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Adverse outcomes epidemiology in elective abdominal surgery: results of a prospective observational multicenter study

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Эпидемиология неблагоприятных исходов в плановой абдоминальной хирургии: результаты проспективного наблюдательного многоцентрового исследования

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Abstract

INTRODUCTION: Risk assessment and identification of the group of patients with a high probability of developing an unfavorable outcome is the basis for effective prevention of postoperative adverse events. **OBJECTIVE:** To determine the incidence, pattern, severity and day of development of postoperative complications in patients after elective abdominal surgery based on STOPRISK database analysis. **METHODS:** The data of 11 478 patients in the STOPRISK database were analyzed. Gender, age, comorbidity, anesthesia and operative characteristics were recorded in all patients after assessment of compliance with the inclusion criteria. In the postoperative period, 30-day complications according to European Society of Anaesthesiology и European Society of Intensive Care Medicine classification and mortality were recorded. **RESULTS:** Of the 11 478 patients, 521 (4.5 %) developed complications in the postoperative period and 71 (0.62 %) developed fatal complications. Thus, among cardiac complications, arrhythmias occurred predominantly on days 1–3, 4–5, and 6–8; non-fatal cardiac arrest, acute myocardial in-

Реферат

ВВЕДЕНИЕ: Оценка риска и выделение группы пациентов с высокой вероятностью развития неблагоприятного исхода — основа эффективной профилактики послеоперационных неблагоприятных событий. **ЦЕЛЬ ИССЛЕДОВАНИЯ:** Определить частоту, структуру, тяжесть и сроки развития послеоперационных осложнений у пациентов после плановых абдоминальных операций на основании анализа базы STOPRISK. **МАТЕРИАЛЫ И МЕТОДЫ:** Произведен анализ показателей 11 478 пациентов базы STOPRISK. У всех пациентов после оценки соответствия критериям включения регистрировали гендерно-возрастные характеристики, коморбидность, особенности анестезии и оперативного вмешательства. В послеоперационный период фиксировали 30-дневные осложнения по классификации European Society of Anaesthesiology (ESA) и European Society of Intensive Care Medicine (ESICM) и летальный исход. **РЕЗУЛЬТАТЫ:** Из 11 478 пациентов у 521 (4,5 %) развились осложнения в послеоперационный период, у 71 (0,62 %) — летальный

farction, and pulmonary embolism were observed in almost every time period. An overwhelming number of cases of cardiogenic pulmonary edema and acute cerebral circulatory failure were detected in the 1–3 day postoperative period. Among respiratory complications (acute respiratory distress syndrome, pneumonia, acute respiratory failure) the greatest number occurred before 8 days. Infectious complications (wound infection, sepsis) predominantly developed on the 4th–8th day. Cerebral complications (delirium) and renal complications (acute kidney injury) — predominantly on day 1–3. Surgical complications (anastomosis failure, intestinal paresis, postoperative bleeding and wound edge divergence) — at all stages of observation, but predominantly on days 1–3 and 4–8. **CONCLUSIONS:** The most frequent complication in the general population was intestinal paresis, followed by wound infection, postoperative bleeding, pneumonia, and the least frequent complications were STEMI and non-fatal cardiac arrest. 92.1 % of complications were of severe degree (II and higher).

KEYWORDS: perioperative risk, epidemiology, postoperative complications, mortality, abdominal surgery

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исход. Среди кардиальных осложнений аритмии встречались преимущественно в 1–3, 4–5 и 6–8-е сут, нефатальную остановку сердца, острый инфаркт миокарда и тромбоэмболию легочной артерии наблюдали практически в каждом из временных отрезков. Среди респираторных осложнений (острый респираторный дистресс-синдром, пневмония, острая дыхательная недостаточность) наибольшее число осложнений произошло до 8 сут. Инфекционные осложнения (раневая инфекция, сепсис) преимущественно развились на 4–8-е сут, церебральные осложнения (делирий) и почечные (острое почечное повреждение) — преимущественно на 1-е–3-и сут. Хирургические осложнения (несостоятельность анастомоза, парез кишечника, послеоперационное кровотечение и расхождение краев раны) — на всех этапах наблюдения, но преимущественно в 1-е–3-и и 4–8-е сут, расхождение краев раны в 20 % случаев также наблюдали на 9–15-е сут. **ВЫВОДЫ:** Наиболее частое осложнение в общей популяции — парез кишечника, далее по значимости — раневая инфекция, послеоперационное кровотечение, пневмония, наименее часто встречались острое нарушение мозгового кровообращения (ОНМК) и нефатальная остановка сердца. Тяжелой степени (III и выше) было 62 % осложнений, что, как правило, требовало лечения этих пациентов в отделении реанимации и интенсивной терапии. При этом две трети осложнений регистрировали в первые пять суток послеоперационного периода.

