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Qualification en radiodiagnostic et imagerie médicale.

Complications des biopsies pulmonaires guidées par tomodensitométrie : comparaison entre techniques coaxiale et non-coaxiale.

Complications in CT-guided transthoracic lung biopsy: comparison between coaxial and non-coaxial techniques.

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Sous la direction de M. LEDERLIN Mathieu

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A notre vie à deux, et bientôt à trois…

Plan

Liste des abréviations

CT	Computed tomography
PCNB	Percutaneous core-needle biopsy
FNA	Fine needle aspiration
ACR	American College of Radiology
SIR	Society of Interventional Radiology
SPR	Society for Pediatric Radiology

ABSTRACT

Objectives: To compare CT-guided transthoracic percutaneous core-needle biopsy (PCNB) complications rate and diagnostic performances between coaxial and non-coaxial techniques and to identify the main risk factors related to each technique.

Methods: 928 consecutive lung PCNB performed in 3 French tertiary referral centers were retrospectively evaluated. All data were collected by reviewing CT-acquisition, radiology and clinical reports. Procedures were separated in two groups depending on biopsy technique (coaxial and non-coaxial).

Results: A total of 553 (59.6%) coaxial and 375 (40.4%) non-coaxial biopsy were performed. Overall complication rate was significantly higher in the non-coaxial group than in the coaxial group (47.7% vs 40.3%, respectively; p=0.025). In both coaxial and non-coaxial groups, the smallest and deepest pulmonary lesions were associated with most frequent occurrence of pneumothoraces, pneumothoraces necessitating chest tube placement. Hemoptysis was most frequent in coaxial group than in non-coaxial (9.4% vs 4.3%, respectively; p=0.004). When we focused on smaller (<30mm large) and deeper (>20mm deep) lesions only, we only observed significant difference for hemoptysis, with a higher rate in coaxial group than in non-coaxial one (18.7% vs 2.5%, respectively; p=0.001). Concerning diagnostic performance, non-diagnostic biopsy rate was significantly higher in non-coaxial group than in coaxial group (18.1% vs 6.2%, respectively; p<0.001)

Conclusion: Coaxial technique for CT-guided PCNB of lung lesion seems to be associated with less complication and less non-diagnostic rates than non-coaxial technique. Non-coaxial technique could be useful in the specific cases of small (<30mm) and deep (>20mm) lesions, as coaxial technique lead to more hemoptysis, but further study are needed as the first one lead to more non-diagnostic outcomes.

INTRODUCTION

Computed tomography (CT)-guided percutaneous core-needle biopsy (PCNB) has a pivotal role in etiologic diagnosis of lung nodules and masses (1,2). With the development of targeted cancer therapy over the past few years, the need for obtaining accurate molecular profile of lung tumors has substantially increased (3–7). Although PCNB is a rather safe technique, some serious and sometimes life-threatening complications may occur, including pneumothorax, hemoptysis, hemothorax and air embolism (8–15).

PCNB can be performed with or without the use of a coaxial introducer. The coaxial technique has been developed in the 90's (13,16) to allow the collection of several tissue samples through a single pleural puncture, offering theoretical advantages in terms of safety and efficiency (17–23). However, coaxial technique may have specific side effects related either to the larger diameter of the coaxial introducer compared to the biopsy device alone, or to the repeated back and forth movements of the biopsy needle within the coaxial. These potential adverse effects may paradoxically increase the risk of lung damage or bleeding (8,19,23).

So far, only a few studies have compared coaxial and non-coaxial techniques with regard to specific complications and success rates (11,22,24). These authors reported no significant difference in pneumothorax rate (22), and a non-significant tendency towards more frequent bleeding using coaxial technique (11,24). However, these studies suffered from substantial heterogeneity in terms of size and depth of pulmonary lesions, whereas it is well known that these factors influence complications rate (8,17,22–26). Moreover, information about success rate was not available. Therefore, it is still unknown whether one method performs better than the other. The current guidelines remain vague with no established consensus regarding the technique of choice (1,27). The British Thoracic Society guidelines proposed that the decision on the type of needle used should be made depending on operator's experience and lesions

characteristics (27). The American College of Chest Physicians guidelines did not mention this point.

The objective of this study was thus triple: (i) to compare PCNB complications rate between coaxial and non-coaxial techniques, (ii) to compare diagnostic performances of these two techniques and (iii) to identify the main risk factors related to each technique.

METHODS

Our institutional review board approved this study.

