

Fatal Pulmonary Embolism in Hospitalized Patients. Clinical Diagnosis versus Pathological Confirmation

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Objective – To assess the incidence of fatal pulmonary embolism (FPE), the accuracy of clinical diagnosis, and the profile of patients who suffered an FPE in a tertiary University Hospital.

Methods – Analysis of the records of 3,890 autopsies performed at the Department of General Pathology from January 1980 to December 1990.

Results – Among the 3,980 autopsies, 109 were cases of clinically suspected FPE; of these, 28 cases of FPE were confirmed. FPE accounted for 114 deaths, with clinical suspicion in 28 cases. The incidence of FPE was 2.86%. No difference in sex distribution was noted. Patients in the 6th decade of life were most affected. The following conditions were more commonly related to FPE: neoplasias (20%) and heart failure (18.5%). The conditions most commonly misdiagnosed as FPE were pulmonary edema (16%), pneumonia (15%) and myocardial infarction (10%). The clinical diagnosis of FPE showed a sensitivity of 25.6%, a specificity of 97.9%, and an accuracy of 95.6%.

Conclusion – The diagnosis of pulmonary embolism made on clinical grounds still has considerable limitations.

Keywords: pulmonary embolism, mortality, clinical diagnosis.

The scarcity of Brazilian statistics makes us resort to using figures obtained from other countries in order to assess the magnitude of health problems in Brazil. Pulmonary embolism represents one of the best examples of the need for epidemiological investigation in our population.

According to the most frequent estimates, pulmonary embolism accounts for 300 thousand hospitalizations and 50 thousand deaths annually in the United States of America¹. In these studies conducted in the 50's, pulmonary embolism accounted for 3% of the deaths and was a contributing factor to 6% of all deaths. More recent investigations, such as the studies conducted by Morrel and Dunnill, have reported much higher incidences. According to these authors, pulmonary embolism alone accounts for 7% of adult deaths in general hospitals².

Autopsy studies have shown that approximately 40% to 60% of the individuals who die as a result of pulmonary embolism are not diagnosed with this condition when alive^{3,4}. Approximately 10% of all patients with pulmonary embolism die within the first hour of symptom onset, precluding the use of more sophisticated diagnostic methods. In those who survive after the first hour, the prognosis is closely related to a correct diagnosis and therapy. Mortality is 5 to 6 times higher in those individuals who are not properly diagnosed and in whom the therapy is not instituted⁵.

The significance of the figures mentioned above underscores the importance of recognizing the clinical features, the predisposing conditions and the natural history of this disease.

We conducted a case-control study at the Department of Pathology of a university hospital to assess the incidence and the accuracy of the clinical diagnosis and the profile of the patients who suffered a fatal pulmonary embolism (FPE).

Methods

We reviewed the records of all autopsies performed on

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individuals above 12 years of age, from January 1980 to December 1990, at the Department of General Pathology of the Hospital Universitário Antônio Pedro (HUAP) of the Universidade Federal Fluminense (UFF).

The Hospital Universitário Antônio Pedro comprises a series of clinical and surgical specialties, as well as pediatrics, obstetrics and emergencies. It provides tertiary health care for the district of Niterói and surroundings, which include a target population of more than 1 million individuals.

According to the hospital's regulatory requirements, an autopsy is required for all deaths occurring within a hospitalization longer than 24 hours, regardless of the existence of doubts concerning the cause of death, provided these deaths are not suspicious nor caused by violent actions. An exception is made in cases where the family does not give the consent for the autopsy. All autopsy records contain a clinical data form listing the suspected cause of death and filled in by the attending physician who assisted the patient during the fatal episode.

All cases where pulmonary embolism was considered the probable cause of death by the internist or the primary cause of death defined by the autopsy were selected. Factors such as sex, age, predisposing clinical conditions, clinical diagnostic suspicion and cause of death were identified. When the cause of death could not be identified at the autopsy, the final diagnosis was described as undetermined.

Clinical and anatomicopathological data were compared. A contingency table was used to calculate the sensitivity, specificity, positive predictive value, negative predictive value, and accuracy of the clinical diagnosis of FPE.

