RESEARCH ARTICLE
НАУЧНАЯ СТАТЬЯ

Pulmonary embolism in Bujumbura

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Abstract. *Relevance*. Pulmonary embolism constitutes a diagnostic and therapeutic emergency. In Africa, data are still difficult to obtain. Thus, the objectives of this work is to describe epidemiological, clinical, therapeutic aspects and short-term outcomes of pulmonary embolism confirmed by thoracic angioscan at Kira hospital in Bujumbura, the biggest city of Burundi with population about 375 000. *Patients and Methods*. This was a descriptive study of 18 patients who had a pulmonary embolism confirmed by thoracic angioscan in Bujumbura from January 1st, 2015 to December 31st, 2018. We included in our study any patient with pulmonary embolism consenting to participate and processing personal data after some clarified explanations in accordance with the World Medical Association's Declaration of Helsinki. For each registered patient, we collected socio-demographic, past history of cardiac disease and factors risk, clinical, echocardiographic and scannographic findings with Wells' score. Variables were presented as means and percentages. *Results and Discussion*. The average age was 53.5 ± 12.3 years with a sex ratio of 1.25 in favor of women. The modal class was the 50 to 59 age group (33.3%). The clinical probability pre-test by simplified Wells score was high in 66.6% and medium in 33.3% of cases. A history of venous thromboembolic disease was the most common risk factor. Dyspnea was the most reason of consultation with 94.4% of cases. One patient died (5.6%) during hospitalization. Six months after discharge from the hospital, we recorded 3 cases (16.7%) of death, 6 cases (33.3%) of pulmonary heart, 3 cases (16.7%) of recurrent pulmonary embolism and one case of vitamin K antagonist overdose with minor bleeding. *Conclusion.* Pulmonary embolism is common in relatively young population with a predominance of females and chronic no communicable diseases as risk factors. Examination of a patient with an angioscanner is a sensitive and specific clinical study of pulmonary embolism. The outcome is favorable under appropriate treatment in short term.

Key words: pulmonary embolism, thoracic embolism, angioscan, Bujumbura, Burundi, Africa

Introduction

Pulmonary embolism (PE) is a frequent, serous, multifactorial pathology, with no clinical pathognomonic sign [1]. The diagnostic and therapeutic approach is based on carrying out additional examinations and the clinical stratification of the risk of early mortality [1]. Its prevalence in Europe is 17—42.6 % of hospitalized patients, 8—52 % of autopsy's checks [2]. In sub-Saharan Africa, PE has been reported more and more since the first series in the 1970s and 1980s but often in the form of autopsy series or small clinical series whose diagnostic confirmation methods are sometimes approximate [3, 4].

In Burundi, a country with limited resources, there is not yet tackled study with optimal diagnostic and therapeutic management on objective basis, which constitute a difficult challenge. Hence the interest of this work, the objective of which is to determine the epidemiological, clinical, therapeutic and progressive aspects of PE confirmed by thoracic angioscan in Bujumbura.

Patients and methods

Study design

This was a descriptive study over a three years period from January 1st, 2015 to December 31st, 2018. The study was initiated during a daily staff of department's cardiologists. The study was intentionally designed to be entirely performed without any financial support from others societies of cardiology or any international organization. The imaging department of Kira Hospital in Bujumbura was the one health structure with available scanner, hence the choice the center. The study rationale was to provide data on PE characteristics, treatment and prognosis in short term. In case of suspicion of PE, all health structures refer patients to the imaging department of Kira Hospital in Bujumbura where, the diagnosis of PE was confirmed or not.

Patients

The target population was patients referred to the imaging department of Kira Hospital in Bujumbura for suspicion of PE. Were included in the study all patients with PE confirmed by thoracic angioscan and who had consented to participate after some clarified explanations in accordance with the World Medical Association's Declaration of Helsinki (WMA Declaration of Helsinki-Ethical Principles for Medical research Involving Human Subjects, 2013) and processing personal data. A total of 18 patients were retained in the study. Patients without evidence of angioscannographic confirmation of PE were excluded. The stratification of the risk of mortality in hospital and within 6 months of anticoagulant treatment was estimated thanks to the scores of PESI and sPESI, combined with right ventricular dysfunction based on echocardiographic and angioscannographic criteria. Wells' criteria for pulmonary embolism risk are shown in the Table 1 [5].

