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Determination of the frequency and influence of senile asthenia syndrome on older patients' treatment results in urgent abdominal surgery

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Abstract. Modern demographic data indicate a constant increase in the quantity older people in the general population structure. With age, the body is affected by many factors that lead to senile asthenia syndrome. The study is devoted to the evaluation of the influence of senile asthenia syndrome on older patients' treatment in emergency abdominal surgery for improvement.

Materials and methods of the study. Examination and evaluation of the treatment results of 161 (100.0%) patients was based on the Municipal non-commercial enterprise "City Hospital of Emergency and Rapid Medical Care". In the first part of the group, 81 (50.3%) patients were diagnosed with cholelithiasis (CHD) and acute cholecystitis. The second part of the group of 80 (49.7%) patients was diagnosed with perforation of a stomach or duodenal ulcer. All patients were examined and operated urgently. Senile asthenia syndrome was assessed using the Edmonton Freil scale [11]. Markers of senile asthenia were: total protein, albumin, somatotropic hormone and interleukin 6.

Results: It was established that hypoproteinemia with a total protein level indicators of 61.35 (55.00; 70.00) g/l, p = 0.0009, U = 1224.0 and dysproteinemia was determined in the main study group. The albumin level in the main group is also significantly reduced - 29.75 (24.70; 35.70) g/l, p = 0.0072, U = 2268.0. The level of somatotropic hormone was considerably lower in the main group 0.89 (0.12, 1.28) mIU/l compared to the comparison group 2.40 (0.33, 3.96) mIU/l, p = 0.0030, U = 2248.5. This indicated the presence of sarcopenia syndrome. The interleukin 6 level in both study groups exceeded the norm. A significant increase in the frequency and mortality of postoperative complications was determined in the group of asthenia patients.

Conclusions. The frequency of senile asthenia syndrome was 50.3% among patients in emergency abdominal surgery. The Edmonton Freil scale can be a quick and effective method of diagnosing senile asthenia syndrome in emergency abdominal surgery.

Keywords: senile asthenia; sarcopenia; malnutrition; somatotropic hormone; interleukin 6

Improvements in lifestyle and modernisation in the health care system lead to the relentless ageing of world nations. Report on Aging and Health more than once published conclusions that by 2050, the number of older people will make up one-fifth of the world's population, which is about 2 billion people [1, 2]. The growth of this age group of the population leads to new questions in gerontology. Nowadays, the debate about the underestimated effect of senile asthenia syndrome (SSA) on the body as a whole and as a complication in the treatment of the main disease of the gerontological group of patients is increasingly being raised.[3].

SSA is a collective concept that includes various factors that affect the body as a whole. Chronic inflammation and progressive immunosuppression are the main pathological processes, underlying

this pathology [4]. Another important factor is the syndrome of malnutrition and malabsorption. These processes lead to a decrease in the blood protein level, dysproteinemia, and dyslipidemia. This chain cascade leads to chronic fatigue, exhaustion of the muscular and nervous systems and, as a result, sarcopenia [5 -7].

Urgent surgical interventions are accompanied by a high frequency of postoperative complications and mortality in comparison with planned surgical care in the examined patients. According to the 2020 data from the National Committee on the Calculation of Treatment and Mortality (NCEPOD), postoperative mortality in elective surgical treatment is 4.0%, while in emergency surgery it is 19.7-23.0%. These indicators increase in people over 75 years old [8,9]. Any factor can significantly affect the treatment results of urgent patients. One of them is concomitant pathology and the patient's age. SSA has an underestimated impact because it negatively affects the results of treatment of surgical patients. Exactly the SSA impact study, its early diagnosis and correction at all stages of treatment, will improve the quality of older people's treatment. This is an important issue in geriatrics.

The work determined the SSA effect frequency and evaluated the treatment results of older people undergoing emergency abdominal surgery.

Materials and methods

Examination and evaluation of the treatment results of 161 (100.0%) patients was based on the Municipal non-commercial enterprise "City Hospital of Emergency and Rapid Medical Care". In the first part of the group, 81 (50.3%) patients were diagnosed with CHD and acute cholecystitis. This diagnosis was chosen because this disease category usually undergoes an operative stage in a delayed manner. The second part of the group of 80 (49.7%) patients were diagnosed with perforation of a gastric or duodenal ulcer because patients with this diagnosis are usually hospitalised in a serious condition with clinical peritonitis and surgical intervention is performed in the first two hours from the hospitalisation moment.

