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Assessment of the risk of venous thrombosis and embolism in operated patients with acute surgical pathology of abdominal organs against the background of COVID–19

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Abstract

Objective. To evaluate the risk of venous thrombosis and embolism in urgently operated patients with acute abdominal surgical pathology and coronavirus disease.

Materials and methods. The single–centre study was based on the analysis of 741 medical records of inpatients admitted to a surgery centre between April 2020 and February 2022. The study analysed 78 medical records of patients operated on for acute abdominal surgical pathology with confirmed COVID–19. 8.9% of patients died, including 5.1% from massive pulmonary embolism with the development of acute cardiovascular failure. Thromboembolic complications were diagnosed in 26.9% of patients.

Results. The scores that assessed the risk factors for venous thrombosis and embolism were determined. A score of up to 15 points corresponded to a low risk, 15–35 points to an average risk, and more than 35 points to a high risk.

Conclusions. The incidence of venous thrombosis and embolism in patients with coronavirus disease in the postoperative period in the low risk group is 8%, medium – 25%, and high – more than 40%. The real risk of thromboembolic complications is underestimated and requires consideration of the specifics of the course of coronavirus disease in patients with acute abdominal surgical pathology.

Key words: venous thrombosis and embolism; COVID–19, thromboembolic complications; acute surgical pathology of the abdominal cavity.

The coronavirus disease pandemic, with more than 400 million cases of COVID–19 and almost 6 million deaths, has forced the global healthcare system to switch to a special, enhanced mode of operation [1, 2]. Among the main components of effective care for patients with coronavirus disease (CD) is an algorithm for preventing serious complications, the key of which is the prevention of venous thrombosis and embolism (VTE) [2, 3]. According to various authors, the incidence of deep vein thrombosis (DVT) and pulmonary embolism (PE) in inpatients has increased dramatically due to the coronavirus pandemic [1, 2, 4]. Using ultrasound duplex angioscopy, DVT was detected in 46% of patients in the general surgical department and in 79% of surgical patients in the intensive care unit [3]. Given the sharp increase in the number of thromboembolic complications (TEC), the prevention of VTE in patients with acute abdominal surgery in the setting of COVID–19 is of particular importance [2].

Despite significant progress in the treatment of CC, the issue of effective VTE prophylaxis in emergency surgery remains unresolved, and routine use of low–molecular–weight (LMWH) or unfractionated (UFH) heparin in standard doses is still common [5, 6]. Non–pharmacological nonspecific methods of prophylaxis are used in individual patients [6, 7]. Given this, it is important to assess the likelihood of VTE in patients with acute abdominal surgery and develop an optimal strategy for its prevention in order to achieve a satisfactory outcome [8]. The fact that many years of experience in the field of thrombosis prevention, dozens of global clinical guidelines and hundreds of clinical practice guidelines have shown their low effectiveness in urgently operated patients in the context of COVID–19 adds to the drama.

The aim of the study was to assess the risk of VTE in urgently operated patients with acute surgical pathology of the abdominal cavity and CC.

Materials and methods

The work, which was approved by the Ethics Committee of the separate subdivision St. Panteleimon's Hospital of the Municipal Non–Profit Enterprise First Territorial Medical Association of Lviv (Appendix to Protocol No. 3 of 22.08.2023), is based on international and national ethical standards, including the Declaration of Helsinki. All patients signed an informed voluntary consent for diagnosis, treatment, surgery and anaesthesia in accordance with the Order of the Ministry of Health of Ukraine No. 110 of 14.02.2012.

The total sample method was used to analyse 741 medical records of inpatients admitted to the surgery centre from April 2020 to February 2022. Thanks to the commissioning of the electronic medical records system (EMR) based on a single patient database, a search was performed using the following key parameters: surgery for acute abdominal pathology, patients over 18 years of age, and the presence of a positive polymerase chain reaction test for SARS–CoV–2 or characteristic lung changes on computed tomography (CT). Taking into account the capabilities of EMS, all patients were stratified according to the modified Caprini risk score for DVT [9], according to which 2 points were added to the total score

in the case of asymptomatic COVID–19 and 3 points in the case of symptomatic COVID–19. Since the modification of the Caprini scale is empirical and not supported by reliable statistical calculations, we did not take into account the item that adds 5 points to the total score in patients with COVID–19 symptoms and a positive D–dimer test. This approach is explained by the fact that the vast majority of operated patients test positive for D–dimer after surgery, so the results obtained will be questionably representative.