1. Study population:

This is a retrospective multicentric study including 3 French tertiary referral centers (Hôpital Pontchaillou - Centre Hospitalier Universitaire de Rennes, Hôpital Cochin - Assistance Publique Hôpitaux de Paris, Hôpital La Timone - Assistance Publique Hôpitaux de Marseille). We recorded all CT-guided PCNB for lung nodule or masse performed between November 2011 and November 2016. A total of 928 consecutive lung PCNB in 883 patients were evaluated. All included patient were over 18 years old. CT images were available for all procedures. Mediastinal and parietal lesions were excluded. 841 patients underwent 1 biopsy, 39 patients, 2 biopsies and 3 patients, 3 biopsies. Mean patient age was 64.5 years ± 12.03 (range, 22-92 years), with a sex ratio of 1.84 (601 men, 327 women). Patients' and lesions' characteristics are summarized in Table 1.

Table 1: Patients and lesions characteristics depending on biopsy technique

Parameter	Number of CT guided PCNB *(n=928)*	Biopsy technique		*p* value
		Coaxial *(n=553)*	Non-coaxial *(n=375)*	
Patient age (y)*	64.5 ± 12.03	65.7 ± 11.5	62.8 ± 12.6	***<0.001***
Sex**				
Male	601 (64.8)	362 (65.5)	239 (63.7)	0.589
Female	327 (35.2)	191 (34.5)	136 (36.3)	
Lesion size (mm)*	40.85 ± 30.15	43.7 ± 33.6	36.7 ± 23.7	***0.001***
Lesion size (categorized)**				***0.005***
<30mm	396 (42.7)	215(38.9)	181(48.3)	
≥30mm	532 (57.3)	338(61.1)	194(51.7)	
Lesion depth (mm)*	15.51 ± 16.55	13.2 ± 15.2	18.9 ± 17.8	***<0.001***
Lesion depth (categorized)**				***<0.001***
0 mm	305 (32.9)	209 (37.8)	96 (25.6)	
1 to 20mm	316 (34.0)	186 (33.6)	130 (34.7)	
>20mm	307 (33.1)	158 (28.6)	149 (39.7)	
Lesion type**				***<0.001***
Solid nodule	853 (91.9)	512 (92.6)	341 (90.9)	
Part-solid nodule	35 (3.8)	11 (2.0)	24 (6.4)	
Groud-glass nodule	11 (1.2)	3 (0.5)	8 (2.1)	
Missing data	29 (3.1)	27 (4.9)	2 (0.6)	
Lobe**				0.093
URL	255 (27.5)	155 (28.0)	100 (26.7)	
ML	45 (4.8)	18 (3.3)	27 (7.2)	
LRL	218 (23.5)	129 (23.3)	89 (23.7)	
ULL	232 (25.0)	140 (25.3)	92 (24.5)	
LLL	178 (19.2)	111 (20.1)	67 (17.9)	
Number of fragment**				***<0.001***
1	342 (36.9)	28 (5.1)	314 (83.7)	
2	229 (24.7)	181 (32.7)	48 (12.8)	
>2	357 (38.5)	344 (62.2)	13 (3.5)	
University hospital**				***<0.001***
Cochin	249 (26.8)	249 (45.1)	0 (0)	
Marseille	186 (20.0)	186 (33.6))	0 (0)	
Rennes	493 (53.1)	118 (21.3)	375 (100)	

* Mean ± SD
** Data are numbers of procedures, with percentages in parentheses

2. Technique:

All lung biopsies were performed using CT guidance. All biopsies concerned lung nodule or mass located in lung parenchyma, of any size. No mediastinal mass, lymph node or chest wall biopsy was included. All biopsies were performed using either non-coaxial technique (18-gauge core-needle), or using coaxial technique (17-gauge introducer and 18-gauge biopsy core-needle).

Each biopsy was performed by consultant radiologist with expertise in lung biopsy or by medical imaging resident under supervision of a consultant radiologist. Absence of contraindication to lung biopsy was verified for each procedure.

A preliminary chest CT was performed and patients were positioned prone or supine depending on the skin entry site chosen by the radiologist. Choice of biopsy technique was left at the discretion of operator. Every possible time, needle entry site was chosen as close as possible to the superior aspect of the rib to avoid intercostal vasculature. Procedure was performed under aseptic conditions and local anesthesia. No blood-patch technique was used.

Each patient was then admitted in day hospital of pneumology department. Systematic chest x-ray was performed at least 4 hours after procedure.