Results

From January 1980 to December 1990, 3,980 autopsies in individuals above 12 years of age were performed at the HUAP. Of the 3,980 autopsies, 114 (2.86%) had pulmonary embolism as the main cause of death, representing approximately one case each month over the study period. No significant variations were found in the incidence of fatal pulmonary embolism between the period of highest incidence, e.g., 1984 and 1985, (3.5%), and the period of lowest incidence, e.g., 1988 and 1989 (2.4%).

Sex distribution was uniform; there were 60 (53%) females and 54 (47%) males. Most individuals were in the 6th decade of life with more than two thirds of the sample above 50 years of age. The mean age was 55.04±18.18 years.

Of the 114 cases where pulmonary embolism was considered the cause of death, 28 had a correct clinical suspicion. In contrast, of the 109 cases with a clinical suspicion of pulmonary embolism as the probable cause of death, only 28 cases had this hypothesis confirmed by the pathological study (fig. 1).

The predisposing conditions most frequently related to pulmonary embolism were neoplasias (20%), in particular those of the digestive system, and congestive heart failure (18.5%). The clinical diagnoses of pulmonary embolism that were found to be incorrect at the autopsy were more frequently related to the conditions listed in table I.

From the findings of the autopsy, it was possible to calculate the accuracy of the clinical diagnosis of FPE: sensitivity - 25.6%; specificity - 97.9%; positive predictive value - 25.6%; negative predictive value - 97.7%; and accuracy - 95.6%.

Discussion

The difficulties in establishing an accurate diagnosis of pulmonary embolism represent a permanent challenge and deserve an extensive literature review^{5,6}. Numerous studies have shown that many factors contribute to the difficulties in establishing the diagnosis of pulmonary embolism, including the pleomorphic clinical findings, the unspecific signs and symptoms, the presence of underlying conditions, the operational characteristics of the diagnostic tests and the pathological location of the embolus in the pulmonary tree.

A differential diagnosis of conditions that are much more frequent than pulmonary embolism is difficult to be made solely on clinical grounds. Pulmonary and cardiovascular diseases that cause dyspnea, chest pain or hemodynamic impairment show unspecific signs and symptoms and require specific tests for the correct diagnosis to be made. This is true of myocardial infarction, which requires an electrocardiogram and markers of myocardial necrosis; of cardiac tamponade, which sometimes requires an echocardiogram to diagnose the condition and guide the pericardiocentesis; and of aortic dissection, in which imaging methods for the aorta such as echocardiogram, computed tomography or

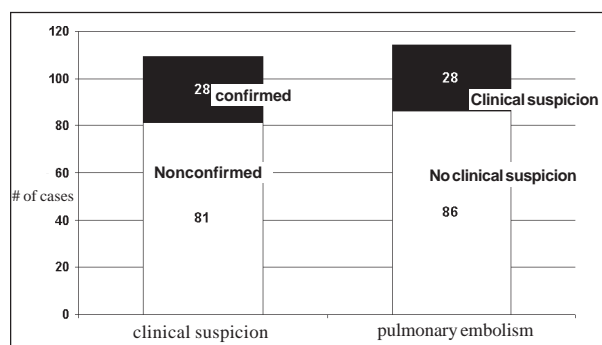


Fig. 1 - Cases of clinically suspected pulmonary embolism confirmed by autopsy compared with cases of confirmed pulmonary embolism without previous clinical suspicion.

Frequency	Diagnosis	# of cases	Percentage
1°	Acute pulmonary edema	16	20%
2°	Pneumonia	15	18%
3°	Acute myocardial infarction	10	13%
4°	Congestive heart failure	9	11%
5°	Metabolic disorders	7	8%
6°	Aortic dissection	4	5%
7°	Cardiac tamponade	4	5%
8°	Undetermined	16	20%

even magnetic resonance imaging are required. The lack of simple methods of diagnostic investigation has an impact on diagnostic ability; patients who did not undergo an electrocardiogram and a chest X-ray had twice as many false-negative results for pulmonary embolism than did the patients who underwent any of these tests ⁶.

The need for an immediate diagnostic confirmation is another key factor when the diagnosis of pulmonary embolism is considered. Studies on the natural history of the disease indicate that 75% to 90% of the deaths occur within the first few hours of the embolic event ⁷, whereas all the late deaths are recurrent episodes of embolism. The time window for the diagnostic investigation is narrow; thus, the disease should be clinically suspected early in its course to guide an appropriate diagnostic screening. Clinical findings that are easily obtained can be very useful when there is a strong suspicion of the disease, evidenced by the presence of dyspnea, tachypnea or chest pain ^{8,9}. These signs and symptoms are found in 97% of the patients with confirmed pulmonary embolism without underlying cardiopulmonary diseases.

