

International Journal of Radiology and Diagnostic Imaging



E-ISSN: 2664-4444
P-ISSN: 2664-4436
Impact Factor (RJIF): 5.68
www.radiologypaper.com
IJRDI 2025; 8(4): 01-05
Received: 10-07-2025
Accepted: 15-08-2025

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affiliation are given
below, after references

Imaging of pulmonary embolism at the Borgou Departmental University Hospital Center from 2023 to 2024

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DOI: <https://www.doi.org/10.33545/26644436.2025.v8.i4a.494>

Abstract

Objective: To study chest CT angiograms performed on patients suspected of having pulmonary embolism at the Borgou Departmental University Hospital Center (CHUD-B) in Parakou.

Materials and methods: This was a descriptive cross-sectional study conducted over an 11-month period (December 1, 2023, to October 1, 2024) in the CT scan unit at CHUD-B. All patients who underwent a chest CT angiogram for suspected pulmonary embolism were included in the study. Descriptive data on sociodemographic characteristics and test results were reported. Data were processed and analyzed using Epi Info version 7.2.2.6 (CDC Atlanta, 2018) and Excel (Microsoft, 2016) software.

Results: Of the 63 patients who underwent chest CT angiography for suspected pulmonary embolism, 31 were pathological. The mean age of patients was 53.7 ± 17.9 years, with extremes of 23 and 92 years. Females were slightly predominant, accounting for 54.8% of cases. The thrombus was mainly lobar in 21 patients (67.7%). 64.5% of patients had indirect signs, the most common of which was pulmonary infarction in 42.8% of cases. Signs of severity were found in 15 patients (48.3%), and in all these cases there was dilation of the pulmonary artery trunk. Five patients (16.13%) had metastatic pulmonary embolism, and fibrin-blood origin was found in the other cases.

Conclusion: Chest CT angiography has become the gold standard for diagnosing pulmonary embolism, which is a life-threatening emergency. The recent introduction of a multi-detector CT scanner has improved diagnosis in the city of Parakou.

Keywords: Pulmonary embolism, thrombus, chest CT angiography, CHUD-B

Introduction

Pulmonary embolism is a partial or total, acute or chronic obstruction of the pulmonary artery or its branches, secondary to the migration of a thrombus, most often of fibrino cruoric origin ^[1].

It is a potentially fatal disease, representing the third most common cardiovascular emergency after myocardial infarction and stroke, with an estimated mortality rate of between 30 and 40% ^[2-4]. Its hospital prevalence varies from 1.76 to 7% in sub-Saharan Africa ^[5, 6].

Diagnosis is based on chest CT angiography after clinical suspicion. Long underestimated due to the difficulty of access to CT scans in sub-Saharan Africa, diagnosis and management have been significantly improved in recent years by the installation of multi-slice scanners in these countries.

In Cotonou, in 2021, chest CT angiography enabled the diagnosis of pulmonary embolism in 119 patients, representing a frequency of 26.4%. It was also observed that the thrombus was mainly located in the lobe (57.9%) and that 21 patients had cardiac repercussions ^[7].

In northern Benin, particularly in Parakou, requests for examinations for suspected pulmonary embolism are quite frequent. As part of its strategy to improve its technical facilities, the Borgou Departmental University Hospital Center (CHUD-B) has equipped its

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medical imaging department with a latest-generation CT scanner.

After two years of operation, the aim of this study was to describe the frequency of chest CT angiograms and the results obtained.

