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ORIGINAL ARTICLE

VENOUS THROMBOEMBOLISM – PECULIARITIES OF COURSE IN EMERGENCY SURGERY DURING COVID-19 PANDEMIC

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ABSTRACT

The aim: To perform a comparative analysis of VTE in patients with acute surgical abdominal pathology before and during the COVID-19 pandemic.

Materials and methods: Retrospective study covered 53062 patients operated in the surgical clinic (Lviv city emergency hospital) in 2000-2019. Prospective analysis was based on the results of treatment of 546 patients operated at the same surgical clinic from April 2020 (1st surgical patient with COVID-19) till December 2021. The study analyzed 48 (8.8%) patients operated for acute abdominal pathology and confirmed diagnosis of COVID-19.

Results: In the 1st group, heparin prophylaxis was used in 42.3% of patients, of which non-fractionated heparin were used in 58.6% and low molecular weight heparin – in the remaining patients. From 2020 to 2021, pharmacoprophylaxis was used in 84.5% of cases, of which 67.2% – low molecular weight heparins, 20.1% – non-fractionated heparins and 12.7% – modern oral anticoagulants. The results were unexpected: with a significant increase in the venous thromboembolism prevention in the 2nd group, a decrease in the number of episodes of thromboembolic complications was not observed. In contrast, pulmonary artery embolism was recorded in 10.6% of patients in the 1st group and 23.5% – in 2nd group, which is a 2.2-fold increase in fatal cases of venous thrombosis ($p<0.05$) in patients with COVID-19.

Conclusions: Increase of mortality due to pulmonary artery embolism more than twicefold in patients with COVID-19 operated for acute surgical abdominal pathology is an objective evidence of a potentiated, uncontrolled risk of venous thromboembolism and requires further in-depth study.

KEY WORDS: venous thrombosis and embolism, COVID-19, thromboembolic complications, acute surgical abdominal pathology

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INTRODUCTION

Prediction and prevention of post-operative complications remains one of the most pressing problems of clinical surgery. Venous thrombosis and embolism (VTE) is a complication, which differs from others by the particular severity of the course, complexity of diagnosis and treatment and high mortality. The sharp rise in venous thromboembolism (VT) in the context of the 2019 COVID-19 pandemic attracts increasing attention of experts around the world [1-4]. According to current data, about a third of patients' deaths in the postoperative period are due to VTE [1, 5, 6]. Clinicians [1, 2, 7] report that 71.4% of patients who died of COVID-19 were diagnosed with multifocal thrombosis as a manifestation of uncontrolled hypercoagulation. Although thromboembolic complications (TEC) are still considered to be the most favorable in the context of prevention, studies of last 2 years have raised the question of assessment of the real risk of VTE in surgical patients with severe respiratory syndrome caused by SARS-CoV.

THE AIM

To perform a comparative analysis of VTE in patients with acute surgical abdominal pathology before and during the COVID-19 pandemic.

MATERIALS AND METHODS

Retrospective analysis of the results of treatment of patients, who underwent surgery for acute surgical abdominal pathology before the COVID-19 pandemic (1st group) and prospective analysis – for the period from April 2020 to December 2021 (2nd group) were done.

The necessity of research was due to following: 1) from April 2020, hospitals began to admit surgical patients with concomitant COVID-19; 2) during the 2nd and 3rd quarters of 2020, there was an increase of VTE in patients with acute surgical abdominal pathology; 3) in early 2021, an urgent need for detailed study of TEC in the clinic and the development of differentiated approaches to specific prevention of VT; 4) rising number of reports about atypical localization of thrombosis of

veins (portal, mesenteric, splenic, renal etc.) in surgical patients with severe COVID-19-induced respiratory syndrome.

Retrospective study covered 53062 patients operated in the surgical clinic (Lviv city emergency hospital) in 2000-2019. Women slightly predominated (53.4%). The mean age of patients was 56.2±11.5. In emergency mode, 53547 interventions were performed for acute diseases of the abdominal organs (appendicitis – 20.1%, cholecystitis – 18.2%, bowel obstruction – 19.5%, incarcerated hernia – 10.8%, perforated gastric or duodenal ulcer – 12.3%, destructive pancreatitis – 3.4%, other acute surgical pathology – 5.5%) and abdominal trauma (10.2%).

