PROSPERITAS VESTRA FINIS NOSTRA!

MEDICAL UNIVERSITY

"PROF. DR. PARASKEV STOYANOV" - VARNA

FACULTY OF MEDICINE

DEPARTMENT OF SURGICAL DISEASES

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PELVIC AND INTESTINAL ABSCESSES

ABSTRACT

of a dissertation for the award of the educational and scientific degree "DOCTOR"

Scientific specialty 03.01.37

Supervisor: Assoc. Prof. Plamen Milchev Chernopolsky, MD, PhD

Varna 2023

The dissertation is written in 129 standard pages, of which 12 pages present the references used. The bibliographical reference includes 143 titles, of which 25 in Cyrillic and 118 in Latin. The material is illustrated with 18 figures and 40 tables.

The dissertation was discussed, accepted and directed for defense by the Departmental Council of the Department of Surgical Diseases, Medical University of Varna with the protocol

№ 121/08.02.2023 г.

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The public defense of the dissertation will take place on .....2023 at ..... at the University Hospital "St. Marina" before a scientific jury composed of:

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The defense materials are available in the Scientific Department and are published on the website of MU- Varna.

Note: The numbers of tables and figures in the abstract do not correspond to those in the dissertation.

CONTENTS

ABBREVIATIONS USED

АБ - Antibiotic
ААПМ - Absolute Atrial Fibrillation
ASA - American Society of Anesthesiologists
ГИТ - Gastrointestinal Tract
ДНК - Deoxyribonucleic Acid
ДИК - Disseminated Intravascular Coagulation
ИБС - Ischemic Heart Disease
ИАА - Intra-abdominal Abscesses
ИАИ - Intra-abdominal Infections
КИАИ - Complicated Intra-abdominal Infections
КАИЛ - Clinic of Anesthesiology and Intensive Care
МА - Small abscesses
ЧА - Intestinal abscesses
ПЗ - Comorbidities
МЗ - Past Medical History
КТ - Computed Tomography
ПЕТ/КТ - Positron Emission Tomography/Computed Tomography
Ро - X-ray
ТВБ - Pelvic Inflammatory Disease
УЗ – Ultrasound

1. INTRODUCTION

Intra-abdominal abscesses are a common surgical problem known to medicine since ancient times, but they continue to challenge surgical practice in terms of diagnostic and therapeutic management algorithm. Over the past century, abdominal abscesses have evolved from a disease with an extremely high mortality rate, even with surgical intervention, to a disease state with a rather "insidious", covert course, thanks in part to the widespread use of antibiotic agents, especially in the postoperative period. However, left untreated, in the majority of cases they lead to a fatal outcome. Late diagnosis and treatment lead to increased mortality rates. The associated pathophysiological consequences are life-threatening, leading to a prolonged period of morbidity and prolonged hospital stay, and therefore to negative socio-economic consequences. Early diagnosis and recognition of the associated pathology based on clinical assessment and laboratory and instrumental investigations are essential to develop an appropriate, individually tailored therapeutic strategy requiring a multidisciplinary approach. This is particularly important for malignant and intestinal abscesses, in which abscess formation is driven by similar pathophysiological mechanisms but the etiopathogenesis of the underlying nosological entity is different. Adequate source control and effective antimicrobial therapy are the two key points necessary to influence the disease state and portend a favorable outcome. In the past, surgical exploration, mechanical debridement and drainage of the abscess cavity were the traditional mainstays in the treatment of intra-abdominal abscesses. Over the past fifty years, image-guided procedures have evolved as an adjunct to advanced surgical drainage techniques. The remarkable advances in the diagnosis and treatment of these diseases are due to the improved capabilities and accessibility of imaging. Computed tomography, magnetic resonance imaging, and ultrasonography provide focused, objective information for expeditious diagnosis and determination of a treatment plan. Dramatic advances in these technologies have also expanded the possibilities for their application, and image-guided therapy now provides additional approaches to drain limited inflammatory collections. These facts, as well as a better knowledge of the pathophysiology of abscess formation, their complications, timely diagnosis and treatment, account for the decreasing mortality rate nowadays.

2. AIM AND OBJECTIVES

2.1 AIM

To study, analyze, classify and standardize the diagnosis, preoperative approach and treatment of patients with malignant and intestinal abscesses in order to optimize treatment outcome, reduce complications, rehospitalizations and achieve a better quality of life.

2.2. OBJECTIVES

1.Retrospective analysis and diagnostic distribution of patients with malignant and intestinal abscesses hospitalized in the Second Clinic of Surgery for the period 2010 - 2020.

2. Descriptive and comparative analysis between diagnostic and therapeutic methods in terms of effectiveness, combinability, radicality, risks, benefits, period of hospitalization.

3.Assessment of risk factors, degree of impairment of the general condition at diagnosis, complications and comorbidities on the final outcome, period of hospitalization, need for intensive care.

4.Analysis of postoperative complications and patient survival.

5. Creation of a diagnostic and therapeutic algorithm.

3. MATERIALS AND METHODS

3.1 DATA COLLECTION

We conducted a retrospective and prospective analysis of 160 patients with intra-abdominal abscesses of intestinal origin, including those with pelvic localization - of intestinal and non-intestinal origin for the period 2010-2020, hospitalized in the Second Clinic of Surgery of University Hospital "St. Marina"- Varna. The diagnosis was based on anamnestic, clinical, laboratory, imaging, intraoperative, histological and microbiological indicators.For this purpose, the available database, reflected in the patients' medical history, stored in the hospital archives, as well as the operative logs of the Second Clinic of Surgery were used.

Of these, 92 were men and 68 women aged 16 to 82. The mean age of the 160 patients studied is 52.85, approximately 53 years. All patients were hospitalized or transferred to the clinic as an emergency. According to the origin of the abscess and the anatomical localization, the patients were divided into groups with the following diagnoses:

Tab. 3- Diagnostic data distribution

Diagnostic data distribution	Frequency	Percentage	Valid %	Cumulative %
Lower GI tract- colon tumor	17	10,6	10,6	10,6
Pelvic abscess	32	20,0	20,0	30,6
Postoperative abscess- lower GIT - small intestine	10	6,3	6,3	36,9
Appendicitis	58	36,3	36,3	73,1
Crohn's disease	8	5,0	5,0	78,1
Postoperative upper GIT – stomach, duodenum	8	5,0	5,0	83,1
Lower GI tract- small intestinal abscess	8	5,0	5.0	88,1
Colon diverticulitis - lower GIT	13	8,1	8,1	96,3
Meckel's diverticulum -lower GIT	2	1,3	1,3	97,5
Postoperative abscess – colon, lower GIT	4	2,5	2,5	100
Total	160	100	100	

3.2 APPLIED RESEARCH METHODS

3.2.1 Diagnostic approach

- Multidisciplinary approach
- Anamnesis and physical examination
- Laboratory Investigations
- Medical Imaging
- Endoscopic Investigations
- Microbiological Investigations
- Histological investigations

3.2.2 Therapeutic approach

- Multidisciplinary approach
- -Conservative treatment
- -Percutaneous drainage under image control
- Endoscopic puncture/drainage
- -Surgical treatment with drainage
- -Combination between percutaneous drainage and operative treatment
- -Intensive Care
- Post-hospitalization therapy

3.2.3.Patient follow-up

- Monitoring the general and local status of patients following discharge within one month.

3.2.4 Statistical methods

1. Grouped data
2. Descriptive method

3. Correlation analysis

4. Statistical hypothesis testing

3.2.4.1. Grouped data

Identifying the subject of statistical study in every research serves as the basis for developing a theoretical model and designing an empirical model. To build the empirical model, it is necessary to register data for individual statistical units, taking into account factors such as time and location of observation, registration period, and observing authorities.

As the third main stage of the overall statistical study, the statistical grouping of data is considered. Being part of the statistical study process, grouping data by content represents an independent analysis method that provides an opportunity to delve into the structure of the studied phenomenon and to reveal relationships, dependencies, and influences. As a result of correctly conducted data grouping, empirical distributions with one-dimensional, two-dimensional, or multidimensional character are obtained.

3.2.4.2. Descriptive methods

Descriptive methods have a direct relationship with the distribution of statistical units by the values of their features, revealing their nature and internal structure. To correctly apply descriptive methods, it is necessary for the observation units to be comparable and specific in terms of time and location.

Descriptive methods establish central tendencies, the degree of difference between individual observation units (patients), and the degree of deviation of empirical distributions of observed units from standard distributions. Different methods are applied for each individual group of characteristics. To establish central tendencies, measures of central tendency such as mode and median are used , to establish differences between units, measures of dispersion such as variance and standard deviation are used. To determine deviations from standard distributions, skewness coefficient and kurtosis coefficient are used.

The graphical representation of the empirical distribution is an essential part of descriptive statistical methodology. The following graphical representations were used in the dissertation: histogram, structural diagram.

3.2.4.3 Correlation analysis

Correlation analysis is a statistical method that measures the strength and direction of the correlation between two or more phenomena. When developing a correlation model, it is essential to correctly define the independent variable X (factor) and the dependent variable Y (consequence). The main measure of the strength of the relationship is the correlation coefficient r. Its value is interpreted according to the following scale:

Value of the correlation coefficient r.	Interpretation of the strength of the dependence
0	no correlation
0-0,3	low correlation
0,3-0,5	moderate correlation
0,5-0,7	significant correlation
0,7-0,9	high correlation
0,9-1	very high correlation
1	functional correlation

When the correlation coefficient r has a positive value, it can be argued that the dependence between the phenomena is direct/positive. When the correlation coefficient r has a negative value, it is argued that the dependence is inverse/negative.

For the proper conduct of a correlation analysis, it is necessary to follow the following stages:

1. Determine the independent variables (factors) X and the dependent variable Y (effect).

2. Select an appropriate correlation coefficient according to the statistical scale to which the variables under investigation belong.

3. Assess the strength of the correlation.

4. Evaluate the statistical significance of the obtained coefficient.

5. Interpret the obtained results

It is essential to assess whether the obtained correlation coefficient is statistically significant. In the conditions of using modern statistical and econometric software products, science allows us to make a decision in an alternative way (without calculating the empirical value). The decision comes down to comparing the standard level of significance (risk of error α) with the calculated critical level of significance (Significance). This method is applied in the current study when testing for statistical significance of the obtained correlation coefficient r. If the calculated level of significance (Sig) based on the sample data is less than the accepted norm level of significance (α), it is assumed that the obtained correlation coefficient is statistically significant and reliable. If the calculated level of significance (Sig) is greater than the perceived as normal level of significance (α), it is accepted that the obtained correlation coefficient is not statistically significant.

The focus is on the non-parametric correlation coefficient of contingency, which is applicable when studying dependencies with variables located on a nominal scale (qualitative variables).

3.2.4.4. Statistical hypotheses testing

The statistical hypothesis is an assumption about the form of an unknown probability distribution function of observed random variables or about the parameters of a distribution function of a known type. The testing of statistical hypotheses involves procedures for defining specific assumptions about the parameters of the populations under study, by formulating a null hypothesis and an alternative hypothesis. The null hypothesis H0 expresses an assumption of zero effect, meaning that there is no difference between the compared variables. The alternative hypothesis H1 is accepted if the null hypothesis is rejected.

In statistical science, hypothesis testing follows the following algorithm, which is also applied in dissertations:

-Define the null hypothesis H0 and the alternative hypothesis H1;

-Choose a significance level α (risk of error);

-Choose an appropriate statistical criterion and theoretical distribution directly related to the formulated null hypothesis;

-Calculate the empirical test statistic based on data from the sample (n);

-Determine the theoretical value according to the parameters of the statistical criterion;

-Make a decision on the choice of the statistical hypothesis based on the comparison of the empirical and theoretical values.

In the conditions of using modern statistical and econometric software products, science allows for a decision to be made in an alternative way (without calculating the empirical value). The choice between the null and alternative hypotheses is reduced to a comparison between the adopted standard level of significance (risk of error α) and the calculated critical level of significance. This method is also applied in the dissertation work when testing statistical hypotheses.

If the calculated level of significance based on the sample data is less than the adopted standard level of significance, the null hypothesis is rejected and the alternative hypothesis is accepted. If the calculated level of significance is greater than the adopted standard level of significance, the null hypothesis is accepted.

4. RESULTS

4.1. Observation parameters

1. Sociodemographic indicators of patients

2. Length of hospital stay

3. Diagnostic distribution of patients

4. Clinical symptoms

5. Laboratory values of leukocytes at admission and discharge

6. Imaging diagnostic methods used

7. Preoperative staging of patients according to ASA

8. Therapeutic approach - source control and antimicrobial therapy

9. Results of microbiological investigation

10. Accompanying and past diseases

11. Need for intensive care

12. Complications

13. Mortality

4.1.1. Sociodemographic indicators of patients with pelvic and intestinal abscesses

The distribution of patients with pelvic and intestinal abscesses by gender is presented in Table 1 and Figure 1:

Sex

N	Valid	160
	Missing	0

Tab. 1 - Distribution of patients by sex

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	92	57,5	57,5	57,5
	Female	68	42,5	42,5	100,0
	Total	160	100,0	100,0	

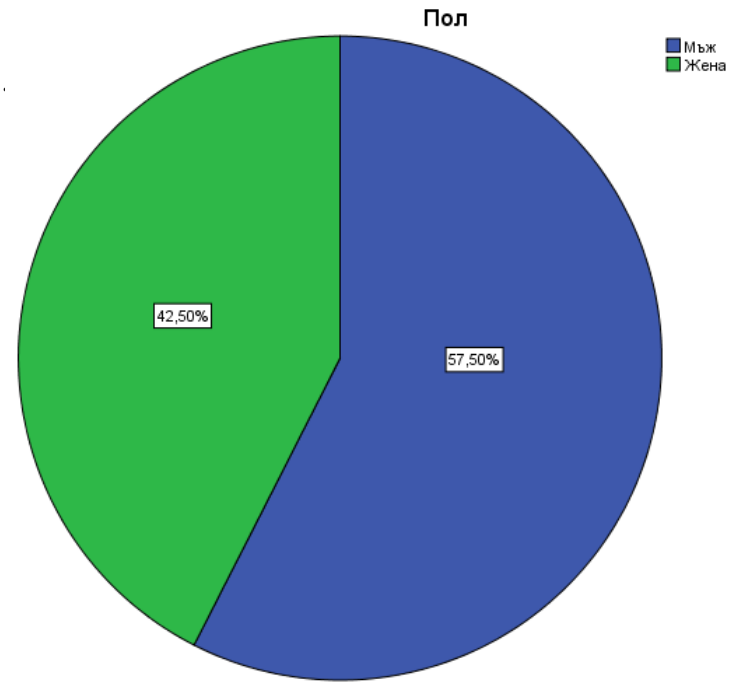


Fig. 1 - Distribution of patients by gender in percentages.

From the presented data, it is clear that male gender prevails, with 15.50% of cases being more often affected than female gender.

The age distribution of the patients is presented in Table 2 and Histogram 1.

Table 2 - Age distribution of patients.

Number (N)	Valid	160
	Missing	0
Mean		52,85
Median		54,50
Mode		63
Std. Deviation		16,460
Skewness		-,286
Std. Error of Skewness		,192
Kurtosis		-,726
Std. Error of Kurtosis		,381
Minimum		16
Maximum		82

N Valid - number of research units - 160 patients.

Mean - arithmetic mean - the average age of the 160 patients studied is 52.85, approximately 53 years old.

Minimum - the minimum age of the patients is 16 years old.