Our findings show an incidence of pulmonary embolism (2.86%) consistent with the setting of a tertiary care hospital with clinical and surgical specialties that provide open care to the community. This incidence approaches the figures of 3.4% found in a Canadian study conducted at a tertiary care hospital ⁴, and the figures of the Framingham cohort ¹⁰.

The mean age of this sample was approximately 55 years, with two thirds of the cases occurring in individuals above 50 years of age. Age has been repeatedly described as a risk factor for morbidity and mortality in pulmonary embolism, with an increased frequency in patients aged from 50 to 65 years and most deaths occurring in individuals older than 50 ⁵.

The features of the diseases incorrectly diagnosed as pulmonary embolism underscore the need for effective diagnostic methods; conditions such as acute pulmonary edema, pneumonia, myocardial infarction, heart failure, aortic dissection and cardiac tamponade show cardiac and pulmonary signs and symptoms similar to pulmonary embolism. However, each one of them requires a specific therapy and some of these therapies are completely the opposite of those used in pulmonary embolism, such as the use of anticoagulation or thrombolysis in patients with cardiac tamponade or aortic dissection. The importance of these findings leads to a reflection about the indiscriminate use of anticoagulation in cases where there is a low suspicion of pulmonary embolism. This practice is supported by the following aphorism: "as soon as the diagnosis of pulmonary embolism is suspected, the institution of anticoagulation with heparin is strongly indicated".

Lack of more accurate methods for the diagnosis of pulmonary embolism in our center, such as ventilation-perfusion scan ^{11,12}, significantly contributed to the establishment of a diagnosis based more on common clinical condi-

tions. This accounted for the low sensitivity of the clinical diagnosis, as, in our institution, pulmonary angiography is not also routinely used.

The high specificity (97.9%) may seem controversial at first, because the clinical examination has a poor capacity for excluding pulmonary embolism. Multiple interpretations can be made, the most important being based on the actual features of the sample studied. In this sample, pathological examinations were routinely performed on patients with well-defined clinical conditions, even when there were no doubts concerning the cause of death. Thus, individuals with conditions, such as intracranial hemorrhage, septic shock or gastrointestinal bleeding, who died did not have a clinical suspicion of pulmonary embolism, and significantly contributed to the high specificity that was found. If we had included in this sample individuals with clinically unexplained deaths only or individuals with previous cardiopulmonary conditions, the specificity of the diagnosis would likely be much lower and the sensitivity much higher than those we found. When demonstrating the importance of the sample for the results we obtained, we found the study of Hull et al ¹³, which included only patients with pleuritic chest pain who died or who underwent pulmonary angiography. This study yielded a specificity of only 37% and a sensitivity of 85%, reflecting a higher prevalence of pulmonary embolism in this group.

Some of the limitations of our study are due to its retrospective design. The medical records could have been inadequately filled in, as the diagnostic tests employed in the formulation of a clinical suspicion were lacking and the pathological criteria for the cause of death were not standardized. Similarly important is the fact that an autopsy is not routinely performed in cases where the death occurs within the first 24 hours of hospital admission. This could have decreased the incidence of deaths caused by pulmonary embolism in our sample. As previously noted, approximately 10% of the patients with pulmonary embolism die within the first hour of the beginning of the symptoms, which represents about half of all patients with pulmonary embolism who will ultimately die ⁵; thus, individuals experiencing pulmonary embolism out of the hospital and who are subsequently hospitalized are poorly represented in this population.

In conclusion, pulmonary embolism remains a significant diagnostic challenge, and a significant number of conditions interfere with the ability to perform an accurate diagnosis. Clinical suspicion still remains below the desirable levels, and a substantial number of patients die without previous clinical suspicion. This hampers the institution of effective diagnostic and therapeutic strategies. A change in the attitude of the health professionals involved in the care of these patients, as well as an increased availability of more effective diagnostic resources are required in order to change this scenario and bring specific therapy to a higher number of patients who suffer from this condition.

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