КЛЮЧЕВЫЕ СЛОВА: периоперационный риск, эпидемиология, послеоперационные осложнения, летальность, абдоминальная хирургия

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epidemiology in elective abdominal surgery: results of a prospective observational multicenter study. Annals of Critical Care. 2025;3:51–63.
https://doi.org/10.21320/1818-474X-2025-3-51-63

Кузовлев А.Н. Эпидемиология неблагоприятных исходов в плановой абдоминальной хирургии: результаты проспективного наблюдательного многоцентрового исследования. Вестник интенсивной терапии им. А.И. Салтанова. 2025;3:51–63.
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Introduction

More than 330 million surgical procedures are performed worldwide every year. There are significant differences in the assessment of postoperative complications and mortality due to the heterogeneity of the design of postoperative outcome reports [1, 2, 3]. For example, about five million surgical procedures are performed annually in the UK and about 1 % of patients die within the first 30 postoperative days [4, 5]. Most perioperative studies use the 30-day mortality as a marker of adverse outcomes associated with surgical intervention [6].

Modern approaches to determining perioperative risk tend to focus on isolated determination of either the risk of death or the risk of specific complications, less often critical events. Postoperative adverse outcomes, such as infections, cardiovascular diseases, pulmonary complications, acute renal injury, etc., occur after every fifth surgical intervention [7]. The results of a large multicenter cohort study in the USA revealed a strong association between postoperative complications and decreased survival [8]. Studies show that 7–15 % of patients who underwent extensive surgery developed postoperative complications [9, 10]. In addition, the overall level of postoperative mortality varies from 0.79 to 5.7 % [11]. The presence of postoperative complications also affects the long-term outcome. The two-year mortality rate was almost 3 times higher in patients with a complicated postoperative period [12].

According to the Clavien Dindo Scale of Surgical Complications, postoperative complications are defined as any deviation from the normal course of the postoperative period, which means that the severity varies from non-life-threatening complications without long-term disability to fatal outcomes [13, 14]. Postoperative complications can have a serious impact on a particular patient, potentially leading to a decrease in both the quality of life and the functional capabilities of the body [9]. And from the point of view of society, these are additional costs for healthcare, treatment in the intensive care unit (ICU), repeated surgery or re–hospitalization [15].

According to the National Confidential Enquiry into Perioperative Deaths (NCEPOD) report [16] "Knowledge of Risk", the risk of death after surgery compared with the absence of disease was about two times higher in patients with respiratory diseases, coronary heart disease, type 2 diabetes mellitus and oncological diseases. It was three times higher in patients with cerebrovascular diseases, type 1 diabetes mellitus and arrhythmias and five times higher in the presence of congestive heart failure and confirmed cirrhosis of the liver. Regarding the postoperative treatment of patients who have undergone surgery, it is necessary to know which patients most often develop complications or death, and which factors contribute the most to this. To this end, in 2019, at the initiative of the Federation of Anesthesiologists and Resuscitators of Russia (FAR), in cooperation with the Federal State Budgetary Educational Institution of Higher Medical Education of Kuban State Medical University of the Ministry of Health of the Russian Federation, the national observational multicenter FAR study "The Role of concomitant diseases in the risk stratification of postoperative complications in abdominal surgery - STOPRISK" was initiated.

Objective

The purpose is to determine the frequency, structure, severity and timing of postoperative complications in patients after elective abdominal surgery based on the analysis of the STOPRISK database.

Material and methods

Twelve thousand patients from 38 centers representing 8 federal districts operated on abdominal and pelvic organs from July 1, 2019 to April 30, 2024 were included into the study. All centers were approved by local ethics committees prior to the start of the study. The patients signed a voluntary informed consent to participate in the study.

The study protocol [17] assumed the collection of information about all patients who met the inclusion criteria for the selected day.

Gender and age characteristics, comorbidity, methods of anesthesia and surgical intervention were recorded in all patients who met the inclusion criteria, In the postoperative period, 30-day complications and death were recorded according to the classification of the European Society of Anaesthesiology (ESA) and the European Society of Intensive Care Medicine (ESICM).

After excluding 522 (4.4 %) individuals due to missing or incomplete data, 11,478 operated patients were included in the subsequent analysis. Depending on the degree of operational risk, they were divided into low risk — 3630 patients (31.6 %), medium risk — 6481 patients (56.5 %), high risk — 1367 patients (11.9 %). Depending on the physical condition (ASA), they were divided into class 1 — 1664 (14.5 %), class 2 — 6000 (52.3 %), class 3 — 3814 (33.2 %). Of these, there were 7164 (62.4 %) women and 4314 (37.6 %) men.

The frequency and structure of complications were determined at the first stage of the study. At the second stage, the severity of complications was analyzed according to the Clavien-Dindo scale of surgical complications. At the third stage, the timing of complications was analyzed for 1–3, 4–5, 6–8, 9–15, 16–30 days, and after 30 days [18].