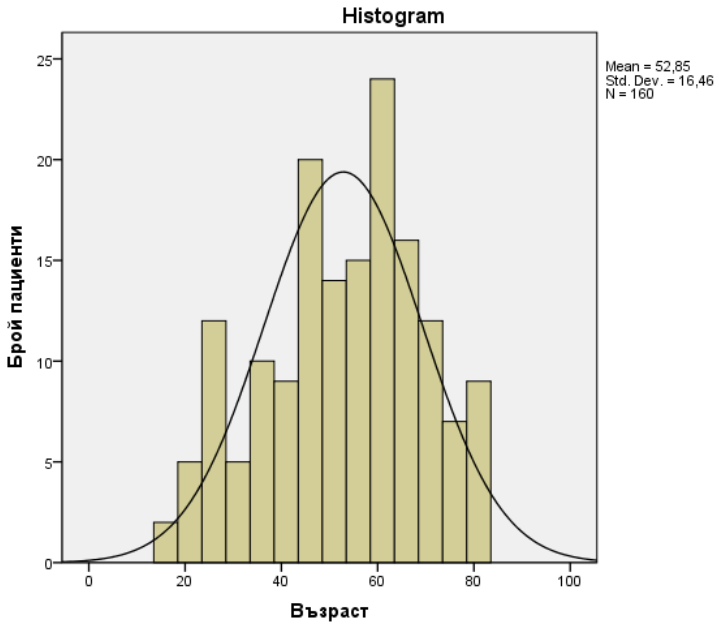
Maximum - the maximum age of the patients is 82 years old.

Mode - the most common occurrence of a unit for a given characteristic - the most common age among the studied patients is 63 years old.

Std. deviation - standard deviation - measures the differences between units for a given characteristic - the 160 patients studied vary in age on average by 16 years.

Skewness - skewness coefficient - relates to the distribution of units - a value of -0.286 indicates moderate right-skewedness of the distribution curve (as as shown in the histogram below).

Kurtosis - coefficient of kurtosis - has a value of -0.726, indicating a moderate clustering of research units (patients) at low frequencies.



Histogram 1 - Age distribution of patients

The moderate asymmetry with a right-skewed distribution curve shows an increased number of affected patients between the ages of 45-65. The peak of the distribution curve indicates an increased number of patients in certain age groups - 45 and 60 years old.

4.1.2. Length of hospital stay

The distribution of patients according to the length of hospital stay is presented in Table 2 and Histogram 2:

Table 2- length of hospital stay

N	Valid	160
	Missing	0
Mean		11,00
Median		8,00
Mode		5
Std. Deviation		10,212
Skewness		4,259
Std. Error of Skewness		,192
Kurtosis		24,278
Std. Error of Kurtosis		,381
Minimum		2
Maximum		85

N Valid - number of research units - 160 patients.

Mean - the average length of hospital stay for the 160 patients under study is 11 days.

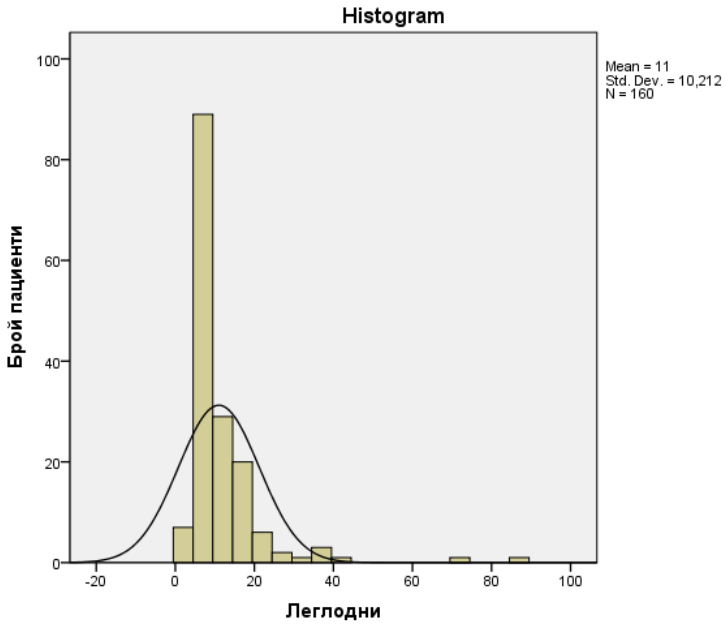
Minimum - the minimum length of hospital stay is 2 days.

Maximum - the maximum length of hospital stay is 85 days.

Mode - the most common duration of hospital stay observed among the units is 5 days

Skewness - the skewness coefficient is -4.259, indicating a moderately left-skewed distribution of the units, as shown on the histogram below.

Kurtosis - the kurtosis coefficient is -24.278, indicating a high degree of peakedness in the distribution of research units (patients) with a low frequency of occurrence.



Histogram 2 - Duration of Hospital Stay

The left-skewed distribution indicates a larger number of patients with shorter hospital stays. The peakedness of the distribution shows that approximately 90 out of the 160 patients have a total hospital stay of 5-7 days.

4.1.3. Diagnostic distribution of patients

Depending on the anatomical location, the affected intraabdominal organ, and the etiology of the disease, all 160 patients were distributed into the following diagnostic groups, presented in Table 3 and Fig. 2:

Table.3 Diagnostic data distribution of patients

Diagnostic data distribution	Frequency	Percentage	Valid %	Cumulative %
Lower GI tract- colon tumor	17	10,6	10,6	10,6
Pelvic abscess	32	20,0	20,0	30,6
Postoperative abscess- lower GIT - small intestine	10	6,3	6,3	36,9
Appendicitis	58	36,3	36,3	73,1
Crohn's disease	8	5,0	5,0	78,1
Postoperative upper GIT – stomach, duodenum	8	5,0	5,0	83,1
Lower GI tract- small intestinal abscess	8	5,0	5.0	88,1
Colon diverticulitis - lower GIT	13	8,1	8,1	96,3
Meckel's diverticulum - lower GIT	2	1,3	1,3	97,5
Postoperative abscess – colon, lower GIT	4	2,5	2,5	100
Total	160	100	100	

Patients with appendicular abscesses represent 36% (58) of all studied patients. Pelvic abscesses were found in 20% (32) of all cases. Two-thirds of cases are associated with gynecological causes - a tubo-ovarian abscess, intrauterine devices, tumors or past hysterectomy. Postoperative abscesses account for 13.8% (22) of all studied patients and are distributed into three groups - consequences of surgical interventions in the area of the stomach and duodenum (upper gastrointestinal tract) - 5% (8), consequences of surgical interventions on the lower gastrointestinal tract - with small intestinal origin - 5% (8) and with large intestinal origin - 2.5% (4). Abscesses resulting from obstructing tumors with perforation were found in 10.6% (17) of all studied cases. In 7 cases, the left colon was involved, while in 10 cases, the right colon was involved. It is noteworthy that abscesses resulting from tumors in the cecum represent 60% (6) of all 10 cases with right-sided localization. Abscesses with diverticular origin represent 9.4% (15) of all studied cases. Of these, 8.1% (13) were a result of diverticulitis of the large intestine, while in 1.3% (2) - a result of perforated Meckel's diverticulum with formed abscess. Crohn's disease-associated abscesses were found in 5% (8) of cases. 3 of them had large intestinal involvement - stenosing form, with a clinical picture of obstructive ileus. The remaining 5 had small intestinal or mixed (small and large intestinal) involvement, with 2 of these cases having evidence of enterocolic and entero-enteral fistulas. The remaining 5% (8) of established abscesses affecting the small intestine were a result of processes of ischemia, necrosis, and free or covered perforation as a result of strangulating, adhesive ileus, or microperforations from foreign bodies.

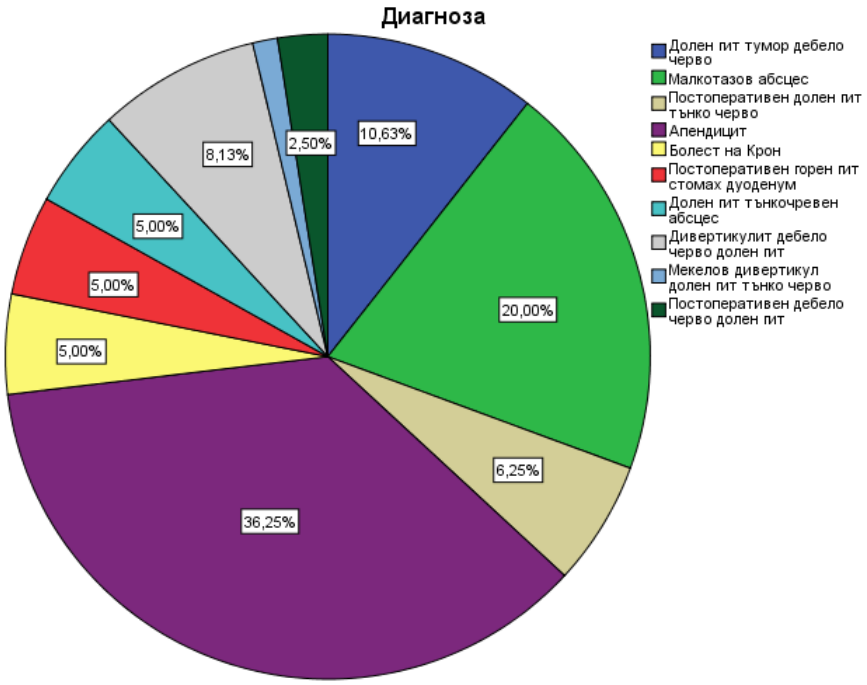


Fig.2 Diagnostic data distribution of patients

4.1.4. Clinical Symptoms

The clinical presentation of patients with small and bowel abscesses is heterogeneous and variable, depending on the extent of damage to the body and the systemic response to the injury. Some of the characteristic clinical symptoms were examined.

4.1.4.1. Abdominal pain

The distribution of patients by abdominal pain symptom is presented in Table 4 and Figure 3:

Table 4: The distribution of patients by abdominal pain symptom

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	140	87,5	87,5	87,5
	No	20	12,5	12,5	100,0
	Total	160	100,0	100,0	

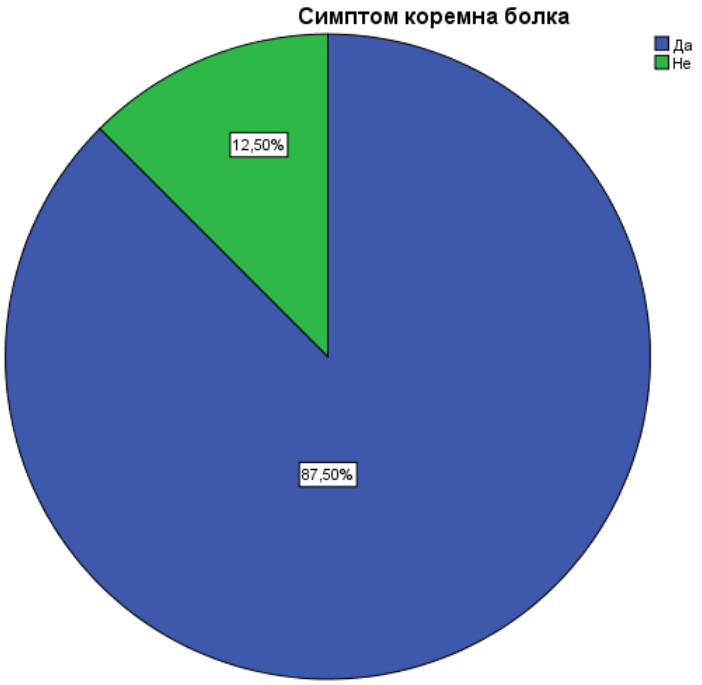


Fig.3- Abdominal pain symptom

From the data, it is clear that abdominal pain is the most commonly reported symptom in patients - in almost 88% of cases. Abdominal pain may be absent in cases of severely compromised patients leading to lethargy, in elderly patients, immunocompromised patients, postoperative abscesses, where other symptoms may be more prominent.

4.1.4.2. Data on peritoneal irritation

Data on peritoneal irritation are presented in Table 5 and Figure 4, showing the distribution of patients according to the available objective data on peritoneal irritation.

Table 5- Peritoneal irritation symptom

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	102	63,8	63,8	63,8
	No	58	36,3	36,3	100,0
	Total	160	100,0	100,0	

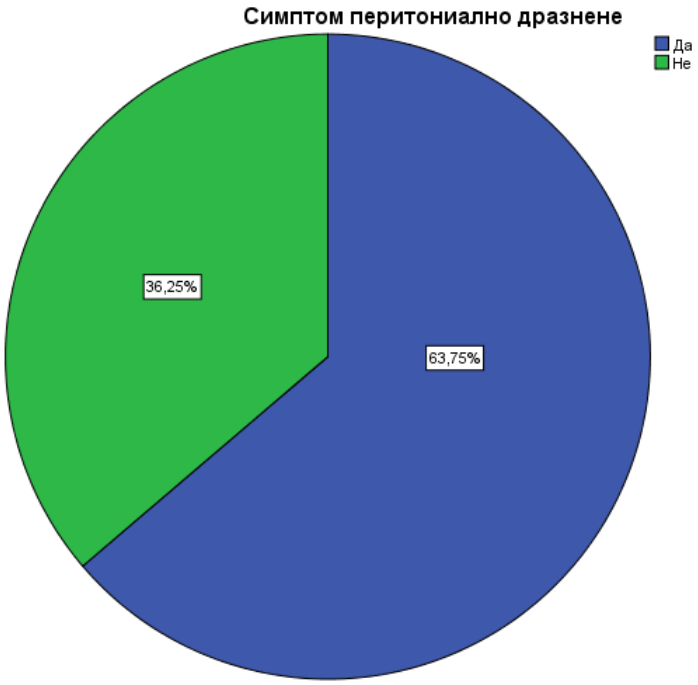


Fig.4. Peritoneal irritation symptom

At 102 (63.8%) out of all 160 patients, there is data on peritoneal irritation - resistance to defans on the anterior abdominal wall and a positive Blumberg's sign.

4.1.4.3. The symptom of a disturbed intestinal transit.

Table 6 and Figure 5 present data on the presence or absence of a disturbed intestinal passage in the patients:

Table 6 The symptom of a disturbed intestinal transit

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	75	46,9	46,9	46,9
	No	85	53,1	53,1	100,0
	Total	160	100,0	100,0	

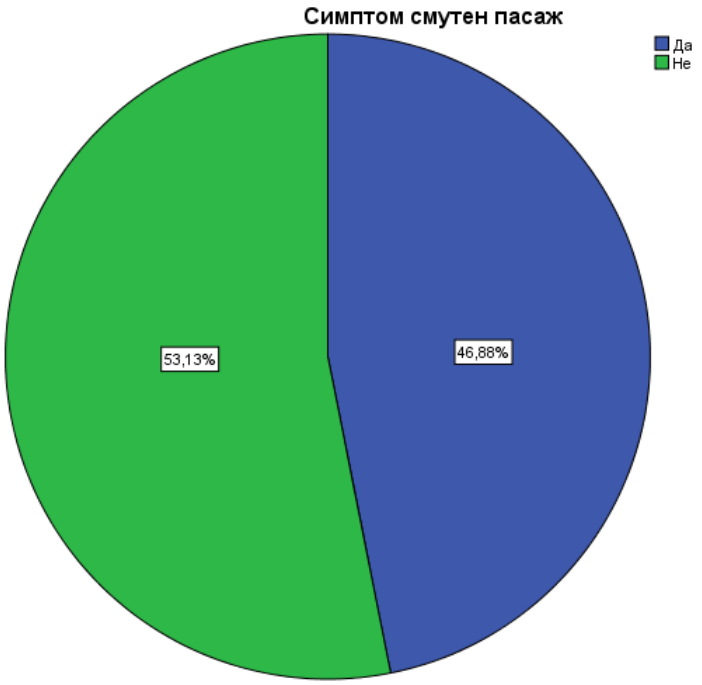


Fig.5 The symptom of a disturbed intestinal transit

In 75 (46.9%) of the patients, there is data on a disturbed intestinal transit - ileus and subileus conditions are predominant, but diarrhea syndrome is also observed. Nausea and vomiting symptoms are also included as additional symptoms.

