(RESEARCH ARTICLE)

Pulmonary embolism: Epidemiological and radiological aspects at the Niamey general reference hospital.

Inoussa DAOUDA BAKO [1, 5, *], Guidah SEYDOU [4, 5], Mahamat Hissene TIJANI [1], Matallah MOUMOUNI SAKHO [1], Mamane Rabilou SALEY MANI [1], Sory AMADOU SIDIKOU [2], Illiassou AMIDOU YACOUBOU [1] and Salia AMADOU MOUSSA [3]

[1] Department of Radiology, General Reference Hospital. Niamey (Niger).
[2] Department of Cardiology, General Reference Hospital. Niamey (Niger).
[3] Department of internal medicine at the General Reference Hospital. Niamey (Niger).
[4] Department of Radiology, Amirou Boubacar Diallo Hospital. Niamey (Niger).
[5] Department of Surgery and Surgical Specialties of Abdou Moumouni University. Niamey (Niger).

Abstract

Introduction: Pulmonary Embolism is a diagnostic and therapeutic emergency. It is one of the clinical manifestations of venous thromboembolism (VTE) which is frequent and the most serious of the latter. The aim of our work is to study the characteristics of pulmonary embolism confirmed by chest CT angiography at the General Reference Hospital. More specifically, it is a question of describing the: epidemiological and radiological aspects of PE confirmed by chest CT angiography.

Material and methods: This is a retrospective and prospective study, carried out at the Reference General Hospital over a period of 18 months: Retrospective over one (1) year from (July 2018 to June 2019), Prospective over six (6) months from July 2019 to December 2019. The study population included all patients referred to the radiology department for chest CT angiography with suspected pulmonary embolism and whose D-dimer dosage was greater than 500ng/ml. Chest x-ray and duplex ultrasound of the lower limbs were requested as additional basic examinations with the aim of exploring venous thromboembolic disease.

Results: During this study, 84 chest CT angioscans were performed and 25 cases of pulmonary embolism were confirmed, representing a prevalence of 29.76%.

The patients were classified according to the levels of clinical thromboembolic risk. Chest x-ray was performed in 16 patients or 64%. Cardiac Doppler ultrasound was performed in 16 patients (64%).

Doppler ultrasound of the lower limbs was performed in only 3 patients. All patients had undergone chest CT angiography.

Conclusion: The advent of chest CT angiography in the diagnostic approach allowed us to note an underestimation of the prevalence of PE in African countries. Thoracic CT angiography provided diagnostic confirmation.

Keywords: Pulmonary embolism; Chest radiography; Cardiac Doppler ultrasound; Lower limb duplex ultrasound; Chest CT angiography; Niamey

* Corresponding author: Inoussa DAOUDA BAKO

1. Introduction

Pulmonary Embolism is a diagnostic and therapeutic emergency. It is one of the clinical manifestations of venous thromboembolism which is frequent and the most serious of the latter. It is defined by the occurrence of an acute or subacute, partial or total occlusion of the trunk or a branch of the pulmonary artery by a circulating foreign body and is the main complication of deep vein thrombosis .

Pulmonary embolism still remains a major challenge in medicine despite progress in terms of prevention, diagnosis and treatment. It is often underestimated, underdiagnosed and therefore undertreated [1].

In Europe, the prevalence of PE is 17 to 42.6% of hospitalized patients and 8 to 52% of postmortem examinations [2,3].

In Sub-Saharan Africa, prevalences vary between 1.4% and 7% depending on the studies.

Indeed, three-month mortality is 6% to 11% in hemodynamically stable patients and 25% to 30% in patients with signs of shock [4].

When PE is suspected, a diagnostic management strategy must be carried out and only chest CT angiography is today the reference examination to confirm the diagnosis and at the same time provide the differential diagnosis [5-7].

The aim of our work is to study the characteristics of pulmonary embolism confirmed by chest CT angiography at the General Reference Hospital. More specifically, it is a question of describing the: epidemiological and radiological aspects of PE confirmed by chest CT angiography.

2. Material and methods

This is a retrospective and prospective study, carried out at the Reference General Hospital over a period of 18 months: Retrospective over one (1) year from (July 2018 to June 2019), Prospective over six (6) months from July 2019 to December 2019.

The study population included all patients referred to the radiology department for chest CT angiography with suspicion of pulmonary embolism as clinical information on the basis of established clinical pulmonary embolism probability score and whose D-dimer dosage was greater than 500ng/ml.

