Echographie & Pathologies Pulmonaires

15 *Raisons pour le Pneumologue en 2015*

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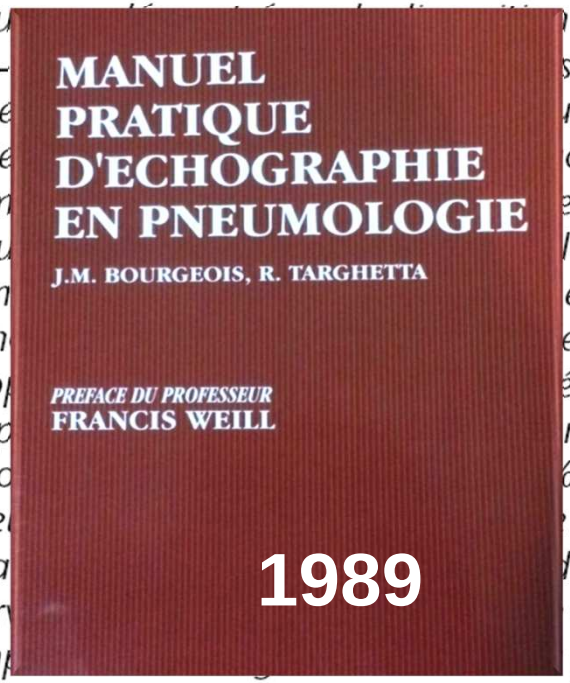
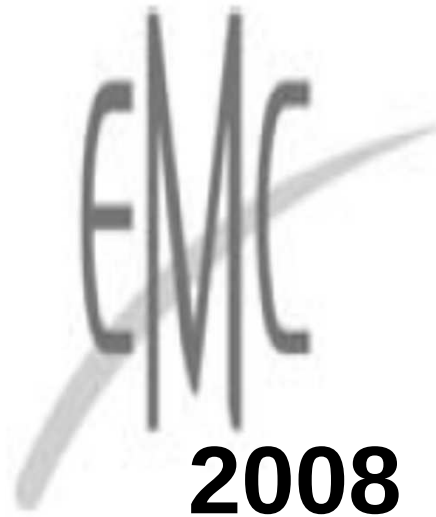
Échographie thoracique en pneumologie

R. Targhetta, J.-M. Bourgeois, J.-M. Sorokaty, H. Sharara, F.-M. Lopez

*L'air pulmonaire représentant un obstacle infranchissable aux ultrasons par un mécanisme de réflexion totale, l'échographie thoracique a été considérée pendant longtemps comme ayant des applications cliniques limitées en dehors des épanchements pleuraux liquidiens. Depuis, de nombreuses publications ont été rapportées, validant cette procédure dans différentes situations cliniques en pneumologie. Les lésions de la paroi thoracique, incluant les lyses osseuses, peuvent être détectées et ponctionnées. L'évaluation de l'extension pariétale d'un cancer bronchique par les ultrasons apparaît plus pertinente, comparée au scanner. Le diagnostic de pneumothorax devient possible en utilisant une sonde haute fréqu du signe du glissement et des échos artéfactiels (*comet-tail *et/ou* ring- surface pulmonaire hyperéchogè que *prése* ue et doit être reconnu par les éc rès *toute* chements, la visualisation directe ites *perm* e en temps réel une ponction si r de *nodu* logiques, à travers la fenêtre ac des *élém* e maligne et guide le geste in de *bron* es, correspondant à des broncl net *d'ap* émentaires par rapport aux rayo ires *périp* roi, l'échographie offre une pro stic *histo* % des cas) avec un très ons *(pne* : 1,8 %). En comparaison au s les *ultra* de l'aiguille en temps réel dan ste *inter* coût. En conclusion, l'échograph gue *d'im* pratique quotidienne, chez des patients sélectionnés, permettant un guidage précis, non irradiant et fiable si un geste interventionnel est retenu. De plus, sa portabilité en fait une procédure de choix chez les patients alités.*





Echographie et Poumon : 15 Raisons ?

1/ Territorialité

2/ Développement en Réanimation/Urgences

3/ … Et en Néonatologie/Pédiatrie

4/ Pneumopathie

5/ Syndrome interstitiel

6/ Lésion pulmonaire périphérique

7/ Procédure autonome (ponction)

8/ Envahissement pariétal

9/ Lyse osseuse

10/ Repérage des vaisseaux

11/ International « Evidence based recommendations »

12/ Echographie pulmonaire VS RX/auscultation ?

13/ Echographie pulmonaire aux Urgences : un « raccourci » diagnostic ?

14/ Réduction imagerie RX/TDM (Soins intensifs)

15/ Femme enceinte

Gargani *Cardiovascular Ultrasound* 2011, **9**:6
http://www.cardiovascularultrasound.com/content/9/1/6

2011

1 Territorialité

CARDIOVASCULAR ULTRASOUND

REVIEW Open Access

Lung ultrasound: a new tool for the cardiologist

Luna Gargani

Abstract

For many years the lung has been considered off-limits for ultrasound. However, it has been recently shown that lung ultrasound (LUS) may represent a useful tool for the evaluation of many pulmonary conditions in cardiovascular disease. The main application of LUS for the cardiologist is the assessment of B-lines. B-lines are reverberation artifacts, originating from water-thickened pulmonary interlobular septa. Multiple B-lines are present in pulmonary congestion, and may help in the detection, semiquantification and monitoring of extravascular lung water, in the differential diagnosis of dyspnea, and in the prognostic stratification of chronic heart failure and acute coronary syndromes.

Background

Sonographic prejudices: the history of lung ultrasound

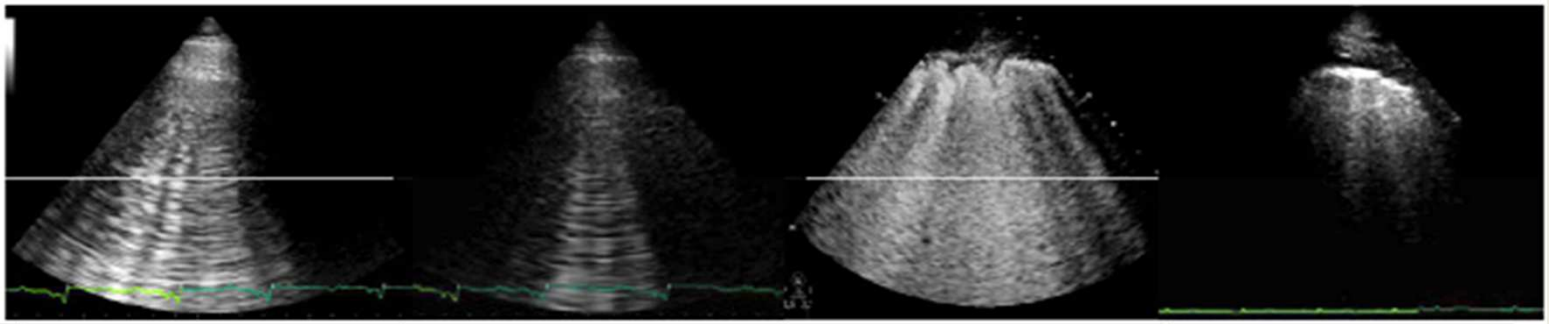
For many years ultrasound has not been employed for the evaluation of the lung [1]. All diagnostic ultrasound methods are based on the principle that ultrasound is reflected by an interface between media with different acoustic impedance. In normal conditions, with aerated lungs, the ultrasound beam finds the lung air and no

the lung becomes completely open, and the lung may be directly visualized as a solid parenchyma, as the liver or the spleen (figure 1). Consolidations may be then measured and followed-up.