4.1.4.4. Objective data on fever during examination.

Table 7 and Figure 6 present data on the presence of fever during examination of the patients:

Table 7 - Symptom – fever

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	63	39,4	39,4	39,4
	No	97	60,6	60,6	100,0
	Total	160	100,0	100,0	

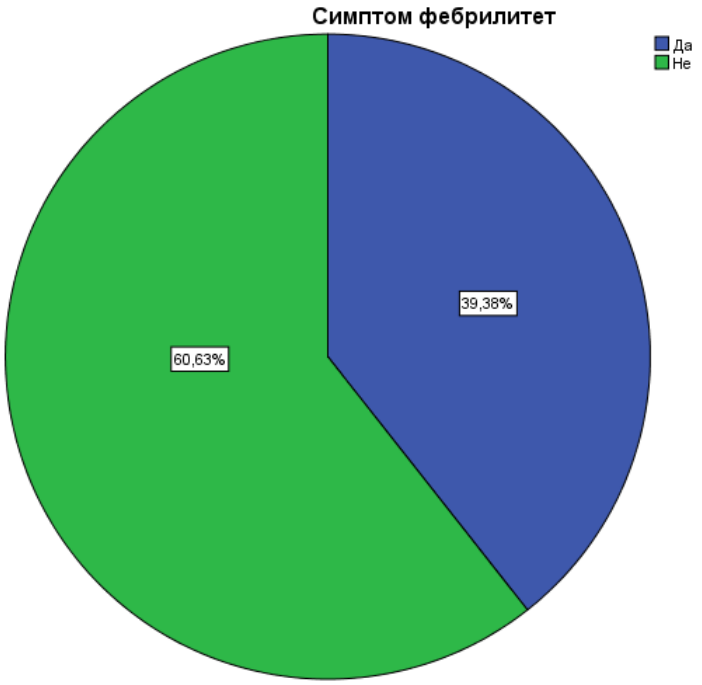


Fig.6 Symptom – fever

Fever was found in nearly 40% of cases during clinical examination of the patients. In almost all cases, there is a history of episodes of elevated body temperature from the beginning of the complaints.

4.1.5. White blood cell values at admission and discharge. Testing hypotheses - differences in white blood cell values at admission and discharge.

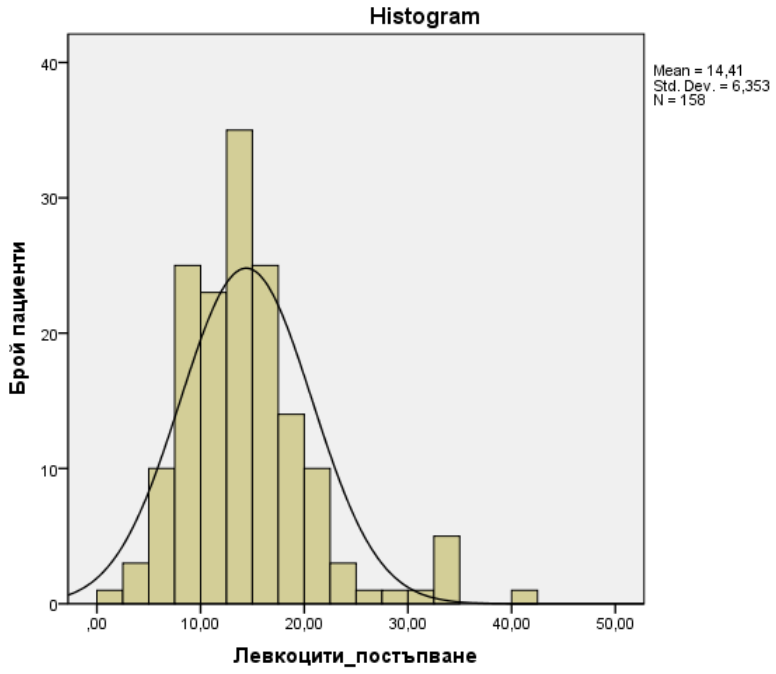
4.1.5.1. White blood cells at admission

Table 8 and Histogram 3 present data on the values of white blood cells at admission to the Clinic:

Table 8. Values of white blood cells at admission

N	Valid	158
	Missing	2
Mean		14,4059
Median		13,7500
Mode		7,70[a]
Std. Deviation		6,35334
Skewness		1,432
Std. Error of Skewness		,193
Kurtosis		3,343
Std. Error of Kurtosis		,384
Minimum		2,31
Maximum		42,06

a. Multiple modes exist. The smallest value is shown



Histogram 3. Values of white blood cells at admission

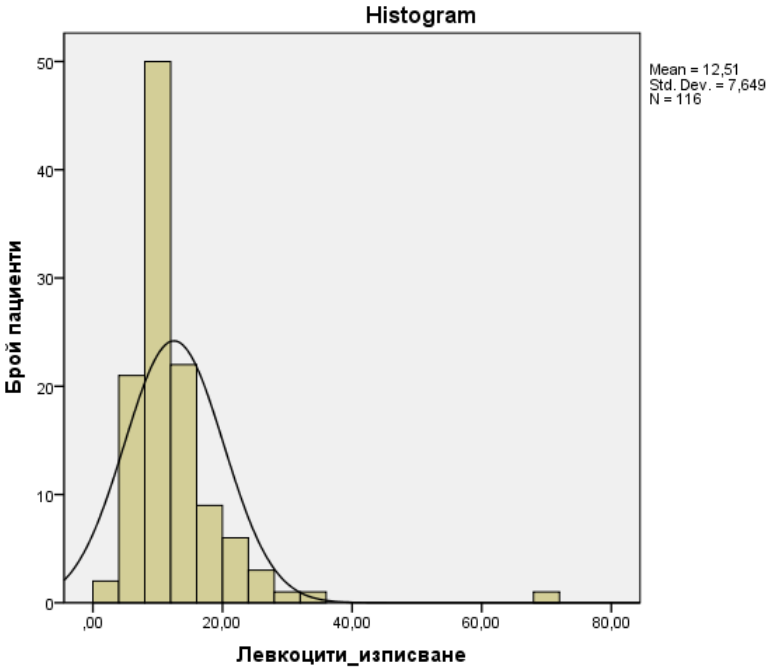
4.1.5.2. White blood cells at discharge

Table 9 and Histogram 4 present data on the values of white blood cells at discharge from the Clinic:

Table 9. Values of white blood cells at discharge

N	Valid	116
	Missing	44
Mean		12,5125
Median		10,8300
Mode		9,20[a]
Std. Deviation		7,64929
Skewness		4,213
Std. Error of Skewness		,225
Kurtosis		28,468
Std. Error of Kurtosis		,446
Minimum		2,10
Maximum		70,57

a. Multiple modes exist. The smallest value is shown



Histogram 4. Values of white blood cells at discharge

4.1.5.3. Testing hypotheses - difference in white blood cell values at admission and discharge.

Tables 10 and 11 present a statistical hypothesis test regarding the difference in white blood cell values at admission and discharge:

Table 10.

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	White blood cell values at admission	14,8466	116	6,86308	,63722
	White blood cell values at discharge	12,5125	116	7,64929	,71022

Table 11. Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	White blood cell values at admission White blood cell values at discharge	2,33405	7,81167	,72530	,89738	3,77072	3,218	115	,002

1. The null hypothesis H0 is defined as there is no statistically significant difference in the white blood cell counts between admission and discharge in 116 patients for whom we have data for both events.
2. The alternative hypothesis H1 states that there is a statistically significant difference.
3. A significance level of $\alpha=0.05$ (5% risk of error) is adopted with a confidence level of p=95%.
4. A t-test is used.

5. The adopted significance level α=0.05 (5% risk of error) with a confidence level of p=95% is compared to the estimated critical value of significance Sig.
6. Sig /p/=0.002< α=0.05, therefore, from the theory of statistics, it can be concluded that the null hypothesis H0 is rejected and the alternative hypothesis is accepted, indicating that there is a statistically significant difference between the two groups of patients, specifically that the mean white blood cell counts decrease by 2.33 units.

4.1.6. Imaging diagnostic methods used

On Table 12 and Figure 7, the imaging diagnostic methods used are presented:

Table 12: Used diagnostic methods

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Ultrasound	58	36,3	36,3	36,3
	CT-scan	23	14,4	14,4	50,6
	X-ray	5	3,1	3,1	53,8
	X-ray-CT scan-ultrasound	58	36,3	36,3	90,0
	Ultrasound+CT scan	16	10,0	10,0	100,0
	Total	160	100,0	100,0	

Fig.7 Used diagnostic methods

Ultrasound examination and computed tomography were used in the highest percentage of cases as imaging diagnostic methods. A total of 132 patients underwent ultrasound examination, while computed tomography was used in 97 patients. Ultrasound + CT were used as a combination in 74 patients. A combination of three imaging studies - X-ray, ultrasound examination, and computed tomography - was conducted in 58 of the patients.

4.1.7 The preoperative staging of patients according to the ASA (American Society of Anesthesiologists)

The preoperative staging of patients according to the ASA is presented in Table 13 and Figure 8. The American Society of Anesthesiologists creates a six-step scale to assess the degree of impairment of the general condition and risk factors in patients undergoing surgical treatment. Only operated patients were included in the study.

Table 13. Staging of patients according to the ASA

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	I	17	10,6	13,1	13,1
	II	36	22,5	27,7	40,8
	III	55	34,4	42,3	83,1
	IV	20	12,5	15,4	98,5
	V	2	1,3	1,5	100,0
	VI	0	0	0	
	Total	130	81,3	100,0	
Missing	System	30	18,8		
Total		160	100,0		

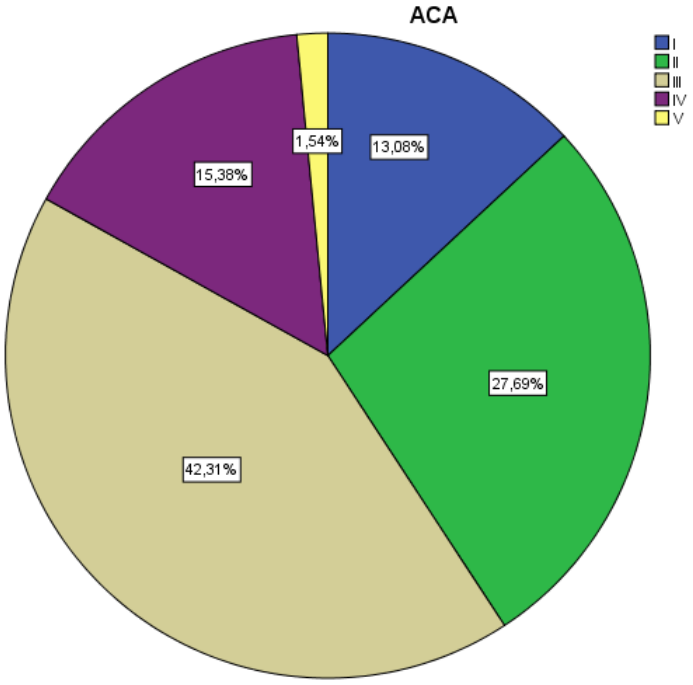


Fig.8. Staging of patients according to the ASA

The highest percentage of cases is occupied by patients with ASA III (34.4% of cases), followed by patients with ASA II (22.5%) and ASA IV (12.5%).

4.1.8. Therapeutic approach - control over the source and antimicrobial therapy.

4.1.8.1. Applied methods for source control

Table 14 and Figure 9 present the methods used for source control in patients with small and intestinal abscesses.

Table 14. Treatment methods

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Surgical treatment	133	83,1	83,1	83,1
	Conservative treatment + Percutaneous drainage	22	13,8	13,8	96,9
	Conservative treatment	1	,6	,6	97,5
	Refused surgical treatment	1	,6	,6	98,1
	Surgical + percutaneous drainage	3	,1.9	1,9	100,0
	Total	160	100,0	100,0	

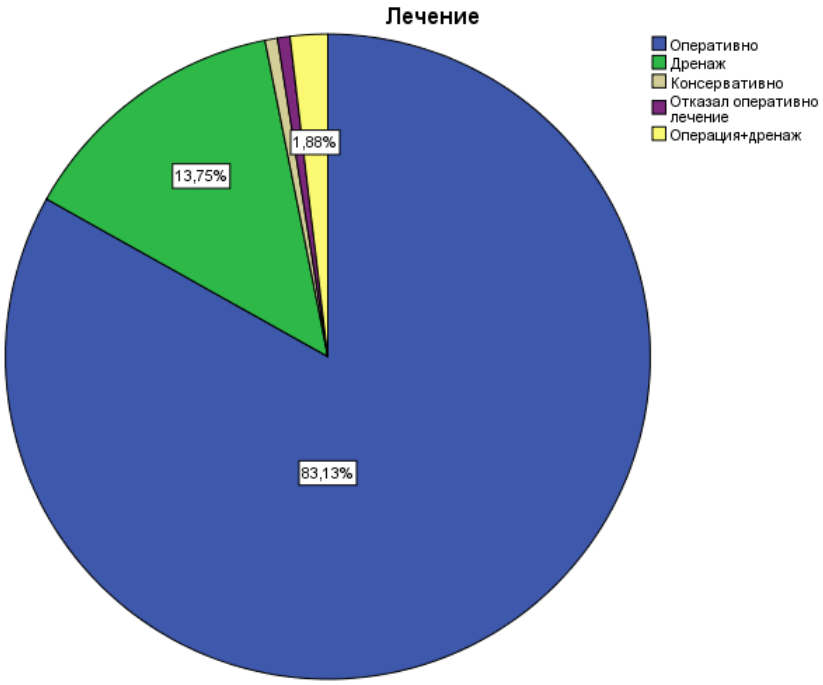


Fig.9 Treatment methods

In 133 (83%) of the patients, conventional surgical treatment was applied for source control. In 22 (13%) patients, source control was successfully achieved only with percutaneous drainage. In 3 (1.9%) of the patients, percutaneous drainage as a standalone procedure did not lead to satisfactory results, and additional surgical treatment was performed. One patient was treated entirely conservatively, and one patient refused surgical treatment.

4.1.8.2. Empirical antimicrobial therapy

Table 15 and Figure 9 present the empirically used antimicrobial agents as monotherapy or in combination with Metronidazole.