The inclusion criteria were patients aged 60 to 89 years who were hospitalised in an urgent order with a diagnosis of acute calculous cholecystitis and perforation of a gastric or duodenal ulcer. Exclusion criteria included age under 60 and 90 years and older, presence of choledocholithiasis, mechanical jaundice, incurable patients, refusal of surgical treatment or participation in the study.

At the preoperative stage, all patients were diagnosed with SSA using the Edmonton Freil scale, which we selected, because it is quite simple and quick to use in emergency abdominal surgery[10,11].

All patients were divided into two groups after diagnosis of SSA according to the Edmonton Freil scale. The main group included 81 (50.3%) SSA patients. There were 50 (31.1%) patients with gastric or duodenal ulcer perforation, who made up subgroup A, and 30 (19.2%) patients with CHD and acute cholecystitis, who made up subgroup B among them. The comparison group included 80 (49.7%) patients without SSA. This group included 30 (18.6%) patients with gastric or duodenal ulcer perforation, who made up subgroup C, and 50 (31.1%) patients with CHD and acute cholecystitis, who made up subgroup D. Both groups were comparable in frequency of diagnoses $p = 0.1994$, $U = 2860.0$.

For the reliability of the SSA assessment, we also used specific markers: interleukin 6 (IL-6) reference values 1.2 - 3.7 pg/ml, the analysis was performed using the Spectrofluorometer Synergy HT (Bio Tek, USA) 570 nm. Determination of total blood protein, and albumin using the biochemical analyser FLEXOR E, "VITALAB" (Netherlands, 2009). The reference values for total protein were – 65-85 g/l, albumin (adults over 60 years old) – 34-48 g/l. Somatotropic hormone was determined using an enzyme-linked immunosorbent assay on a microplate reader Sunrise, Tecan, Austria, with reference values up to 20 mlU/l.

Statistical data processing was made by Statistica 13.0, TIBCO Software Inc. (License no. JPZ804I382130ARCN10-J) and Microsoft Excel 2013 (License no. 00331-10000-00001-AA404). The difference in reliability in indicators between groups was determined by non-parametric statistical analysis methods, namely the Mann-Whitney (U) test for unrelated groups. Textual data was presented as M±SD (arithmetic mean ± standard deviation) for a normal distribution and Me (Q1; Q3) (the sample median with upper (75%) and lower (25%) quartiles) for a different distribution from normal. A statistically significant result was considered if $p < 0.05$.

Results

The concomitant pathology frequency in the comparison group was 92.0%, in the main group it was 100.0%, p = 0.5501. Cardiovascular system pathology was the most common. 80.0% of the comparison patient's group had hypertensive disease, and 100.0% of the main patient's group had it, p = 0.0084. Ischemic heart disease was present in 46.0% of comparison group patients and in 67.8% of main group patients, p = 0.0075.

The average age in the comparison group was 69.7 ± 7.3 and in the main group 72.3 ± 8.3 years, U = 2324.00, p = 0.0528. The age structure of the sample was analysed according to the patient groups, Fig 1.