After surgery, 1673 patients (3.2%) died, mainly from purulent-septic complications or multiple organ failure. Pulmonary artery embolism (PAE) occurred in 178 patients (10.6%) on 7.4±3.2 days after emergency surgery. In 12 patients (6.7%), PAE was clinically subacute and its intensive therapy proved to be effective. Clinical and radiological signs of pulmonary infarction appeared in 8 (4.5%) patients 3-4 days after PAE. Acute sudden heart and lung failure caused death of 101 (56.8%) patient despite resuscitation. In 65 (36.5%) patients with PAE, cause of death was revealed only at autopsy.

Prospective analysis was based on the results of treatment of 546 patients operated at the same surgical clinic from April 2020 (when 1st surgical patient was diagnosed with COVID-19) till December 2021. Men slightly prevailed – 52.7%. Age of patients ranged from 21 to 85 (mean – 62.1±21.2). Acute intestinal obstruction was the indication for surgery in 140 (25.6%) patients, 86 of them (15.8%) had obstructive colon cancer, acute appendicitis – 120 (22.0%), incarcerated hernia – 105 (19.2%) (of which intestinal resection was done in 4.7%), acute cholecystitis – 89 (16.3%), perforated ulcer – 68 (12.5%), perforated diverticulitis of the descending and sigmoid colon – 14 (2.6%) and segmental small bowel necrosis – 10 (1.8%).

The study analyzed 48 (8.8%) patients operated for acute abdominal pathology and confirmed the diagnosis of COVID-19. Positive polymerase chain reaction (PCR) for identification of SARS-CoV-2 was confirmed in 83.3% of patients, express test for antigen was positive only in 17.7% of cases. There were 37 (77.1%) patients in the specialized Intensive care unit (ICU) for patients with COVID-19, of whom 17 (45.9%) required invasive breathing support, average bed stay was 7.6±3.2 days. On days 3.8±1.9, 17 (35.4%) post-surgical patients died, autopsy was performed in 15 (88.2%). Causes of death were: multiple organ failure (35.3%), heart and respiratory failure (29.4%), PAE (23.5%) and purulent-septic complications (11.8%).

In 1st group, 37.1% of patients were diagnosed with peritonitis of various spread: local delimited in 31.2%, local non-delimited – 25.7%, diffuse in – 43.1%. Mannheim peritonitis index (MPI) value was: I – 27.4%, II – 52.3% and III – 20.3%. Despite the fact that in the 2nd group there were more patients with diffuse peritonitis (49.1%) and cases with MPI value III were slightly predominant, no significant difference ($p>0.05$) was noticed between the indicators.

However, assessing the preoperative condition of patients according to the classification of American Society of Anesthesiologists, it was found that in 1st group class I was stated in 13.3% of patients, in 2nd – 9.8%; class II – in 26.2% and in 21.3% respectively; class III – in 28.4% and in 32.4% respectively; class IV – in 21.0% and in 25.2% respectively; class V – in 11.1% and in 11.3% respectively. The increase in the number of patients with class III and IV in the 2nd group was due to an increase in the incidence of disseminated intravascular coagulation and respiratory failure due to viral pneumonia and decreased cardiac ejection fraction due to overload of right part of heart caused by VTE.

Patients of both groups were individually stratified according to VTE risk levels according to the J. Caprini risk assessment scale [5, 8]. Low (1-2 points), moderate (3-4 points) and high (5 or more points) degrees of risk in the 1st group were found in 3.5%, 72.2% and 24.3% of patients, in 2nd – respectively, in 2.8%, 62.2% and 35.0% cases ($p<0.05$). All patients with moderate and high risk were given VTE drug prophylaxis according to the current recommendations and taking into account the peculiarities of COVID-19.

Pre-operative preparation both study groups consisted of correction of water-electrolyte balance, functions of major organs and systems, antibiotic prophylaxis or antibiotic therapy. All surgical interventions were performed within 24 h using general anesthesia in 87.5% of patients (endotracheal – 74.2%), regional– in 12.5%. The average duration of the operation was 98±51.8 min.