Materials and methods

- Our study was conducted in the medical imaging department of the Borgou Departmental University Hospital Center (CHUD-B). This department has a General Electric 64-slice/128-cut CT scanner that was put into service in 2022. The staff consists of a hospital intern, four (04) radiologists (02 senior and 02 junior) and 11 technicians in radiology.
- This is a descriptive cross-sectional study. The study was conducted over a period of 11 months (December 1, 2023, to October 1, 2024).
- Our study targeted all patients who underwent a chest CT angiography in the medical imaging department of CHUD-B.
- The protocol consisted of first performing a volumetric chest scan without contrast injection, followed by a scan with arterial-phase iodinated contrast injection using automatic contrast detection software (bolus) with the region of interest (ROI) positioned at the pulmonary artery trunk. The iodinated contrast agent used was concentrated at 300mg/ml. It was injected at a rate of 1.5ml/kg of body weight at a speed of 4 ml/s to each patient using an automatic injector. The CT angiograms were read on a dedicated console by radiologists.
- The reading was performed by a junior radiologist or hospital intern and then confirmed by a senior radiologist. It consisted of a reading performed in the pulmonary parenchymal window (width 1600 HU, level -600 HU) and in the mediastinal window (350 HU, 50 HU). The data were collected on a data sheet. This enabled us to gather information on age, sex, lesions observed, and radiological diagnosis.
- Our study included patients who underwent a chest CT angiography during the study period and whose complete records were available on the PACS (examination report, images, and findings).
- The sampling was exhaustive and included all patients referred to the imaging department for a chest CT angiography during the study period.
- Data processing and analysis were performed using Epi Info version 7.2.2.6 (CDC Atlanta, 2018) and Excel (Microsoft, 2016) software.
- Qualitative variables were expressed as percentages, represented either in tables or figures. Quantitative variables were expressed as mean $\pm$ standard deviation with their extremes. Qualitative variables were represented by the frequency of each modality.
- The study was approved by the local biomedical research ethics committee of the University of Parakou (No. 540/2024/CLERB-UP/P/SP/R/SA of June 7, 2024) and authorized by the director of CHUD-B.

Results: Frequency of chest CT scans at CHUD-BA

A total of 5,715 CT scans were performed during the study period. Chest CT scans accounted for 7.3% of CT activity at CHUD-B (421). Of the 421 chest CT scans, 63 were chest CT angiograms, representing 15% of chest scans.

Socio-demographic characteristics of the study population

The mean age of the subjects was 53.7 years with a standard deviation of 17.9 years. The majority belonged to the [43-63 [year age group, representing 38.7% (Figure 1). Female patients were the most represented (54.8%) with a sex ratio of 1.21.

Reasons and purposes for chest CT angiograms

The reasons for requesting the scan were dyspnea (51.6%) and chest pain (48.3%). The purpose of the scan was specified in 19.05% of cases and was represented by suspected pulmonary embolism.

Results of chest CT angiograms

Of the 63 CT angiograms performed, only 31 examinations (49.2%) were pathological. They represented 7.36% of chest CT scans and 0.54% of all CT activity in the department. The thrombus was mainly lobar in 21 patients, or 67.7%. In our study, 20 (64.5%) patients had indirect signs, the most common of which was pulmonary infarction (15 patients, or 42.8% of cases). Signs of severity were found in 15 patients (48.3%), and in all these cases there was dilation of the pulmonary artery trunk (Figure 2). Five patients (16.13%) had metastatic pulmonary embolism, as shown in the following table.

Table 1: Distribution of patients with pulmonary embolism according to laterality, thrombus location, indirect signs, signs of severity, and metastatic origin of the thrombus (CHUD-B/A Imaging Department, 2024; N = 31)

	n	Pourcentage
Laterality		
Bilateral	22	70.9
Right	7	22.5
Left	2	06.4
Thrombus location		
Lobular	21	67.7
Troncular	6	19.3
Segmental	3	9.6
Subsegmental	1	3.2
Indirect signs		
No sign	11	35.4
Pulmonary infarction	9	29.0
Pulmonary infarction + pleurisy	6	19.3
Pleurisy	5	16.1
Signs of severity		
No sign	12	38.7
TAP dilatation + right heart chambers + reflux	9	29.0
Dilatation of the TAP + right heart chambers	4	12.9
Dilatation of the TAP	2	06.4
Associated lesions (pericardial effusion)	8	25.8
Nature of the thrombus		
Blood clot	26	83.8
Metastatic thrombus	5	16.1

Discussion: The limitation of our study lies in the absence of several clinical and paraclinical data, which prevented us from making a comparison with clinical and biological data (Wells score, D-dimers, electrocardiogram, cardiac ultrasound), thus limiting multidisciplinary integration and advanced statistical analyses, particularly of risk factors associated with pulmonary embolisms.

However, the rigor of the data analysis process and the comprehensive nature of the sample lend credibility to the results.

Chest CT scans in our study accounted for 7.3% of CT activity at CHUD-B. Our results are higher than those found by Zeh *et al.* in Cameroon, who in their study found frequencies of 4.2% and 4.4% of CT scan activity at the University Hospital Center and the Central Hospital of Yaoundé, respectively [8].