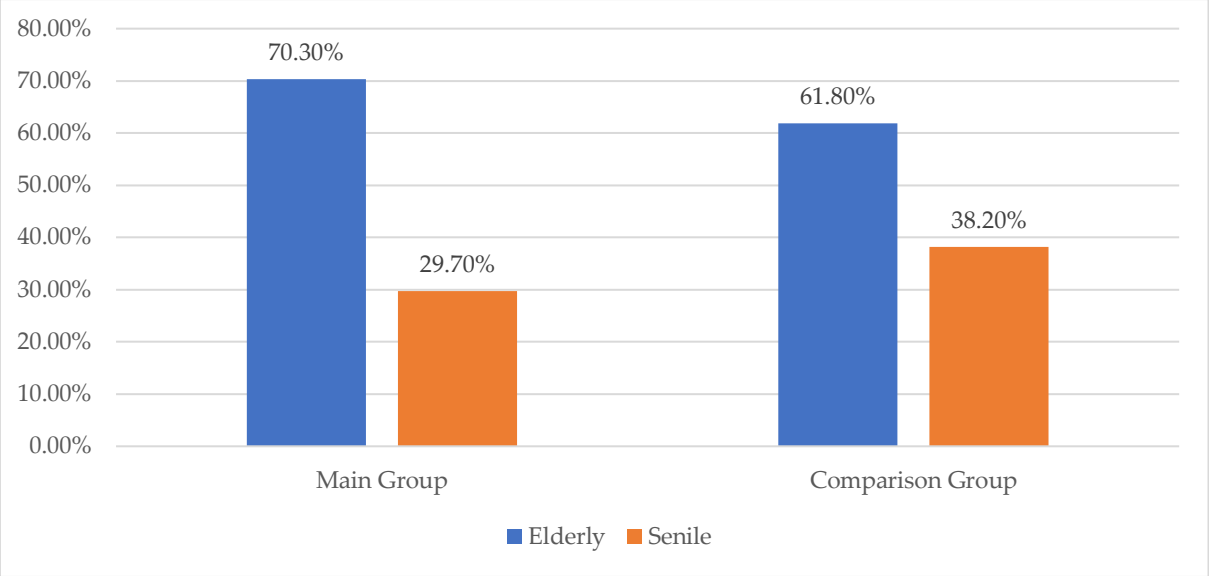

Figure 1. Group distribution according to WHO age classification

According to Fig. 1. Elderly and senile patients met with the same frequency in both study groups, the groups were comparable in age category – p = 0.5215, U = 1685.0. The level of SSA markers in all patients of both groups was assessed before surgical treatment, Tab. 1.

Table 1.

The level of SSA markers by groups

Marker	Reference values	**Main Group,** n = 81 (50.3%)	**Comparison Group,** n = 80 (49.7%)	p
Total protein	65-85 g/l	61.35 (55.00; 70.00)	70.93 (66.00; 76.00)	0.0009
Albumin	34-48 g/l	29.75 (24.70; 35.70)	34.61 (31.50; 38.20)	0.0072
Interleukin 6	1.2 – 3.7 pg/ml	129.22 ± 7.94	36.02 ± 5.41	0.0009
Somatotropic hormone	up to 20 mlU/l	0.89 (0.12; 1.28)	2.40 (0.33; 3.96)	0.0030

The results (Tab. 1) showed an increase in the level of SSA markers in the main group. The results showed hypoproteinemia with total protein level indicators in the main group of 61.35 (55.00; 70.00) g/l, p = 0.0009, U = 1224.0 and dysproteinemia. The albumin level in the main group was significantly reduced - 29.75 (24.70; 35.70) g/l, p = 0.0072, U = 2268.0. Although the level of interleukin 6 in both study groups exceeded the norm, most likely under the influence of an acute inflammatory process, we determined a significant increase in it in the SSA patients group with SCA - 129.22 ± 7.94

pg/ml, while in patients without asthenia, it was 36.02 ± 5.41 pg/ml, p = 0.0009, U = 1224.0. Somatotropic hormone became a more indicative marker. The significant decrease of the somatotropic hormone in the main group was 0.89 (0.12, 1.28) mlU/l compared to the comparison group by 2.40 (0.33; 3.96) mlU/l, p = 0.0030, U = 2248.5. It indicated the sarcopenia syndrome.

Based on the analysis of the effect of SSA on the treatment of the main pathology (Fig. 2), we established a significant increase in the frequency of postoperative complications and mortality in the group of asthenia patients, which corresponds to the literature data [15].