Table. 15 - Empiric antimicrobial therapy

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Amoxicillin	6	3,8	3,8	3,8
	Metronidazole+ other antibiotic	95	59,4	59,4	63,1
	Ceftriaxone	1	,6	,6	63,8
	Cefazoline	50	31,3	31,3	95,0
	Cefuroxime	4	2,5	2,5	97,5
	None	4	2,5	2,5	100,0
	Total	160	100,0	100,0	

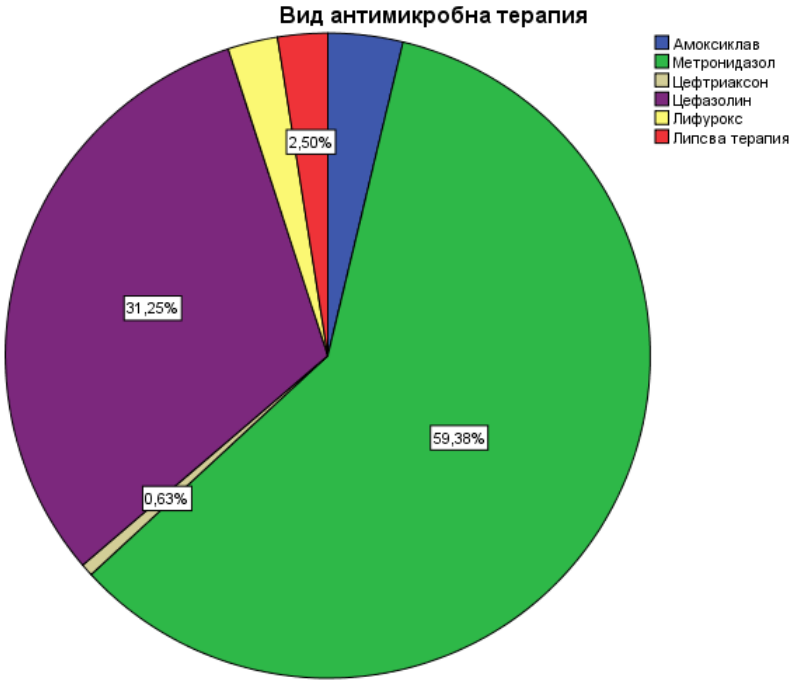


Fig.9 Empiric antimicrobial therapy

From the presented data, it is clear that for empirical therapy, antibiotics from the penicillin, aminoglycoside, and cephalosporin groups are prescribed to patients in combination or without metronidazole (an anti-anaerobic drug). After a completed antibiogram from the conducted microbiological examination, a reassessment of the antibiotic treatment was carried out in relation to the sensitivity of the isolated microorganisms. As additional treatment in severe cases, antibiotics from the fourth-generation cephalosporin group, carbapenems, tetracyclines, polymyxin E (colistin), etc., including antifungals, were used.

4.1.9. Results of the conducted microbiological examination

Table 16 and Figure 10 present the distribution of isolated microorganisms, as well as the cases in which sterile cultures were established. The material for microbiological examination is obtained intraoperatively, by puncturing the abscess or through percutaneous drainage.

Table 16. Results of the conducted microbiological examination

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	E.coli	59	36,9	36,9	36,9
	Staphylococcus aureus	7	4,4	4,4	41,3
	Sterile cultures	43	26,9	26,9	68,1
	Klebsiella oxytoca	3	1,9	1,9	71,3
	Bacteroides fragilis	1	,6	,6	71,9
	Enterococcus faecium	6	3,8	3,8	75,6
	Proteus vulgaris	2	1,3	1,3	76,9
	Klebsiella pneumoniae	8	5,0	5,0	81,9
	Enterobacter aerogenes	3	1,9	1,9	83,8
	Citrobacter freundii	2	1,3	1,3	85,0
	Enterococcus faecalis	5	3,1	3,1	88,1
	Staphylococcus intermedius	1	,6	,6	88,8
	Pseudomonas aeruginosa	9	5,6	5,6	94,4
	CNS	1	,6	,6	95,0
	Streptococcus alpha	3	1,9	1,9	96,9
	Providencia rettgeri	1	,6	,6	97,5
	Candida albicans	1	,6	,6	98,1
	Staphylococcus coagulase negative	1	,6	,6	98,8
	Morganella morganii	1	,6	,6	99,4
	Enterococcus avium	1	,6	,6	100,0
	Acinetobacter baumannii	2	1,3	1,3	69,4
	Total	160	100,0	100,0	

In the predominant percentage of cases, the most commonly isolated microorganism is E. coli (36.9%), followed by Enterococcus spp. (7.3%), P. aeruginosa (5.6%), Kl. pneumoniae (5%), St. aureus (4.4%), B. fragilis (1%). In 26.9% of cases, the cultures remained sterile. These data coincide with the reference made in the literature review.

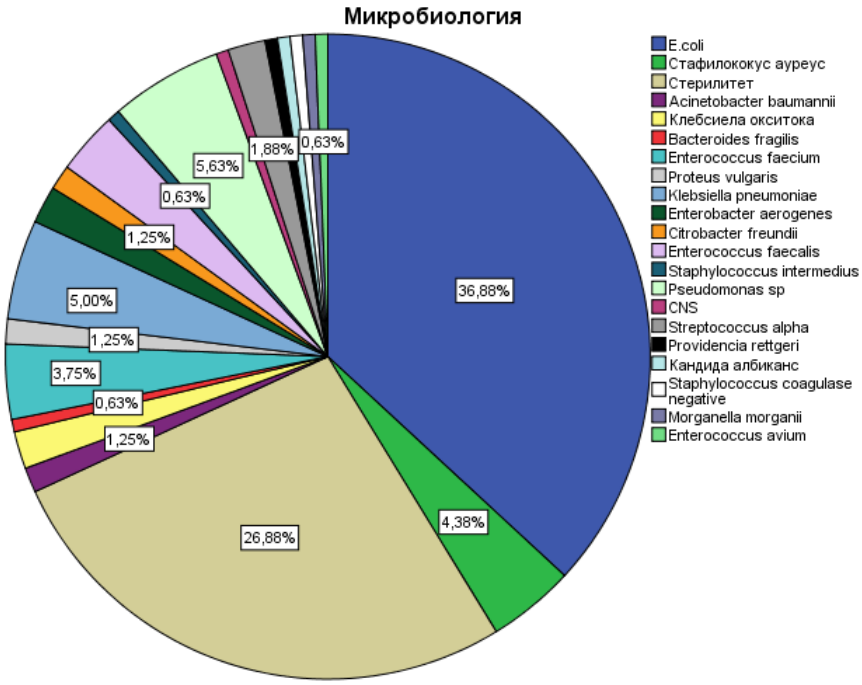


Fig.10. Results of the conducted microbiological examination

4.1.10. Frequency of comorbidities, complications, need for intensive care, and mortality in patients with pelvic and intestinal abscesses

We conducted an analysis of comorbidity, the need for intensive care, complications, and mortality in patients with pelvic and intestinal abscesses.

4.1.10.1. Ratio of the number of comorbidities and past illnesses in patients.

Table 17 and Figure 11 present the distribution of patients according to the number of comorbidities and past illnesses:

Table 17 Patients with comorbidities.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Without comorbities	48	30,0	30,0	30,0
	With one	46	28,8	28,8	58,8
	With two	39	24,4	24,4	83,1
	With three and more	27	16,9	16,9	100,0
	Total	160	100,0	100,0	

Fig.11 Patients with comorbidities

Table 18 Percentage distribution of comorbidities and past illnesses

Comorbidities and past illnesses		**%**
Cardiovascular system	Congestive heart failure, ischemic heart disease, arterial hypertension, hyperlipidemia, history of coronary stenting.	40%
Respiratory system	COPD (chronic obstructive pulmonary disease), bronchial asthma, sinusitis, pleural effusions, history of malignant respiratory diseases	5%
Digestive system	Gastritis, Duodenitis , Crohn's disease, Gallbladder disease, Hepatitis C and B-related cirrhosis, Data on malignant diseases of the gastrointestinal tract.	15%
Endocrine system and metabolic disorders	Diabetes mellitus, Graves' disease, Osteoporosis, Dyslipidemia.	12%
Urinary system	Chronic glomerulonephritis, Chronic pyelonephritis, Bladder cancer, Hydronephrosis, Data on malignant diseases of the urinary system	4%
Central and peripheral nervous system:	Sequelae of traumatic brain injury, Epilepsy, Disc herniation	4%
Other:	History of hysterectomy (5.4%), Thalassemia, Non-Hodgkin lymphoma, Rheumatoid arthritis, etc.	20%

Table 18 presents the percentage ratio of accompanying and past diseases by system. Cardiovascular diseases (40%) have the highest percentage, followed by digestive (15%) and endocrine (12%) diseases. The analyzed data reveals that in 8 out of 32 cases with pelvic abscesses, there is a history of hysterectomy.

4.1.10.2. Complications.

Table 19 and Fig. 12 present data on the number of complications that occurred in patients:

Table 19 Patients with number of complications**.**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Without complications	108	67,5	67,5	67,5
	One	11	6,9	6,9	74,4
	Two	15	9,4	9,4	83,8
	Three and more	26	16,3	16,3	100,0
	Total	160	100,0	100,0	

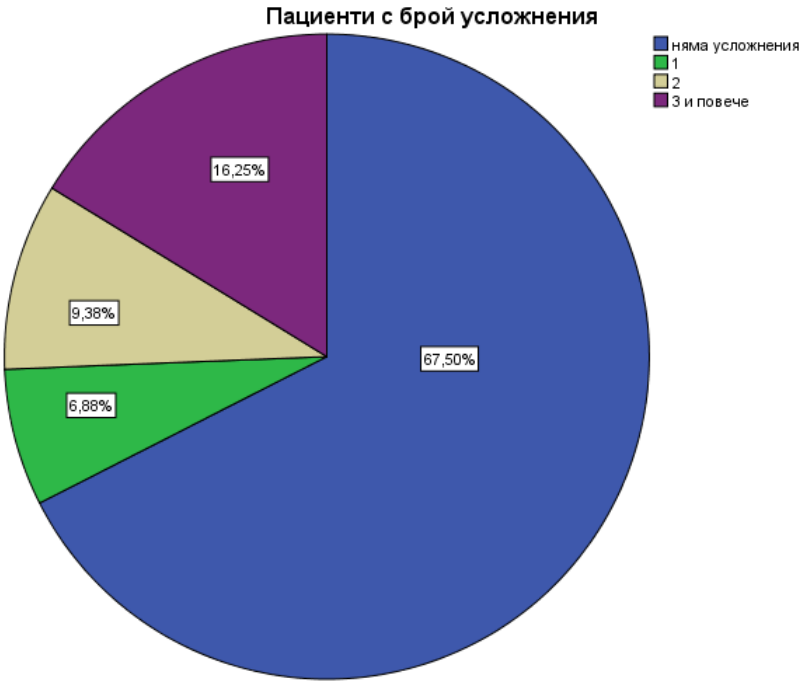


Fig. 12 Patients with number of complications**.**

In 67.5% (108) of cases, no complications were reported. In 16.3% (26) three or more complications were observed.

Table 20 shows the distribution of cases with complications:

Table 20 Distribution of cases with complications:

Complications	Responses		Percent of Cases
	N	Percent	
Dependency on auxiliary mechanisms	11	9,2%	21,2%
Somnolence	22	18,5%	42,3%
Hemodynamic instability	23	19,3%	44,2%
Reactive synovitis of the right hip joint	1	,8%	1,9%
Acute respiratory failure	21	17,6%	40,4%
Cardiac arrhythmia	12	10,1%	23,1%
Sepsis	2	1,7%	3,8%
Hematemesis	1	,8%	1,9%
Stupor	10	8,4%	19,2%
Gastritis	1	,8%	1,9%
Pulmonary embolism	3	2,5%	5,8%
Multiple organ failure	3	2,5%	5,8%
DIC (disseminated intravascular coagulation) syndrome	1	,8%	1,9%
Septic shock	2	1,7%	3,8%
Acute rhythm disorder	2	1,7 %	3,8%
Melena	1	,8%	1,9%
Acute nasopharyngitis	1	,8%	1,9%
Pleural effusion	1	,8 % ,	1,9%
Pneumonia	1	,8 %	1,9%
Total	119	100%	228,8%

On Table 21 and Figure 13, the distribution of primary and secondary healing of the surgical wound is shown (including the drainage holes).

Table 21 Wound Healing

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Primary	141	88,1	88,1	88,1
	Secondary	19	11,9	11,9	100,0
	Total	160	100,0	100,0	

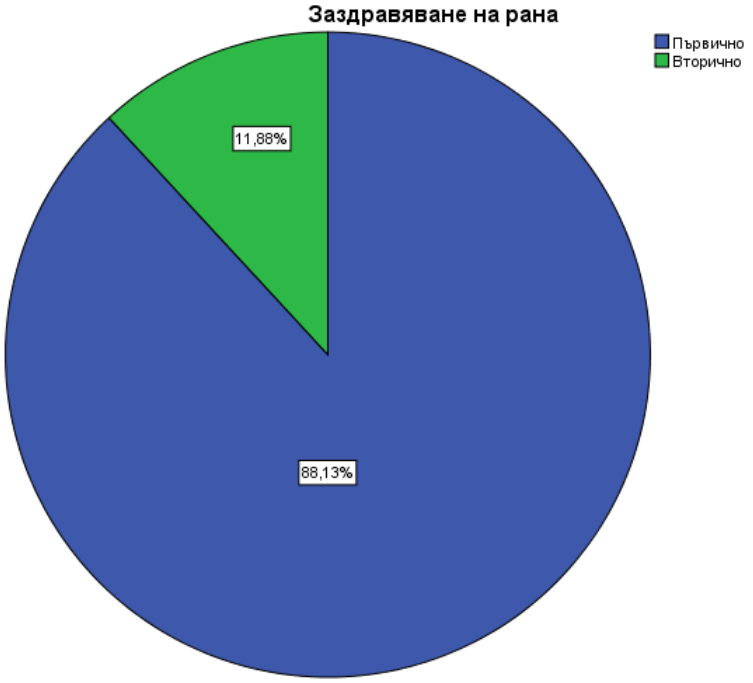


Fig.13 Wound Healing

The presented data shows that the most commonly encountered systemic complications are hemodynamic instability (19.3%), quantitative consciousness disorders (26.9%), respiratory

insufficiency and dependence on auxiliary devices and mechanisms (26.8%), and rhythm disorders (11.8%). An analysis was also made for existing local complications in the area of the surgical wound. Cases for drainage hole healing were also included. In 11.9% (19 patients), a local complication in the area of the surgical wound was reported.

4.1.10.3. Need for intensive treatment.

Table 22 and Figure 14 show the distribution of patients in need of additional treatment in the Clinic of anesthesiology and intensive care.

Table 22- Stay in the intensive care unit

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	44	27,5	27,5	27,5
	No	116	72,5	72,5	100,0
	Total	160	100,0	100,0	

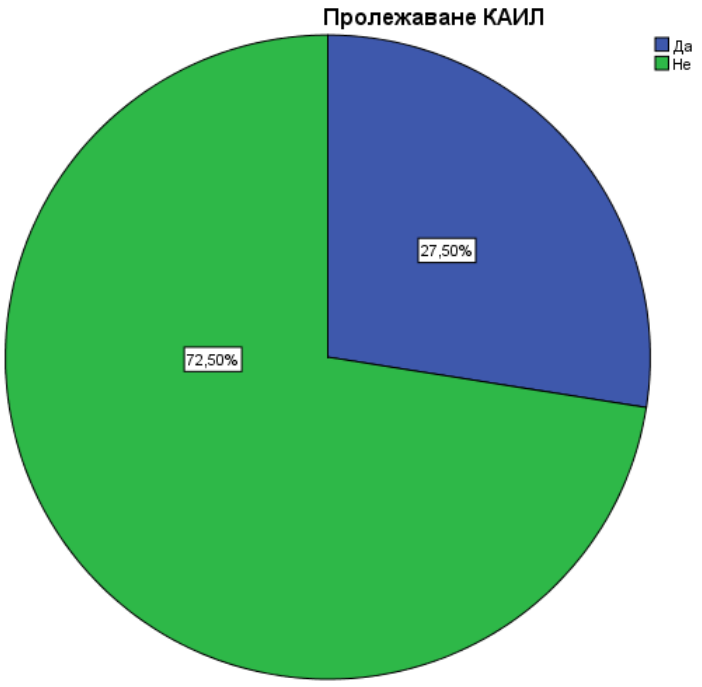


Fig.14. Stay in the intensive care unit

In 27.5% (44) of cases, patients required intensive treatment.