Dyspnea (51.61%) was the most common reason for requesting an examination in our study, followed by chest pain (48.39%). These functional signs are most often the guiding factors in suspected pulmonary embolism, as confirmed by the study by N'diaye *et al.* in Senegal [9].

In our study, 49.2% of chest CT angiograms performed for suspected pulmonary embolism (PE) were positive. This result is higher than that of some European series, which is around 10-20%, and 5-10% in the United States [10]. It is also higher than that found by Akanni *et al.*, who had a frequency of 26.44% in their study [7]. This difference could be explained by better clinical targeting of patients referred to CHUD-B, but also by a recruitment bias linked to the high frequency of patients hospitalized in serious conditions. Adigo and *al.*, on the other hand, found a prevalence similar to ours, at 50.72% in their study [11].

The average age of our patients (53.7 ± 17.9 years) is comparable to that observed by Akanni and *al.* [7], who found an average age of 51.63 ± 15.70 years, and to that of Traoré and *al.*, who found an average age of 52 years [12]. This probably reflects an earlier onset of the disease in our settings, linked to the prevalence of risk factors such as chronic infections, hypercoagulability, or delayed cancer

treatment. The slight female predominance observed in our study (54.8%) is also found in other African studies [13].

Radiologically, the thrombus was mainly located in the lobe (67.7%), which is consistent with the results from Cotonou (57.9%) [7] and Lomé (50%) [6]. The high proportion of bilateral cases (70.9%) in our series highlights the severity of the cases treated at CHUD-B. This result is higher than that of Ndongo and *al.* in Cameroon, who found a bilateral rate of 18% in their study [14].

Pulmonary embolism was massive (truncular) in 19.35% of cases in our study. Our results contradict those found by Pio and *al.* in Togo, who found that 5.4% of patients had truncular embolism in their study [15]. This difference could be explained, on the one hand, by the size of our sample and, on the other hand, by the fact that their study probably underestimated the incidence, as a patient suffering from a trunk pulmonary embolism may not make it to the hospital and may die before the diagnosis is confirmed.

Indirect signs were common (64.5%), dominated by pulmonary infarction (42.8%). This high proportion reflects the severity of the cases and probably the prolonged diagnostic deadline in our context.

Signs of severity (48.3%) were dominated by dilation of the pulmonary artery trunk and right heart. These results are comparable to those found in Cotonou (17.6% right heart involvement) [7], but higher, which further demonstrates the severity of the embolisms diagnosed in our setting.

The presence of metastatic pulmonary embolism in 16.1% of cases is a novel finding in our series. Ben Amar and *al.* in Tunisia [16] found a proportion of 47.5% of metastatic origin in their series. This highlights the need for increased vigilance in cancer patients.