The average age of the patients was (51.6 ± 12.4) years, 48.6% were of working age, and 61.4% were men. Thirty–four (4.6%) patients died, mainly from purulent–septic complications, multiorgan (primarily severe respiratory) failure and VTE. Following the referral of ambulance crews, 67.2% of patients were hospitalised, while the rest sought treatment on their own. Duration of illness: up to 6 hours for 47.3% of patients, 6 to 24 hours for 33.2%, and more than 24 hours for 19.5%.

We analysed in detail 78 medical records of patients operated on for acute surgical pathology of the abdominal cavity with confirmed COVID–19 at the time of hospital admission. Acute appendicitis was treated in 28.1% of patients; acute cholecystitis in 24.2%; acute intestinal obstruction in 18.2% (of which 28.9% had obstruction caused by obstructive cancer); and strangulated hernia in 15.1%; perforated gastric or duodenal ulcer – 6.1%; thrombosis in the mesenteric vascular pool – 2.9%; acute perforated diverticulitis of the colon – 2.4%, other purulent complications of the abdominal cavity – 3.0%. The intervention was performed during the day under endotracheal anaesthesia or epidural analgesia. The average duration of the intervention was (103.2 ± 25.2) minutes. The postoperative mortality rate was 8.9%.

To determine the prognostic significance of the factors, the method of correlation and regression analysis was used – binary logistic regression with a confidence interval of 95% [9]. The degree of risk was determined by univariate regression analysis. Indicators were calculated by regression analysis, namely sequential multivariate Wald analysis. The prediction of the possible value of the outcome trait was assessed by determining the degree of information using the Kulbak formula [9]. Statistical processing was performed using a package of licensed computer programs for analysing the results of biomedical and epidemiological studies STATISTICA® 6.0 (StatSoft Inc., USA, licence number AGFR205F354521FA–5) and Numbers® (Apple Inc., USA, licence number 13.2 7367.0.77).

For ease of calculation and for the purpose of statistical correlation of the results, two groups of patients were identified that were representative in terms of age and gender. Representativeness by age was determined by comparing the average age of patients in both groups, the difference being less than one year. Both groups were dominated by men: in the 1st group – 62.3%, in the 2nd – 60.5%, which was not statistically significant.

In 53 (67.9%) of the hospitalised patients in group 1, mild and moderate forms of COVID–19 were manifested by flu–like symptoms without signs of respiratory failure. In group 2, there were 25 (32.1%) patients diagnosed with severe and critical forms of CD with the development of acute respiratory distress syndrome and multiple organ failure. The criteria for severe and critical forms of COVID–19 were: body temperature above 39 °C, blood saturation level of more than 92% (on oxygen therapy), respiratory rate of more than 30 per 1 min and the presence of one of the additional criteria (invasive mechanical ventilation, septic shock, multiple organ failure, CT scan with signs of characteristic lung damage of more than 75%).

Specific prophylaxis of VTE was performed by subcutaneous injection of LMWH twice daily or LFG 4 times daily. In group 1, 6 (11.3%) patients received LMWH and 47 (88.7%) patients received UFH, and in group 2, 3 (12.0%) and 22 (88.0%) patients received LMWH, respectively, which did not show a statistically significant difference. Taking into account the recommendations for the treatment of patients with COVID–19 in terms of VTE pharmacoprophylaxis, the duration of anticoagulation administration was increased to 28 days. Since the feasibility of newer oral anticoagulants for the prevention of VTE in a surgical hospital in a global pandemic has not been fully established, they were not used in the study patients.

Results

Based on the analysis of the scientific material, the frequency of VTE in patients undergoing acute surgical pathology of the abdominal cavity in the setting of COVID–19 was determined, and the risk of VTE was determined.

VTE was diagnosed in 12 (15.4%) patients: DVT – in 9 (11.5%), thrombophlebitis of the great saphenous vein system – in 2 (2.6%), and submassive PE – in 1 (1.3%) patient. He was brought out of cardiopulmonary shock with the help of intensive care and connection to an extracorporeal membrane oxygenation device.

According to the autopsy findings, the direct cause of death in 4 (5.1%) of the operated patients was a massive DVT, of which 3 had no established source of thrombosis, and 5 (6.4%) patients had thromboemboli in the segmental branches of the pulmonary arteries, which were not the direct cause of death.