The Clavien Dindo scale of surgical complications divides postoperative complications from grades I to V, depending on the need for treatment. Grade I complications include deviations from the normal course of the postoperative period that do not require surgical, endoscopic, radiological, or pharmacological treatment, but may include the use of antiemetics, antipyretics, analgesics, diuretics, electrolyte solutions, physiotherapy, and wound bedside treatment. Grade II complications require pharmacological treatment beyond the permitted treatment for grade I, and also include blood transfusion or complete parenteral nutrition. Grade III complications require surgical, endoscopic, or radiological intervention, meanwhile, grade IIIa interventions are performed under local anesthesia and grade IIIb interventions are performed under general anesthesia. Grade IV complications are life-threatening, including complications from the central nervous system that require ICU treatment. Grade IVa complications indicate single organ failure (including dialysis), and grade IVb complications indicate multiple organ failure. Grade V complications death of the patient [19].

Research registration

The study is registered in an international database https://clinicaltrials.gov under the auspices of the All—Russian public organization "Federation of Anesthesiologists and Resuscitators" (chief researcher — I.B. Zabolotskikh), study number NCT03945968.

Statistical analysis

Statistical analysis was performed using the Excel application: selecting a pivot table in a layout, analyzing data in several tables in a pivot table report in Excel, and creating relationships between them in a Power Pivot table.

Results

Of the 11,478 patients, 521 (4.5 %) developed complications in the postoperative period. There were 71 (0.62 %) lethal outcomes. Isolated complications (1 complication) prevailed. They were noted in 332 patients (63.7 %). Combined complications (2 or more complications) were observed in 189 patients (36.3 % of patients). The most common complications in the overall population are intestinal paresis (1.4 %), wound infection, postoperative bleeding, pneumonia — 0.79–0.83 %; anastomotic leakage — 0.58 %; acute kidney injury, acute respiratory failure (ARF) and arrhythmia — 0.46–0.55 each %; cardiac arrest with fatal outcome and postoperative delirium — 0.41 %, sepsis — 0.35 %, other complications were observed with a frequency of 0.3 % and lower. Thus, surgical, infectious, and respiratory complications were most common in patients in the overall population (table 1).

Figure 1 shows the structure of complications. A total of 939 complications were reported. The most common complications were: intestinal paresis — 161 (17.1 %), wound infection — 95 (10.1 %), postoperative bleeding — 92 (9.8 %), pneumonia — 91 (9.7 %), anastomotic leakage — 66 (7.0 %), acute kidney injury — 60 (6.4 %), ARF — 63 (6.7 %), less frequent arrhythmias — 5.6 %, cardiac arrest with fatal outcome — 5.0 %, postoperative delirium — 5.0 %, sepsis — 4.3 %, ARDS — 3.5 %, reintubation due to acute respiratory failure — 3.7 %, divergence of wound edges — 1.6 %, AMI — 1.4 %, pulmonary embolism (PE) — 1.2 %. Cardiogenic pulmonary edema, nonfatal cardiac arrest, and acute cerebrovascular accident (CVA) were rarely observed in 0.8 %, 0.5 %, and 0.4 %, respectively.

Figure 2 shows the severity of the complications. Grade 1 complications were observed in 27 cases (2.9 %), grade 2 in 330 cases (35.1 %), grade IIIa in 159 cases (16.9 %), grade IIIb in 80 cases (8.5 %), grade IVa in 188 cases (20.0 %), grade IVb in 108 cases (11.5 %), grade V in 47 cases (5.0 %). The severity of complications was mainly represented by: grade II for intestinal paresis, grade II and III for wound infection, wound dehiscence and arrhythmias, grade IV — delirium, sepsis, tracheal reintubation due to acute respiratory failure; grade I and IV — acute kidney injury and acute respiratory failure. Thus, 92.1 % of complications were severe (grade II and higher), which, as a rule, required treatment of these patients in the intensive care unit.

The majority of complications (as shown in figure 3) developed on days 1–3 (344 complications — 36.6 %) and days 4–5 (286 complications — 30.5 %). One hundred thir-

Table 1. Total number and incidence of complications

Adverse outcomes	Total number	Percentage of total complications
Cardiac:		
Arrhythmias	53	0.46
Non-fatal cardiac arrest	5	0.04
Cardiac arrest followed by death	47	0.41
Cardiogenic pulmonary edema	8	0.07
Acute myocardial infarction	13	0.11
Pulmonary embolism	11	0.10
Acute cerebrovascular accident	4	0.03
Respiratory:		
Acute respiratory distress syndrome	33	0.29
Pneumonia	91	0.79
Acute respiratory failure	63	0.55
Reintubation due to acute respiratory failure	35	0.30
Infectious:		
Wound infection	95	0.83
Sepsis	40	0.35
Cerebral:		
Postoperative delirium	47	0.41
Renal:		
Acute kidney injury	60	0.52
Surgical:		
Anastomotic leakage	66	0.58
Intestinal paresis	161	1.4
Postoperative bleeding	92	0.8
Wound dehiscence	15	0.13

ty-four complications (14.3 %) were detected on days 4–8, 110 complications (11.7 %) on days 9–15, 50 complications (5.3 %) on days 16–30, and 15 complications (1.6 %) on days over 30.