3. Data collection:

All preliminary and per-procedure CT acquisitions were reviewed by 3 radiology residents. Lesion-related variables were recorded on these acquisitions. Biopsy technique (i.e. with or without coaxial) and immediate complications were recorded from radiology reports. Clinical reports following the biopsy as well as control chest X-rays were also reviewed and late post-procedure complications were then recorded. Biopsy results were recorded from pathology reports.

Each pulmonary lesion was classified as solid, part-solid or pure ground-glass(28). The largest dimension of the lesion was recorded. Lesion depth was defined by the distance between pleura and the center of the lesion along the needle track. Lobe localization was also recorded.

Complications were categorized in minor and major as defined by Society of Interventional Radiology (29). Complications were considered minor if no specific therapy was needed and if no hospitalization more than overnight admission for observation only was involved.

Complications were considered major if they required specific therapy, or involved prolonged hospitalization (>48 hours), permanent adverse sequelae or death. Pneumothorax was considered significant for any size and extension. Persistent or symptomatic pneumothoraces were defined as necessitating chest tube placement, either performed by the radiologist in the CT room immediately after biopsy procedure, or in the clinical department. Alveolar hemorrhage was defined as new consolidation or ground-glass opacity around the lesion discovered on the post-procedure control CT. Alveolar hemorrhage without any clinical repercussion (not associated with hemoptysis or hemothorax), was not considered a complication. Hemoptysis was recorded if it occurred either immediately after procedure, or during day hospitalization.

The number of fragment collected was recorded from radiology report. A biopsy procedure was considered non-diagnostic if no fragment was collected, or if the biopsy specimen had insufficient tissue for diagnosis.

4. Statistical analysis:

Lesion size was categorized in 2 groups (<30 mm or ≥30 mm). Lesion depth was categorized in three groups: 0mm, 1-20mm, and more than 20 mm.

Procedures were separated in two groups depending on biopsy technique (coaxial and non-coaxial). Comparison between groups for categorical variables was done using Chi-square or exact Fisher's test depending on sample size. T-test or one-way analysis of variance (ANOVA) was used to compare continuous variables. Statistical analyses were performed using SPSS software (SPSS Inc. Released 2006. SPSS for Windows, Version 15.0. Chicago: SPSS Inc.); *p* values less than 0.05 were considered significant.

Graphics and tables were done using Microsoft Excel®.

RESULTS

A total of 553 (59.6%) coaxial and 375 (40.4%) non-coaxial biopsy were performed. Patients' and lesions' characteristics in each group are shown in Table 1.

Complication rates are presented in table 2. Overall complication rate was significantly higher in the non-coaxial group than in the coaxial group (47.7% vs 40.3%, respectively; p=0.025). In particular, pneumothorax was more frequent in the non-coaxial than in the coaxial group (44.8% vs 33.8%, respectively; p=0.001). Major complications were also more frequent in the non-coaxial group than in the coaxial group (16% vs 10.1%, respectively; p=0.008), whereas there was no significant difference for minor complications. We found a higher rate of pneumothorax requiring chest tube placement with non-coaxial than with coaxial technique (11.3% vs 6%, respectively; p=0.004). Conversely, hemoptysis was more frequent in the coaxial than in the non-coaxial group (9.4% vs 4.3%, p=0.004). There was no significant difference between coaxial and non-coaxial techniques for alveolar hemorrhage and hemothorax. Only one air embolism was reported in our series, in the coaxial group. The failure rate was higher in the non-coaxial group with 18.1% of non-diagnostic biopsies versus 6.1% in the coaxial group (p<0.001).

Table 2: Comparison of complication and biopsy failure rate between coaxial and non-coaxial techniques

Parameter	Coaxial group *(n=553)*	Non-coaxial group *(n=375)*	*P* value
Complications			
All	223 (40.3)	179 (47.7)	***0.025***
Minor	167 (30.2)	120 (32.0)	0.560
Major	56(10.1)	60(16.0)	***0.008***
Pneumothorax			
All	187 (33.8)	168 (44.8)	***0.001***
Chest tube placement	33 (6.0)	42 (11.3)	***0.004***
Alveolar hemorrhage	240 (43.4)	152 (40.5)	0.404
Hemoptysis	52 (9.4)	16 (4.3)	***0.004***
Hemothorax	8 (1.4)	2 (0.5)	0.331
Air embolism	1 (0.2)	0 (0)	1
Non-diagnostic biopsy	34 (6.2)	67 (18.1)	***<0.001***

Note: Data are numbers of procedures, with percentages in parentheses

Lesion characteristics influenced major complication rate (Table 3). In both coaxial and non-coaxial groups, the smallest and deepest pulmonary lesions were associated with most frequent occurrence of major complications. Other lesion characteristics (CT density, localization, number of fragments) did not influence the rate of major complication in both coaxial and non-coaxial groups.

