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Prevalence of Pulmonary Embolism in COVID-19 at Quaternary Hospital Running Head: Pulmonary Embolism in COVID-19

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ABSTRACT

Background: Patients with COVID-19 are at greater risk of pulmonary embolism. **Objective:** The aim of the present study was to evaluate the monthly prevalence of pulmonary embolism diagnosed by angiotomography and mortality between March 2020 and May 2021 in more than 6000 patients hospitalized with COVID-19 at a single institution. **Methods:** A clinical trial was conducted with evaluated medical records the patients hospitalized at the institution who developed pulmonary embolism determined by angiotomography. Monthly and overall mortality rates between March 2020 and May 2021 in this population were evaluated. **Results:** A total of 6040 patients were hospitalized in this period, 203 of whom (3.36%) had an angiotomographic diagnosis of pulmonary embolism and 119 of these patients (58.62%) died. The largest number of patients with pulmonary embolism occurred in the periods from July to September 2020 and March to May 2021. No significant difference was found between mortality and the two peaks of the pandemic (p = 0.9, Fisher's exact test). **Conclusion:** Pulmonary embolism is associated a higher mortality rate among patients with COVID-19. Therefore, one of the strategies is an emphasis on the prevention of thrombotic and embolic events.

Keywords: Prevalence, pulmonary embolism, COVID-19.

1. BACKGROUND

Patients with COVID-19 are at greater risk of pulmonary embolism. However, the symptoms of the two conditions overlap and the latter may be underdiagnosed. A routine evaluation found pulmonary embolism in 5.8% of patients (1). A review study reported the occurrence of pulmonary embolism in 8.5% of hospitalized patients, with a relative risk of venous thromboembolism upon admission to the intensive care unit of 2.99 (2). Another study reported the prevalence of venous thromboembolism to be 2.7% in hospitalized patients with COVID-19, with a higher rate in intensive care units. The early establishment of prophylaxis and immediate administration of anticoagulant therapy upon the diagnosis of venous thromboembolism should be the treatment objectives in these patients (3-6).

One study underscores the need for special attention to hospitalized COVID-19 patients with pulmonary embolism and other comorbidities due to the increased risk of in-hospital death (6). Indeed, high biomarkers of clotting (fibrinogen and dimer-D) and inflammation (C-reactive protein and ferritin) are associated with unfavorable outcomes in SARS-CoV-2 (7).

Novel evidence has emerged that COVID-19 is associated with endotheliitis, which is histologically characterized by diffuse endothelial damage and infiltration by inflammatory cells (8). Harm to the endothelium may be the result of direct viral infection facilitated by the overexpression of the angiotensin-converting enzyme 2 receptor, which is the gateway of SARS-CoV-2 in endothelial cells (9).

2. OBJECTIVE

The aim of the present study was to evaluate the monthly prevalence of pulmonary embolism diagnosed by angiotomography and mortality between

	Pulmonary embolism	Deaths	% of deaths
Jun	11	7	63.63
Jul	25	13	52
Aug	18	8	44.44
Sep	29	21	72.41
Oct	8	3	37.5
Nov	3	3	100
Dec	7	4	57.14
Jan	11	6	54.54
Feb	6	5	83.3
Mar	45	27	60%
Apr	25	16	64
May	15	6	40
Total	203	119	58.62

Table 1. Monthly occurrence of pulmonary embolism confirmed by angiotomography, deaths and prevalence of mortality in patients hospitalized with COVID-19

March 2020 and May 2021 in more than 6000 patients hospitalized with COVID-19 at a single institution.

3. MATERIAL AND METHODS

Patients and Settings

All medical records the patients hospitalized with COVID-19 who developed pulmonary embolism (diagnosed by angiotomography) at the public hospital affiliated with the São Jose do Rio Preto School of Medicine in the state of São Paulo, Brazil, between March 2020 and June 2021 were evaluated.

Ethical Consideration

This study received approval from the institutional review board of the São Jose do Rio Preto School of Medicine # 4.802.435. The individual consent form was waived by the ethics and research committee for reviewing medical records, but a declaration signed by the researchers was included for the confidentiality of personal data of patients and their families, including those who died.

Design

A clinical trial was conducted evaluated medical records of the patients hospitalized at the institution who developed pulmonary embolism determined by angiotomography. Monthly and overall mortality rates between March 2020 and May 2021 in this population were evaluated.

Inclusion criteria

All medical records the patients with COVID-19 hospitalized at the institution diagnosed with pulmonary embolism confirmed by angiotomography.

Exclusion criteria

Medical records the patients with a clinical diagnosis of pulmonary thromboembolism.

Statistical analysis

Descriptive statistics of the data and Fisher's exact test considering a 5% alpha error.

Development

Evaluation of hospital data, sex and age group of all patients hospitalized in the wards and intensive care units with COVID-19 at the São Jose do Rio Preto Hospital, SP, Brazil. Monthly analysis of angiotomographic diagnoses of pulmonary embolism and global mortality of these patients. The data were entered on an Excel spreadsheet and analyzed according to the prevalence of mortality.

4. RESULTS

Figure 1 display monthly hospitalizations stratified by sex and age group. A total of 6040 patients were hospitalized in this period, 203 of whom (3.36%) had an angiotomographic diagnosis of pulmonary embolism and 119 of these patients (58.62%) died (Table 1). The largest number of patients with pulmonary embolism occurred in the periods from July to September 2020 and March to May 2021 (Figure 2). No significant difference was found between mortality and the two peaks of the pandemic (p = 0.9, Fisher's exact test).

