

# Age Influence in the Prognosis of Bacterial Secondary Peritonitis

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*Today the age of 60-65 years old is considered the seniority threshold. The structural, functional and metabolic alterations which occur following to the aging process determine an exacerbation of the impact which any aggression will have on the body. This retrospective study analyses a group of 245 patients with severe peritonitis, which had been hospitalized and treated in Surgery 2<sup>nd</sup> Clinic of the Sf. Apostol Andrei Emergency Clinical Hospital in the period 2007-2016. The median age 54 years old [range 30-95]; 68 patients (27.76% of cases) were > 65 years old (65+) and 177 patients (72.24% of cases) with age between < 65 years old (65-). Out of the results obtained, it is obvious the impact of age in the evolution and prognosis of bacterial peritonitis.*

**Keywords:** age, prognosis, peritonitis

According to World Health Organization (W.H.O.) the designation of *senior citizens* is more adequate than old people, as it refers to the sector of population which got beyond their middle of life. Today the age of 60-65 years old is considered the seniority threshold. The structural, functional and metabolic alterations which occur following to the aging process determine an exacerbation of the impact which any aggression will have on the body. Denutrition, hyponatremia, metabolic acidosis, metabolic alkalosis, respiratory acidosis, septic state or hypovolemic shock are physiopathology imbalances which have an increased incidence rate within senior patients.

The abdominal symptomatology at senior patients is frequently diminished, absent or less specific as compared to young patients; accordingly, a large number of patients over 65 years old do not present the classical symptoms of cholecystitis, 30% of the patients with peptic ulcer do not complain about pain and quite frequently, the first sign of the disease is directly the perforation and its complications.

## Experimental part

### Materials and methods

This retrospective study analyses a group of 245 patients with severe peritonitis, which had been hospitalized and treated in Surgery 2<sup>nd</sup> Clinic of the Sf. Apostol Andrei Emergency Clinical Hospital in the period 2007-2016. The median age 54 years old [range 30-95]; 68 patients (27.76% of cases) were > 65 years old (65+) and 177 patients (72.24% of cases) with age between < 65 years old (65-).

Clinical and paraclinical data used in this study were obtained from patient's medical files. These data sustain the diagnosis, therapy options and patient's evolution (table 1).

### Statistical analysis

The SPCXL 2013 computer program was used for data analysis. The dependent sample *t*-test was used to determine the statistically significant difference between two lots of patients. Multivariate logistic regression model was used for the multivariate analysis. The correlation

coefficient was calculated in order to determine the relationship between two or more variables. All *p* values reported are two sided; statistical significance is defined as *p* < 0.05.

## Results and discussions

We have observed a slight prevalence of male patients in both analyzed groups: 52.94% representing 36 cases from (65+) lot and 51.98% (92 cases) in (65-) lot, *p* = 0.89.

The patients' origin environment was the rural one in most cases, 41 cases (60.29%) in (65+) group and 101 cases (58.19%) in (65-) lot, *p* = 0.64, most probably due to poor medical information and low medical assistance.

Regarding peritonitis's stage - occlusion, in 65- lot were 10.73% patients, comparative with 65+ lot with 26.47% of cases, with a statistical - significantly differences, *p* = 0.009.

Time interval between debut of symptomatology and hospitalization were 24-48 h in 76.27% of cases in 65- lot and in 48.53% of cases in 65+ lot, 48-72 h in 16.95% of cases in 65- lot and in 38.24% of cases in 65+ lot, and > 72 h in 6.78% of cases in 65- lot and in 13.23% of cases in 65+ lot, *p* = 0.0004.

The late presentation to the hospital was due to the changed symptomatology, to the low capacity to assess and express the symptoms, to the fear of being hospitalized and to the difficulties in walking. There are multiple factors that contribute to the difficulty of diagnosis and to the increased incidence of the complications observed at senior patients.

Regarding the etiology of peritonitis there were differences between lots but without statistically significance, being appendicular in 42.94% of patients in 65- lot versus 16.18% of cases in 65+ lot, biliary in 11.30% of patients in 65- lot vs. 26.47% of cases in 65+ lot, colonic in 10.17% of patients in 65- lot vs. 14.71% of cases in 65+ lot, small bowel in 2.26% of patients in 65- lot vs. 10.29% of cases in 65+ lot, *p* = 0.05. The peptic perforations were almost equal as percentage, 33.33% of cases in 65- lot vs. 32.35% in 65+ lot.