As can be seen from Table 2, there is some heterogeneity in the timing of the development of various complications. Thus, among cardiac complications, arrhythmias were observed mainly on days 1–3, 4–5, and 6–8; nonfatal and fatal cardiac arrest, AMI, and PE in almost every time interval. The overwhelming number of cases of cardiogenic pulmonary edema and CVA were observed on the 1st–3rd day of the postoperative period. Among respiratory complications (ARDS, pneumonia, ARD), the largest number of complications were observed up to 8 days. Infectious complications (wound infection, sepsis) developed significantly on days 1–3 and 4–5, 9–15. Cerebral complications (delirium) and renal complications (acute renal injury) occur mainly on 1–3 days. Surgical complications (anastomotic leakage, postoperative bleeding, and wound dehiscence) were reported at all stages of follow–up, but mainly on days 1–3 and 4–5, and in 20 % of cases, wound dehiscence was also reported on days 9–15.

Discussion

The analysis of unfavorable outcomes of elective abdominal surgical interventions showed some differences from previously published results [20]. Among such severe complications as acute respiratory distress syndrome and pulmonary embolism, acute myocardial infarction with the development of cardiogenic pulmonary edema, acute cerebrovascular accident, with an increase in the analyzed sample of patients, a decrease in the frequency of occurrence was noted — 1.2 % (2-4 %), 2,3 % (2.6 %), 0.4 % (1 %), respectively. At the same time, 1 complication was noted in 63.7 % of patients, versus 74 %, 2 or more complications occurred in 36.3 % of patients, versus 26 %. Postoperative

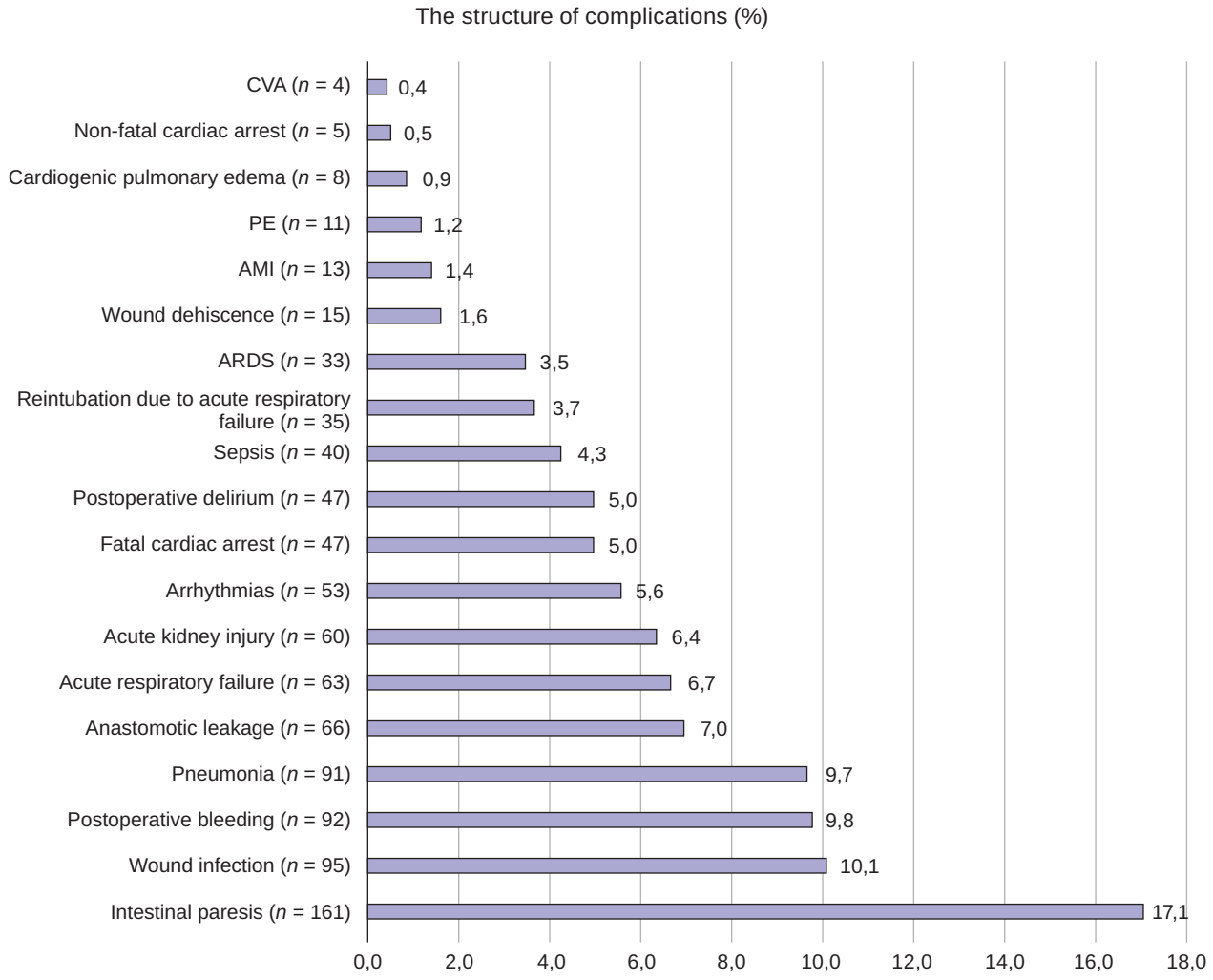

Fig. 1. Structure of complications (*n* = 939)

intestinal paresis accounted for 17.1 % of complications, as opposed to a quarter (25.57 %) according to the results of the preliminary assessment. The distribution of percentages of other complications did not differ significantly and ranged from 7 to 10 %.