There are some anectodical reports on B-lines since the eighties [3,4]. In 1994, Targetta firstly described the presence of B-lines in diseased lungs [5]. But it was Daniel Lichtenstein, a French intensivist, who established for

1

Territorialité



	Acute cardiogenic pulmonary edema	Chronic heart failure	ALI/ARDS	Pulmonary fibrosis
Clinical setting	acute	chronic	acute	chronic
B-lines number	++++	+/++/+++	++++	+/++/+++
B-lines distribution	multiple, diffuse, bilateral (white lung)	multiple, diffuse, bilateral, following decubitant regions (black and white lung)	non-homogeneous distribution, presence of spared areas	more frequently posterior at lung basis
Other LUS signs	pleural effusion	pleural effusion	pleural effusion, pleural alterations, parenchymal consolidations of various size	pleural thickening
Echocardiogram	abnormal	abnormal	likely normal	likely normal

ALI = acute lung injury; ARDS = acute respiratory distress syndrome; LUS = lung ultrasound.

2011

Figure 5 How to distinguish different etiologies of interstitial syndrome by lung ultrasound.

Lung ultrasound in the critically ill

Daniel A Lichtenstein

Développement en Réanimation **2**

Lichtenstein *Annals of Intensive Care* 2014, **4**:1

Abstract

Lung ultrasound is a basic application of critical ultrasound, defined as a loop associating urgent diagnoses with immediate therapeutic decisions. It requires the mastery of ten signs: the bat sign (pleural line), lung sliding (yielding seashore sign), the A-line (horizontal artifact), the quad sign, and sinusoid sign indicating pleural effusion, the fractal, and tissue-like sign indicating lung consolidation, the B-line, and lung rockets indicating interstitial syndrome, abolished lung sliding with the stratosphere sign suggesting pneumothorax, and the lung point indicating pneumothorax. Two more signs, the lung pulse and the dynamic air bronchogram, are used to distinguish atelectasis from pneumonia. All of these disorders were assessed using CT as the "gold standard" with sensitivity and specificity ranging from 90% to 100%, allowing ultrasound to be considered as a reasonable bedside "gold standard" in the critically ill. The BLUE-protocol is a fast protocol (<3 minutes), which allows diagnosis of acute respiratory failure. It includes a venous analysis done in appropriate cases. Pulmonary edema, pulmonary embolism, pneumonia, chronic obstructive pulmonary disease, asthma, and pneumothorax yield specific profiles. Pulmonary edema, e.g., yields anterior lung rockets associated with lung sliding, making the "B-profile." The FALLS-protocol adapts the BLUE-protocol to acute circulatory failure. It makes sequential search for obstructive, cardiogenic, hypovolemic, and distributive shock using simple real-time echocardiography (right ventricle dilatation, pericardial effusion), then lung ultrasound for assessing a direct parameter of clinical volemia: the apparition of B-lines, schematically, is considered as the endpoint for therapy. Other aims of lung ultrasound are decreasing medical irradiation: the LUCIFLR program (most CTs in ARDS or trauma can be postponed), a use in traumatology, intensive care unit, neonates (the signs are the same than in adults), many disciplines (pulmonology, cardiology…), austere countries, and a help in any procedure (thoracentesis). A 1992,

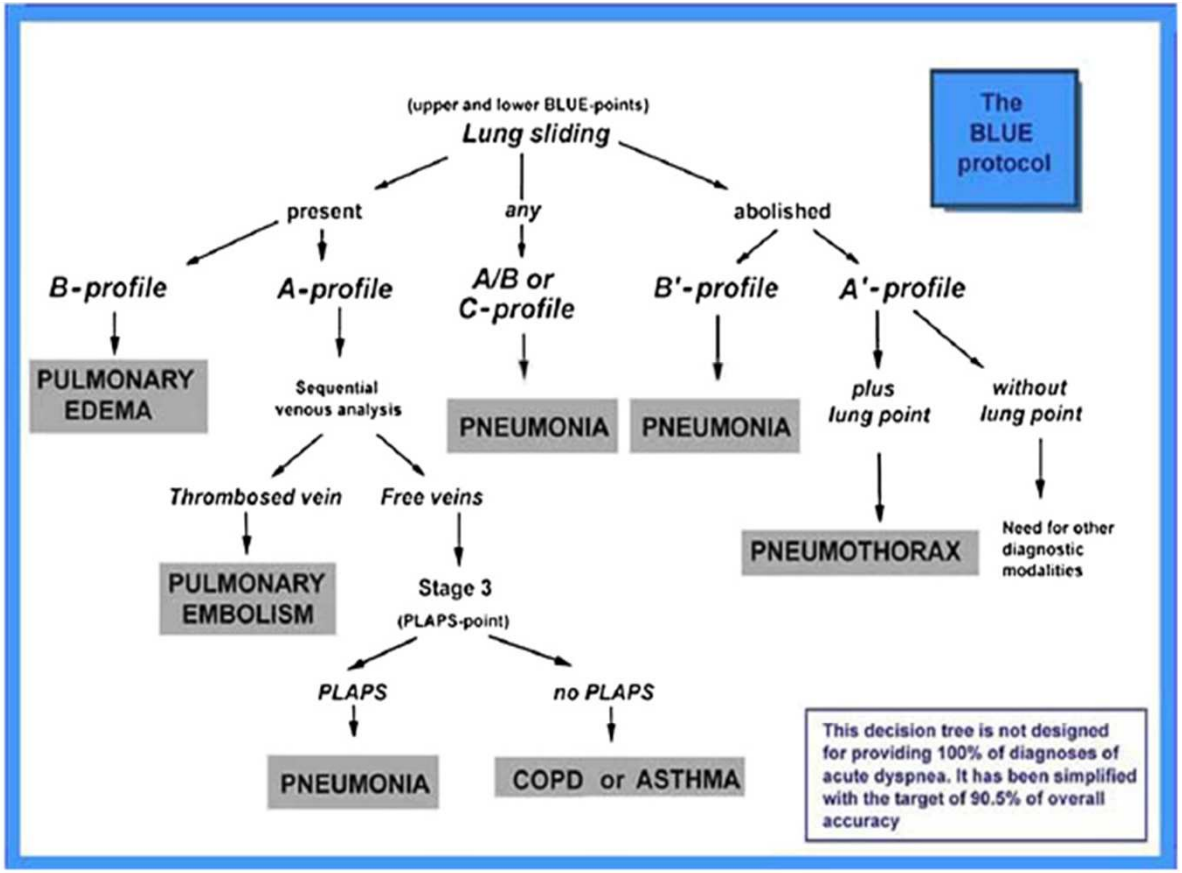
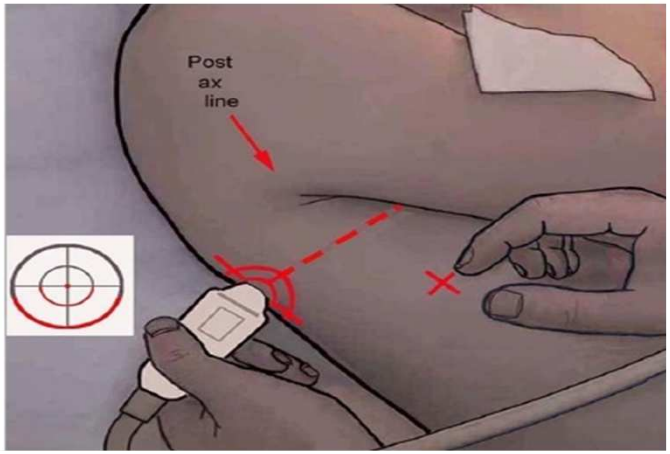


Figure 8 The BLUE-protocol decision tree. This decision tree, slightly modified from the original article (Chest 2008;134:117–125), with the permission of *Chest*, indicates a way proposed for immediate diagnosis of the main causes of acute respiratory failure, using a lung and venous ultrasound approach.

