



ECHOGRAPHIE PLEURO-PULMONAIRE

Critères diagnostiques de PNEUMOTHORAX

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Anesthésie Réanimation Douleur
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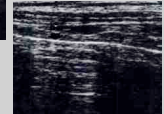


Historiquement

Diagnosis of Pneumothorax by Ultrasound Immediately after Ultrasonically Guided Aspiration Biopsy*

Rémi Targhetta, M.D.; Jean-Marie Bourgeois, M.D.;
Roseline Charagnat, M.D.; and Pierre Balnes, M.D., F.C.C.P.

We report two cases of pneumothorax detected by echographic examination immediately after ultrasonically guided aspiration biopsy and confirmed by chest x-ray film. The pneumothorax was characterized by the disappearance of the lung tumor. In the real-time image, the respiratory excursions of the visceral pleura also disappeared.
(Chest 1992; 101:855-56)



1992: cases reports et études préliminaires sur pneumothorax échographique

Historiquement



Pleural ultrasonography versus chest radiography for the diagnosis of pneumothorax: review of the literature and meta-analysis.

Alrajab S et al.

Septembre 2013

=> **626 articles analysés !!!**

En pratique clinique

En pratique:

➤ **ELIMINER** le
PNT=très accessible



➤ **AFFIRMER** le
PNT=analyse
échographique
rigoureuse



?

En pratique clinique

Sensitivity of Bedside Ultrasound and Supine Anteroposterior Chest Radiographs for the Identification of Pneumothorax After Blunt Trauma

R. Gentry Wilkerson, MD, and Michael B. Stone, MD, RDMS

ACAD EMERG MED • January 2010, Vol. 17, No. 1

- **Méta-analyse à partir d'une situation clinique: dyspnée et douleur thoracique post traumatique chez un adulte et indisponibilité immédiate de la RT**
- **=> écho par le médecin des urgences**
- MEDLINE 1965 à 2009 et EMBASE 1980 à 2009

En pratique clinique

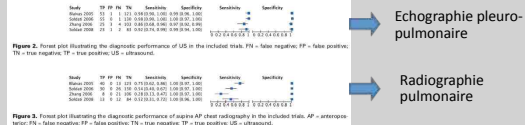
Study	Population	Test Interpretation	Reference Standard
Blavag et al., 2006 ¹	Inclusion: blunt trauma patients receiving a FAST exam, CXR, and chest CT abdominal (including lung windows) CT Exclusion: subjects in whom the US could not be completed for any reason n = 116 Age: >17 yr Sex: 57% male	Timing: secondary survey Operator: EPs Interpreter: EPs Assessor (or radiographist): radiologists Positive test: absence of lung sliding	Helical CT, flush of air during tube thoracostomy (unstable patients)
Soldati et al., 2006 ¹¹	Inclusion: blunt chest trauma patients Exclusion: 1) need for immediate operative intervention, 2) chest wall injuries precluding US evaluation, 3) inability to obtain informed consent n = 189 Age: mean = 52 yr Sex: 63% male	Timing: initial assessment Operator: EPs Interpreter: EPs Assessor (or radiographist): radiologists Positive test: absence of lung sliding and absence of comet tail artifact	Helical CT
Zhang et al., 2006 ¹	Inclusion: blunt multitrauma patients Exclusion: patients with traumatic aortic aneurysms and/or cardiac arrest n = 126 Age: mean = 45 yr Sex: 84% male	Timing: initial assessment Operator: EPs Interpreter: EPs Assessor (or radiographist): radiologists Positive test: absence of lung sliding and absence of comet tail artifact	Helical CT, bubbling in chest drain after tube thoracostomy (unstable patients)
Soldati et al., 2006 ¹¹	Inclusion: blunt chest or multitrauma patients Exclusion: 1) inability to obtain consent, 2) subcutaneous emphysema, 3) need for immediate decompression, 4) need for mechanical ventilation, 5) chest wall injuries that precluded US evaluation, 6) hemodynamic instability n = 109 Age: mean = 41 yr Sex: 67% male	Timing: initial assessment Operator: EPs Interpreter: EPs Assessor (or radiographist): radiologists Positive test: absence of lung sliding and absence of comet tail artifact	Helical CT