In terms of the number of complications and mortality, the STOPRISK study demonstrated results comparable to those of a large-scale study by Mullen M.G. (2017), which included an analysis of 173.643 surgical procedures. During elective operations, complications were noted in 6.7 % of patients, and mortality was 0.4 % [21]. In the STOPRISK study, complications were reported in 4.5 % of patients with a mortality rate of 0.62 %.

A recent study compared the National Surgical Quality Improvement Program (NSQIP) with the study of surgical outcomes in Latin America (LASOS) and Africa (ASOS). Mortality from various causes in three studies did not exceed 2 %, while postoperative complications were almost 1.5–2 times higher in LASOS and ASOS (16–18 %) compared with NSQIP (10 %), and mortality was 2 times higher in LASOS compared with NSQIP, which allowed the authors to conclude that it is necessary to improve the standards of postoperative management of patients [22].

According to the Clavien–Dindo Scale of Surgical Complications, the majority (35.1 %) of complications identified in the STOPRISK study were classified as grade II, i.e. they can be treated with pharmacological agents. Complications requiring surgical correction under local anesthesia (grade III) were detected in 16.9 % of patients, and organ failure (grade IV) in 20 %, which is generally consistent with the data of the world literature [19]. There are indications that the number of complications and their severity are not significantly related to the type of surgical intervention [23].

In a large multicenter study carried out by Downey C.L. in 2023, the following complications according to the Clavien Dindo Scale of Surgical Complications were revealed in 19685 patients who underwent elective abdominal surgery: 54.5 % of patients had no complications at all (Grade 0), 16.0 % of patients had grade I complications, 18.5 % had grade II complications, 7.0 % had grade III, 2.7 % had grade IV, and 0.8 % were fatal (grade V). At