Chest x-ray and duplex ultrasound of the lower limbs were requested as additional basic examinations with the aim of exploring venous thromboembolic disease.

3. Results

During this study, 84 chest CT angioscans were performed and 25 cases of pulmonary embolism were confirmed, representing a prevalence of 29.76%. The sample included 14 men, or 56%, and 11 women, or 44%, so the sex ratio was 1.27 in favor of men (figure No. 1).
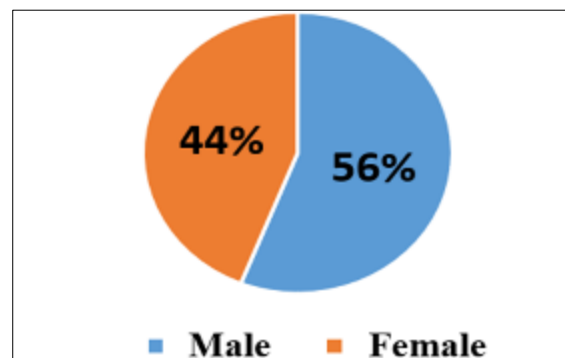

Figure 1 Distribution of patients by sex

The average age of our sample was 47.79 years ± 9, with extremes of 0.75 years (9 months) and 87 years. The 31- to 45-year-old age group was the most affected, followed by the 46- to 60-year-old age group (Table 1).

Table 1 Distribution according to age group

Age groups (years)	Number of cases	Percentage (%)
0 à 15	1	4
16 à 30	3	12
31 à 45	8	32
46 à 60	7	28
61 à 75	3	12
> à 75	3	12
Total	25	100

The patients were classified according to the levels of clinical thromboembolic risk (table 2).

Table 2 Distribution according to levels of thromboembolic risk

Cumulative risk levels/factors	Number	Frequency (%)
Minor risk (1 isolated factor)	3	12
Moderate risk (2 cumulative factors)	5	20
Major risk (≥ 3 cumulative factors)	17	68
Total	25	100

Among our patients, 68% had a major thromboembolic risk with at least 3 cumulative factors.

Chest x-rays were performed in 16 of our patients, or 64%. Cardiomegaly was found in 13 patients (81.25%). Enlargement of a pulmonary artery (Fleischner sign) was present in 10 patients or 62.5% of cases. The rise of a diaphragmatic dome (Zweifel sign) and localized hyperlucency of the parenchyma (Westermarck sign) were found in 4 patients each, i.e. 16% of cases each.

Cardiac Doppler ultrasound was performed in 16 patients (64%), including 12 (75%) who were pathological. Right ventricular dilatation found in 8 patients or 50% of cases and pulmonary arterial hypertension found in 7 patients or 44% of cases were the most common indirect signs of pulmonary cardiac. The direct sign was represented by the presence of a clot in the right atrium and was found in only one patient.

Doppler ultrasound of the lower limbs was performed in only 3 patients or 12%, two of whom were abnormal with right popliteal deep vein thrombosis.

Table 3 Distribution according to direct signs and indirect signs of Pulmonary Embolism on chest CT angiography

Chest CT angiography		Presence or not of direct sign of PE		
		Direct sign (+)	Direct sign (-)	Total
Presence or not of indirect sign of PE	indirect sign (+)	14(56%)	5(20%)	19(76%)
	indirect sign (-)	6(24%)	0	6(24%)
Total		20(80%)	5(20%)	25(100%)

We compared the data of direct signs with those of indirect signs of pulmonary embolism on chest CT angiography (table 3), as follows: 14 patients (56%) had direct signs and indirect signs of associated pulmonary embolism. While 6 patients (24%) had direct signs only and 5 patients (20%) had indirect signs only.

Visualization of the embolus on chest CT angiography was bilateral in 56% of cases and unilateral in 24% of cases (table 4). In 52% of cases for truncal involvement and main branches (proximal embolism) and in 12% of cases for peripheral involvement (distal embolism) (figure 1-3).

