The contribution of percutanous needle biopsy of the lung, under image guidance, in the diagnosis of pulmonary lesions in Ouagadougou, Burkina Faso

A R Ouédraogo, G Badoum, G Ouédraogo, K Boncoungou, N A Ndé, A S Ouédraogo, B Kambou, S Maiga, R Nacanabo, and M Ouédraogo

Abstract

Percutanous needle biopsy of the lung (PNBL) under image guidance consists of obtaining a piece of lung tissue using a needle that is guided with radiological means such as computed tomography (CT) or ultrasound through the chest wall into a suspicious lobe of the lungs. This is a recent technique and is infrequently performed in the context of clinical practice in Burkina Faso. The aim of the study was to determine the diagnostic yield of using PNBL under image guidance in diagnosing pulmonary lesions in patients in Ouagadougou. We conducted a retrospective analysis of the medical records of patients who had had a PNBL performed from 1 April 2012 to 31 March 2016 in Ouagadougou. Data collection took place from 15 January 2016 to 2 April 2016. The mean age of the patients was 54.96±15 years with 57% of the participants being male. The most common indication for PNBL was pulmonary nodules (39.25%). On radiologic images, 39.44% of the tumours were peripherally located in the lung lobes. Out of 107 patients who had PNBL, 89.71% had PNBL with CT and 10.29% had PNBL with ultrasound. The histological diagnosis was specific for 55 biopsies, representing 52.6%. In conclusion, the study showed that more than half those who had PNBL had a specific histological diagnosis, and only 1.8% of those having PNBL had major complications. We recommend the use of this technique in diagnosing pulmonary tumours to improve patients' care.

Introduction

Exploration of lung opacities (nodules, masses, localised infiltrates) sometimes requires a percutanous needle biopsy of the lung (PNBL) under image guidance to establish a definite diagnosis.[1] In general, PNBL of a pulmonary lesion is indicated when the histological diagnosis is likely to identify the stage of the disease and so influence the therapeutic strategy, and also when the diagnosis cannot be established by endoscopic techniques.[1] PNBL is a specialised technique that consists of using a needle that is guided through the chest wall into a suspicious lung tissue under radiological guidance to obtain a lung tissue sample. The samples obtained are subsequently analysed in the laboratory by a pathologist. On most occasions this method allows a diagnosis to be made without invasive surgery.[1]

In developed countries, PNBL is routinely performed and leads to 92– 95% specific histological diagnosis and minimal complications.[2] In North Africa, especially in Morocco, the rate of success of the technique was 72% and 85% for peripheral lesions.[3,4] In sub-Saharan Africa, especially in Burkina Faso, this technique is rarely used. This may be due to the fact that clinicians ignore its indications, the lack of trained staff, or even the fear of complications it may cause, e.g. pneumothorax, haemoptysis, and haemothorax. The consequences are an increase of deleterious and empirical treatments in the absence of a correct diagnosis. In order to reduce the tendency to make presumptive diagnosis, we aim here to determine the diagnosis yield of PNBL under radiological guidance in patients with pulmonary lesions in Ouagadougou, Burkina Faso.

Methods

The study was a descriptive study involving patients who had had a PNBL performed between 1 April 2012 and 31 March 2016 in Ouagadougou. Data collection took place from 15 January 2016 to 2 April 2016. The study population was all the patients who had had PNBL performed under radiological guidance in the two study centres in Ouagadougou (Polyclinique NINA and CMA Schipra). Two private facilities were identified in Ouagadougou: Polyclinique NINA Schiphramedical Center; from these facilities, patient information was obtained for all patients who had had PNBL. The centres where these patients had first presented were then identified; these centres were the Department of Pneumology at the University Hospital, Sanou Souro in Bobo Dioulasso and the Department of Visceral Surgery at both University Hospitals in Yalgado Ouedraogo, and the National Centre for Tuberculosis Control in Ouagadougou, two medical centres (Schiphra and Saint Camille), and two private clinics