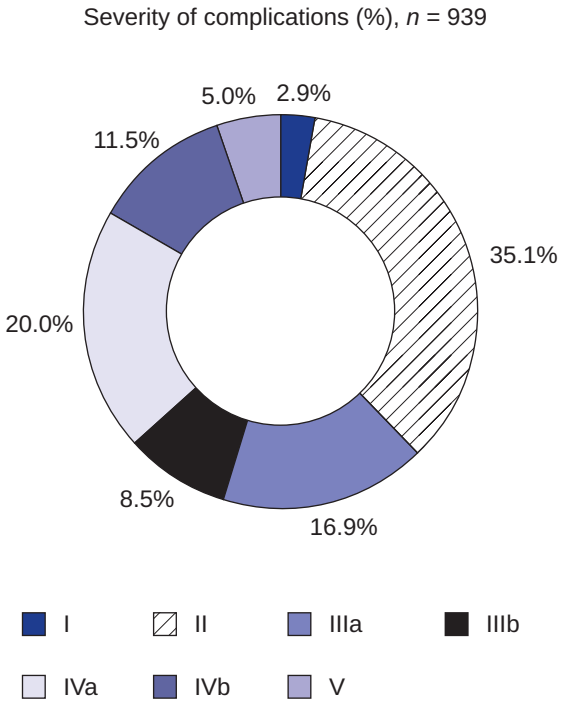

Fig. 2. Severity of complications according to the Clavien-Dindo scale

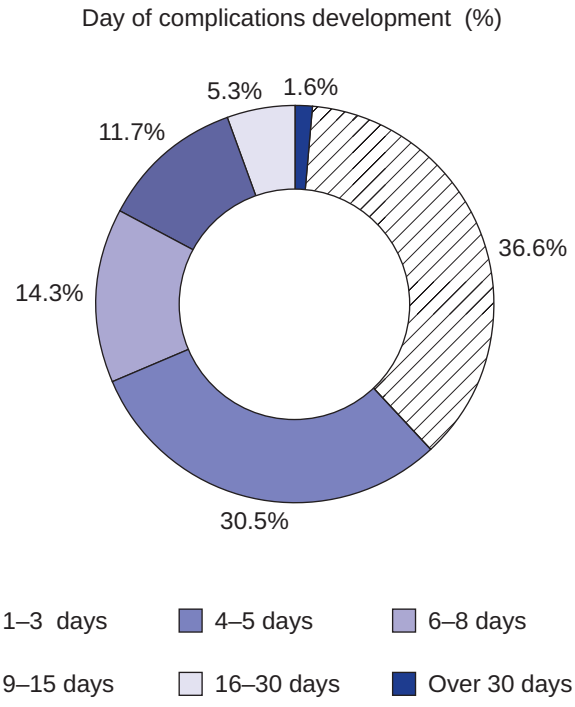

Fig. 3. Periods of complications

the same time, relatively mild and moderate forms (I–II) were most common, while severe complications (III–IV) and deaths were less common [24]. Compared with the STOPRISK study, where the incidence of postoperative complications in 11,478 patients was 4.5 % (with a mortality rate of 0.62 %), there was a lower overall percentage of undesirable outcomes and a lower proportion of severe complications (grade III–IV) compared with the data of the British authors. The authors also studied how the severity of complications affected the quality of life within 12 months after surgery (according to the EQ 5D questionnaire). The results showed that an increase in severity on the the Clavien Dindo scale of surgical complications correlated with a pronounced and persistent decrease in quality of life. The total loss of QALY per year for patients with grade I complications was approximately 0.012, for II — 0.026, for III — 0.033, and for IV reached 0.086 relative to those who did not have complications, which indicates the importance of complications and their role in the long term period. To what extent this relationship is expressed in the national cohort, we will probably learn from the results of another multicenter all-Russian study RuSOS [25] which design fully corresponds to the modern concept of perioperative risk [26].

Duraes L.C. et al. (2018) analyzed data from 2266 patients who underwent elective resections for stage I–III colorectal cancer. The study showed that 669 patients (30 %) had complications (at least one), and the remaining 1597 had no complications [27]. The authors classified patients with any undesirable phenomena according to the most severe degree of Clavien-Dindo recorded in them. As a result, 211 people had grade I complications, 176 had grade II complications, 198 had grade III complications, and 84 had grade IV complications. Thus, almost a third of the patients suffered postoperative complications of varying severity.

It should be noted that in the study of Duraes L.C. et al. (2018) more than 70 % of patients with complications belonged to ASA physical status III–IV, whereas only 33 % of patients with ASA III status were included in STOPRISK. Differences in the initial status of the analyzed patients, apparently, explain the revealed discrepancy in the results.

Limitations

The analysis revealed an uneven distribution of the severity of surgical interventions with a bias towards low-traumatic operations, which affects the frequency of analyzed outcomes and can lead to a distorted understanding of the patterns present in the population.

Not all possible outcomes were included in the protocol, which probably requires its correction and retrospective recovery of some of the data.

Conclusion

Isolated (1 complication) complications prevailed in the structure of complications (63.7 % of patients with complications), while combined complications (2 or more)

Table 2. Periods and frequency of complications

Adverse outcomes	Number of complications											
	1–3 days		4–5 days		6–8 days		9–15 days		16–30 days		Over 30 days	
	Abs.	%	Abs.	%	Abs.	%	Abs.	%	Abs.	%	Abs.	%
Cardiac												
Arrhythmias	35.0	66.0	10.0	18.9	6.0	11.3	2.0	3.8	0.0	0.0	0.0	0.0
Nonfatal cardiac arrest	1.0	20.0	2.0	40.0	0.0	0.0	1.0	20.0	1.0	25.0	0.0	0.0
Fatal cardiac arrest	11.0	23.4	6.0	12.8	6.0	12.8	10.0	21.3	8.0	16.7	6.0	14.6
Cardiogenic pulmonary edema	4.0	50.0	2.0	25.0	0.0	0.0	2.0	25.0	0.0	0.0	0.0	0.0
Acute myocardial infarction	4.0	30.8	2.0	15.4	2.0	15.4	3.0	23.1	2.0	15.4	0.0	0.0
Pulmonary embolism	6.0	54.5	1.0	9.1	2.0	18.2	1.0	9.1	1.0	9.1	0.0	0.0
Acute cerebrovascular accident	3.0	75.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	25.0	0.0	0.0
Respiratory												
Acute respiratory distress syndrome	13.0	39.4	6.0	18.2	7.0	21.2	5,0	15.2	1.0	3.0	1.0	3.0
Pneumonia	31.0	34.1	24.0	26.4	18.0	19.8	11.0	12.1	6.0	6.6	1.0	1.1
Acute respiratory failure	33.0	52.4	12.0	19.0	6.0	9.5	6.0	9.5	5.0	3.5	1.0	1.8
Reintubation due to acute respiratory failure	10.0	28.6	2.0	5.7	10.0	28.6	8.0	22.9	4.0	9.7	1.0	3.2
Infectious												
Wound infection	26.0	27.4	25.0	26.3	15.0	15.8	19.0	20.0	9.0	9.5	1.0	1.1
Sepsis	11.0	27.5	7.0	17.5	10.0	25.0	8.0	20.0	3.0	2.7	1.0	2.7
Cerebral												
Postoperative delirium	38.0	80.9	3.0	6.4	5.0	10.6	1.0	2.1	0.0	0.0	0.0	0.0
Renal												
Acute kidney injury	41.0	68.3	9.0	15.0	5.0	8.3	3.0	5.0	1.0	1.7	1.0	1.7
Surgical												
Anastomotic leakage	24.0	36.4	19.0	28.8	11.0	16.7	9.0	13.6	2.0	3.0	1.0	1.5
Intestinal paresis	0.0	0.0	136.0	84.5	17.0	10.6	7.0	4.3	1.0	0.6	0.0	0.0
Postoperative bleeding	50.0	54.3	15.0	16.3	11.0	12.0	11.0	12.0	4.0	2.2	1.0	1.1
Wound dehiscence	3.0	20.0	5.0	33.3	3.0	20.0	3.0	20.0	1.0	6.7	0.0	0.0