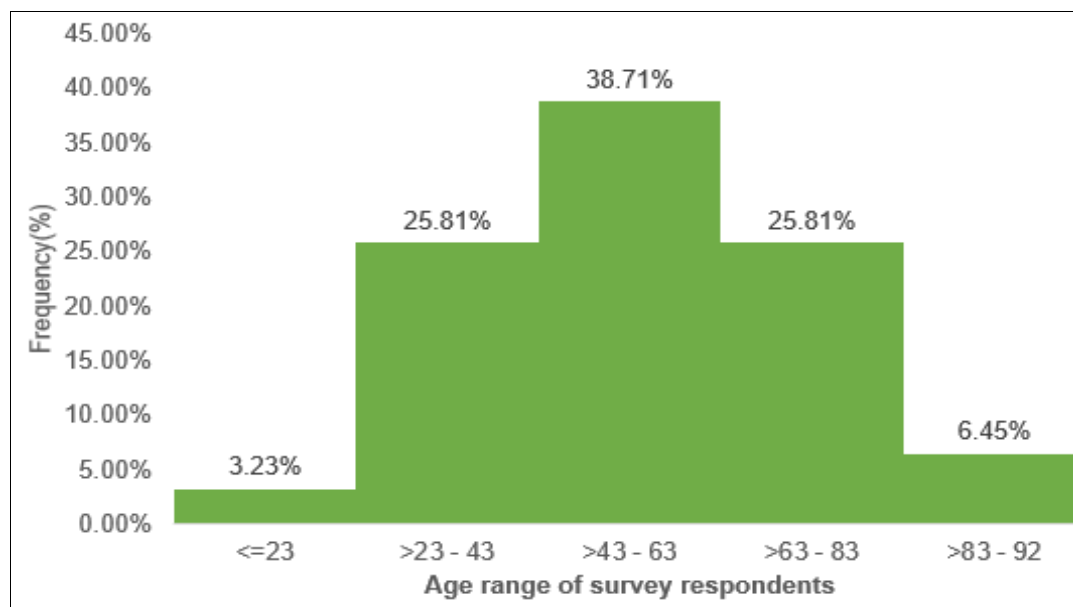


Fig 1: Distribution of patients by age group

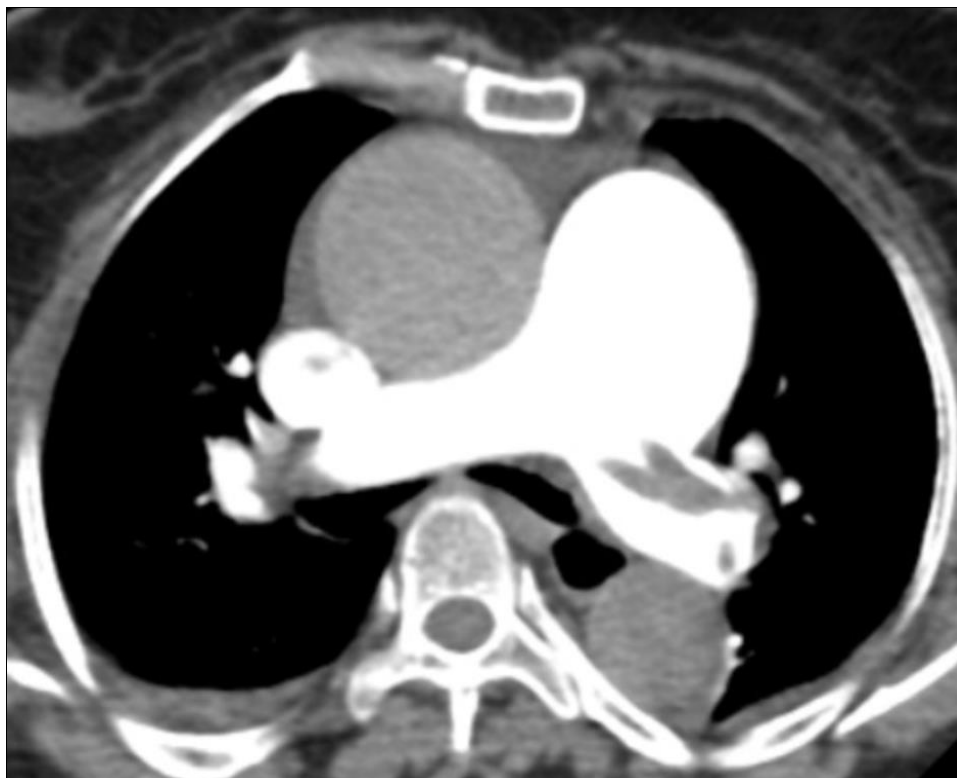


Fig 2: Axial chest CT scan in mediastinal window showing bilateral lobar pulmonary embolism with dilation of the arterial trunk (sign of severity).

Conclusion

This study, the first of its kind at CHUD-B, highlights the significant frequency of pulmonary embolism diagnosed by chest CT angiography, with nearly one confirmed case for every two clinical suspicions. Patients are relatively young and often referred at an advanced stage, as evidenced by the frequency of indirect signs and the severity of hemodynamic repercussions.

The installation of a multi-slice CT scanner has significantly improved the hospital's diagnostic capabilities, enabling earlier and more appropriate management of this life-threatening condition. Nevertheless, diagnostic delays persist and justify raising awareness among the medical profession of the importance of early clinical screening and the use of predictive tools (Wells score, D-dimers).

Prospective multicenter studies combining clinical, biological, and evolutionary data would provide a better understanding of the risk factors and severity of pulmonary embolism in our African context.

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How to Cite This Article

Agai KJ-B, Akanni DWM, Kamdom YEF, Ayi MCA, Samsuamou TEC, Adeyemi B, Adjanayo A-S, Adjadohoun SBM-G, Yekpe AP, Savi de Tove K-M. Imaging of pulmonary embolism at the Borgou Departmental University Hospital Center from 2023 to 2024. International Journal of Radiology and Diagnostic Imaging. 2025;8(4):01-05

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