En pratique clinique

Table 3
Diagnostic Performance of Transthoracic US for Detection of Pneumothorax

Study	Prevalence, % (95% CI)	Sensitivity, % (95% CI)	Specificity, % (95% CI)	LR(+) (95% CI)	LR(-) (95% CI)
Blavag et al., 2006 ¹	30.1 (23.6-37.6)	98.1 (95.0-99.9)	99.2 (98.3-100)	129.7 (17.1-860.2)	0.02 (0-0.13)
Soldati et al., 2006 ¹¹	30.1 (23.7-37.3)	98.2 (89.2-99.9)	100 (96.4-100)	Infinity	0.02 (0-0.12)
Zhang et al., 2006 ¹	21.5 (16.1-29.5)	98.2 (87.4-99.5)	97.2 (91.3-99.3)	30.5 (9.9-93.8)	0.14 (0.06-0.39)
Soldati et al., 2006 ¹¹	11.5 (7.7-16.6)	82 (72.5-99.6)	99.5 (96.7-100.0)	177.6 (25.1-1258.4)	0.08 (0.02-0.3)

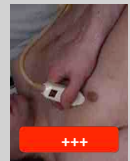
LR(+) = likelihood ratio of a positive test; LR(-) = likelihood ratio of a negative test; US = ultrasound.



- **Meilleure Se et Sp comparable pour l'EPP réalisée par les urgentistes vs RT dans l'évaluation des traumatismes fermés du**

Conduite de l'examen échographique

- **98 % des pneumothorax cliniques sont décollés au moins dans la zone antérieure et inférieure:**
- **Zones d'investigations de niveau 1 et 2**
- **Début d'examen par l'abord culminant = antérieur en décubitus dorsal**



Conduite de l'examen échographique

Occult Traumatic Pneumothorax*

Diagnostic Accuracy of Lung Ultrasonography in the Emergency Department

Gino Soldati, MD; Americo Testa, MD; Sara Sher, MD; Giulia Pignataro, MD; Monica La Sala, MD; and Niccolò Gentilini Silvestri, MD

CHEST / 133 / 1 / JANUARY, 2008

- Etude prospective: 109 patients en VS = trauma fermé du thorax ou polytrauma
- RT, CT et US dans l'heure suivant l'admission
- 25 PNT pour 219 hémithoraxs (2 PNT bilat)

Conduite de l'examen échographique

Table 1—Chest CT Scan, Bx, and US Evaluation of the 25 Cases of PTX*

Case	CT Scan	Bx	US	CT Scan		Bx		US		Diagnosis
				Classification	Side	Classification	Side	Classification	Side	
1	PTX	PTX	PTX	Anterior-lateral	Right	Anterior-lateral	Right	Anterior-lateral	Right	Yes
2	PTX	PTX	PTX	Anterior-lateral	Right	Anterior-lateral	Right	Anterior-lateral	Right	Yes
3	PTX	PTX	PTX	Anterior-lateral	Right	Anterior-lateral	Right	Anterior-lateral	Right	Yes
4	PTX	PTX	PTX	Anterior-lateral	Right	Anterior-lateral	Right	Anterior-lateral	Right	Yes
5	PTX	PTX	PTX	Anterior-lateral	Right	Anterior-lateral	Right	Anterior-lateral	Right	Yes
6	PTX	PTX	PTX	Anterior-lateral	Right	Anterior-lateral	Right	Anterior-lateral	Right	Yes
7	PTX	PTX	PTX	Anterior-lateral	Right	Anterior-lateral	Right	Anterior-lateral	Right	Yes
8	PTX	PTX	PTX	Anterior-lateral	Right	Anterior-lateral	Right	Anterior-lateral	Right	Yes
9	PTX	PTX	PTX	Anterior-lateral	Right	Anterior-lateral	Right	Anterior-lateral	Right	Yes
10	PTX	PTX	PTX	Anterior-lateral	Right	Anterior-lateral	Right	Anterior-lateral	Right	Yes
11	PTX	PTX	PTX	Anterior-lateral	Right	Anterior-lateral	Right	Anterior-lateral	Right	Yes
12	PTX	PTX	PTX	Anterior-lateral	Right	Anterior-lateral	Right	Anterior-lateral	Right	Yes
13	PTX	PTX	PTX	Anterior-lateral	Right	Anterior-lateral	Right	Anterior-lateral	Right	Yes
14	PTX	No PTX	PTX	Anterior	Right	Anterior	Right	Anterior	Right	No
15	PTX	No PTX	PTX	Anterior	Right	Anterior	Right	Anterior	Right	No
16	PTX	No PTX	PTX	Anterior	Right	Anterior	Right	Anterior	Right	No
17	PTX	No PTX	PTX	Anterior	Right	Anterior	Right	Anterior	Right	No
18	PTX	No PTX	PTX	Anterior	Right	Anterior	Right	Anterior	Right	No
19	PTX	No PTX	PTX	Anterior	Right	Anterior	Right	Anterior	Right	No
20	PTX	No PTX	PTX	Anterior	Right	Anterior	Right	Anterior	Right	No
21	PTX	No PTX	PTX	Anterior	Right	Anterior	Right	Anterior	Right	No
22	PTX	No PTX	PTX	Anterior	Right	Anterior	Right	Anterior	Right	No
23	PTX	No PTX	PTX	Anterior	Right	Anterior	Right	Anterior	Right	No
24	PTX	No PTX	No PTX	Anterior	Right	Anterior	Right	Anterior	Right	No
25	PTX	No PTX	No PTX	Anterior	Right	Anterior	Right	Anterior	Right	No
26	No PTX	No PTX	No PTX	Anterior	Right	Anterior	Right	Anterior	Right	No