Table 4 Distribution according to the site of the PE on chest CT angiography

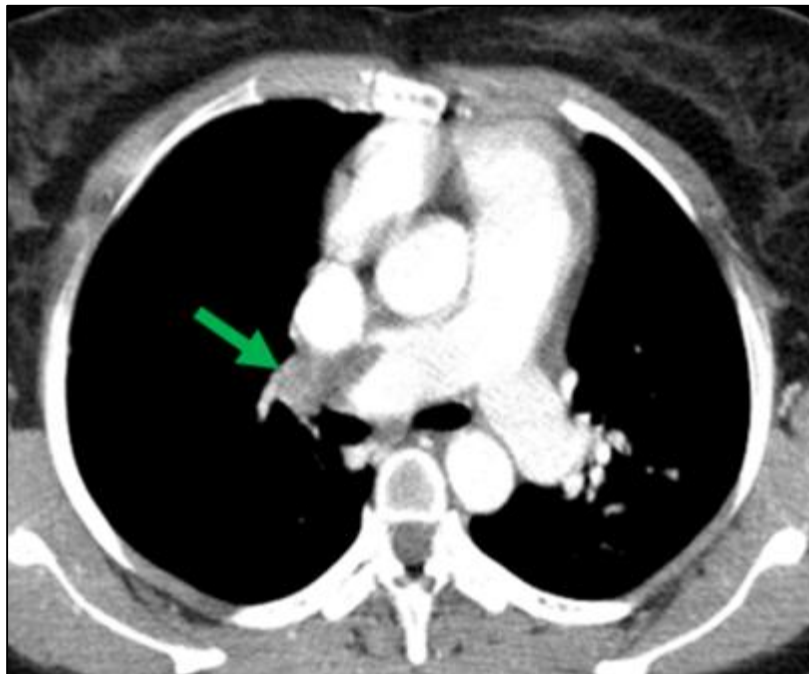| Position	Number	Frequency (%)
Unilatéral PE	6	30
Right Unilatéral	4	
Left Unilatéral	2	
Bilatéral PE	14	70
Proximal PE	13	65
Distal PE	3	15

Figure 2 Axial CT angio section of the thorax in mediastinal window. There is an embolus in the trunk of the right pulmonary artery (green arrow)
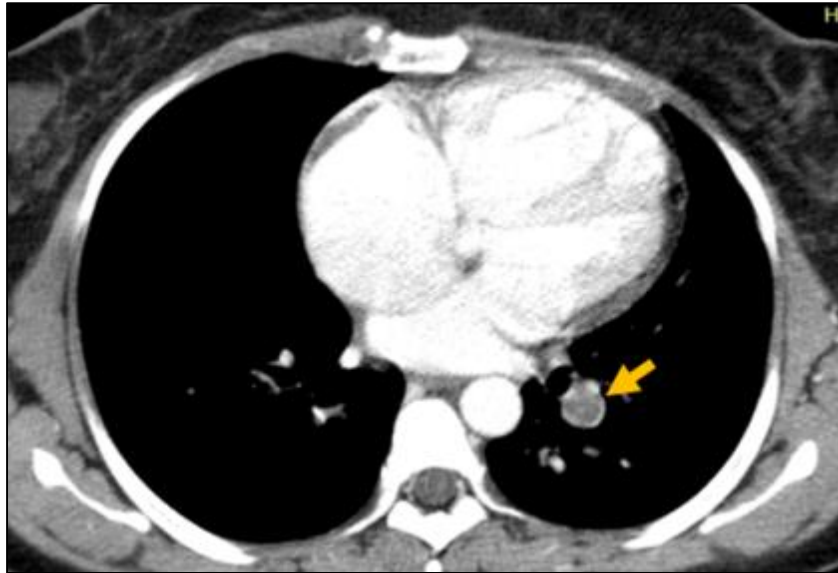
Figure 3 Axial CT angio-section of the thorax in mediastinal window. There is an embolus in the left lower lobar artery (orange arrow)
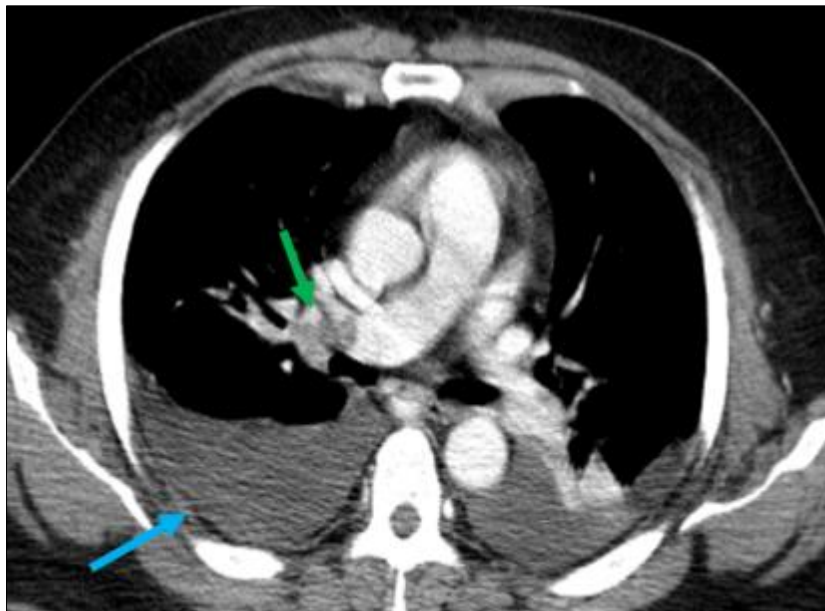