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Parameters	65- lot N=177 (%)	65+ lot N=68 (%)	p
<b>Median age (range) (years)</b>	48 (30-59)	78 (65-95)	<b>&lt;0.05</b>
<b>Sex</b>			
Male	92 (51.98)	36 (52.94)	0.89
Female	85 (48.02)	32 (47.06)	
<b>Area of residence</b>			
Urban	76 (42.94)	27 (39.71)	0.64
Rural	101 (57.06)	41 (60.29)	
<b>Peritonitis's stage - occlusion</b>	19 (10.73)	18 (26.47)	0.009
<b>Debut – hospitalization time (hours)</b>			
24-48	135 (76.27)	33 (48.53)	<b>0.0004</b>
48-72	30 (16.95)	26 (38.24)	
> 72	12 (6.78)	9 (13.23)	
<b>Hemoglobin at hospitalization time Median (dg/mL) (range)</b>	13 (10.6 - 17)	11.35 (7.6 – 14)	<b>&lt;0.0001</b>
<b>Etiology</b>			
Appendicular	76 (42.94)	11 (16.18)	<b>0.05</b>
Biliary	20 (11.30)	18 (26.47)	
Colonic	18 (10.17)	10 (14.71)	
Peptic perforations	59 (33.33)	22 (32.35)	
Small bowel	4 (2.26)	7 (10.29)	
<b>Shock state</b>	22 (12.43)	21 (30.43)	0.04
<b>Occlusive state</b>	19 (10.73)	18 (26.47)	0.009

**Table 1**  
CLINICAL  
PARAMETERS  
65- VS. 65+

The clinical picture of peritonitis had been varied, with different semiology, depending on peritonitis's cause, age, associated diseases, early diagnosis and patient related factors.

The abdominal pain had been the major, constant symptom present in all cases, which had been associated with the peritoneal irritation signs.

A clinical aspect which is special through its dramatic character and gravity was the presence of the shock state which can influence directly and immediately the evolution and prognosis of the patient. The shock state was comparative, more frequent in 65+ lot, 30.43% vs. 12.43% in 65- lot,  $p=0.04$ . The presence of the shock state, in entire lot, has been found in 43 cases (17.55%).

In the 65+ group 26.47% of cases came in the occlusive state of peritonitis with abdominal distension and absence of bowel movement, comparative to the second group, 65-, where only 19 cases (10.73%) of peritonitis-occlusion have been found,  $p=0.009$ .

Regarding associated comorbidities, the cardiovascular diseases are most frequent with a percentage of 67.64% from the total of comorbidities which have been met at patients in (65+) lot, followed by type II diabetes mellitus (DMII) in 41.17% cases and pulmonary disorders in 28.41% cases. These associated diseases decrease the physiological reserve and predispose to pathologic conditions, such as abdominal aortic aneurysm and mesenteric ischemia. In (65-) group only a percentage of 21.46% (38 cases) present cardiovascular diseases and in 14 cases (7.90%) was found DMII.

The immunity function tends to decrease as we get older and in the presence of diabetes mellitus or in the presence of malignant diseases. Also, senior patients have an increased incidence of asymptomatic basic pathology, up to a half of the senior patients having cholelithiasis, diverticulosis and 5-10% present abdominal aortic aneurysm.

From paraclinical point of view, the study of the hemoleucogram (CBC) pointed out anemia of different degrees, leukocytosis, and the degree of laboratory changes being in accordance with the phase of the peritonitis and with patients' age.

The hemoglobin median values at hospitalization time were 13 g/dL (range 10.6-17 g/dL) in 65- lot, comparative with 11.35 g/dL (7.6 – 14 g/dL), in 65+ lot,  $p<0.0001$ . The frequency of anemia at seniors, with an incidence of 8-44 % in the data from the specialty literature, is due to hematopoiesis ageing, through the deficit of erythropoietic factors, necessary for hemoglobin formation (iron, vitamin B12, folic acid, proteins).