4.1.10.4. Fatality rate.

Table 23 and Figure 15 present an analysis of the fatality rate among the patients studied.

Table 23 Fatality rate.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Non-survivors	21	13,1	13,1	13,1
	Survivors	139	86,9	86,9	100,0
	Total	160	100,0	100,0	

13.1% (21) of cases resulted in a fatal outcome. The etiological cause and the anatomical affected organ, the time from the onset of symptoms to diagnosis and control over the source, the degree of impairment of the general condition at the time of diagnosis (degree of systemic inflammation response to injury, shock state, organ dysfunction), risk factors such as age, accompanying and past illnesses of the patients, the occurred complications, and the cases where the abscess was postoperative have an impact on the outcome of the disease.

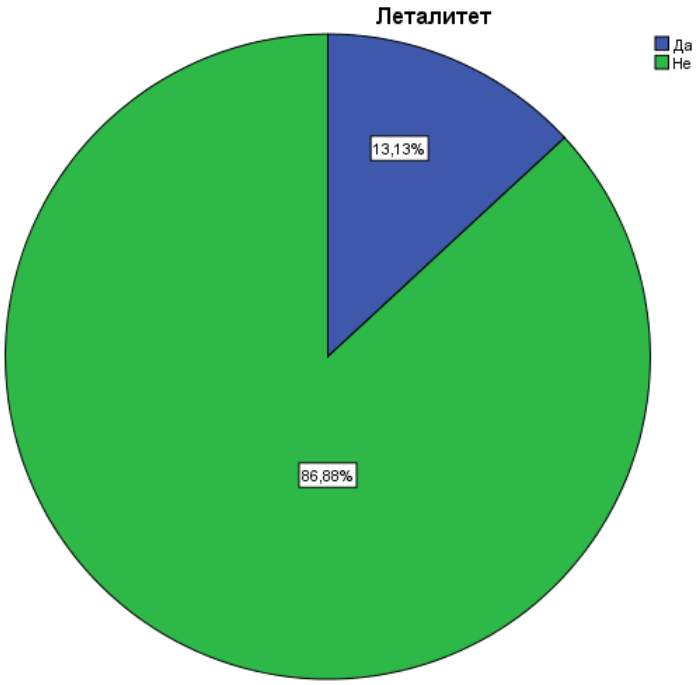


Fig. 15 - Percentage ratio of the fatality rate among patients.

4.2. Correlation analysis of observation parameters.

4.2.1. Comparative analysis between age and length of hospital stay.

From the conducted analysis, a weak (0.259) positive correlation is established between age and length of hospital stay among the 160 patients studied. The correlation is statistically significant with Sig=0.001<α=0.05 (risk of error). Older patients require longer hospitalization.

4.2.2. Comparative analysis between age and ASA.

There is a significant (0.537) positive correlation between age and ASA among the patients studied. The correlation is statistically significant with Sig=0.000<α=0.05 (risk of error). Older patients are categorized in a higher ASA group.

4.2.3. Comparative analysis between sex and ASA.

From the data, it can be concluded that the relationship between sex and ASA is insignificant and statistically insignificant. Only two female patients were categorized as ASA V. No ASA V was reported among male patients. The ratio in different ASA categories is preserved.

4.2.4. Comparative analysis between ASA and complications.

The contingency coefficient shows a significant/0.516/ positive relationship between the number of complications and ASA in the studied patients. The relationship is statistically significant Sig=0.000<α=0.05 /risk of error/. It is evident that cases with 3 or more observed complications are most common among patients categorized as ASA IV.

4.2.5. Comparative analysis between ASA and number of comorbidities.

There is a significant /0.567/ positive correlation between the number of comorbidities and ASA among the examined patients. The correlation is statistically significant with Sig=0.000<α=0.05 /risk of error/.

4.2.6. Comparative analysis between ASA and imaging diagnostic methods used.

There is a moderate positive correlation /0.487/ between the imaging studies performed and ASA among the patients. The correlation is statistically significant with p=0.001<α=0.05 /risk of

error/. The largest number of imaging studies (more than two) were performed on patients categorized as ASA III.

4.2.7. Comparative analysis between ASA, the need for intensive care in ICU, and mortality.

There is a moderate positive correlation (0.453) between mortality and ASA, which is statistically significant. The highest number of fatal outcomes occurred in patients categorized as ASA IV. Both patients categorized as ASA V also had fatal outcomes from the disease.

There is a moderate positive correlation (0.404) between length of stay in ICU and ASA, which is statistically significant. The highest number of patients who spent time in ICU during their hospital stay were categorized as ASA III and ASA IV.

There is a significant positive correlation (0.534) between length of stay in ICU and mortality in patients, which is statistically significant ($p=0.000<\alpha=0.05$/ risk of error).

4.2.8. Comparative analysis between age groups, the number of complications and lethality.

Since both variables are on a weak (nominal) scale, a suitable nonparametric correlation coefficient of contingency is used. Its value is 0.224, indicating a weak correlation between the variables of age group and lethality in the examined patients. The highest mortality is in the age group over 61 years. The correlation coefficient is statistically significant, ≥ since $p=0.014<\alpha=0.05$/ risk of error/.

A significant /0.513/ positive correlation is established between the number of complications and lethality in the examined 160 patients. The relationship is statistically significant, with $Sig=0.000<\alpha=0.05$ /risk of error/. The analysis shows that lethality is increased in cases with 3 or more complications.

4.2.9. Comparative analysis between diagnosis and therapeutic approach.

A significant positive correlation /0.525/ is established between diagnosis and therapeutic approach in patients. The correlation is statistically significant, $p=0.006<\alpha=0.05$/ risk of error/.

4.2.10. Comparative analysis between diagnosis and lethality.

A moderate positive correlation /0.369/ is found between diagnosis and lethality from the conducted analysis. The correlation is statistically significant, $p=0.003<\alpha=0.05$/ risk of error/. The highest number of cases with fatal outcome is registered in patients with postoperative abscesses.

4.2.11. Comparative analysis between the treatment performed and lethality.

No statistically significant correlation is found between treatment and lethality in patients from the conducted analysis. Surgical treatment has been applied in all cases with fatal outcome.

4.2.12. Comparative analysis between length of hospital stay and treatment performed.

A weak correlation /0.181/ is present between the length of hospital stay and the treatment performed in patients from the conducted analysis. The most common range of hospitalization days is 5-7 days, both in operated and percutaneously drained-only treated patients.

4.2.13. Comparative analysis between length of hospital stay and lethality.

A significant positive correlation /0.553/ is present between the length of hospital stay and lethality in the studied 160 patients. The correlation is statistically significant, $Sig=0.000<\alpha=0.05$ /risk of error/. The highest percentage of fatal cases is observed in the range of 15-25 hospitalization days.

5. DISCUSSION

Intra-abdominal infections (IAIs) are one of the significant causes of morbidity and mortality worldwide. They are the second most common cause of severe sepsis in intensive care units. Studies associate severe intra-abdominal infections with a significantly high mortality rate. Clinically, IAIs can be divided into two groups, depending on the extent of the process: uncomplicated and complicated. Uncomplicated abdominal infections involve only the affected organ (e.g., causing intramural inflammation of a certain part of the gastrointestinal tract) without anatomical disruption and peritoneal dissemination. In these cases, treatment can be conservative according to the etiology of the disease or operative, supplemented only by perioperative

antimicrobial prophylaxis. Patients with uncomplicated forms of diverticulitis, cholecystitis, some cases of appendicitis can be treated non-operatively. In case of untimely, inappropriate treatment, the disease progresses and spreads beyond the affected organ, with transmission of inflammation from the visceral to the parietal peritoneum. Local or diffuse peritonitis may occur, depending on the body's ability to limit the process to a specific area of the abdominal cavity. This represents a complicated form of intra-abdominal infection. Treatment of complicated intra-abdominal infections generally requires control over the source of infection (the primary focus), fluid resuscitation as necessary, and effective antimicrobial therapy. Local peritonitis often manifests as the formation of an abscess - a separate collection of infected, usually well-defined from surrounding structures, purulent material (tissue debris, neutrophils, macrophages, microorganisms, exudative fluid), resulting from a localized infection in the abdominal cavity. The process may affect any intra-abdominally located organ or be localized in the free abdominal or pelvic area, including between the folds of the intestinal loops. Each abscess is built up by an inflammatory wall and contains a viscous exudate. The inflammatory barrier may include the omentum, peritoneal adhesions, other adjacent visceral structures and organs. [83,86,96,102]

Intestinal and pelvic abscesses, as complicated intra-abdominal infections, continue to pose a challenge for clinical practice in terms of diagnostic and therapeutic algorithms. Delayed treatment due to late seeking of medical help, delayed diagnosis, the peculiarities of etiopathogenic mechanisms and time of formation, heterogeneous clinical picture, localization of the abscess, and associated pathophysiological consequences are life-threatening and lead to prolonged period of illness, prolonged hospital stay, increased mortality rates, and negative economic impact. The key factors for successful treatment of complicated intra-abdominal infections are timely diagnosis, adequate resuscitation, early initiation of appropriate antibiotic therapy, early and effective control of the source, and reassessment of clinical response with the possibility of additional upgrading of the therapeutic strategy.

Mortality from complicated intraperitoneal infection in the early 20th century was nearly 90%. At that time, this problem was mainly resolved non-operatively until Kishner introduced the basic principles of surgery for intra-abdominal infections into clinical practice: (1) elimination of septic foci; (2) removal of necrotic tissue; (3) drainage of purulent exudate.

By the 1930s, mortality had been reduced to 50%. With the introduction of antibiotics, mortality continued to slowly decrease. The use of cephalosporins in the early 1970s was associated with a decrease in mortality to less than 40%. Subsequent advances in understanding physiology, monitoring and correcting deviations in the cardiorespiratory system, rational use of new drugs, and care in the intensive care unit helped to stabilize mortality at around 30% [13]. Nowadays, the mortality rate varies from 9% to 20 %. Clinical trial results may not always be representative of actual levels of morbidity and mortality in such severe infections. Firstly, patients with complicated forms of appendicitis are usually overrepresented in clinical trials. Secondly, patients with complicated intra-abdominal infections (IAIs) included in clinical trials often have a greater likelihood of recovery and survival. This is because selective studies usually exclude patients with accompanying illnesses, complications, and other factors that are associated with higher mortality rates from complicated intra-abdominal infections. Complicated intra-abdominal infections are associated with high levels of morbidity, mortality, and resource utilization, affecting both high-income and low- and middle-income countries (LMICs). In a multicenter WISS study conducted at 132 healthcare facilities worldwide over a period of 4 months (October 2014 - February 2015), 4553 patients over the age of 18 with complicated intra-abdominal infections were included. The overall mortality rate in this study was 9.2% [124] . In our study, 13.1% (21) of cases resulted in a fatal outcome. The etiological cause and the anatomically affected organ, the time from the onset of symptoms to diagnosis and control of the source, the degree of impairment of the general condition at the time of diagnosis (degree of systemic expression of the inflammatory response as a response to the injury, shock state, organ dysfunction), risk factors such as age, accompanying and past diseases of the patients, the occurred complications, and cases where the abscess is postoperative all affect the outcome of the disease.

The overall classification of intra-abdominal infections should always include the source of the infection, the anatomical extent of the infection, the presumed pathogens involved, and the risk factors for the underlying patterns of resistance, as well as the patient's clinical condition. Developing a classification system that is accepted worldwide and stratifies patients based on the risk of a poor prognosis may be valuable in modulating treatment and improving treatment outcomes. There are different classifications for intra-abdominal abscesses based on anatomical

location, the affected abdominal organ, prior surgical intervention, and the number of abscess collections.

The broad spectrum of intraabdominal abscesses makes their classification extremely complex. They can be classified as visceral and non-visceral, intraperitoneal and extraperitoneal, spontaneous and postoperative, simple and complex. Abscesses of intestinal origin belong to the group of intraperitoneal non-visceral intraabdominal abscesses. They are caused by intestinal flora and often have a polymicrobial origin. They can occur postoperatively or spontaneously as a result of perforated abdominal organs, after appendicitis, diverticulitis, tumors, Crohn's disease, penetrating trauma. Pelvic abscesses are located below the level of the pelvic inlet. They can be postoperative and spontaneous, intraperitoneal and extraperitoneal, and in addition to the etiological causes of intestinal abscesses listed above, they include complications of genitourinary origin - pelvic inflammatory disease (tubo-ovarian abscesses, pyometra), other inflammatory, tumor diseases, and traumas that cause micro- and macroperforations and disrupt the integrity of the genitourinary tract. There is no universally accepted classification of abscesses with intestinal origin, as well as those with pelvic localization.

In the present study, patients with abscesses were classified according to the etiopathogenic cause, localization of the abscesses, and data on previous surgical intervention (Table 3, Fig. 2). Patients with appendicular abscesses represented 36% (58) of all studied patients. Pelvic abscesses were found in 20% (32) of all cases. In 2/3 of the cases, they were associated with gynecological origin - TUB (tubo-ovarian abscesses), intrauterine devices, tumors, or a history of hysterectomy. Postoperative abscesses accounted for 13.8% (22) of all studied patients. They were distributed into three groups - consequences of surgical interventions in the stomach, duodenum (upper GIT) - 5% (8), consequences of surgical interventions on the lower GIT - with small intestinal origin - 5% (8) and large intestinal origin - 2.5% (4). Abscesses resulting from an obstructing tumor with perforation were found in 10.6% (17) of all studied cases. In 7 cases, the left colon was involved, while in 10 cases, the right colon was involved. It is noteworthy that abscesses resulting from a tumor of the cecum represented 60% (6) of all 10 cases with right-sided localization. Abscesses of diverticular origin account for 9.4% (15) of all cases studied. Of these, 8.1% (13) are a result of diverticulitis of the colon, and in 1.3% (2), a result of perforated Meckel's diverticulum (small intestine) with an abscess formation. Crohn's disease-associated

abscesses were found in 5% (8) of cases. Three of them are with colonic involvement - stenosing form with a clinical picture of obstructive ileus. The remaining 5 are with small intestinal or mixed (small and large intestinal) involvement, with 2 of these cases having evidence of enterocolic and entero-enteral fistulas. The remaining 5% (8) of identified abscesses affecting the small intestine are a result of processes of ischemia, necrosis, and free or covered perforation as a result of strangulation, adhesive ileus, or microperforations from foreign bodies.