were observed in 36.3 % of patients with complications. The most common complications in the overall population were intestinal paresis, followed by wound infection, postoperative bleeding, and pneumonia, while cancer and nonfatal cardiac arrest were the least common complications. Sixty-two point one per cent of complications were severe (grade III and higher), which usually required treatment of these patients in the intensive care unit. At the same time, two thirds of complications were recorded in the first five days of the postoperative period.

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Author contribution. All authors according to the ICMJE criteria participated in the development of the concept of the article, obtaining and analyzing factual data, writing and editing the text of the article, checking and approving the text of the article.

Ethics approval. The study was approved by the Independent ethical committees of the participating centers.

Registration of the study. The study was registered in the international database https://clinicaltrials.gov under the auspices of the All-Russian Public Organization "Federation of Anesthesiologists and Reanimatologists" (principal investigator I.B. Zabolotskikh), study number NCT03945968.

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References

[1] *Kable A.K., Gibberd R.W., Spigelman A.D.* Adverse events in surgical patients in Australia. Int J Qual Health Care. 2002; 14(4): 269–76. DOI: 10.1093/intqhc/14.4.269

[2] *Mullen R., Scollay J.M., Hecht G. et al.* Death within 48 h — adverse events after general surgical procedures. Surgeon. 2012; 10(1): 15. DOI: 10.1016/j.surge.2011.01.005

[3] *Pearse R.M., Moreno R.P., Bauer P. et al.* Mortality after surgery in Europe: a 7 day cohort study. Lancet. 2012; 380(9847): 1059–65. DOI: 10.1016/S0140-6736(12)61148-9

[4] *Abbott T.E.F., Fowler A.J., Dobbs T.D. et al.* Frequency of surgical treatment and related hospital procedures in the UK: a national ecological study using hospital episode statistics. Br J Anaesth. 2017; 119(2): 249–57. DOI: 10.1093/bja/aex137

[5] *Dobbs T.D., Gibson J.A.G., Fowler A.J. et al.* Surgical activity in England and Wales during the COVID-19 pandemic: a nationwide observational cohort study. Br J Anaesth. 2021; 127(2): 196–204. DOI: 10.1016/j.bja.2021.05.001

[6] *Myles P.S.* More than just morbidity and mortality - quality of recovery and long-term functional recovery after surgery. Anaesthesia. 2020; 75. Suppl 1: e143–e150. DOI: 10.1111/anae.14786

[7] *Chaudery H., MacDonald N., Ahmad T. et al.* Acute Kidney Injury and Risk of Death After Elective Surgery: Prospective Analysis of Data From an International Cohort Study. Anesth Analg. 2019; 128(5): 1022–29. DOI: 10.1213/ANE.0000000000003923

[8] *Khuri S.F., Henderson W.G., DePalma R.G. et al.* Determinants of long-term survival after major surgery and the adverse effect of postoperative complications. Ann Surg. 2005; 242(3): 326–43. DOI: 10.1097/01.sla.0000179621.33268.83

[9] *Tevis S.E., Cobian A.G., Truong H.P. et al.* Implications of Multiple Complications on the Postoperative Recovery of General Surgery Patients. Ann Surg. 2016; 263(6): 1213–18. DOI: 10.1097/SLA.0000000000001390

[10] *Haynes A.B., Weiser T.G., Berry W.R. et al.* A surgical safety checklist to reduce morbidity and mortality in a global population. N Engl J Med. 2009; 360(5): 491–9. DOI: 10.1056/NEJMsa0810119

[11] *Tevis S.E., Kennedy G.D.* Postoperative complications and implications on patient-centered outcomes. J Surg Res. 2013; 181(1): 106–13. DOI: 10.1016/j.jss.2013.01.032

[12] *Fowler A.J., Brayne A.B., Pearse R.M. et al.* Long-term healthcare use after postoperative complications: an analysis of linked primary and secondary care routine data. BJA Open. 2023; 7: 100142. DOI: 10.1016/j.bjao.2023.100142

[13] *Straatman J., Cuesta M.A., de Lange-de Klerk E.S. et al.* Hospital cost-analysis of complications after major abdominal surgery. Dig Surg. 2015; 32(2): 150–6. DOI: 10.1159/000371861

[14] *Clavien P.A., Sanabria J.R., Strasberg S.M.* Proposed classification of complications of surgery with examples of utility in cholecystectomy. Surgery. 1992; 111(5): 518–26.

