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Original Research Article

Computed tomography aspect of primary lung cancer

Christian Tomboravo[1]*, Toky Rakotoarivo[2], Alice P. Razafindrahova[3], Narindra L. H. Rajaonarison Ny Ony[4], Dina H. Ranoharison[5], Ahmad Ahmad[4]

[1]Department of Medical Imaging, University Hospital Place Kabary, Antsiranana, Madagascar
[2]Department of Medical Oncology, University Hospital Tanambao, Antsiranana, Madagascar
[3]Department of Medical Imaging, Soavinandriana Hospital Mitsinjo Betanimena, Tulear, Madagascar
[4]Department of Medical Imaging, University Hospital Joseph Ravoahangy Andrianavalona, Antananarivo, Madagascar Andohatapenaka, Antananarivo, Madagascar
[5]Department of Medical Imaging, University Hospital Andohatapenaka, Antananarivo, Madagascar

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***Correspondence:**
Dr. Christian Tomboravo,
E-mail: ctomboravo@gmail.com

ABSTRACT

Background: Primary lung cancer (PLC) is the world's leading cancer in terms of incidence and mortality. The objective of our study is to identify morphological criteria by scanning towards a histological type of PLCs.
Methods: This is a retrospective transversal analytical study, carried out at the oncology, radiotherapy and clinical haematology department of Joseph Ravoahangy Andrianavalona teaching hospital, from January 01, 2014 to December 31, 2018, covering all new histologically proven cases of PLC. The parameters of the study were epidemiological, CT scan and anatomopathological data.
Results: We collected 95 cases. The average age was 59.11 years. The male gender was the most affected with a sex ratio of 1.8. The most common clinical call sign was chronic cough with 74.74% of cases. The radiographic appearance was parenchymal opacity in 54.5% of cases. Adenocarcinoma had the predominant histological type with 45.26% of cases associations were found between histological type and tumor site (p=0.0001), intratumor excavation (p=0.0001), intratumor necrosis (p=0.012).
Conclusions: Morphological appearance of CT scan lesions may approach histological type of PLCs.

Keywords: CT scan, Histological type, PLC

INTRODUCTION

Primary lung cancer (PLC) is a malignant tumor resulting from the malignant transformation of the epithelium that lines the intrathoracic airways and develops from the lung parenchyma. PLC represents a major global public health problem, it's the first cancer in terms of incidence with and in terms of mortality.[1,2] Imagery techniques, in particular CT play a fundamental role in the diagnosis, extension assessment and monitoring of PLC. However, making a diagnosis of lung cancer by excess or by default, can have a harmful consequence for the patient. One of the challenges of the imagery is to identify the morphological criteria that would orient the histological type of the PLC. The objective of the study was to evaluate the CT characteristics of primary bronchopulmonary cancer and to identify the morphological criteria in CT indicating to a histological type of primary bronchopulmonary cancer.

METHODS

This is a retrospective transversal analytical study on the files of the patients followed in the department of oncology, radiotherapy and clinical hematology of the center university hospital Joseph Ravohangy

Andrianavalona. It was conducted during five period since 01 January 2014 to 31 December 2018. We included in this work, all patients regardless of their age, for whom a PLC diagnosis was established and with anatomopathological evidence. Each patient underwent at least one thoracic or thoraco-abdominal or thoraco-abdomino-pelvic computer tomography. The non-inclusion criteria were secondary lung cancer on a proven primary extra-pulmonary cancer evident, the recurrence of PLC with the same histological types. The exclusion criteria were patients with the anatomopathological result that was not contributory or who have not undergone of thoracic or thoraco-abdominal or thoraco-abdomino-pelvic. Among the 2053 patients followed in the department of oncology, radiotherapy and clinical hematology of the center university hospital Joseph Ravohangy Andrianavalona during our study period, 95 cases of broncho-primary pulmonaries that met our inclusion criteria. The parameters studied were epidemiological profile of patients (age, gender, smoke) clinical examination data, computer tomography data, the result of anatomopathological study, the information collected was written and coded on Microsoft excel® 2016 version, then processed on Stata® software. For the bivariate analysis, the Pearson chi²-test and the fisher exact test were used. A value of $p<0.05$ was considered statistically significant for all analyses.