Based on the analyzed cases distributed into the diagnostic groups presented and the literature review analysis, it would be possible to create the following classifications for pelvic and intestinal abscesses, presented in Figure 16 and Figure 17:

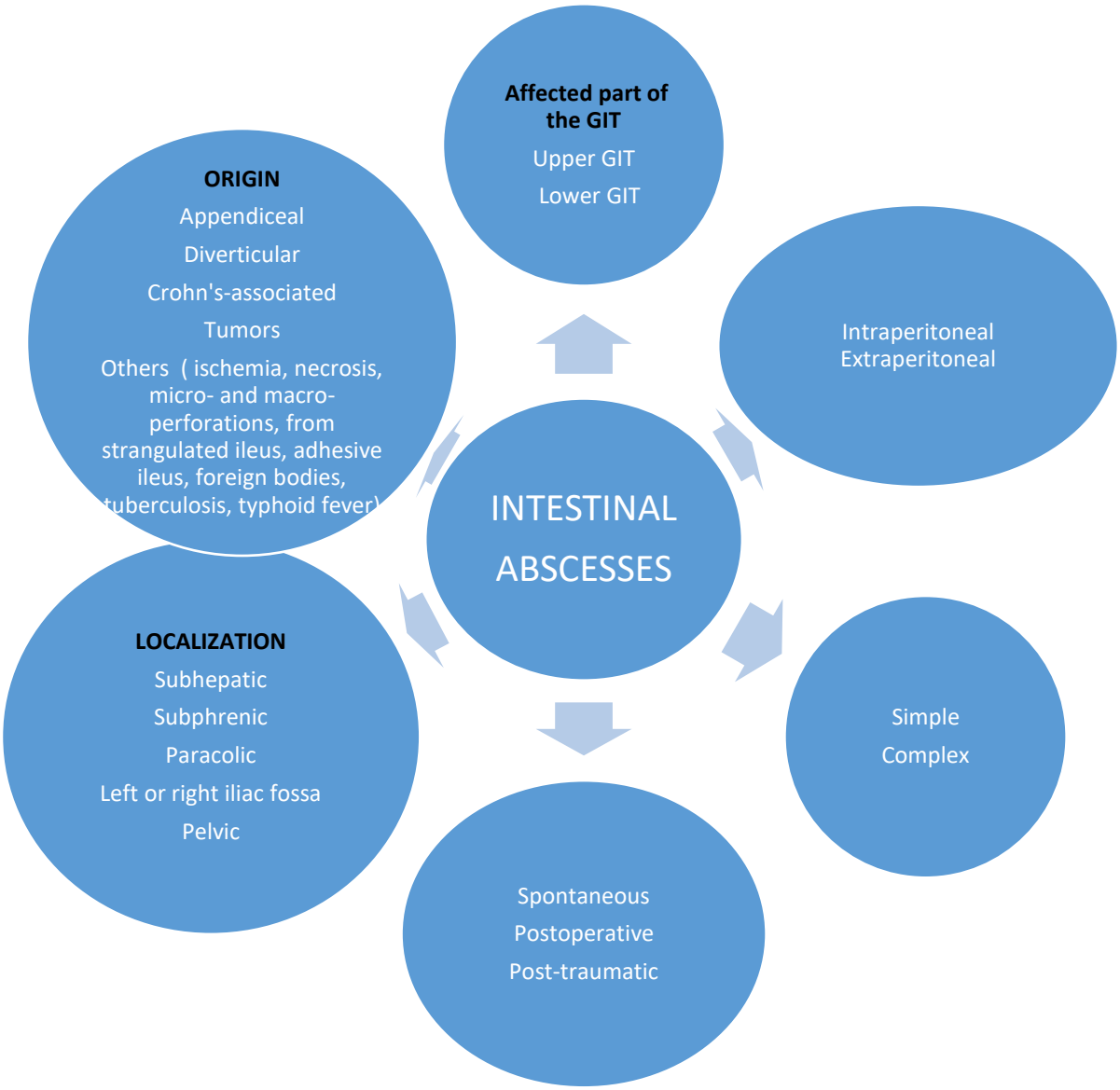


Fig. 16 – Classification of intestinal abscesses

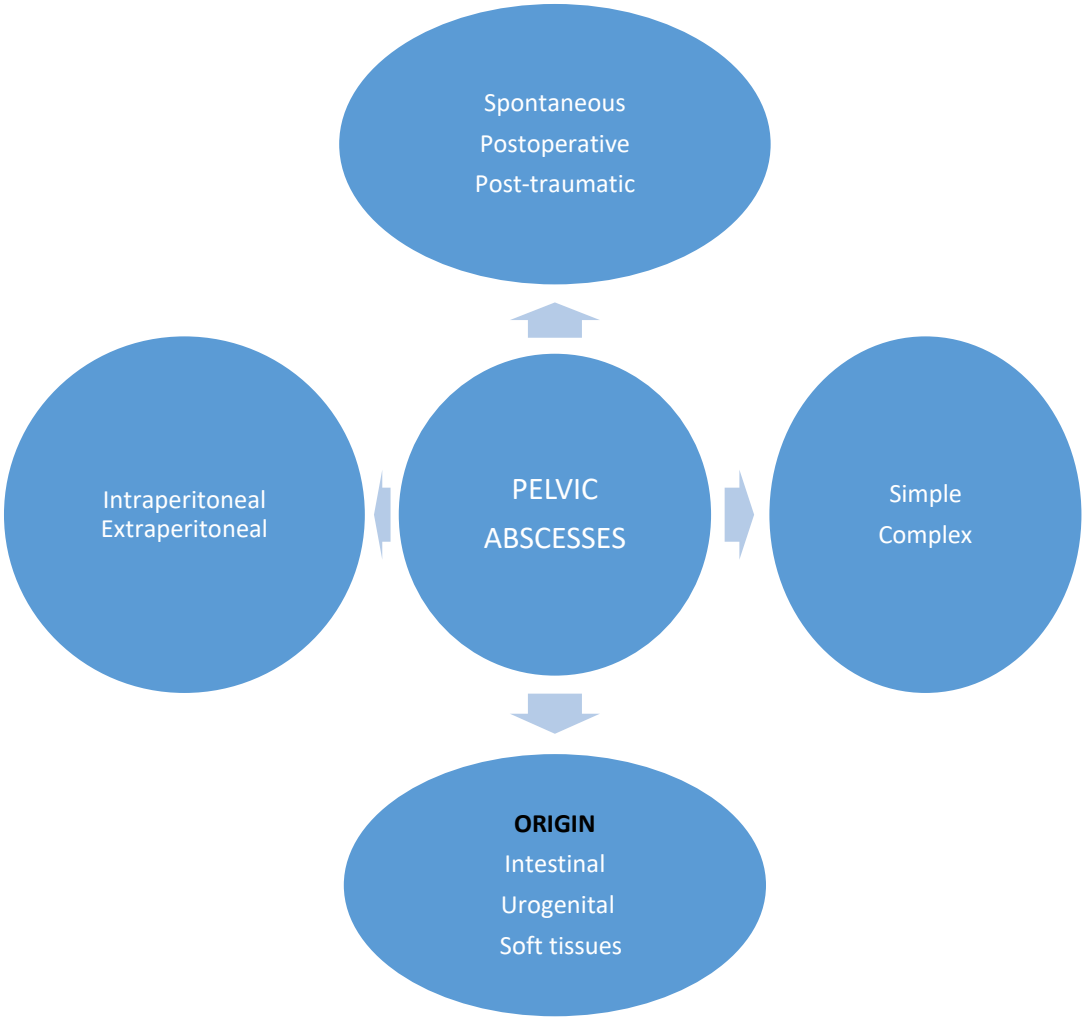


Fig. 17– Classification of pelvic abscesses

Out of the 160 patients examined, 92 (57.5%) were male and 68 (42.5%) were female. In 50% of the cases, the male gender was more commonly affected. The minimum age of the patients was 16 years old, and the maximum age was 82 years old. The most affected age group was patients between 45 and 65 years old, which is considered the active and creative age range. These data are similar to those from the CIAO study ("Complicated Intra-Abdominal Infection Observational" Study), which is a multicenter observational study on complicated intra-abdominal infections involving 68 medical institutions from across Europe and 2,152 patients with an average age of 53.8 years, where the percentage distribution by gender was 53.7% for

males and 46.3% for females [117.] These demographic data have an impact on the workforce of the population and have socioeconomic consequences. The hospital stay of the patients varied from 2 to 85 days, with 5 days being the most common hospital stay. 90 out of all 160 patients had a total hospital stay of 5-7 days.

Early clinical assessment is essential for diagnosing intra-abdominal infection. It helps optimize diagnostic tests and leads to earlier development and implementation of appropriate therapeutic approach. A step-by-step approach to diagnosis is necessary, including clinical examination, assessment of the condition, laboratory and imaging studies. The diagnosis of complicated intra-abdominal infections is mainly clinical. Early detection and initiation of treatment are essential to minimize complications.

Patients with intra-abdominal infection usually present with sudden onset of abdominal pain and symptoms of gastrointestinal dysfunction (loss of appetite, nausea, vomiting, bloating and/or constipation), with or without signs of systemic inflammation (pain, hyperesthesia, fever, tachycardia and/or tachypnea), with or without signs of peritoneal irritation - abdominal rigidity and pain after decompression. Hypotension and hypoperfusion signs such as oliguria, as well as a change in mental status, and evidence of metabolic acidosis indicate the presence of organ dysfunction. Usually, a detailed history and physical examination make it possible to limit the differential diagnoses and provide a clear assessment of the degree of physiological damage in the patient. This assessment, in turn, allows for immediate decisions regarding the need for resuscitation/rehydration, appropriate diagnostic studies, the need and timing for starting antimicrobial therapy, and whether emergency intervention is necessary. Based on this information, the timing and nature of control over the source can be determined. The clinician should be aware that signs of sepsis may be minimal in elderly patients and in patients receiving corticosteroids or other immunosuppressive therapy.

Ultrasound and computer tomography (CT) have been used as confirmatory diagnostic imaging methods over the last two decades. Although CT has higher sensitivity and specificity, concerns about radiation exposure make ultrasound the first choice method when performed by appropriately trained personnel. In order to develop an optimal strategy for performing imaging studies for accurate detection of emergency conditions in patients with acute abdominal pain, a multicenter prospective study has been conducted, demonstrating CT as the method with the

highest sensitivity, but performing CT after negative or inconclusive ultrasound resulted in an approach with the highest sensitivity with only 6% missed emergency conditions and the lowest overall radiation exposure. The authors recommend the use of ultrasound as the first choice method for diagnostic imaging in emergency conditions with acute abdominal pain, followed by CT in cases with insufficient findings from ultrasound. Magnetic resonance imaging (MRI) is not routinely used in emergency conditions and is not available everywhere in healthcare facilities. Its application is appropriate for pregnant patients with abdominal pain when ultrasound is insufficient [123, 121].

In our study, some of the most characteristic clinical symptoms were examined. Abdominal pain was the most commonly reported symptom, present in 140 (88%) of cases. Abdominal pain may be absent in cases where patients are in severely compromised conditions leading to lethargy, in older patients, immunocompromised patients, postoperative abscesses, where other symptoms are dominant. In 102 (63.8%) of all 160 patients, there were signs of peritoneal irritation - resistance to defense of the anterior abdominal wall and a positive Blumberg sign, indicating disease progression with involvement of the parietal peritoneum and manifestations of systemic inflammation in a large proportion of patients. This corresponds largely to the duration from the onset of complaints to seeking medical help and making the diagnosis. In 75 (46.9%) of patients, there were data on a disturbed intestinal transit - ileus and subileus states predominated, but diarrhea syndrome was also observed. Nausea and vomiting were also included as symptoms. Prolonged ileus is a common condition in patients with abscess formation in the postoperative period or in cases of retroperitoneal or pelvic abscesses, where it is often accompanied by fever and mild liver dysfunction. In addition to prolonged ileus, patients may report abnormal bowel function, including both constipation and diarrhea syndrome. In cases of postoperative abscess formation, the postoperative period is smooth in the first three days, followed by a period of general fatigue, accompanied by fever, abdominal pain, and non-recovering peristalsis. In nearly 40% (63) of cases, fever was detected during clinical examination of patients. In almost all cases, there were data on episodes of increased body temperature from the onset of symptoms. Fever is one of the characteristic symptoms indicating the systemic response of the body to the injury [120,131].

In the present study, an analysis of the leukocyte laboratory values at admission and discharge of patients was performed. The mean leukocyte count at admission was 14 x 10^9, while at discharge it was 12 x 10^9. A hypothesis test was conducted to assess the difference in leukocyte values at admission and discharge, which demonstrated a statistically significant difference between the two groups of patients, specifically that the mean leukocyte count decreased by 2.33 units.

In order to confirm the clinical assessment, imaging diagnostic methods such as ultrasound, computed tomography (CT), and X-ray were used. Ultrasound and CT were used in the majority of cases as imaging diagnostic methods. A total of 132 patients underwent ultrasound examination, while CT was used in 97 patients. Ultrasound and CT were used as a combination in 74 patients. A combination of three imaging studies, X-ray, ultrasound, and CT, was performed in 58 patients. In 58 (36.3%) of the cases, ultrasound was the only imaging method used to confirm the diagnosis. The use of ultrasound as the primary method of choice, followed by CT in cases of insufficient data from ultrasound, is the gold standard in the diagnostic approach, which coincides with global recommendations for the diagnosis of complicated intra-abdominal infections.The therapeutic algorithm for the treatment of complicated intra-abdominal infections, such as intestinal and mesenteric abscesses, requires a so-called "step-by-step" approach. After the diagnosis is made, treatment generally consists of two steps: "source control" and effective antimicrobial therapy. Along with this, the remaining part of the treatment includes measures aimed at restoring the body's homeostasis, correcting disturbances in water-electrolyte and acid-base balance, compensating for catabolic changes, rehydration, and rehabilitation.Source control involves all measures and actions aimed at eliminating the focus of infection, preventing ongoing contamination, and correcting anatomical disturbances to restore physiological function. The timing and adequacy of source control are considered two of the most important criteria in the treatment of complicated intra-abdominal infections, due to the negative consequences of delayed treatment or inappropriate approach. According to SIS/IDSA consensus, source control in patients with diffuse peritonitis should be immediately implemented, while in some cases, intervention may be delayed for 24 hours in cases of localized infection, and conservative treatment with appropriate antimicrobial therapy, fluid resuscitation, and clinical monitoring should be initiated . [96, 131] In one of De Waele's studies, control over the source of infection is considered an essential element in the treatment of sepsis and should be implemented

immediately after the diagnosis is made. According to the recommendations of the Surviving Sepsis Campaign from 2016, rapid detection of the anatomical focus of infection is necessary in septic patients or those in septic shock in order to achieve adequate control over the source. Delay of only 3-6 hours has been associated with increased mortality. Sotto and colleagues in a retrospective study in 2002 found that the time interval from diagnosis to surgical intervention influenced patient mortality. In this study, the prolonged period from diagnosis to surgery was a predictive factor for fatal outcomes within 30 days of diagnosis. In another retrospective analysis of 129 patients with non-traumatic complicated intra-abdominal infections, a delay of 60 hours or more in performing surgical treatment was a predictive factor for increased mortality rates or the need for relaparotomy in patients [53,120, 124] .

The appropriate method for achieving source control is the most crucial factor in the treatment of intra-abdominal infections. Inadequate source control has been associated with increased mortality rates and complications in patients. In addition, adequate source control can shorten the duration of antibiotic therapy. Furthermore, without adequate control, antibiotic treatment may have little or no effect. Source control requires a comprehensive understanding of the biological principles, the complexity of the body's response to injury, the extent of operative and non-operative options, and the combination of aggressiveness in therapeutic strategy and reasonable caution on the clinician's part, who is burdened with the responsibility of making decisions about the approach to treatment.

