstrate that there aren't differences between the groups (Tables 2, and 3).

For colonic acute disease 31 patients underwent emergency laparoscopic surgery, while 36 were managed in open. T-Test to compare OT ( $p=0,35$ ) showed no differences between the groups (Table 1). Chi-square test for morbidity rate ( $p: 0,25 < p < 0,9$ ) and for mortality rate ( $0,25 < p < 0,9$ ) show no differences between the groups (Tables 2, and 3).

9 patients underwent emergency lap for appendicitis while 8 patients underwent emergency open surgery. T-Test to compare OT ( $p=0,22$ ) shows no differences between the groups (Table 1). Chi-square test for morbidity rate ( $0,05 < p < 0,1$ ) and for mortality rate ( $0,25 < p < 0,9$ ) show no differences between the groups (Tables 2 and 3).

2 patients underwent lap emergency surgery for complicated ventral hernia, 2 were submitted to open repair. T-Test to compare OT ( $p=0,12$ ) found no differences between the groups (Table 1). Chi-square test for morbidity rate ( $p > 0,9$ ) and for mortality rate ( $p > 0,95$ ) reveal that there are not differences between the groups (Tables 2 and 3).

We observed 3 cases of gastro-duodenal perforations from ulcers managed with emergency lap and 3 patients by emergency open surgery T-Test to compare OT didn't found differences ( $p=0,9$ ) (Table 1). Chi-square test for morbidity rate ( $p > 0,9$ ) and for mortality rate ( $p > 0,95$ ) show no differences between the groups (Tables 2 and 3).

17 patients underwent emergency lap for acute cholecystitis, 19 cases of cholecystitis were managed in open. T-Test to compare OT results  $p: 0,0002$  (Table 1), lap group showing lower OT. Chi-square test for morbidity rate ( $0,1 < p < 0,25$ ) and mortality rate ( $0,25 < p < 0,9$ ) show no differences (Tables 2, and 3).

TABLE 1 - OPERATIVE TIME IN LAP AND OPEN GROUPS FOR THE SEVERAL DISEASES.

Cause of acute abdomen	Operative Time Average (St. Dev.), min		T-Test (p-value)
	Lap	Open	
Small bowel emergency	138 (36.5)	150 (37.1)	0,4
Colonic acute disease or obstruction	243 (30.9)	232 (58.7)	0,35
Appendicitis	61 (7.8)	68 (14.4)	0,22
Ventral or groin hernia	93 (4.2)	120 (14.1)	0,12
Gastro-duodenal ulcer disease	102 (33.6)	98 (38.2)	0,9
Cholecystitis	62 (25.6)	100 (28)	0,0002

TABLE 2 - MORBIDITY IN THE LAP AND OPEN GROUP.

Cause of acute abdomen	N. of patients		Morbidity (%)		Chi-square (p-value)
	Lap	Open	Lap	Open	
Small bowel emergency	13	16	7.7	18.7	0,25<p<0,9
Colonic acute disease or obstruction	31	36	12,9	19,4	0,25<p<0,9
Appendicitis	9	8	0	25	0,05<p<0,1
Ventral or groin hernia	2	2	0	0	p>0,9
Gastro-duodenal ulcer disease	3	3	0	0	p>0,9
Cholecystitis	17	19	0	10,5	0,1<p<0,25

TABLE 3 - MORTALITY IN THE LAP AND OPEN GROUP.

Cause of acute abdomen	N. of patients		Mortality (%)		Chi-square (p-value)
	Lap	Open	Lap	Open	
Small bowel emergency	13	16	7,7	6,2	0,25<p<0,9
Colonic acute disease or obstruction	31	36	3,2	5,5	0,25<p<0,9
Appendicitis	9	8	0	12,5	0,25<p<0,9
Ventral or groin hernia	2	2	0	0	p>0,95
Gastro-duodenal ulcer disease	3	3	0	0	p>0,95
Cholecystitis	17	19	0	5,3	0,25<p<0,9

## Discussion

Surgical care on senior patients is complex due to the presence of multiple comorbidities which can lead to increased postoperative complications (5-12).

Watt et al. reported that emergency laparotomies are related to worse outcomes in elderly people aged >70 years with a 30 day mortality of 22% and 1-year mortality of 38% (13).

The 30-day morbidity is reported to be around 58% and is influenced by a number of independent risk factors such as dysrhythmia, vascular disease and renal disease but the number of comorbidities alone should not suggest a limited treatment (12).

Allen et al. showed that elderlies (aged>80) have an increased rate of emergency admissions and even though receive lower levels of aggressive interventions and resources than younger patients (11).

Undoubtable, as the population is aging, the number of old patients will rise, so an improvement in their treatment is needed.

Laparoscopic surgery is approved as a feasible and safe alternative in the approach to almost all abdominal emergencies and could be a good option also in elderlies offering the best known advantages of the minimal invasive surgery (1-3, 14).