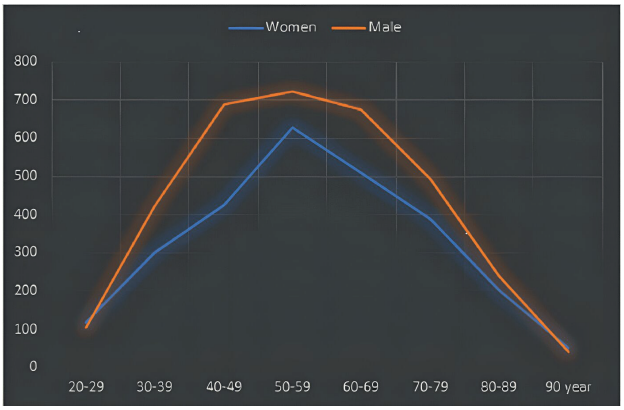

Figure 1. Female and male patients hospitalized monthly with COVID-19

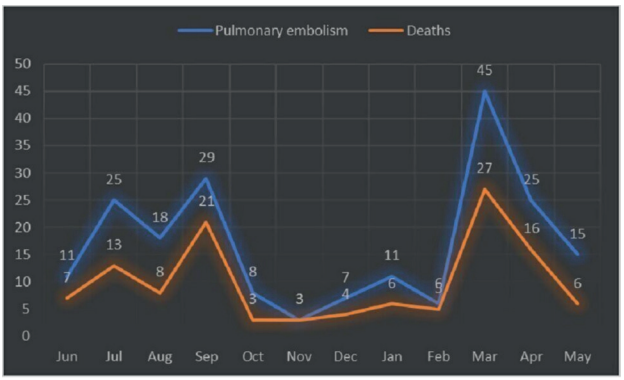

Figure 2. Evolution of monthly pulmonary embolism associated with COVID-19-June 19, 2020 to May 2021

5. DISCUSSION

The present study evaluated the prevalence of mortality due to pulmonary embolism diagnosed by angiotomography among 6040 patients with COVID-19 hospitalized in the wards and intensive care units of a quaternary hospital. The prevalence of pulmonary embolism was 3.33%, with mortality occurring in 58.65% of these patients. Prevalence data from the literature vary

depending on the methodology employed. However, the prevalence increases when routine evaluations of pulmonary embolism are performed in all patients (1-5).

One of the doubts arises since the differential diagnosis with pulmonary thrombosis is not always easy. The impairment of the pulmonary parenchyma, which is generally bilateral, is associated with greater severity as well as the presence of other associated diseases. One of the patients in the present sample had splenic thrombosis, bilateral renal thromboses, thrombosis in the liver, lower mesenteric, aorta and pulmonary thrombus/embolism. During care with non-fractionated heparin and aspirin, another thrombotic event occurred in the upper limb. Moreover, a biopsy of a pulmonary lesion revealed the presence of previous lung cancer.

Failures have occurred in the prophylaxis of thrombosis among patients in intensive care. With the predominance of the Gamma variant in March 2021, the overall prevalence of venous thrombosis increased from approximately 2.5% to 7-9%.Older age is associated with higher mortality and depends on the comorbidities of each patient (10, 11).

A study in the publication phase with 200 consecutive patients evaluated to investigate the hypothesis of thrombosis found a 67% mortality rate among those with deep vein thrombosis compared to 31% of those negative for deep vein thrombosis in the lower limbs. This suggests that both lower limb venous thrombosis and pulmonary embolism have high mortality rates, underscoring the need for more adequate prophylaxis in these patients. Pulmonary embolism is associated a higher mortality rate among patients with COVID-19. Therefore, one of the strategies is an emphasis on the prevention of thrombotic and embolic events.

6. CONCLUSION

Pulmonary embolism is associated a higher mortality rate among patients with COVID-19. Therefore, one of the strategies is an emphasis on the prevention of thrombotic and embolic events.

- **Patient Consent Form**: All participants were informed about subject of the study.
- **Scientific Responsibility Statement**: The authors declare that they are responsible for the articles scientific include study design, data collection, analysis and interpretation, writing, preparation and scientific review of the contents, and approval of the final version of the article.
- **Data Availability statement**: The data used to support the findings of this study are included within the article.
- **Author's Contribution**: Design and conduct of the study: Godoy JMP, Dizero AG, Lopes MVC, Godoy HJP, Godoy MRP. Collection data: Godoy JMP, Dizero AG, Lopes MVC, Godoy HJP, Godoy MRP. Management: Godoy JMP, Dizero AG, Lopes MVC, Godoy HJP, Godoy MRP. Analysis and interpretation of the data: Godoy JMP, Dizero AG, Lopes MVC, Godoy HJP, Godoy MRP. Preparation: Godoy JMP, Dizero AG, Lopes MVC, Godoy HJP, Godoy MRP. Review: Godoy JMP, Dizero AG, Lopes MVC, Godoy HJP, Godoy MRP. Approval of the manuscript: Godoy JMP, Dizero AG, Lopes MVC, Godoy HJP, Godoy MRP. Decision to submit the manuscript for publication: Godoy JMP, Dizero AG, Lopes MVC, Godoy HJP, Godoy MRP. All authors agree the manuscript.
- **Conflicts of interest**: There are no conflicts of interest.
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