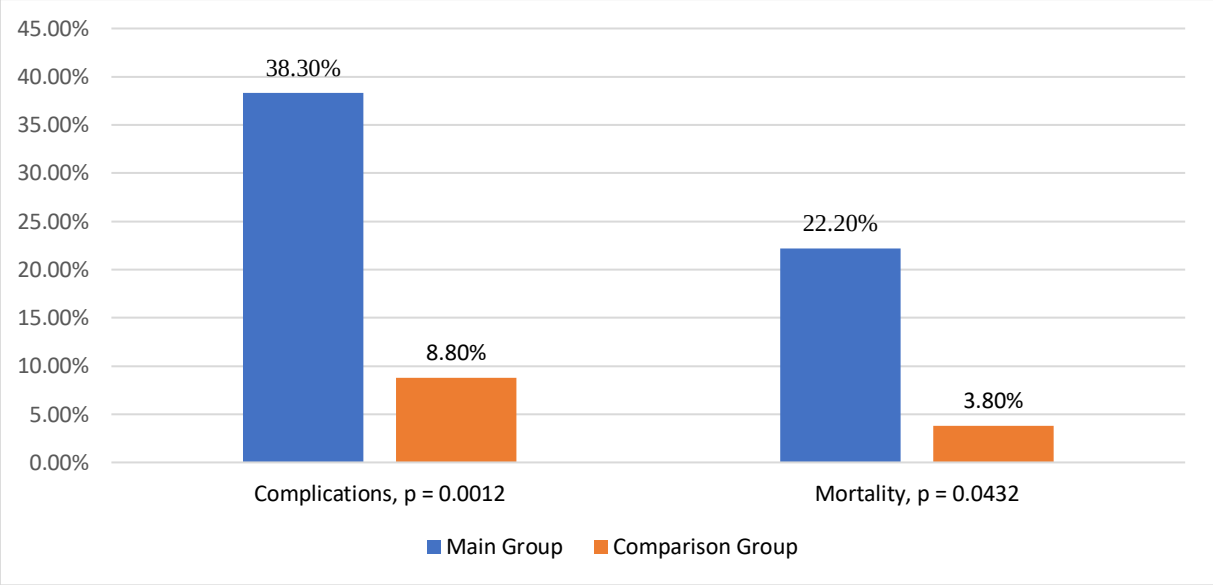

Figure 2. Analysis of postoperative complications and mortality

Against determining the SSA frequency in the surgical patients of the geriatric group, we evaluated the impact of this syndrome complex on the main treatment results. For this purpose, we analysed the frequency of postoperative complications in Tab. 2 and mortality in both studied groups.

Table 2

The structure of postoperative complications by group

Complications	**Main Group**, n = 81 (50.3%)				**Comparison Group** n = 80 (49.7%)			
	Subgroup A n = 50 (31.1%)		Subgroup B n = 31 (19.2%)		Subgroup C n = 30 (18.6%)		Subgroup B n = 50 (31.1%)	
	quantity	%	quantity	%	quantity	%	quantity	%
surgical								
Postoperative wound suppuration	2	4.0	0	-	0	-	0	-
Failure of plastic or anastomosis seams	2	4.0	-	-	2	6.7	-	-
Anastomosis	1	2.0	-	-	0	-	-	-
Eventeration	0	-	-	-	2	6.7	-	-
Seroma of the gallbladder	0	-	2	6.5	0	-	1	2.0
Biloma	0	-	2	6.5	0	-	1	2.0

not surgical								
Pneumonia	3	6.0	2	6.5	1	3.3	0	-
Pulmonary edema	2	4.0	0	-	0	-	0	-
Hydrothorax	9	18.0	1	3.2	0	-	0	-
Pleurisy	1	2.0	0	-	0	-	0	-
Pulmonary embolism	3	6.0	0	-	0	-	0	-
Postoperative delirium	1	2.0	0	-	0	-	0	-
Total by Subgroups	24	48.0	7	22.6	5	16.7	2	4.0

Analysing the results of Tab. 2 we determined that, in general, postoperative complications prevailed in the main group - 31 (38.3%), while in the group of patients without asthenia there were 7 (8.8%), p = 0.0012, U = 2283.5. The analysis of the structure of complications showed that in the main group, the vast majority of them were non-surgical complications 22 (27.2%), p=0.0097, U=2754.00; in the group of patients without asthenia, the part of non-surgical complications was 1 (37, 5%), surgical 6 (7.5%), p = 4960, U = 6640, no statistical difference was detected.

When analysing postoperative mortality, we determined a significant predominance in the main group - 18 (22.2%) patients, while in the comparison group 3 (3.8%) patients, p = 0.0432, U = 2641.5. In both groups, mortality was observed among patients with gastric or duodenal ulcer perforation.

Discussion

Based on the analysis of the SSA frequency in the conditions of emergency abdominal surgery, we determined that 50.3% of hospitalised patients had this syndrome, which corresponds to literature data[12]. According to various literature sources, the SSA frequency ranges from 12.9 to 45.0%. However, in patients with chronic heart failure, chronic obstructive pulmonary disease, and chronic kidney disease, a sharp increase in the syndrome (over 50.0%) is noted.[13,14].