Lichtenstein *Annals of Intensive Care* 2014,



2

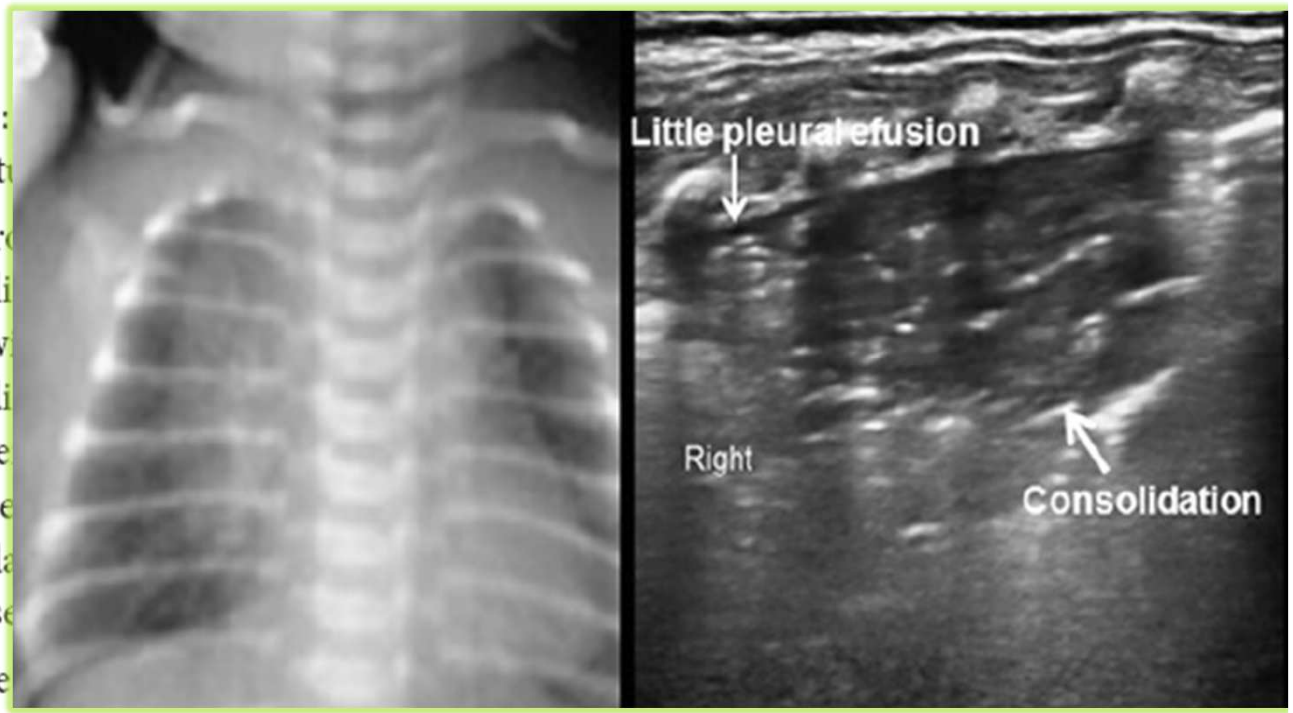
[Développement en Réanimation]

Lung Ultrasonography for the Diagnosis of Severe Neonatal Pneumonia

Jing Liu, MD, PhD; Fang Liu, MD; Ying Liu, MD; Hua-Wei Wang, MD; and Zhi-Chun Feng, MD

3

Néonatologie



BACKGROUND: adults. This st

METHODS: Fr Hospital, affili 40 neonates w and chest radi jects underwe cian performe lung consolida and lung pulse

RESULTS: The areas of lung consolidation with irregular margins and air bronchograms, pleural line abnormalities, and interstitial syndrome. A large area of lung consolidation with irregular margins had 100% sensitivity and 100% specificity for the diagnosis of neonatal pneumonia.

CONCLUSIONS: Lung ultrasonography is a reliable tool for diagnosing neonatal pneumonia. It is suitable for routine use in the neonatal ICU and may eventually replace chest radiography and CT scanning.