Table 3: Risk factor of major complication depending on biopsy technique

Parameter	Coaxial			Non-coaxial		
	Major complication *(n=56)*	No major complication *(n=497)*	*p* value	Major complication *(n=60)*	No major complication *(n=315)*	*p* value
Patient age (y)*	65.7 ± 13.7	65.7 ± 11.5	0.976	61.5 ± 13.7	63.0 ± 12.4	0.388
Sex**			0.476			0.170
Male	36 (64.3)	326 (65.6)		42 (70.0)	197 (62.5)	
Female	20 (35.7)	171 (34.4)		18 (30.0)	118 (37.5)	
Lesion size (mm)*	32.8 ± 26.5	44.9 ± 34.1	***0.010***	29.1 ± 19.1	38.2 ± 24.2	***0.006***
Lesion size (categorized)**			***<0.001***			***0.001***
<30mm	37 (66.1)	178 (35.8)		40 (66.7)	141 (44.8)	
≥30mm	19 (33.9)	319 (64.2)		20 (33.3)	174 (55.2)	
Lesion depth (mm)*	22.8 ± 15.8	12.1 ± 14.8	***<0.001***	31.4 ± 17.3	16.5 ± 16.9	***<0.001***
Lesion depth (categorized)**			***<0.001***			***<0.001***
0 mm	7 (12.5)	202 (40.6)		1 (1.7)	95 (30.2)	
1 to 20mm	20 (35.7)	166 (33.4)		18 (30.0)	112 (35.6)	
>20mm	29 (51.8)	129 (26.0)		41 (68.3)	108 (34.3)	
Lesion type**			0.156			0.537
Solid nodule	52 (94.5)	460 (97.7)		57 (95.0)	284 (90.7)	
Part-solid nodule	3 (5.5)	8 (1.7)		2 (3.3)	22 (7.0)	
Groud-glass nodule	3 (0.6)	0 (0.0)		1 (1.7)	7 (2.2)	
Lobe**			0.910			0.380
URL	14 (25.0)	141 (28.4)		15 (25.0)	85 (27.0)	
ML	2 (3.6)	16 (3.2)		6 (10.0)	21 (6.7)	
LRL	13 (23.2)	116 (23.3)		9 (15.0)	80 (25.4)	
ULL	17 (30.4)	123 (24.7)		18 (30.0)	74 (23.5)	
LLL	10 (17.9)	101 (20.3)		12 (20.0)	55 (17.5)	
Number of fragment**			0.056			0.666
1	5 (8.9)	23 (4.6)		52 (86.7)	262 (83.2)	
2	24 (42.9)	157 (31.6)		7 (11.7)	41 (13.0)	
>2	27 (48.2)	317 (63.8)		12 (3.8)	7 (11.7)	

* Mean ± SD

** Data are numbers of procedures, with percentages in parentheses

When analyzing complications according to biopsy technique and lesion size (Table 4), lesions of less than 30mm were associated with higher rate of minor and major complications. In particular, pneumothoraces (requiring chest tube placement or not) and alveolar hemorrhage were more frequent in smaller lesions of both coaxial and non-coaxial groups. By contrast, smaller lesions were associated with a higher hemoptysis rate in the coaxial group only. Lesion size did not influence the rate of non-diagnostic biopsies.

For lesion diameter <30mm, hemoptysis rate was higher in coaxial group than in non-coaxial group (15.3% vs 3.9%, respectively, $p<0.001$) (Figure 1). For lesion diameter >30mm, non-coaxial technique was associated with more major complication (10.3% vs 5.6%, respectively; $p=0.046$) and more pneumothorax necessitating chest tube placement (8.2% vs 2.7%, respectively; $p=0.004$).