*PTX = high intercostal space; Bx = within intercostal space; L = low intercostal space. The degree of difference between the CT scan and US assessments is expressed in absolute values (in parentheses).

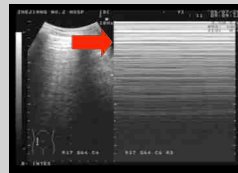
→ Niveau d'investigation 1 et 2

Symptomatologie élémentaire: Disparition du glissement pleural

- Disparition du glissement pleural = signe élémentaire
- Targhetta R, Bourgeois JM et Balmes JL. Ultrasonic approach to diagnosing hydropneumothorax. **CHEST 1992**



Pas de mouvement de la ligne pleurale durant le cycle respiratoire en mode B



Ligne pleurale sans ondulation durant le cycle respiratoire en mode TM

Symptomatologie élémentaire: Disparition du glissement pleural

CHEST

Original Research

CHEST IMAGING

Occult Traumatic Pneumothorax* Diagnostic Accuracy of Lung Ultrasonography in the Emergency Department

Gino Soldati, MD; Americo Testa, MD; Sara Sher, MD; Giulia Pignataro, MD; Monica La Sala, MD; and Niccolò Gentilini Silvestri, MD

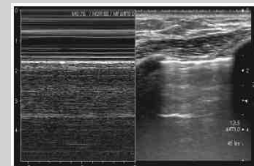


FIGURE 1. Normal US lung imaging in M-mode (left) and B-mode (right)

PNT (-)

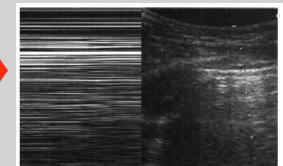


FIGURE 2. US PTX in M-mode (left) and B-mode (right)

PNT (+)

Symptomatoologie élémentaire: Disparition du glissement pleural

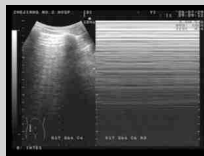
CHEST
Official publication of the American College of Chest Physicians

Lichtenstein D et Menu Y.
**A bedside ultrasound sign ruling out
pneumothorax in critically ill: lung sliding.**
Chest 108 : 1345-1348

**Sensibilité 95 %; 100 % (si on
élimine les emphysèmes sous
cutanés)**

VPN = 100 %

Problème: Spécificité basse = 78 %



Symptomatoologie élémentaire: Profil A exclusif

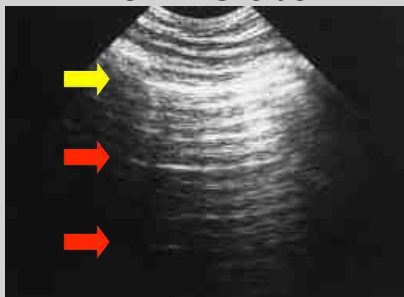
**Disparition de toutes lignes B (générées par la
plèvre viscérale) = Profil A exclusif**