Figure 4 Axial CT angio section of the thorax in mediastinal window. We note an embolus in the trunk of the right pulmonary artery as a direct sign (green arrow) and reactive right pleurisy as an indirect sign (blue arrow)

For the Revised Geneva score compared to CT angiography data: of the 17 patients with a moderate clinical probability, 13 had an embolus on chest CT angiography. And of the 4 cases with a low clinical probability, 3 had an embolus and all 4 patients with a high clinical probability presented an embolus on chest CT angiography (table 5).

Table 5 Distribution according to Wells score and CT angiography data

		Chest CT angiography		
		Visualization of the embolus	Non-visualized embolus	Total
Wells Score	Low Probability	3(12%)	1(4%)	4(16%)
	Moderate Probability	13(52%)	4(16%)	17(68%)
	High probability	4(16%)	0(0%)	4(16%)
	Total	20(80%)	5(20%)	25

4. Discussions

The overall prevalence in our study was 29.76%. A clearly significant prevalence than that encountered in Sub-Saharan Africa, where prevalences vary between 1.4% and 7% depending on the studies [8]. These results can be explained by the improvement of the medical technical platform through the availability of paraclinical examinations.

The occurrence of a pulmonary embolism does not seem to be influenced by sex. Even if in our study there is a male predominance as found by certain authors [9], other authors have found a female predominance.

On the other hand, age is an independent thromboembolism risk factor [10], and patients over 40 years old have an increased risk of pulmonary embolism. This risk approximately doubles after each decade [11] and in our case, 60% of patients were over 40 years old.

Frontal chest x-ray, although more accessible than CT, is rarely required in cases of suspected pulmonary embolism. It made it possible to find anomalies such as cardiomegaly in 13 patients (81.25%). Enlargement of a pulmonary artery (Fleischner sign) in 10 patients or 62.5% of cases. The rise of a diaphragmatic dome (Zweifel sign) and localized hyperlucency of the parenchyma (Westermarck sign) in 4 patients each, or 16% of cases each. These signs, in the absence of chest CT angiography, are valuable because they help to make the diagnosis of pulmonary embolism.

Doppler echocardiography, which is part of the diagnostic means for pulmonary embolism, is also in little demand like Doppler echocardiography of the lower limbs. The results of these examinations provide indirect signs of pulmonary embolism which are signs of acute cardiac pulmonary. The direct sign which is the visualization of the embolus either in the cardiac cavities or in the pulmonary arterial network is rare. Doppler echocardiography is an important examination in the diagnostic process of serious pulmonary embolism and must be performed as first intention [12,13].

Doppler ultrasound of the lower limbs is a useful examination for the assessment of venous embolic thrombosis disease and therefore useful for the etiological assessment of pulmonary embolism. This examination is unfortunately little requested in our regions [12]. However, it gives satisfactory results. In view of our results where it was performed in only 3 patients, i.e. a completion rate of 12% and two (2) of whom had right popliteal DVT.

At the end of the CT angiogram, pulmonary embolism was confirmed in 25 patients included in the study, representing a prevalence of 29.76%. Thoracic CT angiography made it possible to make the diagnosis of pulmonary embolism by showing direct signs and indirect signs. It also made it possible, in the event of a direct sign, to locate the embolus exactly, which was bilateral in 70% of cases and unilateral in 30% of cases. In 60% of cases the location of the emboli was truncal and in the main branches (proximal embolism) and in 15% of cases the involvement was peripheral (distal embolism). Our results were sometimes superimposable to certain studies [14, 15] and sometimes they were different from those of other authors [16]. The random nature of the diffusion of emboli from the right ventricle would explain these differences.