RESULTS AND DISCUSSION

Venous thrombosis and embolism is a complication in surgery being exceptional for the number of existing guidelines, consensuses, clinical protocols and standards of prevention [6, 9]. Nevertheless, with the threating pace of SARS-CoV-2 spread, global medicine had faced new, unknown challenges associated with VT, which are much more aggressive, dramatically worsening treatment outcomes. Assessing the danger, it was necessary to modernize clinical guidelines, mainly changing the concept of VTE risk assessment in patients

with COVID-19 and developing new diagnostic and preventive methods, adapted to current reality.

For comparative analysis, we stratified both study groups by degree of VTE risk in accordance with the 9th ACCP guideline. A distinct increase in the number of high-risk patients with TEC was seen in the 1st group from 24.3% to 35% ($p<0.05$), while in the 2nd this was due to an increase in the number of operations for complicated surgical pathology, significant increase in hospital stay and, consequently, prolongation of bed rest for more than 72 hours and the number of central vein catheterizations.

Analysis of the nature and effectiveness of specific VTE prevention was performed in both study groups. In the 1st group, heparin prophylaxis was used in 42.3% of patients, of which non-fractionated heparins (NFH) were used in 58.6% and low molecular weight heparins (LMWH) – in the remaining patients. From 2020 to 2021, pharmacoprophylaxis was used in 84.5% of cases, of which 67.2% – LMWH, 20.1% – NFH and 12.7% – modern oral anticoagulants. The results were unexpected: with a significant increase in the VTE prevention in the 2nd group, a decrease in the number of episodes of TEC was not observed. In contrast, PAE was recorded in 10.6% of patients in the 1st group and 23.5% – in 2nd group, which is a 2.2-fold increase in fatal cases of VT ($p<0.05$) in patients with COVID-19. The reasons for such a substantial increase in the incidence of VT are confirmed by preliminary data on the potentiated risk of VTE in patients with acute surgical abdominal pathology on the background of severe respiratory syndrome caused by SARS-CoV-2.

As well, this comparative analysis of groups' stratifications revealed a slight increase in the number of patients with a high risk of VTE in the 2nd (COVID-19) group. Widely known, in case of low degree risk it is advisable to limit the use of mechanical prophylaxis, while in moderate and high degrees of risk, the use of anticoagulants in appropriate doses is necessary [10]. Therefore, the application of the 8th edition of the ACCP guideline and local clinical protocols, especially developed for emergency surgery, will elevate the importance of pharmacological prevention of VTE. Giving priority to specific prophylaxis will optimize the solution to the problem of VTE in Ukraine, where most mechanical methods (graded elastic compression, intermittent pneumocompression, electrical muscle stimulation etc.) are mostly not available and non-specific prevention is reduced only to early activation of the patient after surgery.

Indicators of the timing of death after surgery in study groups deserve special attention. Thus, in the 1st group it equaled 7.4±3.2 days, in 2nd – 3.8±1.9, which may point upon a more aggressive course of thanatogenesis in patients with COVID-19 and a theoretical increase in the number of TEC in patients due to the progression of respiratory failure, which do not "live up" until PAE occurs.

CONCLUSIONS

1. Venous thrombosis and embolism are one of the most serious postoperative complications in emergency surgery, especially on the background of the COVID-19 pandemic.
2. Modern features of the problem of VTE in surgical patients with COVID-19 are the decrease in the proportion of patients with low risk of VTE and an increase in the number of patients with high risk of VTE.
3. Optimizing the solution to the problem of VTE in emergency surgery is seen in assessment of the real scale of TEC in patients with COVID-19 and widening of the indications for pharmacological prevention of VT.
4. Increase of mortality due to PAE more than twicefold in patients with COVID-19 operated for acute surgical abdominal pathology is an objective evidence of a potentiated, uncontrolled risk of VTE and requires further in-depth study.
5. Actual TEC values in surgical patients with COVID-19 may be underestimated due to shortening of the hospitalization-death period.

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The Authors declare no conflict of interest.

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