RESULTS

Epidemiological data

We collected 95 cases of PLC that met our inclusion criteria. Men constituted 65,26% of patients (62 cases) and women 34.74% (33 cases); with a sex ratio of 1.88 (Figure 1). the average age of the patients was 59.11±9.58 years with extremes of 22 years to78 years. The majority of patients were in the group between 50 and 59 years old with a proportion of 38.95%, followed by the age group between 60 and 69 years old with a proportion of 34.74%. Patients aged 70 and over accounted for 13,68% of cases. Twelve-point sixty-three percent of the patient were less than 50 years old (Figure 2). The active smoking was found in 47 patients, or 49.47% of cases. The passive smoking was found in 10.53% of patients. Twenty-one point five of patients were non-smokers, and 18,95% were former smokers. Forty-one-point five percent of men were active smokers compared to 8.42% of women. Passive smokers were all women (Figure 3).

Clinical data

All patients presented with respiratory signs indicative of their disease. These signs were dominated by chronic cough with a proportion of 74.74%, followed by dyspnea with proportion of 25,26%. Chest pain was found in 16.84% and hemoptysis in 9.47%. The 57.89% of patients had a performance status (PS) less than 2 at the time of diagnosis.

CT scan data

The CT presentation of the tumor lesion was a pulmonary tissue mass in 72.63% of cases, pulmonary nodule in 20% of cases and an alveolar condensation in 7.37% of the cases. Central sear tumor predominated with a proportion of 38.95% of cases, followed by a peripherally located tumors (Figure 4), with a proportion of 37.89%. Twenty-three-point sixteen percent of lesions was indeterminate location. The tumors were located in the right side of the lung in 67.37% of the cases. The lesions had a speculated outlines (Figure 5) in 69.47% of cases and lobulated in 23.16% of cases. Only 7.37% of lesions had regular contours. The lesions were with a heterogeneous-densities in 78.95% of cases and showed enhancement after injection of contrast product in 68,42% cases. The tumors presented intra-tumoral lesions were excavation type (23.16%), necrosis (36.84%), calcification (31.58%).

Anatomopathological data

The diagnostic modalities were bronchial biopsy (52.63%), trans parietal biopsy (18.95%), mediastinoscopy (10.53%), biopsy of metastases (9.47%) and thoracotomy (8.42%). The sampling site was the tumor itself in 65.26% of cases. The histological data found 86.32% of cases of non-small cell lung cancer (NSCLC) whose the main type was adenocarcinoma with a proportion of 45.26%, among the other types, there were 27.37% of carcinomas squamous cell and 8.42% large cell carcinomas. Small cell lung cancer (SCLC) accounted for 13.68% of cases (Figure 4). Most patients presented with locally advanced or metastatic tumors (Figure 5) at diagnosis. The most common stage of NSCLC was stage IVA with a proportion of 47.56% of cases followed by stage IVB with a proportion of 17.07% of cases. Seventy-six-point ninety-two percent of SCLCs were in the diffuse stage at the time of diagnosis.

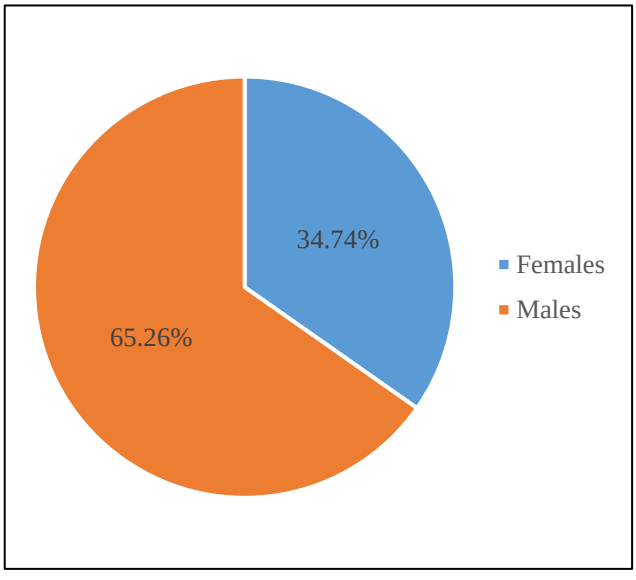

Figure 1 : Distribution of patients by gender.