The biochemical monitored the degree of modification of homeostasis, coagulogram, transaminases, urea, creatinine and proteinemia at patients from the study groups, in the dependency with the peritonitis phase, has observed parameters a little changed, statistically significant, at patients with peritonitis in toxic and terminal phase, as compared to the patients with reactive peritonitis.

Regarding the etiology of peritonitis there were differences between lots but without statistically significance, being appendicular in 42.94% of patients in 65- lot versus 16.18% of cases in 65+ lot, biliary in 11.30% of patients in 65- lot vs. 26.47% of cases in 65+ lot, colonic in 10.17% of patients in 65- lot vs. 14.71% of cases in 65+ lot, small bowel in 2.26% of patients in 65- lot vs. 10.29% of cases in 65+ lot,  $p=0.05$ . The peptic perforations were almost equal as percentage, 33.33% of cases in 65- lot vs. 32.35% in 65+ lot.

In both lots of patients we tried to find out statistical significant correlations between analyzed parameters.

Thus, in 65- lot, correlation matrix evidenced a strong positive correlation between shock state and symptomatology debut: the shock state has been installed more frequent in patients with symptomatology debut > 72 h. Other strong correlation has been established in 65- lot between age and etiology.

	Hb 65-	Shock state 65-	etiology 65-	debut 65-	age 65-
Hb 65-	1.0	-0.487447	-0.025757	-0.413499	-0.143739
Shock state 65-		1.0	0.261366	0.763558	0.218205
etiology 65-			1.0	0.312884	0.635896
debut 65-				1.0	0.281474
age 65-					1.0
Summary					
Mean	13.152	0.12429	13.407	1.3051	47.486
StDev	1.5059	0.33085	1.3832	0.59125	8.2882
Count	177	177	177	177	177

**Table 2**  
CORRELATION  
MATRIX FOR 65- LOT

	debut 65+	etiology 65+	Hb 65+	Shock state 65+	age 65+
debut 65+	1.0	0.346824	-0.705852	0.720428	0.038665
etiology 65+		1.0	-0.443352	0.42792	0.050812
Hb 65+			1.0	-0.679566	-0.115769
shock state 65+				1.0	-0.058603
age 65+					1.0
Summary					
Mean	1.6471	13.941	11.312	0.30882	78.559
StDev	0.68599	1.2916	1.6774	0.46544	6.4215
Count	68	68	68	68	68

**Table 3**  
CORRELATION  
MATRIX FOR  
65+ LOT

Negative correlation was shown between shock state and hemoglobin value: patients with shock state installed have had lower hemoglobin values. Also patients with debut of symptomatology >72 h have had lower hemoglobin values.

Weak positive correlations have been found between shock state and etiology, shock state and age, etiology and debut, debut and age. Weak negative correlations have been found between hemoglobin values and age respective etiology (table 2).

In 65+ lot correlation matrix (table 3) evidenced a strong positive correlation between shock state and symptomatology debut: the shock state has been installed more frequent in patients with symptomatology debut > 72 h.

A strong but negative correlation was shown between shock state and hemoglobin value: patients with shock state installed have had lower hemoglobin values. Also patients with debut of symptomatology >72 h have had lower hemoglobin values.

Weak positive correlations have been found between shock state and etiology, etiology and debut, debut and

age. Weak negative correlations have been found between hemoglobin values and age respective etiology (table 3).

The Pearson correlation coefficient was calculated, in two lots of patients 65- and 65+, in order to determine the relationship between death cases and different variables: hemoglobin values, shock state, etiology and debut. The results are showed in table 4. We found a strong and negative correlation in 65+ lot, between death cases and hemoglobin values, Pearson coefficient being -0.6. The higher frequency of deaths was registered in patients with lower Hb values. This correlation has been found also in 65- lot, but was a low correlation (Pearson coefficient = -0.1). Also, a strong and positive correlation in 65+ lot, between death cases and shock state have been found, Pearson coefficient = 0.4.

In 65- lot we found correlations between death cases and mentioned variables but not strong because the small number of death cases.