Table 4: Complication rate depending on biopsy technique and lesion size

Parameter	Coaxial		*p* value	Non-coaxial		*p* value
	Lesion size <30mm *(n=215)*	Lesions size ≥30mm *(n=338)*		Lesion size <30mm *(n=181)*	Lesions size ≥30mm *(n=194)*	
Complications						
All	119 (55.3)	104 (30.8)	***<0.001***	107 (59.1)	72 (37.1)	***<0.001***
Minor	82 (38.1)	85 (25.1)	***0.001***	68 (37.6)	52 (26.8)	***0.017***
Major	37 (17.2)	19 (5.6)	***<0.001***	40 (22.1)	20 (10.3)	***0.001***
Pneumothorax						
All	99 (46.0)	88 (26.0)	***<0.001***	104 (57.5)	64 (33.0)	***<0.001***
Chest tube placement	24 (11.2)	9 (2.7)	***<0.001***	26 (14.5)	16 (8.2)	***0.040***
Alveolar hemorrhage	154 (71.6)	86 (25.4)	***<0.001***	101 (55.8)	51 (26.4)	***<0.001***
Hemoptysis	33 (15.3)	19 (5.7)	***<0.001***	7 (3.9)	9 (4.7)	0.465
Hemothorax	2 (0.9)	6 (1.8)	0.338	2 (1.1)	0 (0.0)	0.232
Air embolism	1 (0.5)	0 (0.0)	1	0 (0.0)	0 (0.0)	1
Non-diagnostic biopsy	13 (6.0)	21 (6.2)	0.542	37 (20.9)	30 (15.5)	0.110

Note: Data are numbers of procedures, with percentages in parentheses

Fig. 1: Complication rate depending on lesion size and biopsy technique. a: major complication rate; b: chest tube placement rate; c: hemoptysis rate

When analyzing complications according to biopsy technique and lesion depth (Table 5), the same tendencies were observed, in particular with a higher rate of hemoptysis in deeper lesions of the coaxial group only. Lesion depth did not influence the rate of non-diagnostic biopsies.

For pulmonary lesions abutting pleura, there was no difference in complications between coaxial and non-coaxial technique (Figure 2). For lesion depth of 1-20mm, hemoptysis rate was higher in the coaxial than in non-coaxial group (11.3% vs 3.1%, respectively; p=0.016). For deepest lesions (depth>20mm), non-coaxial technique was associated with more pneumothorax necessitating chest tube placement (20.9% vs 10.1%, respectively; p=0.009) but less hemoptysis (4.8% vs 15.8%, respectively; p=0.001).

Table 5: Complication rate depending on biopsy technique and lesion depth

Parameter	Coaxial				Non-coaxial			
	Lesion depth 0mm *(n=209)*	Lesion depth 1 to 20mm *(n=186)*	Lesion depth >20mm *(n=158)*	*p* value	Lesion depth 0mm *(n=96)*	Lesion depth 1 to 20mm *(n=130)*	Lesion depth >20mm *(n=149)*	*p* value
Complications								
All	45 (21.5)	86 (46.2)	92 (58.2)	***<0.001***	16 (16.7)	71 (54.6)	92 (61.7)	***<0.001***
Minor	38 (18.2)	66 (35.5)	63 (39.9)	***<0.001***	15 (15.6)	53 (40.8)	52 (34.9)	***<0.001***
Major	7 (3.3)	20 (10.8)	29 (18.4)	***<0.001***	1 (1.0)	18 (13.8)	41 (27.5)	***<0.001***
Pneumothorax								
All	42 (20.1)	72 (38.7)	73 (46.2)	***<0.001***	13 (13.5)	67 (51.5)	88 (59.1)	***<0.001***
Chest tube placement	4 (1.9)	13 (7.0)	16 (10.1)	***0.004***	1 (1.0)	10 (7.8)	31 (20.9)	***<0.001***
Alveolar hemorrhage	35 (16.7)	89 (47.8)	116 (73.4)	***<0.001***	8 (8.4)	54 (41.5)	90 (60.4)	***<0.001***
Hemoptysis	6 (2.9)	21 (11.3)	25 (15.8)	***<0.001***	5 (5.2)	4 (3.1)	7 (4.8)	0.706
Hemothorax	1 (0.5)	2 (1.1)	5 (3.2)	0.090	0 (0.0)	1 (0.8)	1 (0.7)	0.703
Air embolism	0 (0.0)	0 (0.0)	1 (0.6)	1	0 (0.0)	0 (0.0)	0 (0.0)	1
Non-diagnostic biopsy	20 (9.1)	7 (3.8)	8 (5.1)	0.069	17 (19.7)	24 (17.2)	30 (19.0)	0.918