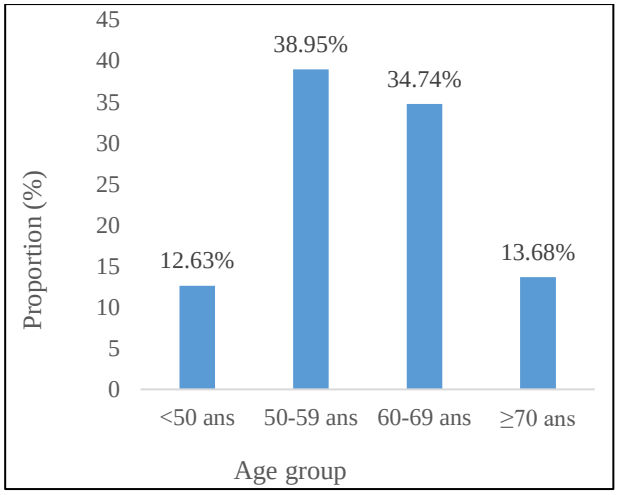

Figure 2: Distribution of patients by age group.

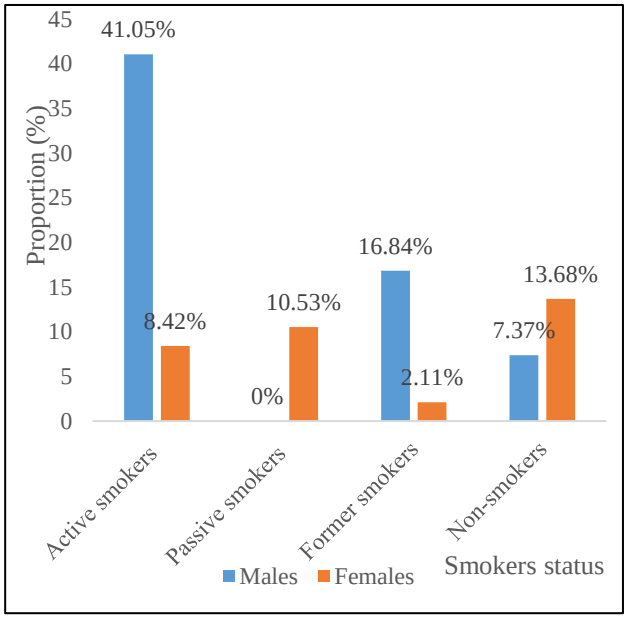

Figure 3: Distribution of patients by tobacco exposure and gender.

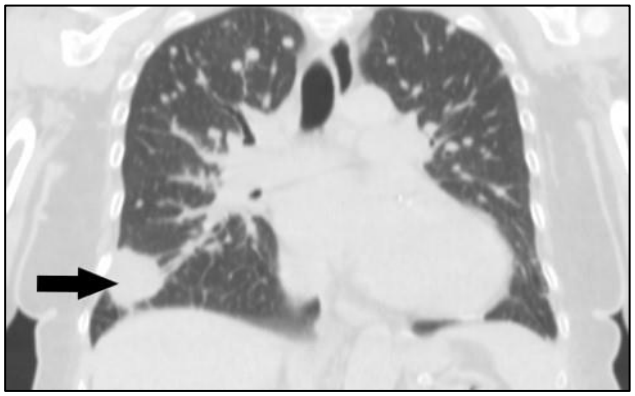

Figure 4: Chest CT, coronal reconstruction, parenchymal window, showing right peripheral seat pulmonary mass (black arrow).

Figure 5: CT axial cross-section of the thorax in a parenchymal window showing the spiculated appearance (white fleche) of a nodule of the right upper lobe.

CT results were correlated with histological data. A strong association was found between tumor site and histological type with a p=0.0001. Adenocarcinoma was of peripheral seat in 60.47% of cases and squamous cell carcinoma was of central seat in 57.69% of cases. A strong association between intra-tumoral excavation and histological type was also found with a p=0.0001. Indeed, 61.54% of cases of squamous cell carcinoma present an intra-tumoral excavation. A significant association was found between intra-tumoral necrosis and histological type with a p=0.012. Fifty-five-point eighty-one percent of squamous cell carcinoma cases present with intra-tumoral necrosis.

DISCUSSION

Lung cancer is the most frequent cancerous location in Central and Eastern of Europe and the second location in other European countries.[3] Lung cancer is the leading cause of death from cancer in men in all European countries, except in Sweden, where the prostate is the leading cause of death from cancer.[4] In Africa, in 2018, PLC ranks 6th among cancers with 39353 new cases or 3.7% in terms of incidence.[5] In this study, 95 cases of PLC were followed in the department of oncology, radiotherapy and clinical hematology of the CHU-JRA, during the 5 years (2014-2018) with an annual average of 19 cases. The difference observed between the incidence of PLC in industrialized countries and that of third world countries could be explained by the presence of undiagnosed cases in less developed countries and the implementation of screening and awareness-raising strategies followed in developed countries.