It has been studied the etiology of peritonitis from the group analyzed and it has been observed that in the group with those with age over 65, there is the predominance of peritonitis through peptic perforations in 22 cases (32.35

Correlated variables	Pearson coefficient 65- lot	Pearson coefficient 65+ lot
Death and hemoglobin values	-0.1	-0.6
Death and shock state	0.25	0.4
Death and etiology	0.15	0.3
Death and debut	0.2	0.3

**Table 4**  
VALUES FOR PEARSON CORRELATION IN  
65- LOT VS. 65+

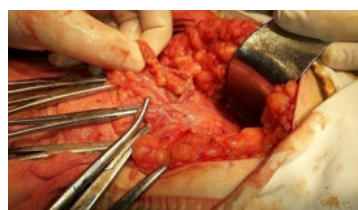


Fig.1. Appendicular peritonitis (1)



Fig.2. Appendicular peritonitis (2)

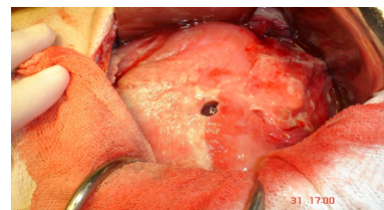


Fig.3. Peritonitis by perforated gastric ulcer



%), followed by peritonitis of biliary cause in 18 cases (26.47 %), appendicular peritonitis in 11 cases (16.18 %), peritonitis through colon pathology in 10 cases (14.71 %) and peritonitis through the pathology of the small bowel in 7 cases (10.29 %). By comparison with the data from specialty literature, according to Copper et al.[3], a study on acute peritonitis at patients with ages over 65 places the appendicular peritonitis on the first place, followed by the ones through diverticular sigmoid perforation and those of biliary cause.

Contrary to the results of the first group, appendicular peritonitis have prevailed in the second group in 76 cases (42.93%), followed by peritonitis through gastro-duodenal perforations in 63 cases (35.59%), biliary peritonitis in 20 cases (11.29%) and by colonic pathology in 18 cases (10.16%). For the patients from this group, gastro-duodenal perforations were due mainly to peptic ulcer, while in case of patients with age over 65, the perforation was produced due to gastric neoplasia in most cases.

The bacteriologic study of acute peritonitis has an important value in the differentiated treatment of each and every patient. The secondary peritonitis having an intra-abdominal origin, usually a digestive perforation, the microbial flora varies according to the affected organ, the microorganism quantity increasing progressively from the stomach level,  $10^2/\text{ml}$  and reaching  $10^{12}/\text{g}$  of faeces at colonic level.

The microbial synergism can neatly increase the pathogenic effect and accordingly, the severity of the infection in many ways: (i) the oxygen consumption of aerobic bacteria induces tissular hypoxia and a decrease of the oxidoreduction potential, which favors the increase of anaerobic bacteria; (ii) specific nutritious substances, produced by bacteria, can encourage the development of cohabiting pathogenic microorganisms and (iii) some anaerobes are capable to affect the immune function of the host cells and accordingly, they offer an advantage for themselves or for other cohabiting microorganisms [2].

On both groups analyzed, *E.coli* was the aerobic species most frequently developed on cultures (44.48% and respectively 48.58%), followed by *Enterobacter* (23.67% and 13.55%), *Pseudomonas* (7.75 and 6.77%) and *Klebsiella* (6.53 and 6.21%). Among Gram positive cocci, the following were predominant: enterococcus, streptococcus and staphylococcus. Among anaerobic bacilli, *Bacteroides* species had been frequently found, especially *Bacteroides fragilis* (17.14 and 12.42%).

A study similar to our study in the specialty literature, regarding the pathogenic bacteria associated to secondary peritonitis, according to C.N.Akujabi et col., 2006, had identified that the most frequent among aerobes was *E.coli* in 31.4%, followed by *Klebsiella* in 11.4% and *Pseudomonas* in 2.9% and the most frequent among anaerobes was *Prevotella* spp. in 40%, followed by *Bacteroides fragilis* in 22.9%.

There are a few studies in the specialty literature which refer specifically to the therapy by antibiotics against secondary acute peritonitis, but there are abundant data in the antibiotherapy protocols for the treatment of intra-abdominal infections, associated to surgical interventions.