Note: Data are numbers of procedures, with percentages in parentheses

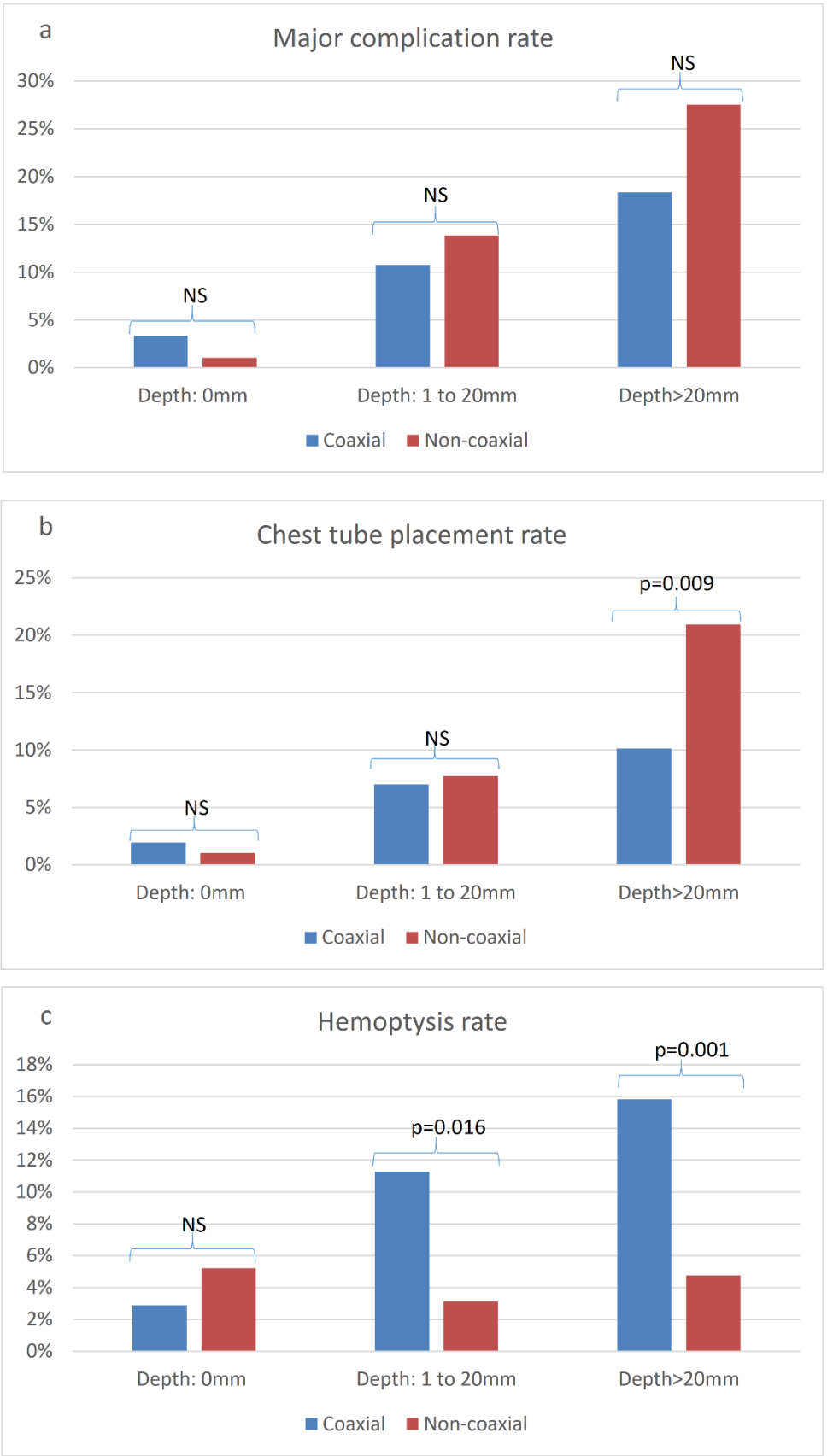

Fig. 2: Complication rate depending on lesion depth and biopsy technique. a: major complication rate; b: chest tube placement rate; c: hemoptysis rate

When we focused on smaller (<30mm large) and deeper (>20mm deep) lesions only (Table 6), we only observed significant difference for alveolar hemorrhage and hemoptysis, with a higher rate in coaxial group.