A R Ouédraogo, G Badoum, G Ouédraogo, K Boncoungou, S Maiga, and M Ouédraogo, Pneumology Department, University Teaching Hospital Yalgado Ouedraogo, Ouagadougou, Burkina Faso; N A Ndé and B Kambou, Radiology Department, University Teaching Hospital Yalgado Ouedraogo, Ouagadougou, Burkina Faso; A S Ouédraogo, Laboratory of Anatomy and Pathological Cytology, University Hospital Yalgado Ouedraogo, Ougadougou, Burkino Faso; R Nacanabo, Pneumology Clinic, Regional Hospital Ouahigouya, Burkina Faso. Correspondence to: Ouedraogo Abdoul Risgou, CHU-YO, Service de pneumologie, 03 BP 7022 Ouagadougou, Burkina Faso.Email: oarisgou@yahoo.fr

(Edgard Ouédraogo and VITA). We collected anatomopathological data from the laboratories where the biopsies were sent for analysis. These included the Laboratory of Anatomy and Pathological Cytology of the University Hospital, Yalgado Ouedraogo and two private laboratories (Polyclinic Sandof and Clinic Philadelphie).

Data were collected on an individual form from:

- Patient registers at the Schiphra and the Polyclinique NINA medical centres.
- Records and analysis reports from the pathology laboratories at the University Hospital Yalgado Ouedraogo and polyclinics Sandof and Philadelphia.
- Clinical records of patients in prescribing services if available, and the follow-up record of some patients contacted by phone.