[15] *Healy M.A., Mullard A.J., Campbell D.A. Jr. et al.* Hospital and Payer Costs Associated With Surgical Complications. JAMA Surg. 2016; 151(9): 823–30. DOI: 10.1001/jamasurg.2016.0773

[16] *Cain D., Ackland G.* Knowing the risk? NCEPOD 2011: a wake-up call for perioperative practice. Br J Hosp Med (Lond). 2012; 73(5): 262–4. DOI: 10.12968/hmed.2012.73.5.262

[17] *Заболотских И.Б., Трембач Н.В., Мусаева Т.С. и др.* Национальное многоцентровое проспективное обсервационное исследование «Роль сопутствующих заболеваний в стратификации риска послеоперационных осложнений» — STOPRISK: протокол исследования. Вестник интенсивной терапии им. А.И. Салтанова. 2022; 4: 24–35. [*Zabolotskikh I.B., Trembach N.V., Musaeva T.S. et al.* National multicenter prospective observational study "The role of concomitant diseases in postoperative complications RISK stratification — STOPRISK": study protocol. Annals of Critical Care. 2022; 4: 24–35. (In Russ)]. DOI: 10.21320/1818-474X-2022-4-24-35

[18] *Grocott M.P., Browne J.P., Van der Meulen J et al.* The Postoperative Morbidity Survey was validated and used to describe morbidity after major surgery. J Clin Epidemiol. 2007; 60(9): 919–28. DOI: 10.1016/j.jclinepi.2006.12.003

[19] *Idriss A.M., Tfeil Y., Baba J.S. et al.* Applicabilité de la classification Clavien-Dindo dans l'évaluation des complications postopératoires dans la clinique chirurgicale du Centre Hospitalier National de Nouakchott: analyse observationnelle de 834 cas [Applicability of the Clavien-Dindo classification in the evaluation of postoperative complications at the Surgery Department of the National Hospital Center of Nouakchott: observational study of 834 cases]. Pan Afr Med J. 2019; 33: 254. DOI: 10.11604/pamj.2019.33.254.18024

[20] *Заболотских И.Б., Трембач Н.В., Магомедов М.А. и др.* Структура и частота сопутствующих заболеваний и связанных с ними послеоперационных осложнений: национальное наблюдательное многоцентровое исследование STOPRISK. Вестник интенсивной терапии имени А.И. Салтанова. 2023; (3): 43–57. [*Zabolotskikh I.B., Trembach N.V., Magomedov M.A. et al.* Structure and frequency of comorbidities and associated postoperative complications: a national observational multicenter study STOPRISK. Annals of Critical Care. 2023; 3: 43–57. (In Russ)]. DOI: 10.21320/1818-474X-2023-3-43-57

[21] *Mullen M.G., Michaels A.D., Mehaffey J.H. et al.* Risk Associated With Complications and Mortality After Urgent Surgery vs Elective and Emergency Surgery: Implications for Defining "Quality" and Reporting Outcomes for Urgent Surgery. JAMA Surg. 2017; 152(8): 768–74. DOI: 10.1001/jamasurg.2017.0918

[22] Latin American Surgical Outcomes Study (LASOS) group. Patient outcomes after surgery in 17 Latin American countries (LASOS): a 7 day prospective cohort study. Lancet Glob Health. 2025; 13(4): e635–e645. DOI: 10.1016/S2214-109X(24)00558-8

[23] *Moeng M.S., Sparaco A., Mare I. et al.* Clavien-Dindo Classification of Post-Operative Complications in a South African Setting. Wits J Clin Med, 2021 Mar 5; 3(1): 11–8. DOI: 10.18772/26180197.2021.v3n1a2

[24] *Downey C.L., Bainbridge J., Jayne D.G. et al.* Impact of in-hospital postoperative complications on quality of life up to 12 months after major abdominal surgery. Br J Surg. 2023; 110(9): 1206–12. DOI: 10.1093/bjs/znad167

[25] *Заболотских И.Б., Белкин А.А., Григорьев Е.В. и др.* Национальный регистр послеоперационных исходов — RuSOS: протокол исследования. Вестник интенсивной терапии имени А.И. Салтанова. 2024; 1: 158–67. [*Zabolotskikh I.B., Belkin A.A., Grigoryev E.V., et al.* Russian registry of Surgical OutcomeS — RuSOS: study protocol. Annals of Critical Care. 2024; 1: 158–67. (In Russ)]. DOI: 10.21320/1818-474X-2024-1-158-167

[26] *Заболотских И.Б*. Концепция периоперационного риска: обзор литературы. Вестник интенсивной терапии имени А.И. Салтанова. 2024; 4: 40–57. [*Zabolotskikh I.B.* The concept of perioperative risk: a narrative review. Annals of Critical Care. 2024; 4: 40–57. (In Russ)]. DOI: 10.21320/1818-474X-2024-4-40-57

[27] *Duraes L.C., Stocchi L., Steele S.R. et al.* The Relationship Between Clavien-Dindo Morbidity Classification and Oncologic Outcomes After Colorectal Cancer Resection. Ann Surg Oncol. 2018; 25(1): 188–96. DOI: 10.1245/s10434-017-6142-6