Table 6: Comparison of complication and biopsy failure rate between coaxial and non-coaxial techniques for smaller (<30mm large) and deeper (>20mm deep) lesions only

Parameter	Coaxial *(n=91)*	Non-coaxial *(n=82)*	*P* value
Complications			
All	55 (60.4)	50 (61.0)	0.534
Minor	35 (38.5)	27 (32.9)	0.275
Major	20 (22.0)	24 (29.3)	0.178
Pneumothorax			
All	45 (49.5)	50 (61.0)	0.086
Chest tube placement	13 (14.3)	17 (21.0)	0.170
Alveolar hemorrhage	75 (82.4)	56 (68.3)	***0.023***
Hemoptysis	17 (18.7)	2 (2.5)	***0.001***
Hemothorax	2 (2.2)	1 (1.2)	0.539
Air embolism	0 (0.0)	1 (1.2)	0.474
Non-diagnostic biopsy	5 (5.5)	21 (23.8)	***0.001***

Note: Data are numbers of procedures, with percentages in parentheses

DISCUSSION

The lack of recommendation about biopsy technique choice for CT-guided lung biopsy (1,27) and the few studies carried out about this subject (22,24) have lead us to wonder about the safest and more accurate technique to use. Our results suggest that, overall, the use of a coaxial introducer for CT-guided PCNB is safer than a non-coaxial technique. Major complications, especially pneumothoraces necessitating chest tube placement, were significantly more frequent with non-coaxial technique. In contrast, hemoptysis was more frequent with coaxial technique. All these complications were dramatically influenced by lesion size and depth. Kuban et al (23) have shown that pneumothorax and chest tube placement rates occurred more frequently when lesion size was smaller and when needle path length was longer. Regarding hemorrhage, Tai et al (11) have shown that higher-grade hemorrhage occurred more frequently for lesions diameters less than 30mm and for deeper lesions. These findings, in agreement with our results, may be explained by the more complex trajectories required to reach small and deep lesions, thus inducing more needle motions and subsequently more complications.

In our series, pneumothorax was more frequent with non-coaxial technique, which might have a mechanic explanation. With non-coaxial technique, the core-biopsy needle slides directly through the pleura, and the rapid forward motion of the outer cutting canula is likely to induce a shear stress on the pleural membrane, which could result in pneumothorax. With coaxial technique, the core-biopsy needle slides within the hollow coaxial introducer, thus limiting shear stress applied to the pleura.

The higher rate of hemoptysis using coaxial technique might be explained by the higher caliber of the needle, as demonstrated by the meta-analysis of Heerink et al (8). Ocak et al. (19) did not show significant difference in hemoptysis rate between 14 and 22 gauge needles, but this study compared fine needle aspiration (FNA) and core-needle biopsy. Another explanation probably lies in the greater number of collected fragments using coaxial technique, since the number of tissue fragments is a risk factor for hemoptysis (25). Our results also showed that coaxial technique had a better technical success rate than non-coaxial technique, which may be confidently linked to the higher number of fragment as well.

When analyzing complication rate for smaller (<30mm large) and deeper (>20mm deep) lesions only, there was significantly more complications with coaxial technique. However, there was also more non-diagnostic biopsies, which prevents recommending one technique or the other for such small deep pulmonary lesion.

Pneumothorax rates vary widely across studies, depending on pneumothorax definition used. In our study, we chose to take into consideration every pneumothorax of any abundance, even minor. This could explain our relatively high rate comparing to literature. Practice parameters published in 2013 by The American College of Radiology (ACR), the Society of Interventional Radiology (SIR) and the Society for Pediatric Radiology (SPR) (32) provide complication rates thresholds for transthoracic percutaneous needle biopsy. Our results are consistent with these recommendations (12-45% for all pneumothoraces, and 2-15% for pneumothoraces necessitating chest tube placement). Concerning hemoptysis, a recent meta-analysis by Heerink et al. (8) revealed hemoptysis rates ranging from 0 to 14.4%. Our findings are in line with these results with 9.4% and 4.3% for coaxial and non-coaxial techniques respectively. Concerning success rate, our results (93.8% success rate with coaxial technique and 81.9%

with non-coaxial technique) are also in agreement with ACR-SIR-SPR recommendations (suggested thresholds of 77-96%).

There are several limitations to our study. First, our two groups were heterogeneous for lesion size and depth. Subgroup analyses aimed at circumventing this issue faced the problem of loss of statistical power. Another limitation is due to the retrospective design of this multicentric study, which prevented controlling all potential confounding factors. In this regard, the major flaw is probably the fact that all non-coaxial biopsies were performed in the same university hospital. This might have induced a "centre" effect, and might have created a selection bias limiting the impact of our results. Finally, some information such as emphysema and pulmonary hypertension were not available in patient medical reports and therefore not included in analysis. These classically reported risk factors for biopsy complications may have added additional relevant information with regard to coaxial and non-coaxial techniques.