In total, VTE manifestations were diagnosed in 21 (26.9%) patients, but the actual number of patients with VTE may be an order of magnitude higher, as DVT and PE were diagnosed empirically based on the relevant symptoms or were found on autopsy. This indicates that one in four patients with COVID–19 after emergency surgery has a VTE, meaning that VTEs are among the most common in emergency surgery, which significantly worsens mortality rates.

Nonspecific prophylaxis of VTE, which consisted of elastic compression of the lower extremities, was performed in some patients, mainly in case of varicose veins and early activation of the patient after surgery. Mechanical methods of accelerating blood circulation in the lower extremities, such as intermittent pneumatic compression or myostimulation, were not used because there was no appropriate support. Adequate pain relief and assistance of nursing staff in rapid mobilisation of the

patient were considered an important component of motor activity recovery.

Drug prophylaxis was used in 40 (75.4%) patients of group 1 and 25 (100%) patients of group 2. This result is primarily due to the fact that patients with complicated COVID–19 in the postoperative period were in the intensive care unit for a long time, and the alertness of the doctors in this unit to VTE is somewhat higher.

The study found that VTE manifestations were diagnosed in 9 (16.9%) patients in group 1 and 12 (48.0%) patients in group 2, which statistically significantly ($p<0.05$) indicates a potential risk of thrombosis in operated patients with severe or critical COVID–19. Such a high incidence of thrombosis in the setting of heparin prophylaxis proves the relevance of studying and implementing the latest schemes for determining the risk of thrombosis in urgently operated patients.

We also investigated the prognostic significance of 31 risk factors for TEU in patients with emergency abdominal surgical pathology and COVID–19, and using the Kulbak method [9], we identified 7 significant ($p<0.05$) factors with an assessment as the sum of the scores of each of them. Thus, the duration of surgery for more than 120 minutes was estimated at 15 points, the presence of COVID–19 – 11 points, age over 65 years – 8 points, duration of invasive mechanical ventilation for more than 48 hours – 7 points, body mass index over 30 kg/m2 – 5 points, presence of malignant oncological process – 5 points, thromboembolic episodes in history – 3 points.

Thus, the following levels of VTE risk were identified: low, moderate and high. A low risk level corresponded to a score of up to 15, a moderate risk level to 15–35 points, and a high risk level to more than 35 points. The frequency of VTE at low, moderate and high risk was calculated by statistical analysis, which was 8, 25 and more than 40%, respectively.

Discussion

According to the study, it was found that in determining the prognostic significance of VTE risk factors, the maximum scores were given to prolonged surgery, the presence of COVID–19, advanced age and senility, and prolonged invasive mechanical ventilation. These results substantiate the need to develop a method for predicting VTE in urgently operated patients with acute abdominal pathology and COVID–19 in the future, which may serve as a basis for developing updated recommendations for the prevention of VTE in the context of viral respiratory pandemics.

A realistic assessment of the risk of VTE in urgently operated patients with surgical pathology in the context of COVID–19 is hampered by the lack of physician alertness to the problem of VTE, difficulties in objectively assessing the risk of VTE in the presence of many factors, some of which are poorly understood due to the new pandemic, failure to take into account the severity of pneumonia, invasive ventilation in determining the prophylactic dose of LMWH, and debatable schemes of heparin prophylaxis. A significant number of problematic issues can be resolved by developing and implementing a national standard for the prevention of VTE in surgical patients in the context of a global pandemic.

The issue of the optimal VTE risk assessment scale remains relevant, as the existing ones do not sufficiently or at all take into account the realities of VTE prevention in the context of the COVID–19 pandemic. In our opinion, the only revised in 2021 J. Caprini risk assessment scale for VTEs does not sufficiently take into account the realities of today, as the number of points is calculated empirically. All of the above encourages scientists in many countries to search for an optimal, scientifically and mathematically sound scoring scale for assessing the risk of VTE.

Conclusions

1. The incidence of VTE during the COVID–19 pandemic in emergency surgery can reach 26.9%.

2. The real risk of VTE is not sufficiently assessed, and the dependence of VTE frequency on the characteristics of the course of CC in operated patients needs further study.

3. An objective assessment of VTE risk should be based on a score of prognostically relevant factors.

4. The incidence of VTE in patients with CC in the postoperative period at low risk is 8%, at medium risk – 25%, at high risk – more than 40%.

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Consent to publication. All authors have read and approved the final version of the manuscript and agreed to its publication.

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