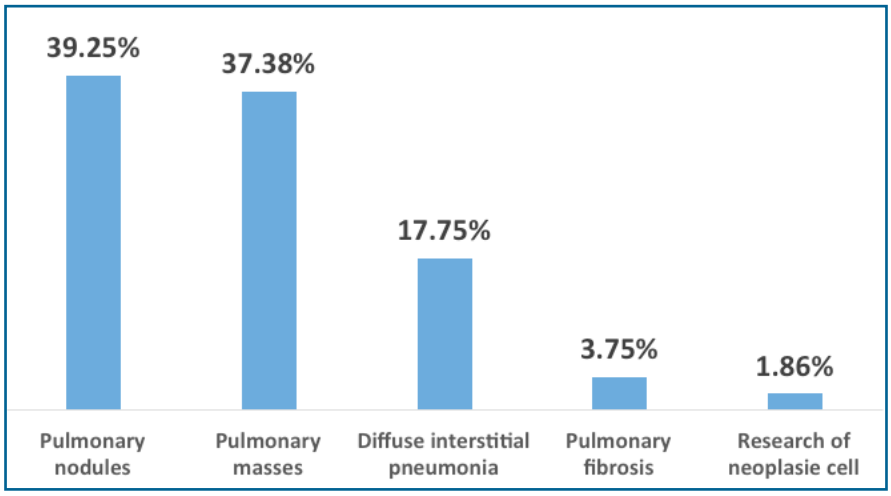

Figure 1 Indications for PNBL

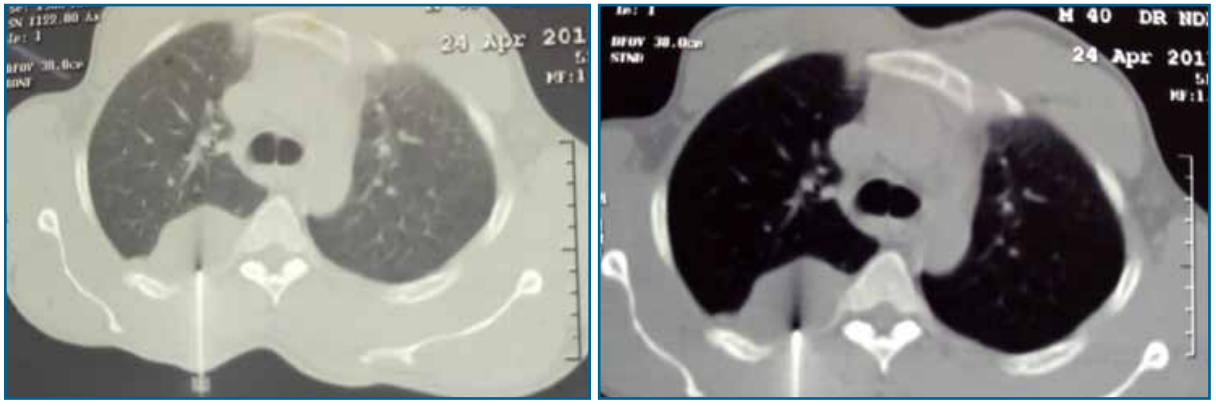

Figure 2 CT-guided percutaneous core biopsy of the lung

Data collected included socio-demographic data, clinical history and paraclinical data of the patients, as well as the data related to the PNBL. The data were entered and analysed using Epi Info 7 software. The Pearson chi-squared test or Fisher's exact test were used to compare the categorical variables when necessary. The mean values are presented with the standard deviation. Association between the variables was considered statistically significant when $p<0.05$. Table 1 gives definitions of the terms used in this report.

Results

A total of 107 patients who had had PNBL were identified during the study period. The average number of PNBLs was 26.75 per year. Patients were aged 19–82 years, with an average age of 54.96±15 years. Patients aged 60 and over represented 43% of the patients; 57% of the participants were male. The main indications for PNBL were pulmonary nodules (in 42 (39.25%) of the patients) and pulmonary masses (in 40 (37.38%) patients) (Figure 1). The average interval between ordering the PNBL and performing the PNBL was 5.25±2.5 weeks (range 2–13 weeks).

Seventy-one chest radiographs were found. In these, 45.07% of the lesions were located in the left lung field and 47.89% of the lesions were located in the lung apices. Out of the seventy-one chest radiographs, 71.83% showed lesions extending to more than one-third of the lung field. The location of the lesions was central in 45.07% of the cases. Among the peripheral lesions, lesions in contact with the wall were noted in 60.71% of the cases and 39.29% of the cases invaded the parietal pleural (Table 2).

PNBL was performed with CT in 96 (89.71%) patients and with ultrasound in 11 (10.29%) patients. The average number of biopsy pieces obtained was 2.02±1.05 (range 1–5 pieces). Complications were reported in 16 (14.95%) patients. These complications were minor in 13.1% (14/107) of cases and major in 1.8% (2/107) of the cases. There were 11 cases of pneumothorax (10.3%), 3 cases of haemorrhage in the wound (2.8%), and 2 cases of haemothorax (1.8%). Pneumothorax accounted for 68.75% (11/16 patients) of all complications. Patients who had presented with pneumothorax during the PNBL had air elimination with needle aspiration and were put under observation. Pleural catheter drainage was performed in the two patients who developed haemothorax during the procedure.

Among the 104 histological results found, 55 gave a specific histological diagnosis, i.e. a diagnostic yield of 52.6% (Table 3). The average time taken to publish the anatomopathological results was 15.1 ±12.3 days (range 11–98 days). The diagnostic time was 4.08±1.46 months (range 2–8 months). The number of fragments removed during PNBL was significantly associated with making a specific diagnosis (number of fragments greater than 2, odds ratio (OR)=3.9, 95% confidence interval (CI) [1.4, 12.3], p=0.00) (Table 4).

Term	Definition
Diagnostic time	Time between the onset of the first symptoms of the disease and the day of diagnosis
Diagnostic yield	Obtaining a specific histological result after anatomopathological analysis of the biopsy pieces
Time to give pathological results	Time taken by the pathology laboratory to deliver the histological results
Minor complication[5]	PNBL-related incidents requiring: • no treatment, without any consequence, or • nominal treatment without any consequence, or • only patient observation.
Major complication[5]	PNBL-related incidents: • requiring treatment, with hospitalisation of less than 48 hours, or • intensive, prolonged treatment with hospitalisation exceeding 48 hours, or • resulting in permanent adverse effects, or • causing death