« Signe de la stratosphere »



Symptomatoologie élémentaire: Profil A exclusif



Absence de ligne b = profil lignes A exclusives

Symptomatoologie élémentaire: Profil A exclusif

Intensive Care Med (1999) 25: 383-388
© Springer-Verlag 1999

ORIGINAL

D. Lichtenstein
G. Mezière
P. Biderman
A. Gepner

**The comet-tail artifact: an ultrasound sign
ruling out pneumothorax**

- 42 PNT (chez 41 patients) et 148 hémithorax sans PNT (74 patients de ICU)
- Confirmation diagnostique = CT
- **Positive test for PNT = aucune ligne B et présence exclusive de ligne A sur tout le champ d'investigation antérieur**

Symptomatologie élémentaire: Profil A exclusif

Table 1 Overall reliability of comet-tail artifact analysis at the anterior chest wall

	"Comet-tail artifacts" present	"Comet-tail artifacts" absent ^a	Non-artifactual patterns ^b	Uninterpretable examination	Total
Pneumothorax group	0	41	0	1	42
Pneumothorax-free group	87	56	3	2	148

^a Replaced by horizontal artifacts

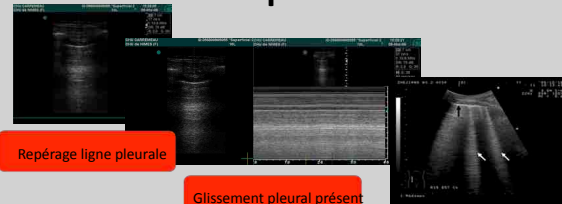
^b Alveolar consolidation or pleural effusion

Table 3 Combination of comet-tail artifact and lung sliding analysis (41 analyzable complete pneumothoraces and 143 analyzable hemithoraces with artifactual pattern)

	Horizontal artifacts and absent lung sliding	Horizontal artifacts plus lung sliding	"Comet-tail artifacts" plus lung sliding	"Comet-tail artifacts" and absent lung sliding	Total
Proven complete pneumothorax	41	0	0	0	41
Proven absence of pneumothorax	5	51	53	34	143

Se = 100%
Mais Sp = 60 %

En pratique clinique: Eliminer un pneumothorax



= Absence de PNEUMOTHORAX

En pratique clinique: Affirmer le pneumothorax ?

- **Problématique:** affirmer le pneumothorax avec un degré de certitude diagnostic satisfaisant ?
- **Disparition du glissement pleural** (VPN et Se=95% mais Sp=60%)
- **Absence de ligne b = profil lignes A exclusives** (Se=100% mais Sp=60%)

Symptomatologie combinée: Absence de glissement + Profil A

Ultrasound diagnosis of occult pneumothorax*

Daniel A. Lichtenstein, MD; Gilbert Mezière, MD; Nathalie Lascols, MD; Philippe Biderman, MD; Jean-Paul Courret, MD; Agnès Gepner, MD; Ivan Goldstein, MD; Marc Tenoudji-Cohen, MD

Crit Care Med 2005 Vol. 33, No. 6

- 43 PNT occultes (non trouvés sur RT) et confirmés par CT et 155 patients au groupe contrôle.
- Étude du glissement pleural, lignes A et absence de lignes B

Symptomatologie combinée: Absence de glissement + Profil A exclusif

Table 2: Overall results

	Occult Pneumothorax Group	Pneumothorax-Free Group
Step 1—abolished lung sliding	43 of 43	65 of 302
Step 2—abolished lung sliding + the A line sign	43 of 43	16 of 302
Step 3—no lung sliding + not a true sign = lung point	43 of 43	0 of 302



	Occult Pneumothorax Group		Pneumothorax-Free Group	
	A Line Sign	B Lines	A Line Sign	B Lines
Lung sliding present	0	0	98	129
Lung sliding absent	41	2	16	49

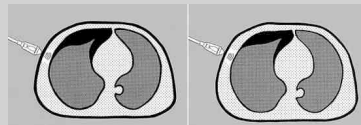
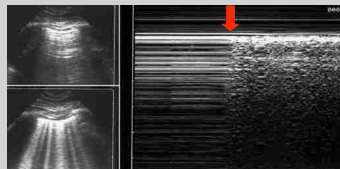
Table 4: Accuracy of ultrasound as a function of the number of signs used