CHEST 2014; 146(2):383-388

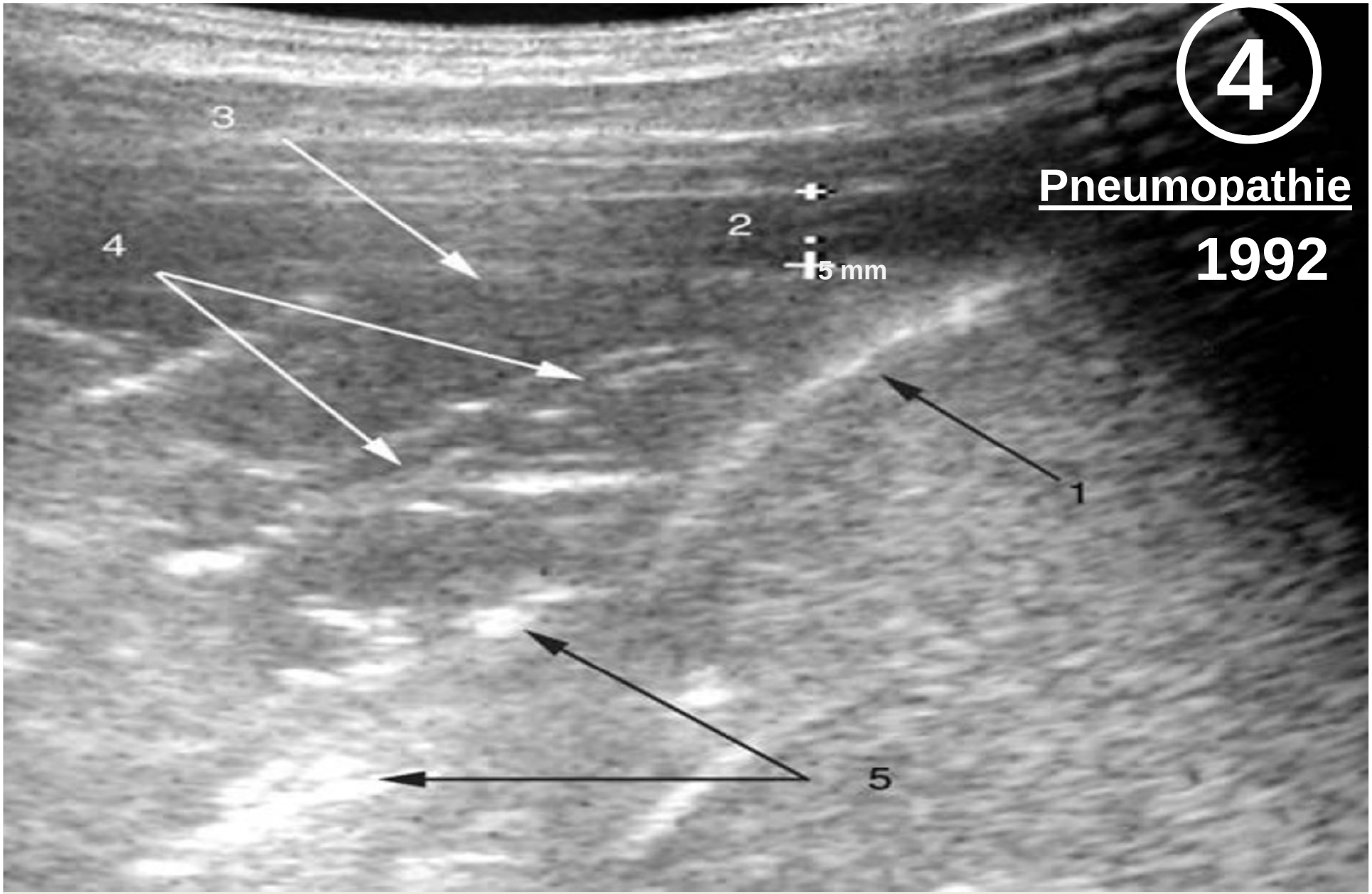
2014

4 Pneumopathie

2008

Bronchogramme hydrique ou liquidien

Lorsque les bronches ou les bronchioles sont remplies de sécrétions pathologiques, entourées d'un syndrome de comblement alvéolaire, celles-ci deviennent invisibles sur une radiographie standard. À l'opposé, en échographie, les parois bronchiques sont échogènes et présentent un contraste échodécelable du fait du syndrome alvéolaire péribronchique [72] et de leur contenu transsonore (sécrétions muqueuses et/ou purulentes par exemple). Le bronchogramme hydrique (dit également liquidien) est une structure tubulaire qui laisse passer les ultrasons, se distinguant ainsi du bronchogramme aérique (Fig. 10). Il est présent dans 92 % des cas d'une série de 50 cas [68]. Il se distingue des images tubulaires artérielles par son absence de pulsatilité [72]. Le doppler codé couleur est une méthode aisée de différenciation.



Sonographic approach to diagnosing pulmonary consolidation

Targhetta R, Chavagneux R, Bourgeois JM, Dauzat M, Balmes P, Pourcelot L.

J Ultrasound Med. 1992;11(12):667-72

4

Lung ultrasound for the diagnosis of pneumonia in adults: a systematic review and meta-analysis

Miguel A Chavez[1,2], Navid Shams[1], Laura E Ellington[1], Neha Naithani[3], Robert H Gilman[3], Mark C Steinhoff[4], Mathuram Santosham[3], Robert E Black[3], Carrie Price[5], Margaret Gross[5] and William Checkley[1,3*]

Chavez *et al. Respiratory Research* 2014, 15:50

Abstract

Background: Guidelines do not currently recommend the use of lung ultrasound (LUS) as an alternative to chest X-ray (CXR) or chest computerized tomography (CT) scan for the diagnosis of pneumonia. We conducted a meta-analysis to summarize existing evidence of the diagnostic accuracy of LUS for pneumonia in adults.

Methods: We conducted a systematic search of published studies comparing the diagnostic accuracy of LUS against a referent CXR or chest CT scan and/or clinical criteria for pneumonia in adults aged ≥18 years. Eligible studies were required to have a CXR and/or chest CT scan at the time of evaluation. We manually extracted descriptive and quantitative information from eligible studies, and calculated pooled sensitivity and specificity using the Mantel-Haenszel method and pooled positive and negative likelihood ratios (LR) using the DerSimonian-Laird method. We assessed for heterogeneity using the Q and I^2 statistics.

Results: Our initial search strategy yielded 2726 articles, of which 45 (1.7%) were manually selected for review and 10 (0.4%) were eligible for analyses. These 10 studies provided a combined sample size of 1172 participants. Six studies enrolled adult patients who were either hospitalized or admitted to Emergency Departments with suspicion of pneumonia and 4 studies enrolled critically-ill adult patients. LUS was performed by highly-skilled sonographers in seven studies, by trained physicians in two, and one did not mention level of training. All studies were conducted in high-income settings. LUS took a maximum of 13 minutes to conduct. Nine studies used a 3.5-5 MHz micro-convex transducer and one used a 5–9 MHz convex probe. Pooled sensitivity and specificity for the diagnosis of pneumonia using LUS were 94% (95% CI, 92%-96%) and 96% (94%-97%), respectively; pooled positive and negative LRs were 16.8 (7.7-37.0) and 0.07 (0.05-0.10), respectively, and the area-under-the-ROC curve was 0.99 (0.98-0.99).

Conclusions: Our meta-analysis supports that LUS, when conducted by highly-skilled sonographers, performs well for the diagnosis of pneumonia. General practitioners and Emergency Medicine physicians should be encouraged to learn LUS since it appears to be an established diagnostic tool in the hands of experienced physicians.

5 Syndrome interstitiel

1994

Journal of Ultrasound in Medicine

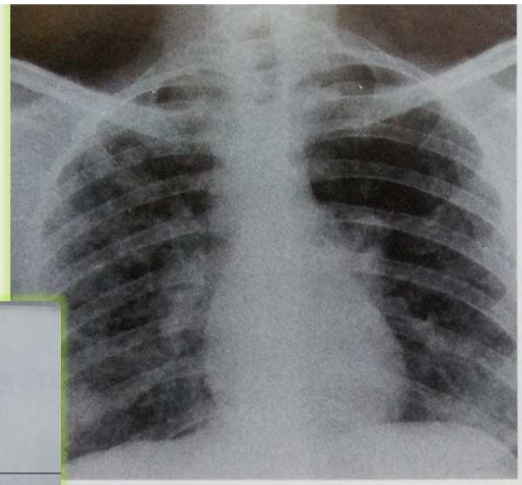
Sonographic Lung Surface Evaluation i Pulmonary Sarcoidosis:

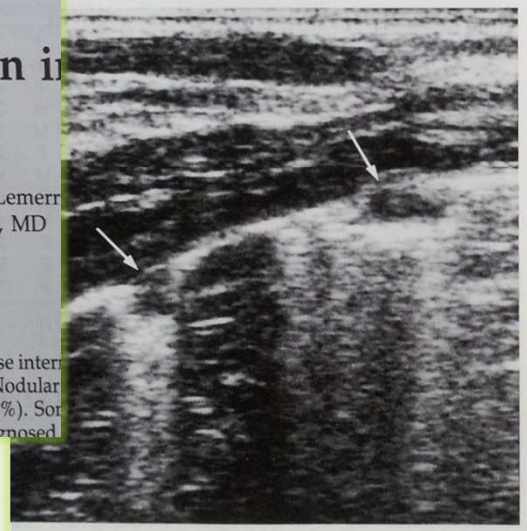
Preliminary Results

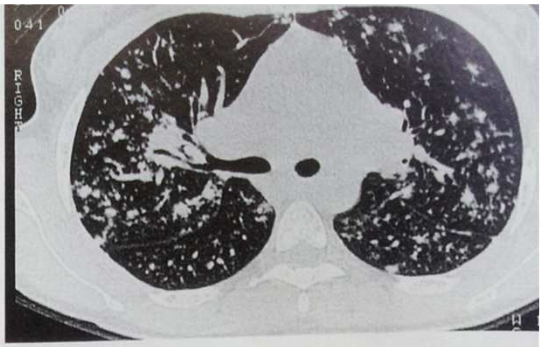
Rémi Targhetta, MD, Roseline Chavagneux, MD, Pierre Balmes, MD, Charles Lemerr
Jean-Marc Mauboussin, MD, Jean-Marie Bourgeois, MD, Léandre Pourcelot, MD