Table 1

Wells' criteria for pulmonary embolism risk

N°	Criteria of pulmonary embolism risk	No	Yes
1	Symptoms of deep venous thrombosis	0	+3
2	Other diagnostic that doesn't explain the probability of the disease	0	+3
3	Heart rate > 100	0	+1.5
4	Previous deep venous thrombosis or pulmonary embolism	0	+1.5
5	Hemoptysis	0	+1
6	Malignant condition	0	+1

Interpretation:

Score > 6: High probability of pulmonary embolism

Score ≥ 2 and ≤ 6: mean probability

Score < 2: low probability

Prognostic biomarkers (troponin and NT pro BNP) were not feasible in Bujumbura.

Data collection

Epidemiological data, past history of cardiac disease and factors risk, clinical, echocardiographic and scannographic findings were recorded. Data relating to intra-hospital management and 6 months after discharge from the hospital on anticoagulant therapy were collected. Those data were obtained from the register of admissions and results of thoracic scan performed for suspected PE. We particularly made

attention on localization of the lesion, the RV/LV ratio and the pleuropulmonary abnormalities. No found data were sought from computerized patient records from hospital. At least we may reach patients at home because each of them was given an observation sheet and a database was established.

Echocardiographic and angioscannographic examinations

All echocardiographic examinations were performed by trained cardiologists. Right ventricular dysfunction, on echocardiography, was defined by the presence of a dilatation of the right ventricle (RV) defined by a basal diameter right ventricle/left ventricle (RV/LV) ratio ≥ 0.9 measured in section of 4 cavities through the apical incidence and / or pulmonary arterial hypertension defined by systolic pulmonary arterial pressures (SPAP) ≥ 35 mm Hg and/or an impairment of the systolic function of RV defined by a systolic excursion of the plane of the tricuspid ring < 17 mm.

The angioscannographic diagnostic criteria retained was a lacuna or defect of intraluminal opacification in the pulmonary arterial network, carried out by radiologists on a helical scanner of the TOSHIBA Aquilion series type with 64 bars. Right ventricular dysfunction on chest angioscannography was defined by dilatation of the right cavities defined by a RV/LV diameter ratio ≥ 0.9 in axial section.

Statistical analysis

Continuous variables are expressed as means and standard deviations and categorical variables as frequencies and percentages; these were computed using the SPSS statistical software package. Means comparisons were made using Student's t-test. Percentages were compared using Pearson's Chi2 test. A probability of P < 0, 05 was considered to be significant.

Results and Discussion

Patients

Among a total of 90 patients examined with scanner from 2015 to 2018 in the imaging department of Kira Hospital, 18 cases of PE were confirmed (20 %). There were 10 women (56.6 %) and 8 men (44.4 %). The sex ratio was 1.25 in favor of women. The mean age was 53.5 ± 12.3 years with extremes of 31 and 75 years. The modal class was the 50—59 age group (33.3 %) followed by the 40—49 age group (27.8 %). Fifteen patients (83.3 %) were urban and 16.7 % lived in rural regions. The thromboembolic risk factors found were a history of thromboembolic disease, an age greater than 60 years and a history of decompensated heart failure in 38.9 %, 27.8 % and 16.7 % respectively. Active cancer was found in 16.7 % of cases, while a history of stroke and hysterectomy were found once each. Cardiovascular risk factors were dominated by high blood pressure and diabetes with 22.2 % each. Physical inactivity was found in 4 patients (22.2 %), smoking and obesity in two patients (11.1 %) each.

Clinical findings

The functional signs were dominated by dyspnea with 16 cases (88.9 %) followed by chest pain, syncope and hemoptysis with 44.4 %, 22.2 % and 16.7 % of cases respectively. The physical signs recorded were tachycardia in all patients, pattern of right ventricular failure in eight patients (44.4 %) and one case of cardiogenic shock. The probability of PE (as shown in Table 2), according to Wells score was of high probability in 66.6 % (score > 6) and medium probability in 33.4 % of cases (score 2).

Table 2

Incidence of pulmonary embolism according to the Wells' score

Wells score and probability of PE	Effective	Percentage
High probability (score > 6)	12	66.6
Average probability (score 2—6)	6	33.3
Total	18	100

Electrocardiographic findings

The electrocardiogram performed in 18 patients (100 %) showed electrical abnormalities in all patients. Sinus tachycardia, found in 16 patients (88.9 %), was associated in 44.4 % with right axial deviation. Eight (44.4 %) had a complete right bundle branch block and one patient had a complete arrhythmia by atrium fibrillation.