The principles of source control are as follows: (First) Time, Radicality, Technique, (Second) Time. The first time refers to the time of starting treatment after the diagnosis is made. Delaying by every hour has a negative effect on the outcome of the disease. Radicality refers to the complete elimination of the septic focus, removal of the sources of infection, debris, and damaged tissues, opening of cavities and spaces, evacuation of purulent exudates and other fluids, resection of ischemic segments of the gastrointestinal tract with or without restoration of continuity, lavage of the abdominal cavity, and drainage. The second time refers to the reassessment of the initial control and consideration of additional actions if necessary [123] .

Operative and non-operative techniques can be applied to control the source. The selection of an appropriate method requires a strict assessment of the etiological factor, the patient's condition, and risk factors. Non-operative interventional procedures include percutaneous

drainage under imaging (Ultrasound/CT) control of peritoneal and extraperitoneal abscess collections. In appropriately selected patients, these methods can be safe, effective, and fully sufficient in terms of control radicality. Percutaneous drainage in appropriate cases can eliminate or reduce the need for open techniques. The main reason for failure in this approach is an incomplete diagnosis regarding the size, spread, complexity, localization of the abscess, the character and viscosity of the exudate, as well as the caliber of the placed drain. Conventional surgical approaches are recommended for poorly localized and isolated collections, complex abscesses, diffuse exudative collections, evidence of tissue necrosis, high-density fluids, and percutaneously inaccessible collections for drainage. A thorough evaluation of the abscess collection is necessary to avoid inappropriate drainage procedures in cases of free perforation of the abdominal organ and evidence of acute peritonitis. There are cases where placing a percutaneous catheter for drainage is not the appropriate procedure of choice. If the clinical findings suggest evidence of peritonitis, the patient should undergo surgery, regardless of the fact that imaging studies show drainable collections, except in exceptional circumstances where the patient is deemed unsuitable for surgical intervention. Nevertheless, interventional methods in certain cases can be used as the initial method of choice, along with fluid resuscitation and empirical antibiotic therapy, preceding surgical treatment. In these cases, some detoxification is achieved, the condition is stabilized, and the possibility of obtaining materials for microbiological examination and preparation of an antibiogram is facilitated [123,131] .

Surgical control of the source remains the most important determining factor for survival and should be placed at the top of the therapeutic priority list. The operative intervention includes all measures and actions aimed at determining and eliminating the focus of infection, draining fluid collections, preventing ongoing contamination, correcting anatomical abnormalities to restore physiological functions. Transabdominal exploration allows thorough debridement of adhesions and formed fibrin, as well as mobilization of various structures with the possibility of drainage of all synchronous abscess collections present in 23%-25% of patients. Transabdominal access is indicated for multiple abscesses or those where drainage under imaging control is impossible (complicated abscesses with fistulizations, disruptions in the integrity of the gastrointestinal tract, etc.). During laparotomy, the surgeon must perform direct or digital exploration to ensure that all loculations and septae are eliminated, and debris and exudate are evacuated, after which etiological surgical treatment is performed according to the given pathology and completed with

adequate drainage. Improved clinical status three days after the intervention is a good prognostic indicator.

In recent years, laparoscopy has found increasingly widespread application in the diagnosis and treatment of intra-abdominal infections. The laparoscopic method is applicable in many cases with evidence of peritonitis. It allows for adequate diagnosis and appropriate treatment with less invasive access, faster recovery, and fewer postoperative complications at the surgical site. However, there are still debates about whether this is the appropriate method of choice, given that pneumoperitoneum may have a negative impact on critically ill patients, expressed in acid-base disturbances, as well as changes in cardio-pulmonary status. Some authors even consider laparoscopy contraindicated in cases of complicated intra-abdominal infections, due to the theoretical risk of increased bacteremia and endotoxemia as a result of stretching of the mesothelium and increased permeability due to pneumoperitoneum [94, 120,121,123] .

In our study, conventional surgical treatment was used for control of the source in 133 patients. In 22 cases, control of the source was successfully achieved through percutaneous drainage as a standalone procedure. Most of these cases were pelvic abscesses (14), with patients who had recently undergone hysterectomy (3), complicated forms of pelvic inflamatory disease - tuboovarian abscess (2), patients with descended pararenal (2) and psoas abscesses (3), complicated acute proctitis of the rectal stump after Hartmann's procedure (2), after diverticulitis and abscess with pelvic localization/Hinchey II/ (1), and abscess in the pelvis after appendectomy (1). Surgical treatment was performed in cases of pelvic abscesses resulting from adhesive and strangulation ileus conditions - after hysterectomy in the past (5), resection of the rectum according to Hartmann (2); gynecological tumors (3); tuboovarian abscesses with diffuse peritonitis (3); and diffuse peritonitis resulting from pyometra from an intrauterine device (3). In two cases of pelvic abscesses, a combined approach of preoperative percutaneous drainage followed by surgical treatment was used in patients with complicated Hinchey II diverticulitis with interintestinal and pelvic abscesses.

In 9 cases of intrabdominal abscess resulting from diverticulitis, surgical treatment was performed. In 5 of them, there was a severe picture of progressive peritonitis. In 8 of these cases, Hartmann's resection was performed. In one of the cases of diverticulitis with abscess at the hepatic flexure, right hemicolectomy was performed. 3 of the cases were affected by

percutaneous drainage. These are cases with paracolic / Hinchey Ib / abscess. One of the cases with a paracolic abscess <3cm was affected solely by conservative treatment.

Meckel's diverticulum with inflammation, perforation, and abscess was found in two patients who underwent surgery due to strangulation ileus. They are separated in a separate group.

In Crohn's-associated abscesses, control over the source was achieved through conventional surgical treatment in 7 cases. Of these, 3 involved colonic involvement - a stenosing form leading to obstructive ileus with perforation and abscess. 2 cases involved small bowel involvement and a stenosing form leading to ileus, perforation, and abscess. 2 cases had mixed involvement, with enterocolic and entero-enteral fistulas. In one patient with small intestine involvement and abscess, percutaneous drainage was performed as a separate procedure due to inflammation.

Only one patient with appendiceal abscess underwent percutaneous drainage as a standalone procedure. All other patients were operated on. In 3 of the total of 58 patients, the volume of the operative intervention had to be expanded to ileocolonic resection. In two of these cases, necrosis and perforation of the cecum were intraoperatively detected, and in one of them - appendiceal carcinoma.

For source control in patients with obstructive tumors of the gastrointestinal tract with perforation and formed abscess, a conventional surgical approach was used.

Patients with postoperative intestinal abscesses were divided into three groups - upper gastrointestinal tract (covering the stomach and duodenum up to the duodeno-jejunal flexure), lower gastrointestinal tract (on the small intestine), and lower gastrointestinal tract (on the colon). One patient from each group underwent percutaneous drainage as a standalone procedure. The rest underwent emergency surgery.

The materials for conducting microbiological research in our study were obtained during the control over the source of the abscess contents, following the global recommendations for the treatment of intra-abdominal infections, according to which the material (fluid/tissue) should be obtained from the site of the infection (septic focus) in a volume of about 1-2 ml, and transported to the laboratory in a suitable transport system [131] . It is not necessary to conduct anaerobic culture testing if the assigned empirical therapy covers anaerobic microorganisms. The lower isolation rates of anaerobes than expected are related to problems in obtaining and transporting

the materials. Stone et al. demonstrated that prolonged exposure of materials from the peritoneal cavity to oxygen leads to a decrease in the number of isolated anaerobic strains. M. Marina, B. Korukov, St. Stoyanov, D. Damyanov, and colleagues showed the presence of anaerobic flora in 93.3% of cases in closed cavities of intra-abdominal abscesses and 59% in the studied peritoneal exudates [15].

From the microbiological analysis conducted in this dissertation, it is evident that the most commonly isolated microorganism is E. coli (36.9%), followed by Enterococcus spp. (7.3%), P. aeruginosa (5.6%), Kl. Pneumoniae (5%), St. aureus (4.4%), and B. fragilis (1%). In 26.9% of the cases, the cultures remained sterile. The percentage ratio of the isolated microorganisms corresponds to the references made in the literature review from the global literature, which reports that in most cases, intra-abdominal abscesses contain polymicrobial flora. In a large percentage, coliforms (family Enterobacteriaceae, especially E. coli, as well as Klebsiella spp.) and anaerobes (especially B. fragilis) prevail. The main challenge with these isolates is associated with the extended spectrum beta-lactamase producing microorganisms from the Enterobacteriaceae family. In addition, Enterococcus spp. are frequently isolated Gram-positive forms, which are reported from 7.7% to 16.5%. In a Dutch study on peritonitis in 2012, it is reported that cases with predominant Gram-positive enterococci are associated with a more unfavorable prognosis. In some populations and societies, relatively high rates of isolation of non-enteric microorganisms with high resistance such as Pseudomonas aeruginosa would direct clinicians to reassess the selection of appropriate empirical antimicrobial therapy. Infections originating from the stomach, duodenum, biliary system, and proximal small intestine contain gram-positive and gram-negative aerobic and facultative microorganisms. Infections originating from the distal small intestine contain gram-negative facultative and aerobic microorganisms. Localized abscesses often form with perforations of this type, with developing peritonitis following abscess rupture. Anaerobes such as B. fragilis are often present in these cases. Associated complicated infections originating from the colon contain facultative and obligate anaerobic organisms. Regardless of the fact that in many cases it is believed that intra-abdominal abscesses arise secondarily after the onset of infection, according to global statistics, microbiological confirmation is uncertain, with 26% of bacterial cultures remaining sterile [96,131].

Empirical antimicrobial therapy should be based on data from local epidemiological studies on the most commonly isolated microorganisms and their resistant forms, individual patient risk factors, degree of clinical impairment, and anatomical focus of infection. In the past two decades, antimicrobial resistance has become a global threat to the healthcare system. Prolonged courses of treatment, overuse, and inappropriate use of antibiotics are key factors in the rapidly progressing antimicrobial resistance worldwide. Infections associated with resistant gram-negative bacteria, particularly from the Enterobacteriaceae family, prevail and create serious challenges for healthcare workers because they are difficult to treat and are associated with increased morbidity and mortality rates. This group includes bacteria that produce extended-spectrum beta-lactamases (ESBLs) such as Klebsiella pneumoniae and Escherichia coli, as well as carbapenemase-producing Klebsiella pneumoniae. Other difficult-to-treat microorganisms include vancomycin-resistant enterococci (VRE) and non-fermenting forms of gram-negative bacteria such as Pseudomonas aeruginosa, Acinetobacter baumanii, and Stenotrophomonas maltophilia. The main risk factors for possible isolation of ESBLs are: 1. Hospitalization for 48 hours in the last 90 days; 2. Use of broad-spectrum antibiotics in the last 90 days; 3. Colonization with ESBLs in the last 90 days [123].

Empirical antimicrobial therapy for intra-abdominal infections can be single-agent or combination multi-regimen. Empirical therapy for intra-abdominal infections should cover enteric gram-negative aerobic and facultative microorganisms, as well as aerobic gram-positive streptococci. Coverage against obligate anaerobic organisms should be provided in cases of distal small bowel abscesses, as well as those originating from the large intestine. Beta-lactamase inhibitor drugs such as amoxicillin/clavulanic acid, piperacillin/tazobactam have in vitro activity against gram-positive, gram-negative, and anaerobic microorganisms. The increasing resistance of E. coli and other members of the Enterobacteriaceae family to amoxicillin/clavulanic acid has limited the use of this drug in recent years, as well as the use of fluoroquinolones due to increasing resistance to them. Third-generation cephalosporins in combination with metronidazole are a preferred therapy for these microorganisms. Other options include the use of aminoglycoside drugs, but due to their nephrotoxic and ototoxic effects, their use must be strictly regulated. Tigecycline and eravacycline are other possible options for empirical therapy under certain circumstances, as they have in vitro coverage against anaerobic microorganisms as well as some ESBL and carbapenemase-producing strains, Acinetobacter baumanii, Stenotrophomonas

maltophilia. However, they do not show in vitro activity against Ps. aeruginosa or P. mirabilis. Ceftolozane/tazobactam and ceftazidime/avibactam are new antimicrobial agents approved and successfully used for the treatment of complicated intra-abdominal infections (in combination with metronidazole). Their application as empirical therapy, however, needs to be investigated . [96,131] .

In our study of empirical therapy in patients, antibiotics from the penicillin, aminoglycoside, and cephalosporin groups were prescribed in combination or without metronidazole (an anti-anaerobic drug). In 95% of cases, antibiotics were used, most commonly third-generation cephalosporins in combination with metronidazole. After a completed antibiogram from the microbiological investigation of the patients, a reassessment of antibiotic treatment was carried out based on the sensitivity of the isolated microorganisms. As additional treatment in severe cases, antibiotics from the fourth-generation cephalosporin, carbapenem, tetracycline, polymyxin E (colistin), piperacillin/tazobactam, and other groups, including antifungals in cases with isolated Candida spp., were used. In 2017, the World Alliance for Surgical Infection published recommendations stating that short courses of antimicrobial therapy are equally effective as longer courses after adequate source control has been established, regardless of signs of inflammation. For intra-abdominal infections, a four-day course of therapy is equally effective as an eight-day course in patients with moderate disease activity. If antibiotic therapy fails in patients a few days after source control has been established, measures should be taken for additional control (Second-source control) [121,123,126] .

Different factors in patients can have a significant impact on treatment outcomes. Determining which patient is at high risk for treatment failure can be challenging. First, it's important to define what constitutes treatment failure. Is it mortality? Failure of surgical or antibiotic control? Second, high risk may relate to other underlying patient factors such as age (reduced physiological reserve, limited response to injury, susceptibility to energy depletion and delayed diagnosis due to nonspecific clinical symptoms), comorbidities, degree of impairment of the general condition at presentation, etiological cause and anatomically affected organ. In addition, patients with "low" risk may become high-risk if the clinician misses the appropriate "therapeutic window" for diagnosis, resuscitation, and adequate control. Therefore, there are several factors and circumstances to consider when determining the prognosis for treatment outcomes.

Generally, patients with factors such as advanced age, immunosuppression, malignancies, accompanying and preceding illnesses, disease factors determining the degree of impairment of the general condition, categorized in scoring systems (ASA, APACHE, SOFA), data on sepsis and septic shock, delay in initiating source control (usually >24 hours), inability to carry out source control, need for hospitalization in the intensive care unit, hospital-acquired complicated intra-abdominal infections (as opposed to community-acquired ones) are considered high-risk [120] .