The value of sonography in lung diseases such as sarcoidosis is not established. Twelve patients with pulmonary sarcoidosis and eight control subjects underwent a sonographic examination using a high fre-

peared irregular and rough with coarse interr producing an increase of artifacts. Nodular were found in nine of 12 patients (75%). Sor also revealed abnormalities not diagnosed







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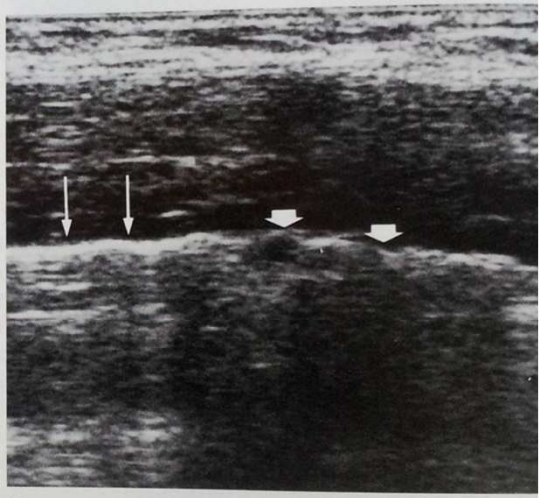

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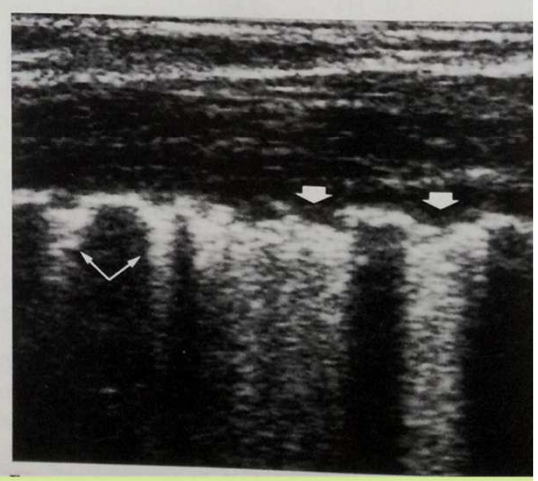


ure 4 A, B, Radiographs showing mediastinal lymph des and diffuse reticulonodular parenchymal abnormal- s (patient 1). C–E Sonograms at different intercostal aces (same patient). Sonography demonstrates the main tterns of the pulmonary surface occurring in sarcoidosis. Nodular patterns (*arrows*); D, disappearance (*arrowheads*) lung surface (*arrows*); E, interruptions of lung surface *rowheads*), which appears smooth and irregular with an crease of reverberation echo artifacts, especially comet- ls (*arrows*). Real time allows a better visualization of these normalities, thus emphasizing the gliding sign of the lmonary surface

Comparison of a new, modified lung ultrasonography technique with high-resolution CT in the diagnosis of the alveolo-interstitial syndrome of systemic scleroderma

Afshin Mohammadi[1], Sima Oshnoei[2], Mohammad Ghasemi-rad[3]

Syndrome interstitiel 5

Med Ultrason 2014, Vol. 16, no. 1, 27-31

Table I. The 10 intercostal sites used for ultrasound examination

Location	Anatomical line	US B- Line assessment (right and left)
Anterior	mid-clavicular	4th ICS
Lateral	anterior axillary	4th ICS
	mid-axillary	4th ICS
Posterior	sub-scapular	8th ICS
	posterior axillary	8th ICS

ICS – intercostals site

Table II. The Warrick scoring system for alveolo-interstitial involvement

Parenchymal alteration	Severity score
Ground glass opacities	1
Irregular pleural margins	2
Septal/subpleural lines	3
Honeycombing	4
Subpleural cysts	5
Number of lung segments	
1–3	1
4–9	2
>9	3

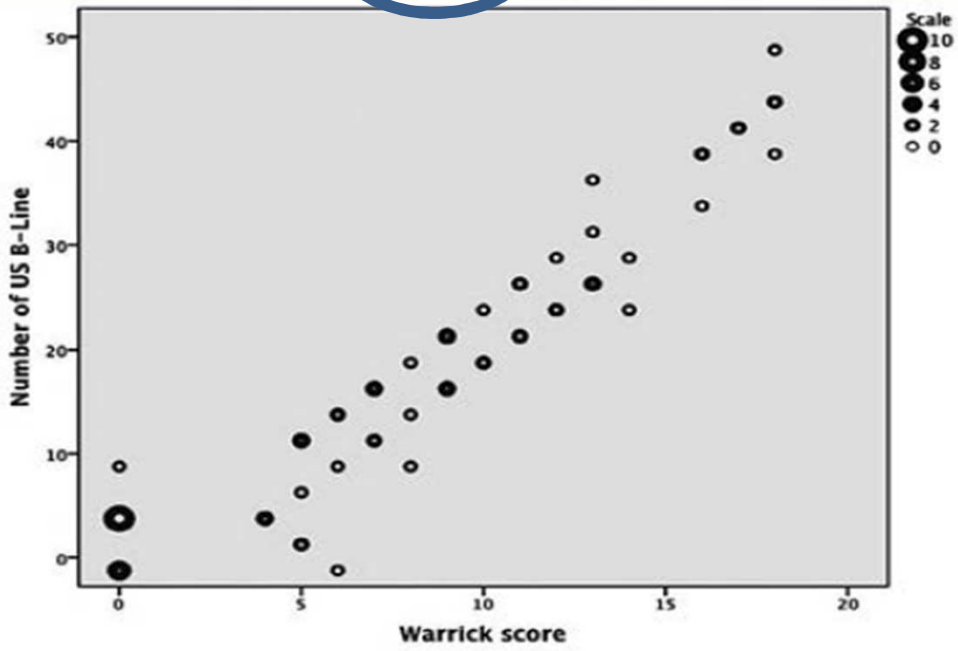


Fig 5. The correlation between HRCT and TTUS.

pulmonary involvement. **Patients and method:** Seventy subjects with SSc diagnosed according to the American College of Rheumatology criteria were enrolled. All subjects underwent HRCT followed by TTUS for comet tail sign detection in order to predict the degree of lung fibrosis. The modified TTUS assessment was performed at 10 intercostals spaces level. **Results:** A significantly positive correlation between TTUS and the severity of pulmonary involvement (Spearman's correlation coefficient= 0.695, P < 0.001), (LR=74.36, P<0.001) was found. When compared with HRCT as the gold standard method, the sensitivity, specificity, positive and negative predictive value of TTUS was 73.58%, 88.23%, 95.12% and 51.72% respectively. Kappa values for the intra-observer modified TTUS assessment was 0.838. **Conclusions:** Our study showed that the modified TTUS comet tails scoring system could be useful in the assessment of the pulmonary involvement in patients with SSc.