The average age of PLC diagnosis is variable from one study to another, depending on the country, the level of care in each region and the smoking habits of the population. In this study, the average age of the patients was 59.19 years with extremes of 22 years and 78 years.

This result was close to that reported by the African studies. In Morocco, Belmoktar et al found an average age of 59.13 years and in Senegal, Niang et al reported an average age of 56.8 years.[6,7] On the other hand, in developed countries, the average age of diagnosis of CBPP is higher. Indeed, in France, Colonna had reported an average age of 66 years.[4] Inoue et al in Japan and Kadota et al in the United States had respectively found an average age of 66 and 69 years.[8,9] This difference of age could be explained by the aging of the population in developed countries.

Despite the gradual increase in the incidence of PLC in women, which is probably due to the increase in female smoking, the male predominance of lung cancer remains noted in PLC.[10] The male predominance in all series can be explained by smoking habits: the early age of begin of smoking, excessive consumption.

The carcinogenic role of tobacco, universally recognized and proven since the work of Doll et al.[11] Quoix et al published that passive smoking plays a much less important compared to active smoking, but still not negligible.[12] In this study, 78.95% of patients had been exposed to tobacco, including 49.47% of active smokers, 18.95% of former smokers and 10.53% of passive smokers. These data are in agreement with other studies. In Morocco, Belmokhtar et al reported that 86.15% of his patients had been exposed to tobacco.[6] Kadota et al in the United States found 83% active smoking and 11% passive smoking.[9] Inoue et al in Japan reported a higher proportion of passive smoking with 33% and active smoking at 67%.[8]

Symptoms revealing PLC were numerous but not specific. In this study, chronic cough was the most frequently encountered reason for consultation with a proportion of 74.74% of cases. This is comparable to the study by Ndiaye et al in Senegal which reported that chronic cough was the main reason for consultation with a proportion of 67.86% of cases.[13] On the other hand, Inoue et al in Japan, had found chest pain as a frequent reason for consultation with a proportion of 72.2%.[8]

The general condition can also be appreciated by the WHO status performance index. In this study, the PS of patients at the time of diagnosis was less than 2 in 57.89% of cases. This result is close to that of Kwas et al in Tunisia who reported that 60% of patients had an PS of less than 2 at the time of diagnosis.[14]

The CT scan is the cornerstone of PLC imaging, allowing the tumor to be detected, an accurate extension assessment to be carried out and staging to be established, on which the therapeutic modalities depend.[15] In this study, PLC presented as a lung mass in 72.63% of cases and a lung nodule in 20% of cases. These data are comparable to the study by Shankar et al which reported that PLC presented mainly in the form of a mass with a proportion of 73.6% of cases.[16]

According to the definition of Brooks et al a tumor is in central site is a tumor whose center is at the level of the hilar structures and a peripheral tumor, such as one where the center is in the parenchyma and without or with a minimal contact with hilar structures.[17] When the seat of the tumor could not be precisely defined, it is an indeterminate seat. In this study, the lesion was central in 38.95% of cases and peripheral in 37.89% of cases. The lesion was of indeterminate seat in 23.16% of cases. Nanguzgambo et al reported in South Africa a proportion of 46.6% of central site PLC and 43.6% peripheral site.[18]

As for the affected lung side, 67.37% of the lesions were located on the right lung. This predominance on the right is also mentioned in the literature. Indeed, Kadota et al as well as Cadoli et al respectively reported a predominance on the right in 59% and 57% of cases.[9,19] This could be explained by the better aeration of the right lung and especially the right upper lobe, and therefore an increased vulnerability to toxic substances.

Tumor excavation is due to destruction of the tumorous lung parenchyma either spontaneously (central ischemic tumor necrosis, superinfection) or secondarily (post-therapeutic necrosis).[15,20] In this study, the lesion presented an intra-tumor excavation in 23.16% of cases.

Intra-tumoral calcifications can be described according to topography (diffuse, central or eccentric) or according to morphology (arciform, coarse or micro calcification). Pathologically, they correspond to secondary calcium deposits to tumor secretions or to dystrophic calcifications of necrotic tumors.[15,19,20] In this study, the lesion showed intra-tumoral calcification in 23.16% of cases.

The intra-tumor air bronchogram corresponds to the incorporation of voluminous bronchioles or small bronchi in the areas of lung condensed by tumor cells.[19,20] In this study, the lesion presented an intra-tumor bronchogram in 31.58% of cases.