In conclusion, coaxial technique for CT-guided PCNB of lung lesion seems to be associated with less complication and less non-diagnostic rates than non-coaxial technique. In the specific cases of lesions smaller than 30mm and deeper than 20mm, further study could be useful to investigate whether a non-coaxial approach (leading to more non-diagnostic outcomes) might be substituting for coaxial approach (leading to more hemoptysis).

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FIGURES

TABLES

TABLE DES MATIERES

FABRE Clément

Complications des biopsies pulmonaires guidées par tomodensitométrie : comparaison entre techniques coaxiale et non-coaxiale.

RÉSUMÉ

Objectifs: Comparer deux techniques de biopsies trans-thoraciques guidées par tomodensitométrie (coaxiale et non-coaxiale) quant à la survenue de complications et aux performances diagnostiques, et identifier les principaux facteurs de risques de complication pour chacune d'elles.

Méthodes: 928 biopsies pulmonaires effectuées dans 3 centres hospitaliers universitaires français ont été évaluées. Les données ont été relevées de façon rétrospective. Les biopsies étaient séparées en deux groupes : coaxial et non-coaxial.

Résultats: Au total, 553 (59.6%) biopsies coaxiales et 375 (40.4%) non-coaxiales ont été étudiées. Le taux global de complication était plus élevé dans le groupe non-coaxial (47.7% et 40.3% respectivement; p=0.025). Les biopsies des lésions les plus petites et les plus profondes se compliquaient plus fréquemment de pneumothorax, de pneumothorax nécessitant un drainage. Le taux d'hémoptysie était plus élevé dans le groupe coaxial (9.4% et 4.3% respectivement; p=0.004). En étudiant exclusivement les petites lésions (moins de 30mm de diamètre) et les plus profondes (plus de 20mm de la plèvre), on observait un taux plus important d'hémoptysie dans le groupe coaxial (18.7% et 2.5% respectivement; p=0.001). Le nombre de biopsies non contributives était plus élevé dans le groupe non-coaxial (18.1% et 6.2% respectivement; p<0.001).

Conclusion: La technique de biopsie trans-thoracique coaxiale semble moins pourvoyeuse de complication que la technique non-coaxiale. Cette dernière pourrait être utile dans le cas spécifique de petites lésions profondes, la technique coaxiale entrainant plus d'hémoptysies pour ces gestes, sous réserve d'un plus grand nombre de biopsies non-contributives, et pourrait faire l'objet d'une prochaine étude.

Mots-clés : Biopsies transthoraciques, coaxial, non-coaxial, complications.

Complications in CT (-guided transthoracic lung biopsy: comparison between coaxial and non-coaxial techniques.

ABSTRACT

Objectives: To compare CT-guided transthoracic percutaneous core-needle biopsy (PCNB) complications rate and diagnostic performances between coaxial and non-coaxial techniques and to identify the main risk factors related to each technique.

Methods: 928 consecutive lung PCNB performed in 3 French tertiary referral centers were retrospectively evaluated. All data were collected by reviewing CT-acquisition, radiology and clinical reports. Procedures were separated in two groups depending on biopsy technique (coaxial and non-coaxial).

Results: A total of 553 (59.6%) coaxial and 375 (40.4%) non-coaxial biopsy were performed. Overall complication rate was significantly higher in the non-coaxial group than in the coaxial group (47.7% vs 40.3%, respectively; p=0.025). In both coaxial and non-coaxial groups, the smallest and deepest pulmonary lesions were associated with most frequent occurrence of pneumothoraces, pneumothoraces necessitating chest tube placement. Hemoptysis was most frequent in coaxial group than in non-coaxial (9.4% vs 4.3%, respectively; p=0.004). When we focused on smaller (<30mm large) and deeper (>20mm deep) lesions only, we only observed significant difference for hemoptysis, with a higher rate in coaxial group than in non-coaxial one (18.7% vs 2.5%, respectively; p=0.001). Concerning diagnostic performance, non-diagnostic biopsy rate was significantly higher in non-coaxial group than in coaxial group (18.1% vs 6.2%, respectively; p<0.001)

Conclusion: Coaxial technique for CT-guided PCNB of lung lesion seems to be associated with less complication and less non-diagnostic rates than non-coaxial technique. Non-coaxial technique could be useful in the specific cases of small (<30mm) and deep (>20mm) lesions, as coaxial technique lead to more hemoptysis, but further study are needed as the first one lead to more non-diagnostic outcomes.

Keywords : CT-guided, transthoracic, biopsy, coaxial, non-coaxial, complications

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