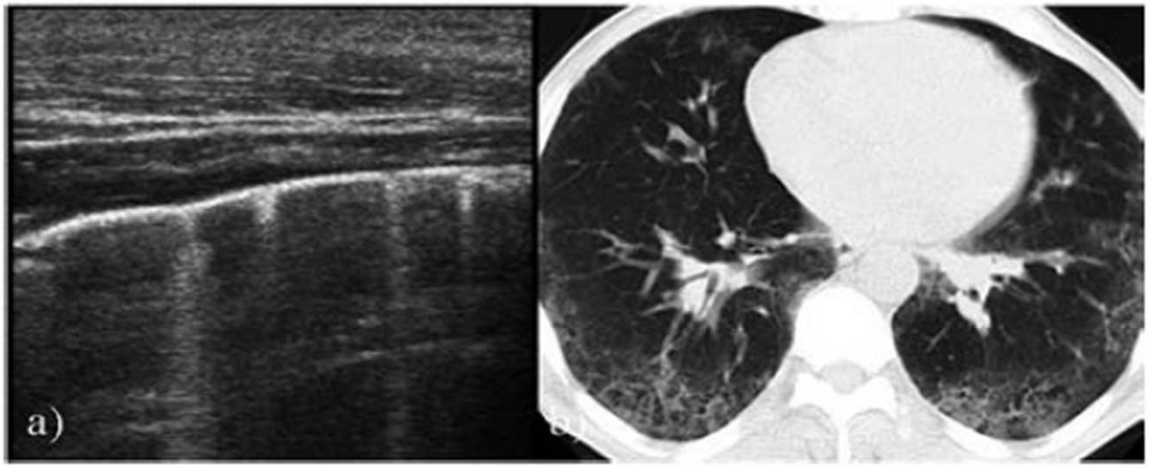


Fig 3. a) The comet tail sign (4 B-lines) in moderate form of alveolo-interstitial involvement in systemic sclerosis. b) HRCT showing moderate form of alveolo-interstitial involvement in systemic sclerosis (Warrick score=14).

Med Ultrason 2014, Vol. 16, no. 1, 27-31

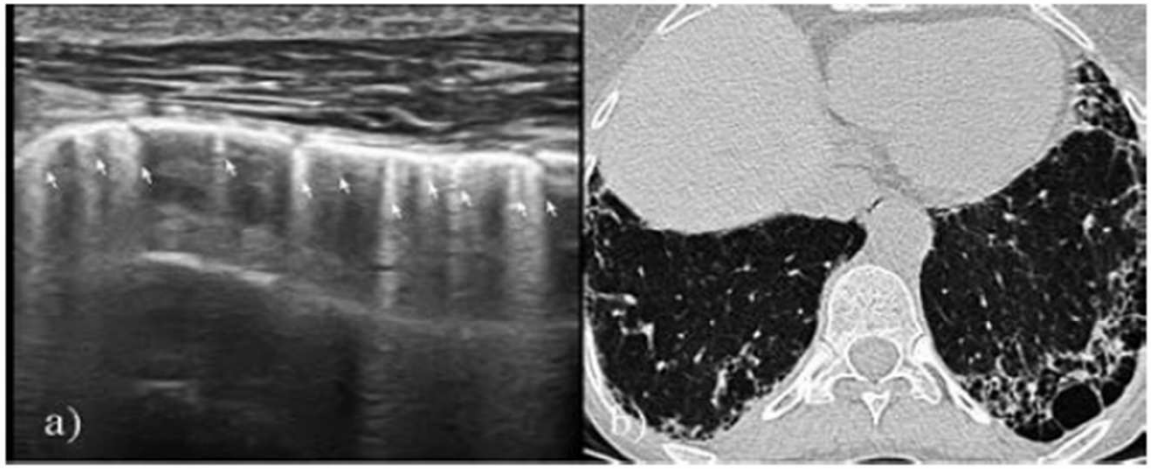


Fig 4. a) The comet tail sign (several B-lines) in the severe form of alveolo-interstitial involvement in systemic sclerosis. b) HRCT showed severe form of alveolo-interstitial involvement in systemic sclerosis (Warrick score = 30).

Journal of Ultrasound in Medicine
VOLUME 12, NUMBER 7 JULY 1993

1993

6

Lésion pulmonaire périphérique

Peripheral Pulmonary Lesions:
Ultrasonic Features and Ultrasonically Guided Fine Needle Aspiration Biopsy

Remi Targhetta, MD, Jean-Marie Bourgeois, MD, Christiane Marty-Double, MD,
Estelle Coste, MD, Alain Proust, MD, Pierre Balmes, MD, Leandre Pourcelot, MD

When transthoracic biopsy is required for diagnosing lung diseases, radiographic procedures are the methods of choice, sonographic application being still limited. Sixty-four consecutive patients with pulmonary lesions adjacent to the chest wall underwent sonography. Findings showed hypoechoic homogeneous lesions (56 cases) with posterior regular margin (57 cases). Increasing echoes deep to the mass and sonographic interruption of hyp
seen in all patients. In two cas
had been diagnosed. Histolog
in 55 of the 64 patients (85.9%)
occurred. Sonography is a us
technique for diagnosing selec
KEY WORDS: Ultrasound; Lung
Fine needle aspiration biopsy;

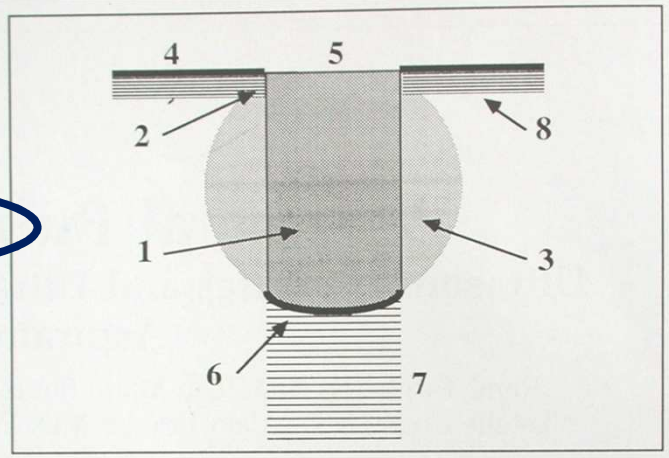


Figure 1 Schematic drawing of the sonographic visualization of a peripheral pulmonary lesion through the intercostal space, using a linear array scanner. This homogeneous hypoechoic lesion (**1**) with no tapered edge produces a right angle (**2**) between the lesion and the chest wall when a linear probe is used. Note the lateral underlying structures masked (**3**) by aerated lung surface (**4**). The sonographic disappearance (**5**) of the hyperechoic pulmonary surface (**4**) and the hyperechoic posterior margin (**6**) generating apparent enhancement artifacts (**7**) were, in all cases, visualized in our series. Echo reverberation artifacts are produced by aerated lung (**8**). In real time, it is necessary to look for the "gliding sign" between the lesion and the chest wall.

Peripheral pulmonary lesions: ultrasonic features and ultrasonically guided fine needle aspiration biopsy
Targhetta R, Bourgeois JM, Marty-Double C, and al.