At present, there is no reference antibiotic for secondary peritonitis, being possible for the severity level to be a modulation factor in choosing the antibiotics molecules.

From frequency point of view, the immediate postoperative complications for the group of patients with ages over 65 have been the following: parietal suppurations in 24 cases (35.29%), prolonged postoperative ileus in 19 cases (27.94%), eviscerations in 12 cases (17.64%), intra-

peritoneal abscesses in 4 cases (5.88%), intestinal fistulae in 2 cases (2.94%). For the group of patients with age between 30 and 65, from frequency point of view, the parietal suppurations had been maintained, but with a lower percentage, 29 cases from the total of 177 patients (16.38%), followed by intra-peritoneal abscesses in 11 cases (6.21%), eviscerations in 5 cases (5.82%) and intestinal fistulae in 4 cases (2.25%).

The risk factors involved in the occurrence of parietal suppurations have included the diagnosis which imposed the intervention (preoperative infectious processes), surgery factors such as the type and duration of the surgical intervention, the surgery technique, preoperative preparation, but also the old age, the presence of diabetes, of neoplasia, of obesity and malnutrition. The improvements in the management of these problems have been contributing to the decline of the postoperative parietal suppurations rate. [5]

The prolonged postoperative ileus, found in those 27.94% of the cases with age over 65, caused by surgical handling of the bowel or by stimulating the opioid receptors, is in accordance with the data from literature, exemplified through a prospective study where there had been compared the surgical results at patients with age over and below 80 and the incidence of the postoperative ileus had been higher at patients over 80 years old [7].

Among the general postoperative complications found within the patients with age over 65, the most frequently met had been the neurologic complications in 29 cases (42.64%), followed by the pulmonary ones in 26 cases (38.23%) and by the renal ones in 21 cases (30.88%), as against the data from specialty literature, according to Hamel et al.[7], study which mentions as frequent the pulmonary and renal complications.

Among the neurologic complications, the most frequently met complication was postoperative delirium (72.41%) in 21 cases (30.88%), superposable to the specialty literature, which reports a postoperative delirium frequency rate between 15 and up to 50% [1], with variation according to the type of the surgical intervention (25 up to 65% in emergency regime, as against 15-25% in scheduled regime) [10].

The mechanisms staying at the basis of delirium occurrence are uncertain. However, it seems to be an imbalance between the cholinergic central nervous system and the dopaminergic activity. This is supported by using anti-cholinergic and dopaminergic medicines [8], observing the occurrence of confusions after their administration. A key factor in preventing the postoperative delirium is recognition of the patients at risk. The risk factors mostly associated with the development of the postoperative delirium are preoperative cognitive disorders [4], meaning a careful and thorough anamnesis.

Among patients with age between 30 and 65, the general postoperative complications had resumed to renal complications in 8 cases (4.51%), cardiovascular complications in 3 cases (1.69%) and pulmonary complications in 2 cases (1.12%).

The mortality in the group analyzed was 27.94%, 19 cases, in the group of patients with age over 65 and 4 cases (2.25 %) in the second group with ages between 30 and 65, data which are in accordance with the specialty literature data which finds a mortality rate of 34% in surgical emergencies at seniors[9], in abdominal surgery a mortality of 2% below the age of 50, over 75 years old is 12%, its incidence being doubled for surgical interventions in emergency [10].

The mortality causes were the septic shock in most cases, 8 patients (42.10%) in the first group and those 4 cases from the second group, followed by cardiovascular causes in 6 cases (31.57%), causes explained also by the frequency of associated cardiovascular comorbidities. The data are superposable to the ones from specialty literature, as a study from Italy, according to L. De Santis and colab. [11], when analyzing the causes of postoperative mortality, had identified the sepsis (29.8%) as the main cause, followed by cardiovascular causes (17.7%) and by respiratory causes 11.6%.

## Conclusions

Being admitted in the surgical service must not be limited by age.

The surgical intervention, next to its curative effect and in many cases being the only available medical cure, has a degree of aggression over the body, felt more over a weak organism with limited biological resources that occurs in the majority of elderly patients.

The posttherapeutic recovery of an elderly patient aims to insure his independence by providing him with the capacity of self care and self service.

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