Table 1 Definitions of terms used in the article

Radiological lesions	Number	Percentage (%)
Pulmonary field		
Left	32/71	45.07
Right	26/71	36.63
Bilateral	13/71	18.30
Localisation in lung field		
Central	32/71	45.07
Peripheral	28/71	39.44
Mixed	11/71	15.49
Type of peripheral localisation		
No contact with chest wall	17/28	60.71
Parietal invasion	11/28	39.29
Predominance		
Apex	34/71	47.89
Base	19/71	26.76
Perihilar region	18/71	25.35
Spread		
All the lung	8/71	11.27
More than half to two-thirds of lung	20/71	28.17
More than one-third to half of lung	31/71	43.66
Less than one-third of lung	12/71	16.90

Table 2 Radiological localisation of pulmonary lesions

Discussion

PNBL is generally indicated when the histological diagnosis is likely to identify the stage of the disease, and so influence the therapeutic strategy and also when the diagnosis cannot be established by endoscopic techniques.[1] It is a less invasive alternative to thoracoscopy and is common practice in developed countries.[2] In our study, we reported a low number of PNBLs carried out (26.75/year). This may be due to:

a) Limited human and technical resources - in fact only two centres have three radiologists performing this procedure in the whole country. This leads to long delays between requesting the PNBL and performing the PNBL (5.25±2.5 weeks; range 2–13 weeks);

b) Lack of knowledge of some of the practitioners about the indications for PNBL;

c) The cost of the PNBL being too high for the vast majority of the patients - the overall cost (including histological study) ranges from $103 to $204 in a country where the minimum monthly wage is $62.6,7

The patients in our study were predominantly male and over 60 years of age. Other authors, such as Serif et al in Bosnia and Herzegovina[8] and Moustarhfir et al in Morocco,[3] found this male predominance (sex ratio at 2.18 and 15.26 respectively) and a mean age of 55 and 61 years respectively. This male predominance may be partly due to epidemiological differences in terms of exposure, risk of infection, and progress of disease. Thus, the histological diagnoses found in our study were dominated by neoplastic causes. It is recognised that advanced age and male sex are factors associated with the occurrence of neoplastic pathologies.[1]

PNBL indications in our study – dominated by pulmonary nodules (39.25%), followed by pulmonary masses (37.38%) and diffuse interstitial pneumonia (17.75%) – were consistent with those found in the literature.[1,9]

Two radiological techniques were used in our study, namely CT-guided transthoracic punch biopsy (TPB) (89.71%) and ultrasound-guided PNBL (10.29%). This high proportion of PNBL with CT could be explained by the fact that CT is particularly useful in guiding the puncture of an intra-pulmonary lesion that is difficult to localise by another technique.[10] It also allows the determination of the optimal skin entry point to avoid damaging small or large vessels, bronchi, or other structures. This is logical since nearly half of the lung lesions of our patients are centrally located. Ultrasound guidance is most useful in cases of pleural lung injury.[11] Real-time CT is now available and combines the advantages of cross-section imaging and real-time process control to avoid complications. The only disadvantage is the higher cost compared with ultrasound.

The level of post-biopsy complications reported in our study was 14.95%. Moustarhfir et al in Morocco found 13.01% pneumothorax and haemoptysis.[4] Aktas et al in Turkey reported 37.2% post-biopsy complications.[12] The complications in our study

Histological results	n	%
Histological specific diagnosis/ lesions		
Mucinous and moderately differentiated adenocarcinoma	21	20.3
Squamous cell carcinoma, large and small cell	14	13.5
Pulmonary haematoma	4	3.8
Metastasis of an undetermined carcinoma	2	1.9
Diffuse lymphoma	2	1.9
Fibromyxoid sarcoma	2	1.9
Fibrous nodule	2	1.9
Giant cell squamous granuloma	2	1.9
Normal histology	2	1.9
Endocrinological tumour	1	0.9
Pulmonary liposarcoma	1	0.9
Schwannomas	1	0.9
Fibrolipoma	1	0.9
Nonspecific diagnosis/lesions		
Pseudo inflammatory tumour	23	22.2
Chronic lung disease	8	7.8
Non-contributory	8	7.8
Chronic inflammatory lesion	6	5.8
Acute pneumonitis lesion	4	3.8