5. Conclusion

In Niger, the definitive diagnosis of pulmonary embolism was rarely made. The advent of chest CT angiography in the diagnostic approach allowed us to note an underestimation of the prevalence of PE in African countries. In this study, a male predominance was observed and the victim population was relatively young. Imaging examinations such as frontal chest X-ray, cardiac Doppler ultrasound, and lower limb Doppler ultrasound reinforced the diagnostic probability of pulmonary embolism by showing indirect signs. Thoracic CT angiography provided diagnostic confirmation.

Compliance with ethical standards

Disclosure of conflict of interest

The authors declare no conflict of interest.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

References

[1] Washington L, Gulsun M. Ct for thromboembolic disease. Curr probl diagn radiol 2003 mayjun; 32(3): 105-26

[2] Barrelier MT, Lezin B, Landy S, Le Hello C. Prevalence of venous thrombosis diagnosed by Doppler ultrasound of the lower limbs in suspected pulmonary embolism and in confirmed pulmonary embolism. J Mal Vasc. 2001; 26(1): 23-30.

[3] Palud L, Laurent M, Guéret P, Meunier C, Garin E, Benoît P et al. Interest in the association of D-Dimer dosage and evaluation of clinical probability in a non-invasive diagnostic strategy for pulmonary embolism. Arch Bad Heart Vaiss. 2004; 97(2): 93-9.

[4] Huisman M.V., Klok F.A. Diagnostic management of clinically suspected acute pulmonary embolism. J Thromb Haemost 2009 Jul; 7 Suppl 1: 312-7.

[5] Agnelli G, B ecattini C. A cute pulmonary embolism. N Engl J Med. 2010; 363:266–74.

[6] West J., Goodacre S., Sampson F. The value of clinical features in the diagnosis of acute pulmonary embolism: systematic review and meta-analysis. QJM 2007; 100:763-9.

[7] Ruiz Y., Caballero P., Caniego J.-L. et al. Prospective comparison of helical CT with angiography in pulmonary embolism: global and selective vascular territory analysis-interobserver agreement. Eur Radiol 2003; 13:823-9.

[8] Igun. A 10-year review of venous thromboembolism in surgical patients seen in Jos, Nigeria. Niger Postgrad Med J 2001, 8: 69-73.

[9] Houenassi M, Sacca-Vehounkkpe J, Tchabi Y et al. Evaluation of the management of pulmonary embolism in a country with a low socio-economic level: case of Benin. Cardiol Trop 2013, 136:1-8

[10] Mahé I, Caulin C, Bergmann JE. What explains the increased rate of thromboses among the elderly: Pathophysiological data. Med Press 2005; 34(12): 887-895.

[11] Anderson FA JI', Spencer FA. Risk factors for venous thromboembolism. Traffic. 2003 Junl7; 107(23 suppl1): 19-16

[12] Soulemane Pessinaba, Yaovi Dodzi Molba Atti, Soodougoua Baragou, Machihude Pio, Yaovi Afassinou, Mohamed Kpélafia et al. Pulmonary embolism at the Lomé Campus university hospital (Togo): retrospective study of 51 cases. Pan Afr Med J. 2017; 27:129.

[13] Mongo Ngamami SF, Ellenga Mbolla BF, Kouala Landa CM, Makani Bassakouahou JK, Ikama MS, Bakekolo RP et al. Echocardiographic and CT Aspects During Acute Pulmonary Embolism in the Cardiology Department of Brazzaville University Hospital (Congo). Annals of Marien N'GOUABI University, 2018; 18(2): 51-57 Health Sciences ISSN: 1815 – 4433 www.annalesumng.org

[14] Adigo AMY, Adjénou KV, Sonhaye L, Adambounou K, Agoda-Kousséma LK, Djagnikpo O et al. How do we make the imaging diagnosis of pulmonary embolism (PE) in Lomé? Rev. CAMES SANTE Vol.2, No. 2, December 2014, P 52-56.

[15] Traoré M, Konaté M, Sidibé FM, Koné A C, NDiaye M, Diawara Y et al. Contribution of chest CT angiography in the diagnosis of pulmonary embolism in the radiology and nuclear medicine department of the "G" point university hospital. MALI MEDICAL. 2019. No. 1. P 7-12.

[16] Hantous-Zannad S, Esseghaier S, Ridene I, Zidi A Zidi A, Ben Romdhane K, Baccouche I et al. Acute Pulmonary Embolism: Epidemiologic And Computed Tomography Study. Tunisia Medical 2010; 88 (012): 880-884.