Echocardiographic findings

On echocardiography, we recorded ten cases (55.6 %) of normal echocardiography. The other eight cases (44.4 %) presented dilatation of the right cavities with a ratio of the RV/LV diameters > 0.9 and a paradox septum with SPAP > 40 mm Hg.

Angioscannographic findings

On angioscannography, PE was bilateral in twelve patients (66.7 %), localized on the right in five patients (27.7 %) and on the left in one patient (5.6 %). The RV/LV ratio was greater than 0.9 in eight patients (44.4 %). It was less than 0.9 in ten patients (55.6 %). The pleuropulmonary abnormalities associated with PE were characterized by pulmonary infarction with reactive pleurisy in three patients (16.6 %), parenchymal nodules in three patients (16.6 %), a cavitary image in one patient (5.6 %) and a diving goiter in a patient (5.6 %). Thirteen patients (72.2 %) were at intermediate risk with a simplified PESI score greater than or equal to one. The simplified PESI score was 0 in four patients (22.2 %) and in one patient (5.6 %) was at high risk.

Outcome

The therapeutic management was based on low molecular weight heparin (enoxaparin) with a dose adapted to the weight and renal function. Vitamin K antagonists were started on the first day of heparin therapy in 100 %. Non-invasive monitoring of vital parameters was systematic. The adjuvant treatment was oxygen therapy adapted to oxygen saturation with perfusion of physiological saline 0.9 %.

The intra hospital evolution was favorable in 94.4 % of the cases. One death has been recorded in cardiogenic shock with cardiopulmonary arrest against a background of massive pulmonary embolism in the first 24 hours of admission. Six months after discharge from the hospital, we recorded 3 cases (16.7 %) of death, 6 cases (33.3 %) of pulmonary heart, 3 cases (16.7 %) of recurrent PE and one case of vitamin K antagonists overdose with minor bleeding.

The objective of our study was to determine the epidemiological, clinical, therapeutic and progressive aspects of PE confirmed by chest scanner in Bujumbura. The need to use a chest angiogram to confirm the diagnosis explains the choice of Kira Hospital as the data collection site because it is the only hospital with a functional scanner in Bujumbura. In addition, as the patients came from all the health facilities in Bujumbura, we did not calculate the prevalence of PE. In our study, 18 cases of PE were confirmed out of 90 requests for a chest scanner for suspected PE, or 20 % of requests, Fig. 1. The mean age was 53.5 ± 12.3 years with extremes of 31 and 75 years. Overall, this was a relatively young
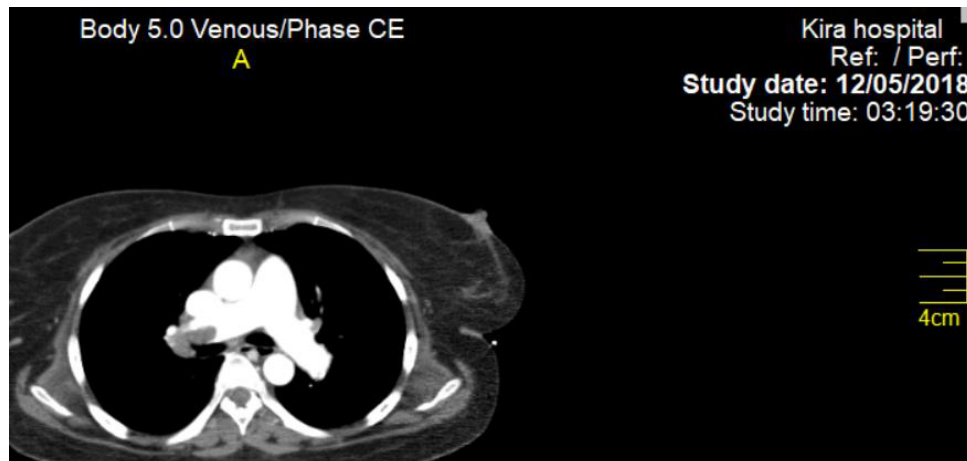

Fig. 1. Pulmonary angiogram in axial section centered on the pulmonary trunk showing clots in the branches of the proximal pulmonary artery

population. In Africa, according to several authors, PE is a pathology found in a young population [27, 32]. Indeed, Souleymane P et al. and Diall IB et al. respectively found an average age of 52.7 ± 14.4 years and 51 ± 16.9 years [6, 7]. In western industrialized countries, the average age is more advanced with 68 years in Germany and 67.6 years in France [8, 9].