Table 3 Summary of pathological diagnoses on PNBL

Variables	Number	Diagnostic yield	OR [IC 95%]	*p*
Sex				
Female	45	24 (53.4%)		0.9
Male	59	31 (52.5%)	0.9 [0.41; 2.2]	
Guidance techniques				
Ultrasound	11	8 (72.7%)		0.2
CT	93	47 (50.5%)	0.3 [0.06; 1.73]	
Localisation of lesions				
Central	32	20 (62.5%)		
Peripheral	28	17 (60.7%)	1.05 [0.3; 3.4]	0.9
Number of fragments				
≤2 fragments	75	33 (40%)		
>2 fragments	**29**	**22 (75.9%)**	**3.9 [1.4; 12.3]**	**0.00**

Table 4 Factors associated with diagnostic yield

were mainly minor (13.1%), pneumothorax (10.3%), and wound haemorrhage (2.8%). The proportion of pneumothorax reported in the literature varies widely, ranging from 0 to 61%.[1-3,12,13] The proportion of pneumothorax in our study was below the 45% threshold accepted by the Society of Interventional Radiology (SIR) and the American College of Radiology (ACR).[5] Factors associated with the occurrence of pneumothorax include: chronic obstructive pulmonary disease (COPD), absence of pleural adhesion, especially in the absence of a surgical history of the lung, an elderly or low-collaborative patient, the experience of the radiologist, the length of the procedure, the diameter and flexibility of the needle, the obliquity of the angle of penetration into the pleura and the number of transplant passages, the depth and diameter of the targets, the difficulty of localisation, the cavity of the lesions, and assistance by mechanical ventilation.[14,15]

The major complications were haemothorax (1.8%); however their proportion was below the threshold allowed by the SIR and the CRA.[5] A haemothorax is usually secondary to an involvement of an internal or intercostal mammary artery or vein.[1]

The retrospective nature of the study and the size of our sample did not allow us to assess the true proportion of the short-, medium- and long-term complications of PNBL. Indeed, as a bias, common to other studies on PNBL,[16] patients who had an altered general condition, or severe emphysematous lesions, certainly did not benefit from the act because of the high risk of complications. Also we did not know whether there were some late complications such as the parietal dissemination of the malignant lesion along the path of the needle or infection.

Histological lesions were dominated by tumours (45%) with 20.3% of the tumours being adenocarcinomas and squamous cell carcinomas (13.5%). Malignant tumours accounted for 91.5%, with 8.5% of tumours being benign. Among the 104 histological results found, the histological diagnosis was specific for 55 patients, i.e. a diagnostic yield of 52.6%. This yield was below the 75% recommended by the SIR and the ACR.[5] It is also below the diagnostic yields found by other authors, including Aktas et al,[12] Moustarhfir et al,[4] and McSweeney et al in Ireland[16] (62.8%, 72%, and 95%, respectively). Our low diagnostic yield was due to the fact that the material sampled during some PNBLs was inadequate or insufficient (in this case, the procedure should be repeated with the additional costs that would generate), or due to insufficient assessment in the pathology laboratories (due to a limited access to immunohistochemistry). In all three studies above, the lesions were mostly peripheral and sometimes invaded the wall, thus promoting good diagnostic performance.[4,12,16] A good diagnostic yield would be favoured by a high number of fragments removed from the PNBLs. In our study, there was a significant association between a specific diagnosis and the collection of more than two biopsy pieces (OR = 3.9, 95% CI [1.4, 12.3], p=0.00). McSweeney et al mentioned in their study an average of 3.1 biopsy pieces collected. This might explain the 95% diagnostic yield.[16]

Conclusion

In our study, PNBL allowed a specific histological diagnosis in more than half of the cases, with minor complications. PNBL was a useful procedure in making specific diagnosis of pulmonary lesions in our context. Therefore efforts must be made by practitioners and health authorities to increase its use in order to better manage patients with pulmonary lesions.

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Author Declaration

Competing interests: none.
Any ethical issues involving humans or animals: none.
Was informed consent required: yes - documentation on file.

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