The use of prognostic scoring systems can be useful in clinical practice for risk assessment and optimization of treatment. Scoring systems can generally be divided into two major groups: general organ failure severity (ICU) scores used in intensive care units, and peritonitis-specific (surgical) scores. The first group includes systems that assess the function of various organ systems (respiratory, hemodynamic, respiratory, neurological, coagulation, etc.). APACHE II (The Acute Physiology and Chronic Health Evaluation) and SAPS (Simplified Acute Physiology Score) systems are based on clinical and paraclinical parameters during the first 24 hours of ICU stay and can be applicable to patients with peritonitis data. The SOFA (Sequential Organ Failure Assessment) score is an objective method for evaluating dysfunction of six organ systems (respiratory, cardiovascular, coagulation, hepatic, renal, and neurological). The system allows for tracking of the patient's condition throughout their stay in the intensive care unit and is suitable not only for prognosis but also for clinical monitoring in critically ill patients. The second group includes scoring systems that use intraoperative findings, degree of spread, and anatomical involvement. They can be specific to a particular disease (there are many scoring systems for diverticulitis, appendicitis, and gastro-duodenal perforations) or universal, such as the Mannheim Peritonitis Index (MPI) - calculating factors such as the degree of spread of peritonitis, origin of the septic focus, sex , age, time interval between perforation and surgery, type of exudate, and others; the Peritonitis Index Altona (PIA); and the WSES (World Society of Emergency Surgery) score system for complicated intra-abdominal infections from the WISS (WSES cIAIs Score Study) 2015 survey. This is a multicenter, prospective study involving 4533 patients from 132 medical institutions worldwide and is based on previous studies - the CIAO Study ("Complicated Intra-Abdominal infections Observational" Study) from 69 medical institutions in Europe (Jan-Jun 2012) and the CIAOW Study ("Complicated Intra-Abdominal infection Observational" Study worldwide) from 57 medical institutions worldwide (Oct 2012-Mar 2013). The WSES/WISS score system calculated at the time of patient admission to the medical facility includes data on

the clinical condition during examination, acquisition environment and conditions, etiological origin, delay in source control, risk factors such as age, immunosuppression, comorbidity. The scoring system is based on a point system ranging from 0 to ≥18. The overall mortality in this study is 9.2%. The overall mortality was 0.63% for those with a score of 0-3, 6.3% for those with a score of 4-6, and 41.7% for those with a score of ≥7. Among patients who had a score of ≥9, the mortality was 55.5%, while for those with a score of ≥11, the mortality was 68.2%, and for those with a score of ≥13, the mortality was 80.9%. As a result of these studies, several independent criteria have been shown to be associated with predictiveness regarding lethality in patients with complicated intra-abdominal infections. These include factors such as age, the presence of a non-appendicular intestinal source of infection (including complicated diverticulitis, small bowel perforation, and postoperative abscesses), delay in controlling the source of infection, septic condition or septic shock at diagnosis or in the immediate postoperative period, the need for intensive care unit admission, and white blood cell count above 12x109 or below 4x109, which are all associated with elevated mortality rates. According to the CIAO study, mortality rates do not differ significantly between patients who receive adequate source control versus those who do not. However, delay in achieving source control is associated with higher mortality rates [96,117,118,120,124].

Based on an analysis of comorbidities, the need for intensive treatment, complications, and mortality in patients with intestinal and pelvic abscesses, it was found that 30% of patients did not have any accompanying illnesses. 28.8% had one accompanying illness, 26.6% had two, and 16.9% had three or more. An analysis of the illnesses by system revealed that the greatest percentage were related to cardiovascular diseases (40%) such as hypertension, ischemic heart disease, absolute arrhythmia in atrial fibrillation, chronic left-sided heart failure, and status post-coronary stenting, followed by gastrointestinal diseases (15%) such as gastritis, duodenitis, Crohn's disease, gallbladder disease, cirrhosis of the liver (HCV, HBV), and evidence of malignant diseases of the digestive system. Regarding endocrine system diseases (12%), leading conditions include type II diabetes, Graves' disease, osteoporosis, and dyslipidemia. Respiratory system diseases account for 5% of all past and accompanying diseases, with COPD, bronchial asthma, and malignant respiratory diseases being the leading ones. Disorders of the urunary system account for 4% of all past and accompanying diseases. Leading conditions include chronic kidney disease, chronic glomerulonephritis, chronic pyelonephritis, kidney stone disease,

hydronephrosis, and malignant diseases of the urinary system. CNS diseases (4%) are predominantly represented by conditions following ischemic stroke and epilepsy. Diseases from other systems are classified as "Other" and account for 20% of all investigated past and accompanying diseases - thalassemia, non-Hodgkin's lymphoma, rheumatoid arthritis. From the analyzed data, it is noteworthy that in 8 (25%) of all 32 cases of pelvic abscesses, there were records of a hysterectomy performed in the past medical history.

The operated patients were classified according to the ASA (American Society of Anesthesiologists) score system, which was subsequently used in the scientific study for comparative analysis based on various parameters, subjected to descriptive analysis. The highest percentage of cases were occupied by patients with ASA III - 55 (34.4% of cases), followed by patients with ASA II - 36 (22.5%) and ASA IV - 20 (12.5%). 17 (10.6%) of the patients were categorized as ASA I. All of them had data for an abscess of appendiceal origin.

In 108 (67.5%) of the patients, no complications were observed during treatment. In 26 (16.3%) cases, three or more complications were observed. In 15 (9.4%) patients, two complications were observed, and in 11 (6.9%) patients, only one complication was observed. The analysis shows that the most commonly observed complications in the studied patients were quantitative deviations in consciousness (26.9%), which were a result of disruptions in the body's homeostasis, respiratory insufficiency, and dependence on supportive devices and mechanisms (26.8%), hemodynamic instability (19.3%), rhythm disturbances (11.8%), and evidence of sepsis and septic shock (8%). An analysis was also conducted for any local complications in the area of the surgical wound, including cases where the drainage site had healed. In 19 patients (11.9%), a local complication in the area of the surgical wound was observed, while in 141 patients (88.1%), no complications were observed in the surgical wound area. During treatment, 44 (27.5%) patients required additional treatment in the ICU . In 116 (72.5%) cases, hospitalization did not require lying in the ICU. Of all 160 cases, 21 (13.1%) resulted in death.

A comparative analysis of observation parameters was performed in the dissertation. A positive, statistically significant correlation was found between age and the length of hospital stay , indicating that older patients had longer hospital stays.

Significant positive, statistically significant correlations were also found between older patients and higher ASA scores, as well as those with 3 or more medical and surgical complications. Mortality was highest in the age group over 61 years old. The mortality rate was higher in cases with 3 or more complications. Cases with 3 or more complications were most commonly observed in patients categorized as ASA IV. The highest number of imaging studies (more than two) was performed in patients categorized as ASA III. The largest number of patients who spent time in the ICU during their hospital stay were categorized as ASA III and ASA IV. The highest number of deaths occurred in patients categorized as ASA IV. In both patients categorized as ASA V, there was a fatal outcome from the disease. The results obtained indicate that the system can be successfully used as a prognostic marker for the possibility of complications during treatment, hospitalization period, diagnostic and treatment resources used, as well as the outcome of the disease. In all 21 patients who had a fatal outcome, there was a stay in the intensive care unit. In 23 of the patients who stayed in the intensive care unit during their hospital stay, there was a favorable outcome of the disease.

From the conducted comparative analysis between the etiological cause and lethality, a moderate, statistically significant correlation is established, indicating that the highest mortality is observed in patients with postoperative intestinal abscesses (8) - 5 of them involving the lower GI tract and 3 of them involving the upper GI tract. The second highest mortality is observed in patients with tumors in the lower GI tract with perforation and formed abscesses (4). No lethal outcome was recorded in any of the patients (58) with abscesses of appendicular origin. A correlation analysis between the therapeutic approach and lethality in patients did not reveal a statistically significant relationship. This fact supports the opinion of the CIAO study [117] . that adequacy of source control does not have a significant impact on mortality, while delays in its implementation are important for a possible unfavorable outcome. A weak correlation has been found between the length of hospital stay and the therapeutic approach in patients. The most common range of hospitalization is 5-7 days, both for operated patients and those treated only with percutaneous drainage. A positive, statistically significant correlation is established between the number of hospitalization days and lethality. The highest percentage of fatal cases is observed in the range of 15-25 hospitalization days.

DIAGNOSTIC-THERAPEUTIC ALGORITHM

Figure 18 presents a diagnostic-therapeutic algorithm for managing patients with pelvic and intestinal abscesses.

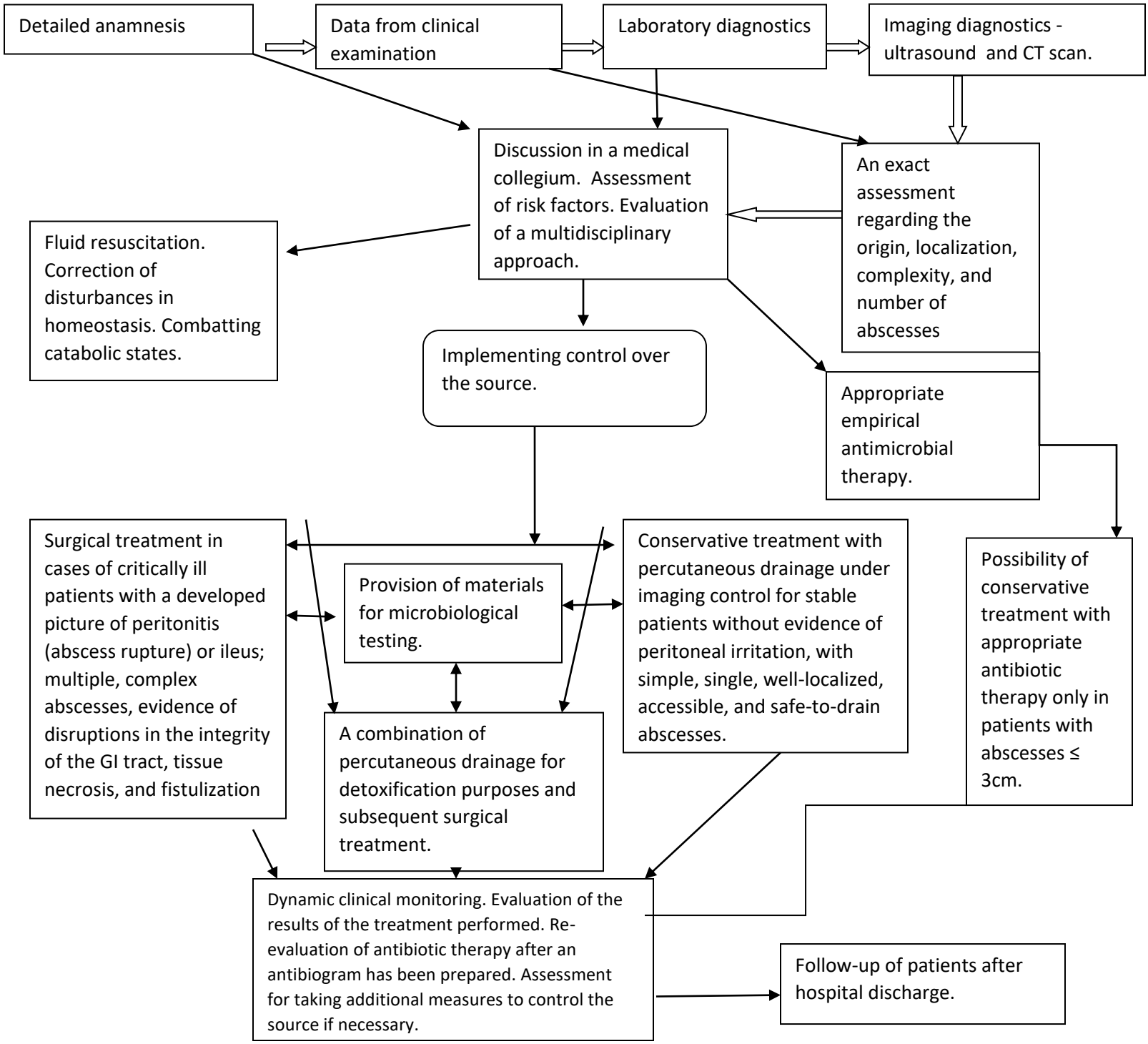


Fig. 18 - Diagnostic-therapeutic algorithm for management of patients with pelvic and intestinal abscesses.

FINDINGS

1. Periappendicular abscesses are the most common abscesses of intestinal origin. Surgical interventions in the pelvis, especially after gynecological surgeries, are a prerequisite for abscess occurrence.

2. The use of US as the first method of choice with a switch to CT in the setting of insufficient US findings is the gold standard in the diagnostic approach as confirmatory diagnostic imaging modalities in suspected intestinal and non-intestinal abscesses, including those with small bowel localization.

3. Intestinal and small intestinal abscesses most often contain polymicrobial flora. The most common isolates are Gram-negative microorganisms - E. coli, Klebsiella spp. Enterobacter spp., Proteus spp. or Pseudomonas spp.; Gram-positive bacteria such as Streptococcus spp., S. aureus, Enterococcus spp.; Anaerobic bacteria - Bacteroides, Clostridium. According to world statistics, in 26% bacterial cultures remain sterile.

4. The multidisciplinary approach, timely, adequate control of the source, appropriate empirical antimicrobial therapy, the adoption of measures aimed at restoring the homeostasis of the organism, correction of disturbances in the water-electrolyte and acid-base balance, compensation of catabolic changes, rehydration, rehabilitation, dynamic clinical monitoring and reassessment of results are the key points regarding the effective treatment of patients with malignant and intestinal abscesses.

5. The therapeutic approach regarding the implementation of source control should be strictly and individually refined. In appropriately selected patients, nonoperative methods may prove safe, effective, and completely sufficient in terms of radicality of control. The main reason for failure in this approach is incomplete diagnosis regarding the size, extent, complexity, localization of the abscess, the nature and viscosity of the exudate, and the caliber of the drain placed.

6. Surgical source control remains the most important determinant of survival and should be placed at the top of the therapeutic priority list. Operative methods are well established in terms of adequacy and radicality, low recurrence rates, and rehospitalizations. Disadvantages are expressed in possible complications on the side of the surgical wound and expansion of the volume of surgical intervention. If clinical findings suggest evidence of peritonitis with signs of systemic inflammation, the patient should be operated on, despite the fact that imaging studies show drainable collections.

7. Despite tremendous advances in the diagnosis and treatment of complicated limited intra-abdominal infections of intestinal and non-intestinal origin, including those of small-volume localization, 9-13% of cases result in a fatal outcome. Predictive risk factors influencing treatment failure and leading to prolonged hospital stay, costs and increased lethality rates are related to the age and comorbidity of the patients, the etiological origin of the disease (non-appendicular source of infection, postoperative abscesses, abscesses due to malignancy), delay in diagnosis and source control (due to frequent atypical clinical symptomatology, untimely seeking of medical attention, etc.), degree of impairment of general condition at initial examination, high ASA-score, complications, need for intensive treatment, isolation of poly-resistant bacterial strains.

CONTRIBUTIONS

1. Diagnostic distribution of patients with pelvic and intestinal abscesses is performed and classification according to etiopathogenetic origin and localization is proposed.

2. The most frequent clinical symptoms, the appropriate imaging modalities of choice, and the results of microbiological studies are analyzed.

3. Non-operative and operative approaches for source control, their advantages and disadvantages in terms of time, adequacy, radicality, hospitalization period, risks and benefits are analyzed. The role of antimicrobial therapy in the management of patients with pelvic and intestinal abscesses- duration, adequacy, appropriate regimens-is specified.

4. Preoperative risk and predictive risk factors such as age, comorbidity, need for intensive care, occurrence of complications affecting length of hospital stay and outcome are specified and analyzed.

5. A diagnostic and therapeutic management algorithm is developed.

PUBLICATIONS RELATED TO DISSERTATION WORK

Hr. Nikov, Pl. Chernopolsky, V. Bozhkov, R. Madjov. Periappendicular abscesses. Journal of Surgery, issue 1. 2023.

P. Chernopolsky, V.Bozhkov, V. Draganova, D. Chaushev, **Hr. Nikov**, R.Madjov. Abdominal tuberculosis report of 5 patients and literature review. International journal of innovation scientific research and review vol. 03, issue, 02, february, 2021; pp.872-874

Pl. Chernopolsky, V. Bozhkov, At. Lisnichkov, D. Chaushev, V. Draganova, **Hr. Nikov**, R. Madjov. Treatment of patients with liver abscess. Journal of Biomedicine and Clinical Research; Volume 15, Number 2, Supplement 1, 2022; pp 55-56