Various scales are used for SSA determination. However, most of them require special complex tests and analyses for a diagnosis. At the same time, the Edmonton Freil scale allows you to quickly and reliably determine SSA presence, which is a very important factor in emergency medical care. We confirmed the effectiveness of this scale with SSA markers.

Malnutrition syndrome is the main component of SSA, which leads to age-related changes in the oral cavity and, as a result, to the involution of taste buds. As a result, nutrition is disturbed and the receptors' sensitivity to satiety increases, as opposed to the brain, so such patients feel satiety from a smaller amount of food consumed. Such changes lead to a decrease in the level of blood proteins, dysproteinemia and dyslipidemia. [15]. Hypoproteinemia with a total protein level of 61.35 (55.00, 70.00) g/l, p = 0.0009, U = 1224.0 confirmed the syndrome of malnutrition and dysproteinemia. The albumin level in the main group was also significantly reduced - 29.75 (24.70; 35.70) g/l, p = 0.0072, U = 2268.0.

Malnutrition syndrome with an insufficient protein level in the body starts a chain reaction that disrupts the functions of the skeletal-muscular system, leading to atrophy and sarcopenia. A decrease in the somatotropic hormone level is one of the precise markers of sarcopenia. We found this in the group of SSA patients: the somatotropic hormone level was significantly lower in the main group 0.89 (0.12, 1.28) mIU/l compared to the comparison group 2.40 (0.33, 3.96) mIU/l, p = 0.0030, U = 2248.5, which indicated sarcopenia syndrome.

One of the main theories explaining the main pathogenesis of CSA is chronic, constantly progressing inflammation. However, the study of the chronic inflammatory process in a group of patients with acute abdominal surgical pathology is a more difficult task. The interleukin 6 level in both study groups exceeded the norm, most likely under the influence of an acute inflammatory process. We

determined a significant increase in it in the group of SSA patients - 129.22 ± 7.94 pg/ml, while in patients without asthenia, it was 36.02 ± 5.41 pg/ml, p = 0.0009, U = 1224,0.

Somatotropic hormone and interleukin 6, as the SSA markers, cannot be routinely used in emergency surgery due to their low availability, the long duration of the study, and the significant influence of the inflammatory process on the result, which shows the level of interleukin 6 in the groups [16,17].

It is known that the SSA frequency increases to 50.0% in patients with chronic heart failure and chronic obstructive pulmonary diseases [13,14]. This was tracked in the frequency and structure of the postoperative complications. A detailed analysis showed that in the main group of SSA patients, non-surgical complications predominated - 22 (27.2%), p = 0.0097, U = 2754.00, while in the group of patients without asthenia, the part of non-surgical complications totalled only 1 (1.37.5%) case, and surgical 6 (7.5%) cases, p = 4960, U = 6640.0. No statistical difference was found.

The obtained work results allow us to state that the SSA negatively affects all organs and systems of the body. In turn, this complicates the course of the postoperative period and negatively affects the overall results of the surgical patient`s treatment of older people. A detailed study, timely diagnosis and modification of approaches will improve the treatment of patients with SSA.

Conclusions:

1. It was determined that the frequency of SSA in older persons in emergency abdominal surgery is 50.3%.
2. The Edmonton Freil scale can be used as a quick and effective method for diagnosing SSA in emergency abdominal surgery, which is reliably confirmed by such markers as total protein, albumin, interleukin 6, and somatotropic hormone.
3. SSA negatively affects the results of surgical patients' treatment. In the main group (asthenia patients), the number of postoperative complications prevailed and was 31 (38.3%), while in the group of patients without asthenia 7 (8.8%), p = 0.0012, U = 2283.5. Corresponding results were obtained when assessing mortality: in the main group - 18 (22.2%) patients, while in the comparison group 3 (3.8%), p = 0.0432, U = 2641.5.

This work was carried out in accordance with the Declaration of Helsinki (General Assembly of the WMA, 1964 with additions in 1975, 1983, 1989, 1996, 2000), Protocol of the Bioethics Commission No. 4 dated December 2, 2024.

Prospects for further research. The findings and new treatment protocols in emergency abdominal surgery for the elderly are promising for further studies in the future.

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Conflicts of Interest: authors have no conflict of interest to declare.

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