J Ultrasound Med. 1993;12:369-74

6

Pleural and Peripheral Lung Lesions: Comparison of US- and CT-guided Biopsy[1]

Luca Maria Sconfienza, MD, PhD

Radiology: Volume 266: Number 3—March 2013

Radiology

Implication for Patient Care

- Compared with CT guidance, US-guided biopsy of pleural and peripheral lung nodules has a 9% lower incidence of postprocedural pneumothorax, with a 42% shorter median procedure time and a comparable technical success rate (97.1% with US guidance, 96.5% with CT guidance) without the use of ionizing radiation.

Parameter	Overall	US Guidance	CT Guidance
No. of patients	273	103	170
Men	115	44	71
Women	158	59	99
Mean age (y)†	65 ± 11	67 ± 10	64 ± 12
Men	67 ± 9	66 ± 9	65 ± 10
Women	64 ± 12	67 ± 11	63 ± 12
No. of lesions	273	103	170
Pleural lesions	86 (31.5)	31 (30.1)	55 (32.4)
Peripheral pulmonary lesions	187 (68.5)	72 (69.9)	115 (67.6)
Mean lesion diameter (cm)†	2.5 ± 0.9	2.6 ± 0.9	2.4 ± 0.8

Advantages of Thoracic Ultrasound-Guided Fine-Needle Aspiration Biopsy in Lung Cancer and Mesothelioma

6

Nov 2014

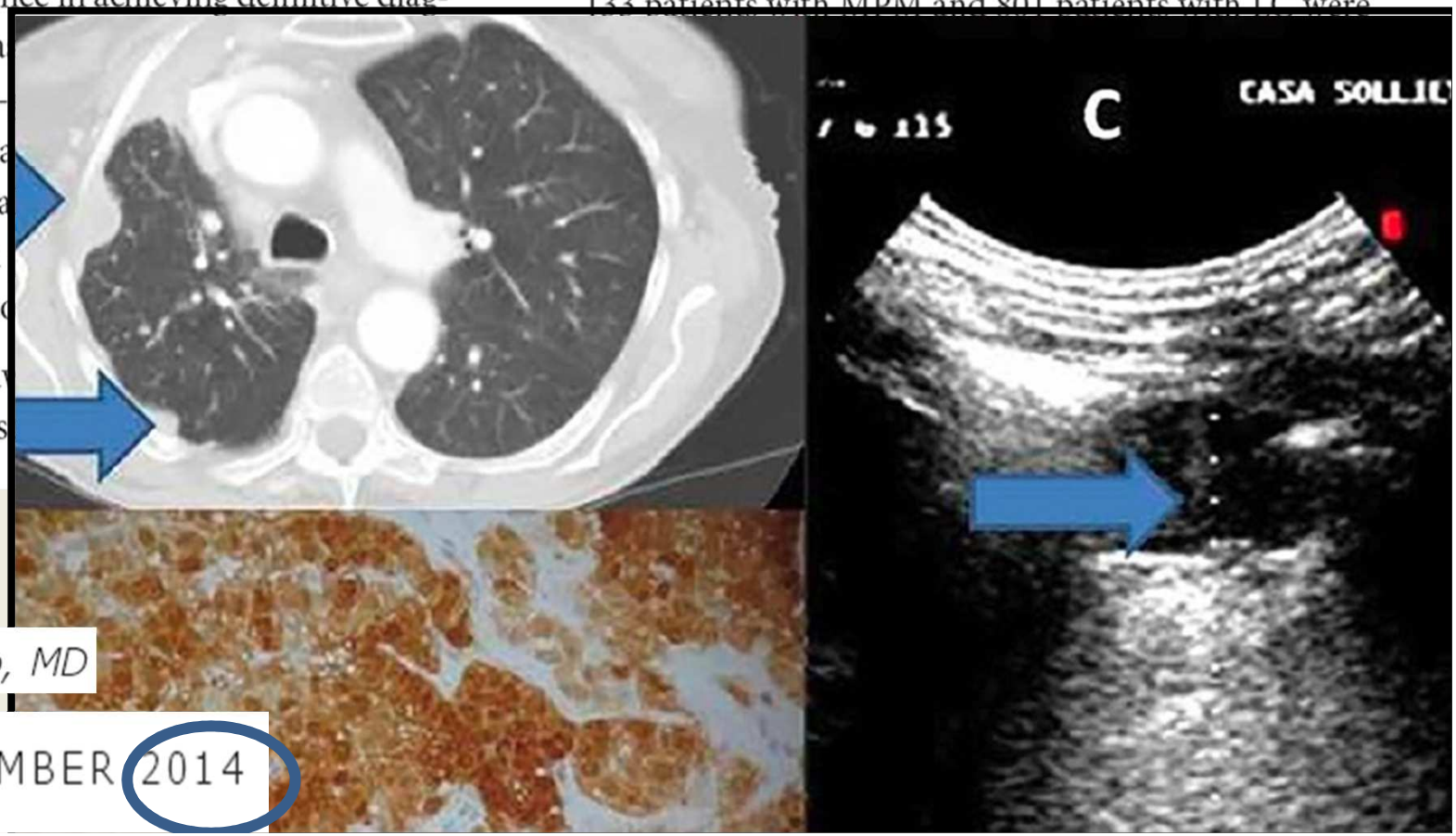
To the Editor:

In a recent issue of *CHEST* (October 2014), Hallifax et al[1] describe their experience in achieving definitive diagnosis of pleural disea
fluid cytology. Image-
practice, and physicia
cutting-needle pleura
successfully in a high
those of failed thorac

Differently, without a
we use thoracic ultras

fine-needle aspiration biopsy (FNAB) as a primary intervention procedure. These tools, quite neglected, are complementary to CT imaging in patients with malig-
nant pleural mesothelioma (MPM) or lung cancer (LC), are less traumatic, and are equally or more successful, with minimal discomfort for the patient.[2-5]

TUS imaging, diagnostic yield, and complications of TUS-guided FNAB were reassessed. The records of
133 patients with MPM and 801 patients with LC were



Marco Sperandeo, MD

CHEST NOVEMBER 2014

7 Ponctions échoguidées pulmonaires

Détection immédiate échographique du pneumothorax

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

Rémi Targhetta, M.D.; Jean-Marie Bourgeois, M.D.; Roseline Chavagneux, M.D.; and Pierre Balmes, 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)