In the last years, the number of elderly patients managed with lap has increased also in our O.U. even if this approach in elderlies has some restrictions due to anesthesiologist problems, critical clinical conditions and technical contraindications.

Of course, the physiologic demands of laparoscopy should be considered before recommending it as surgical treatment (5). As known, the CO<sub>2</sub> pneumoperitoneum tends to induce alterations on acid-base balance, blood gas balance and cardiovascular and pulmonary physiology, severe septic state (30). Most of these changes should not result in clinical significance but in elderly patients with comorbid conditions they could evolve in decreased cardiopulmonary reserve and moreover in patients with severe cardiopulmonary disease the hypercarbia could lead to significant acidosis (6, 7). The abdominal insufflation could also produce changes in pulmonary mechanics, where diaphragmatic excursion could become limited and the patient may show a rise in peak airway pressures and a decline in vital capacity (6). In addition, the intra-abdominal pressure and the Trendelenburg position could worsen gastroesophageal reflux and aspiration risk in susceptible patients (7).

Intra-abdominal pressure produces alterations in hemodynamic function that may alter cardiac function and the perfusion of vital organs. The increasing intra-abdominal pressure is associated with the decrease of venous return to the heart and could induce tachycardia, decreases vascular perfusion and reduces renal and hepatic function (6, 8, 10).

Our data showed similar morbidity rate even for the lap or the open approach, so, not correlating complication rate to the surgical management modality applied.

In regards to the different diagnoses Ingrham et

al. analyzed a series of 32,683 patients collected from the ACSNSQIP database in 222 U.S. hospitals and concluded that laparoscopic appendectomy is associated with lower overall morbidity in selected patients. However, patients with complicated appendicitis may have a greater risk of organ space surgical site infection (15). Thereaux shows that lap is a safe and feasible procedure with a low conversion rate (3.5 %) and an affordable morbidity rate derived from intra-abdominal abscess (7.1%) (16, 17); in accordance, our data show no difference between open and lap management of acute appendicitis in elderlies.

Lap is considered the gold standard for the surgical management of the gallbladder acute disease each one in simple forms than in gangrenous or emphysematous cholecystitis for either young or old peoples (3, 18). The feasibility and safety of laparoscopic approach for acute cholecystitis in >70-years-old patients was proposed by a retrospective study on 73 patients (19). However, a recent meta-analysis of Yang et al. containing 14645 patients affected by acute cholecystitis indicates that age >65 years, male gender, acute cholecystitis, thickened gallbladder wall, diabetes mellitus and previous upper abdominal surgery were significantly associated with increased risk of conversion (20). In our analysis comparable rates of morbidity and mortality were found even in open and lap approach and reduced OT in the lap group.

Complicated diverticulitis can be treated with lap (21-26). Gentile et al. show that in patients with a middle age of 64.8 suffering II-III Hinchey grade, laparoscopic lavage and drainage are related to lower operative risk, lower morbidity and mortality rates as well as shorter hospital stay in comparison to Hartmann procedures with the possibility to avoid stoma (20). Several articles described the absence of substantial differences between open and laparoscopic Hartmann's procedure (22-24). Minimally invasive approach should be considered for patients without systemic toxicity and in experienced centres (31). It is interesting to note that in our study, we found equivalence between the two approaches also in elderly people even if we did not perform distinction by grades.

Khubuthiya et al. proposed the use of laparoscopic approach as the first diagnostic tool in the management of penetrating abdominal trauma; using the same approach for therapeutic purposes (27-29). In a recent Cochrane Review, it has been demonstrated the feasibility of laparoscopy in the treatment of perforated peptic ulcer disease (29). Our retrospective study shows comparable morbidity and mortality rate and similar OT between open and laparoscopic approach also in elderlies.

## **Conclusions**

In conclusion, we found not relevant differences between the open and laparoscopic management of the most common abdominal surgical emergencies in elderlies. One of the limitations of this study is due to the small sample size, being a single center study without randomization for the participants in laparoscopic and open surgery.

Minimally invasive approach could likely be offered in the emergency management in elderlies as well as in general population through a widespread surgeons' lap skills and the improvement of anesthesia teams' lap management.

Further studies will be needed to validate these results.

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## **Ethics, consent and permissions**

Informed consent was obtained from the participants to the study.

The study will meet and conform to the standards outlined in the Declaration of Helsinki and Good Epidemiological Practices.

Consent to publish was obtained from the participants to the study.

## **Competing interests**

The authors declare that they have no competing interests.

## **Authors' contributions**

GC, FN, RT have made substantial contributions to conception and design, analysis and interpretation of data; FN, TF have made substantial contributions to acquisition of data; RT, GS, GS, LL have been involved in drafting the manuscript and revising it critically for important intellectual content; GC, GS, GS and GG have given final approval of the version to be published; GC, FN, RT, TF, GS, GS, LL, GG agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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