Intra-tumoral necrosis is the consequence of chronic cellular hypoxia. In fact, rapid tumor growth requires increased blood supply from the peripheral part of the tumor, thus creating a microenvironment of hypoxia at the center of the lesion. On CT scan, it appears in the form of a para-liquid hypodense area within the nodule or tumor mass, not enhanced after intravenous injection of contrast product.[15,19,21] In this study, the lesion showed intra-tumoral necrosis in 36.84% of cases.

The definitive diagnosis of lung cancer is based on the results of the anatomopathological examination. The choice of sampling technique depends on the location of the disease, the general condition of the patient and his comorbidities, in particular the presence or absence of respiratory failure. In this series, bronchial fibroscopy was the most frequently used type of sampling, and through bronchial biopsy confirmed the diagnosis of PLC

in 52.63% of cases, thus joining the results of the literature. Indeed, Inoue et al had found 44.28% of cases of PLC confirmed by examination of bronchial biopsies performed during bronchial fibroscopy.[8] This proportion was even higher in the study by Kwas et al with a proportion of 74% of cases.[14]

In this series, the histological distribution is comparable to the data in the literature with 86.32% of NSCLC and 13.68% of SCLC. Within NSCLC, adenocarcinoma was the most common histological type, representing 45.26% of cases, followed by squamous cell carcinoma with a proportion of 27.37% of cases. This agrees with those reported in the literature. Indeed, in Morocco, Belmoktar et al reported a predominance of adenocarcinoma with a proportion of 46.48%, followed by squamous cell carcinoma with a proportion of 26.69% and small cell carcinoma represented 12.47% of cases.[6] Cadelis et al in Guadeloupe, also reported this predominance of adenocarcinoma with a proportion of 43.4%.[22] In Japan, according to Inoue et al this predominance of adenocarcinoma is even more remarkable with a proportion of 78.7% of cases.[8]

The diagnosis of PLC is often late and this is confirmed by the literature and by this study. Indeed, in this series, 64.63% of NSCLC are diagnosed at stage IV and 76.92% of SCLC at a diffuse stage. In Morocco, Belmoktar et al reported that 90.91% of NSCLC were diagnosed at stage IV and 96.49% of SCLC were diagnosed at diffuse stage.[6] In Guadeloupe, Cadelis et al reported 51% of NSCLC cases diagnosed at stage IV and 100% of SCLC cases diagnosed at a diffuse stage.[22] The high rate of advanced stages can be explained by the non-specific symptomatology of PLC most often related to smoking and by the lack of screening policy for PLC in our context leading to a diagnostic delay in the majority of cases.

A strong association was found between tumor site and histological type with a p=0.0001. In this study, the adenocarcinoma was peripheral in 60.47% of cases. Squamous cell carcinoma was central in 57.69% of cases. The small cell carcinoma was central in 61.54% of cases. This agrees with those of the literature, in fact, adenocarcinomas are more likely to have a peripheral seat. Ariozzi et al reported that 75% of adenocarcinomas present as nodules or peripheral masses, while only 30% of squamous cell carcinomas are peripheral.[23] The majority of authors note that approximately 90 to 95% of SCLCs present as central site tumors, developed upstream of a segmental bronchus with a mediastinal extension.[15]

A strong association between intra-tumoral excavation and histological type was found with a p=0.0001. In this study, 61.54% of squamous cell carcinoma cases presented with an intra-tumoral excavation. This result is consistent with the data in the literature which state that the presence of a spontaneous tumor excavation is largely suggestive of the diagnosis of squamous cell carcinoma.[17,24]

A significant association was found between intra-tumoral necrosis and histological type with a p=0.012. Tumor necrosis is the consequence of chronic cellular hypoxia. In this study, 55.81% of squamous cell carcinoma cases presented with intra-tumoral necrosis. Tumor necrosis is seen more frequently in squamous cell carcinomas according to different studies.[17,24] Areas of tumor necrosis are rare in SCLC. [25]

The limitation of this study is a monocentric study. These results may not be representative of the general population. Ideally, this study should be expanded to a multi-centre analysis.

CONCLUSION

Lung cancer is one of the main causes of death in both men and women. It is often caused by tobaccos smoke containing a genotoxic substance. The diagnosis of primary bronchopulmonary cancer is based on the association of suggestive clinical symptoms, suspicious chest and histological proof. CT is the essential imaging during the initial assessment of bronchopulmonary cancer and allowing the staging of the tumor. In the light of the data from this study, it proves that CT morphological aspect of the tumor could orient to a histological type of PLC. Whatever the appearance of the presumed bronchopulmonary cancer on imaging, it is needed to obtain a definite diagnosis on the anatomopathological examination.

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