According to some studies like ICOPER (International Cooperative Pulmonary Embolism Registry) and PIOPED II (Prospective Investigation of Pulmonary Embolism Diagnosis), the female prevalence of PE is common. It is linked to the existence of certain factors specific to women such as venous insufficiency during pregnancy, oral contraception with estrogen-progestin and longevity [10, 11]. In our study, the sample included 10 women (55.6 %) and 8 men (44.4 %) with a sex ratio of 1.25 in favor of women. The risk factors, dominated by an advanced age, the female sex, a history of thrombo-embolic disease, hypertension, diabetes are classic according to the literature [6, 7, 12]. These factors as identified in the literature are advanced age, female gender, history of thromboembolic disease, recent surgery, hospitalization, immobilization, trauma, transfusions, cancer and constitutional or acquired abnormalities of hemostasis [6, 11].

The functional signs were dominated by dyspnea with 16 cases (88.9 %) followed by chest pain, syncope and hemoptysis with 44.4 %, 22.2 % and 16.7 % of cases respectively. Dyspnea is the dominant functional sign in the literature with a frequency ranging from 73 to 100 % [7, 13]. However, only 20 % of patients diagnosed with pulmonary embolism will have presented the classic triad: dyspnea, chest pain and hemoptysis [14]. Even more confusing, in patients who die from massive pulmonary embolism, dyspnea is found in only 60 % of cases, chest pain in 17 % and hemoptysis in 3 % of cases [14]. Tachycardia is sometimes the only symptom leading to PE. It is found in 30 to 40 % of cases depending on the series and it can be caused by pain, fever, hypoxia or a drop in blood pressure [13].

The physical signs were dominated by tachycardia with 100 % of the cases and the signs of right heart failure in 44.4 % of the cases. Souleymane P et al. in Togo and Ouldzein from Tunisia found tachycardia in 80.4 % and 60.5 % respectively [6, 12]. One of the European recommendations to avoid unnecessary tests and false positives is the use of the Wells score [5]. In our series, incidence of PE according to the simplified Wells clinical probability score was high probability in 66.6 % of cases, intermediate probability in 33.4 %. In the study by Souleymane P et al., the Wells score for PE confirmed by chest scanner was low in 21.6 %, moderate in 29.4 % and high in 49 % [6].

According to the literature, the low clinical pre-test probability of PE corresponds to a confirmed incidence of PE of 10 %, the intermediate or moderate probability will correspond to an incidence of 30 % and in case of high probability, the incidence of PE will be 65 % [15]. In our study, the pre-test clinical probability assessed by the corrected Wells score was probable in 100 % of the cases.

The electrocardiogram was abnormal in 100 % of the cases and objectified a tachycardia in 88.9 %, a right branch block in 44.4 %, an axial deviation on the right in 44.4 % and a case of complete arrhythmia by atrium fibrillation. According to the literature, the most frequently found anomalies are sinus tachycardia, right branch block, S1Q3 appearance, witness of right ventricular overload, right axial deviation, changes in the «ST» segment or the «T» wave and «P» pulmonary wave [16].

The trans-thoracic echocardiography was performed in 100 % of the cases and was abnormal in 44.4 % of the confirmed PEs. The abnormal echocardiographic signs were dilation of the right cavities, diameter RV / LV greater than 0.9, and a paradoxical septum with pulmonary pressures greater than 40 mm Hg.

According to Souleymane P et al., 71 % of patients had performed transthoracic cardiac ultrasound and three-quarters had images suggesting a pulmonary heart [6]. Echocardiography allows a rapid and satisfactory assessment of the hemodynamic state, especially for patients in shock. In a patient with clinical suspicion of PE, in shock and without a cardiopulmonary history, the presence of an acute pulmonary heart on echocardiography confirms the diagnosis [17]. A direct sign in favor of PE is the right intra-cavitary thrombus

present in 7 to 18 % of resuscitation patients and the indirect sign is pulmonary arterial hypertension [2, 18].