	Pneumothorax	Control Group
Lung sliding (LS) abolished	43 of 43	65 of 302
LS abolished + A line sign	43 of 43	16 of 302
LS abolished + A line sign + lung point	43 of 43	0 of 302
Sensitivity, %		Specificity, %
LS abolished	100	71
LS abolished + A line sign	100	84
LS abolished + A line sign + lung point	100	100

Pour le diagnostic de PNT:

**Abolition de glissement pleural +
profil A exclusif**

Symptomatologie élémentaire: Point Poumon

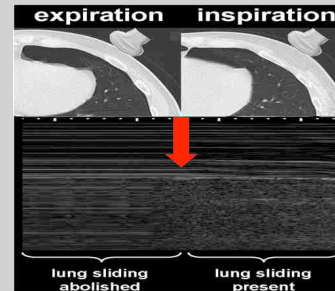


Point poumon

Symptomatologie élémentaire: Point Poumon

- Le **point poumon** correspond à la **jonction accolement expiratoire-décollement inspiratoire**.
- Soit une jonction entre zone de glissement pleural présent et absent.
- Soit une jonction en mode TM entre une zone de « signe de bord de mer » et zone de ligne A exclusives
- En général localisé en antérieur ou latéral (niveau d'investigation 1 ou 2)
- **Spécifique de pneumothorax**

Symptomatologie élémentaire: Point Poumon



Pleural Ultrasound Compared With Chest Radiographic Detection of Pneumothorax Resolution After Drainage

Arnaud Garbino, Hatif Ali-Oufella, Jean-Luc Baudel, Tomek Kofman, Julie Boffiers, Stéphanie Viennet, Clémentine Riababe, Salima Jabbour, Abdelham Bouzeman, Bertrand Guidet, Georges Offenstadt and Eric Maury

CHEST / 138 / 3 / SEPTEMBER, 2010

Point poumon

Symptomatologie élémentaire: Point Poumon

Intensive Care Med (2000) 26:1434-1440
DOI 10.1007/s001340000627

ORIGINAL

Daniel Lichtenstein
Gilbert Mezière
Philippe Biderman
Agnès Gepner

The "lung point": an ultrasound sign specific to pneumothorax

- Prospectif, 70 PNT consécutifs en ICU chez 64 patients
- 50 en VS et 20 en VM et 51 ont nécessité un drainage
- Groupe contrôle : 238 poumons chez 139 patients consécutifs ayant bénéficié d'un CT

Symptomatologie élémentaire: Point Poumon

Table 1 Detection and location of the "lung point" (70 cases of pneumothorax and 238 controls)

Radiography ¹ (1) or CT ² (2)	Ultrasound patterns at the chest wall in supine patients					
	"Lung point" present (n = 44)			"Lung point" absent	Other patterns ⁴	Non-feasible study
	Anterior	Lateral	Posterior			
Pneumothorax						
Radio-ocult ²	5	1	0	2	0	2
Partial ¹	9	1	1	3	0	0
Complete and moderate ¹	3	7	2	2	0	0
Complete retraction ¹	0	8	7	12	0	2
Parietal adhesions ¹	0	0	0	2	0	0
Control group ²	0	0	0	233	3	2

¹ anterior alveolar syndrome or pleural effusion

Table 3 "Lung point" of 66 analyzable cases of pneumothorax and 233 analyzable controls with air pattern

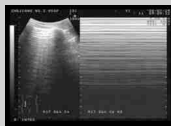
	Ultrasound	
	"Lung point" detected	"Lung point" not detected
Pneumothorax patient on radiography ¹	38	20
Radio-ocult pneumothorax ²	0	2
Control group ²	0	233

- Point poumon:

➤ Sp = 100%

➤ Se = 66%

En pratique clinique: Affirmer un pneumothorax



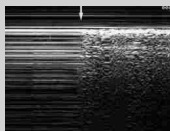
Absence de
glissement pleural



Profil lignes A
exclusives



**Diagnostic
probable**
Sp = 96%



Point poumon



Diagnostic certain
Sp = 100 %

En pratique clinique: Affirmer un pneumothorax