The lack of feasibility of D-dimmers, blood gas, BNP, NT-pro BNP and troponin did not allow us to correctly make the diagnostic and prognostic stratification of pulmonary embolism. In the absence of contraindications, the chest angiography is the first line examination to perform in order to make a diagnosis of certainty. It is a rapid, sensitive, specific examination, allowing the positive diagnosis of PE, the characterization of the quality of the underlying pulmonary parenchyma but also the search for differential diagnoses [13, 19]. It allows reliable visualization, at least up to the segmental branches [5].

During the study period, we identified a total of 90 thoracic angioscannography requests for suspected PE and the diagnosis of PE was confirmed in 18 patients representing 20 % of the requests. In the study by H. Ouldzein et al., thoracic angioscannography performed in 24 patients (55.8 % of the requests), confirmed the PE in 83 % of the cases [12]. The PIOPED II study had shown that for the same scanner result «in favor» of PE, a non-low clinical pre-test probability corresponded to a final diagnosis of PE of 95 % but only 58 % in the presence of a low pre-test clinical probability. According to the literature [6, 12], the initial treatment makes use of heparins with relay by AVK just as in our study. In the absence of a technical platform, we did not perform an embolectomy or thrombolysis for severe massive PE. Mortality was high in accordance with the literature [15, 20]. We recorded 5.6 % during hospitalization and 16.7 % over the next six.

Conclusion

Pulmonary embolism is pathology of a relatively young population predominant in women. In addition to the female sex, the risk factors are dominated by the thromboembolic disease, the old age and the chronic no communicable diseases (hypertension, diabetes, cancer,). The clinical signs are not specific but the Wells score is very helpful in the diagnosis. In the absence of contraindications, the thoracic scanner is a para-clinical examination of first choice, very sensitive and specific.

In the short term, the outcome is favorable under appropriate treatment. Prevention of thromboembolic diseases is essential to reduce the negative impact of PE.

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Тромбоэмболия легочной артерии в Бужумбуре

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Аннотация. *Актуальность.* Тромбоэмболия легочной артерии требует неотложной диагностики и лечения. В Африке получение данных относительно данной патологии по-прежнему остается сложной задачей. Таким образом, целью данной работы является описание эпидемиологических, клинических, терапевтических аспектов и исходов в краткосрочной перспективе тромбоэмболии легочной артерии, подтвержденной торакальным ангиосканером в больнице Кира в Бужумбуре, крупнейшкм городе Бурунди с населением около 375 000. *Пациенты и методы.* В описательном исследовании принимали участие 18 пациентов, с тромбоэмболией легочной артерии, подтвержденной торакальным ангиосканом в Бужумбуре с 1 января 2015 г. по 31 декабря 2018 г., и подписавших добровольное согласие на участие в исследовании и обработку персональных данных согласно Хельсинкской декларации Всемирной медицинской ассоциации. Для каждого зарегистрированного пациента были собраны социально-демографические данные, истории заболеваний и факторы риска; клинические, эхокардиографические и сканнографические данные с оценкой по системе Уэлс. Результаты представлены в виде средних значений и процентов. *Результаты и обсуждение.* Средний возраст пациентов составил 53,5 ± 12,3 года при соотношении полов 1,25 в пользу женщин. Основной была возрастная группа от 50 до 59 лет (33,3 %). Предварительный тест клинической вероятности по упрощенной шкале Уэлс был высоким в 66,6 % и средним в 33,3 % случаев. Наиболее частым фактором риска была венозная тромбоэмболия в анамнезе. Одышка была основной причиной обращения в 94,4 % случаев. Один пациент умер (5,6 %) во время госпитализации. Через шесть месяцев после выписки из больницы мы зарегистрировали 3 случая (16,7 %) смерти, 6 случаев (33,3 %) легочного сердца, 3 случая (16,7 %) рецидива тромбоэмболии легочной артерии и один случай передозировки антагонистами витамина К с незначительным кровотечением. *Выводы.* Тромбоэмболия легочной артерии распространена среди относительно молодого населения

с преобладанием женщин и хронических неинфекционных заболеваний как факторов риска. Обследование с помощью ангиосканера является чувствительным и специфическим способом клинического исследования эмболии легочной артерии. Результат благоприятный при соответствующем лечении в краткосрочной перспективе.

Ключевые слова: легочная эмболия, торакальная эмболия, ангиосканер, Бужумбура, Бурунди, Африка

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Информация о конфликте интересов. Авторы декларируют отсутствие конфликта интересов.

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