UGAB = ultrasonically guided aspiration biopsy

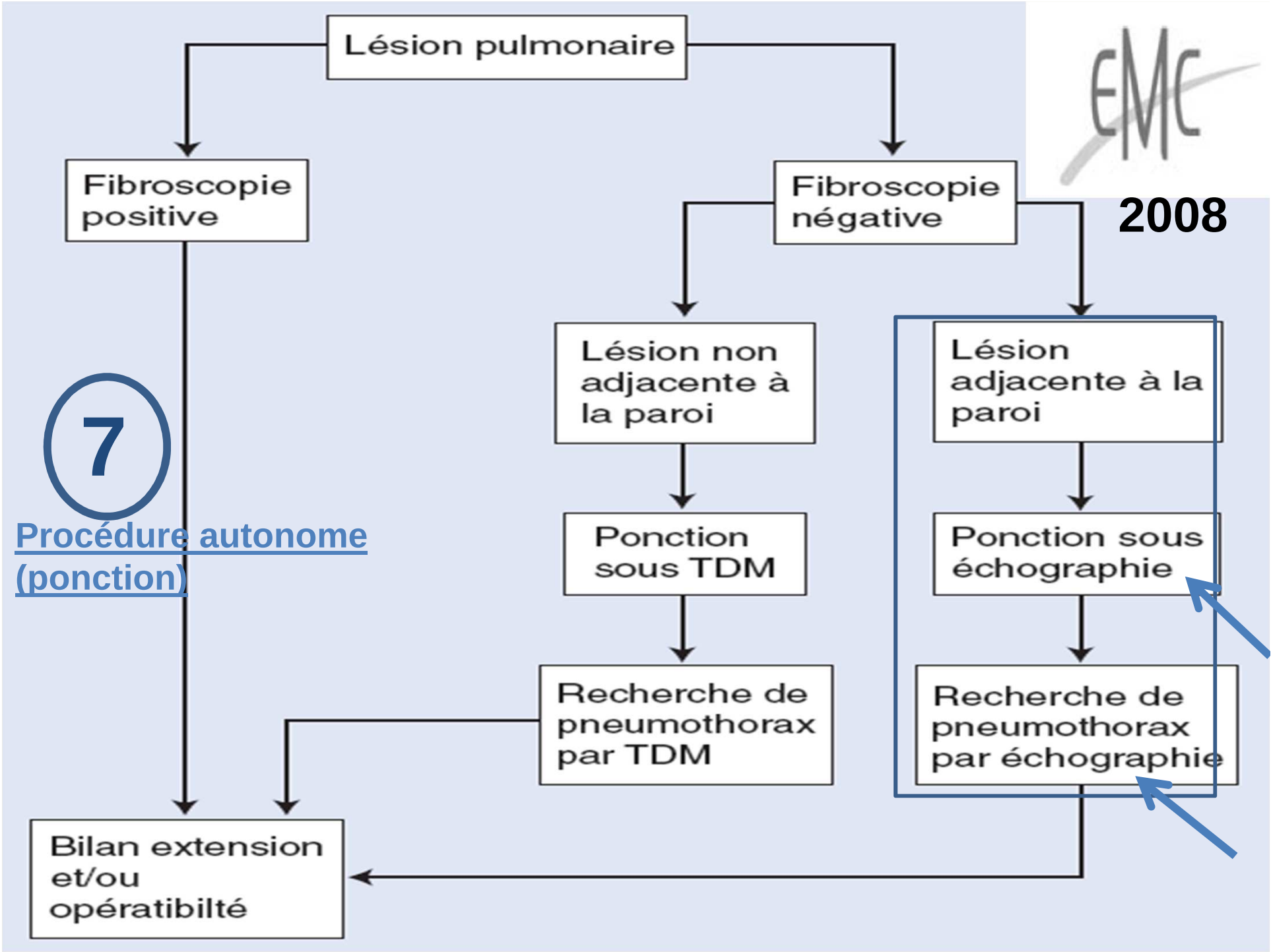
In the diagnosis of pneumothorax (PN) after a thoracic puncture, chest roentgenography (CXR) or computed tomography (CT) is the method of choice. However, peripheral pulmonary tumors are more often punctured under ultrasonically guided aspiration biopsy (UGAB).[1-6] Because the needle position can be followed in real time, UGAB is an accurate and safe technique. No publication has ever mentioned the possibility of PN diagnosis by ultrasound (US) after pulmonary puncture. The value of PN diagnosis by US after UGAB and then confirmed by CXR was assessed in 66 patients with peripheral pulmonary lesions. We present two cases (2/66) of PN detected by echographic examination immediately after UGAB.

FIGURE 1, Case 1. Ultrasonogram of peripheral adenocarcinoma of the lung, using 7.5-MHz scanner. Transverse scan from posterior fourth intercostal space showed a well-defined hypoechoic tumor *(T)*. Movement of the tumor and respiratory excursions of the visceral pleura *(VP)* can be clearly discerned in real-time image.

midhemithorax. With the 7.5-MHz linear electronic scanner positioned in the intercostal space, the movements of the tumor and of the hyperechoic lung surface were visualized more clearly during US examination.

Immediately after UGAB, an asymptomatic PN was detected by US, before CXR, by the disappearance of the echographic lung tumor. Neither pleural movements nor hypoechoic tumor could be detected by US examination in this second case of PN.

R Targhetta et al. Chest 1992;10:855-856


Lésion pulmonaire
Fibroscopie positive
Fibroscopie négative
Lésion non adjacente à la paroi
Lésion adjacente à la paroi
Ponction sous TDM
Ponction sous échographie
Recherche de pneumothorax par TDM
Recherche de pneumothorax par échographie
Bilan extension et/ou opératibilté
2008
7
Procédure autonome (ponction)

Masses pulmonaires périphériques

→ Diagnostic de l'envahissement pariétal

n=120 preoperatively study 19 invasions
US Sensitivity= 100%, Sp= 98%
TDM sensitivity= 68%, Sp= 66%

N. Suzuki, Radiology, 1993

8

EMC 2008

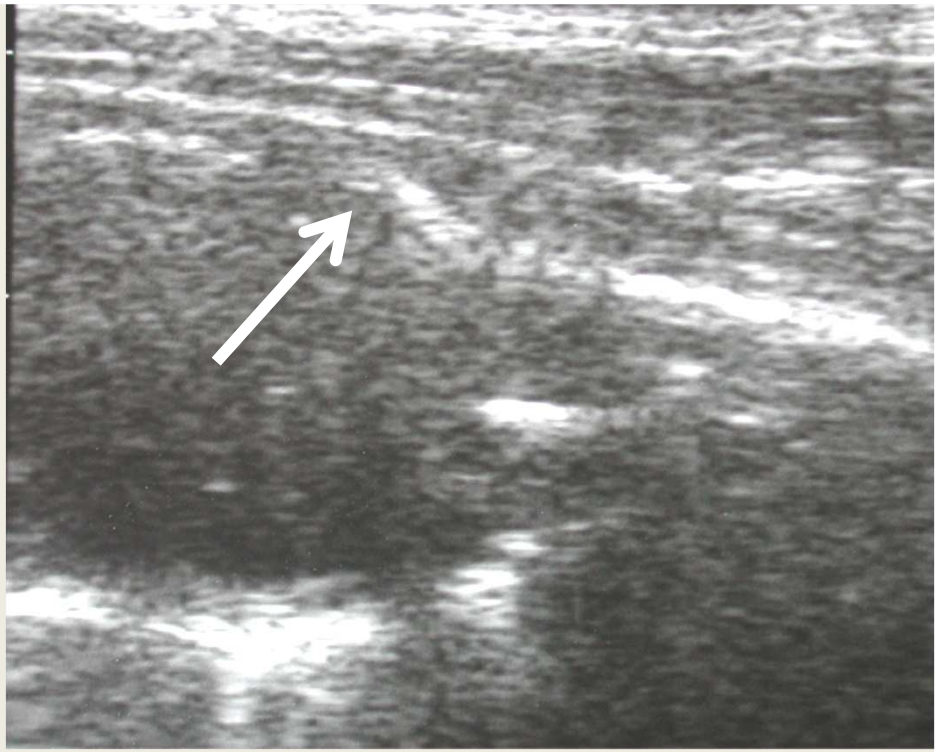
Lyse osseuse

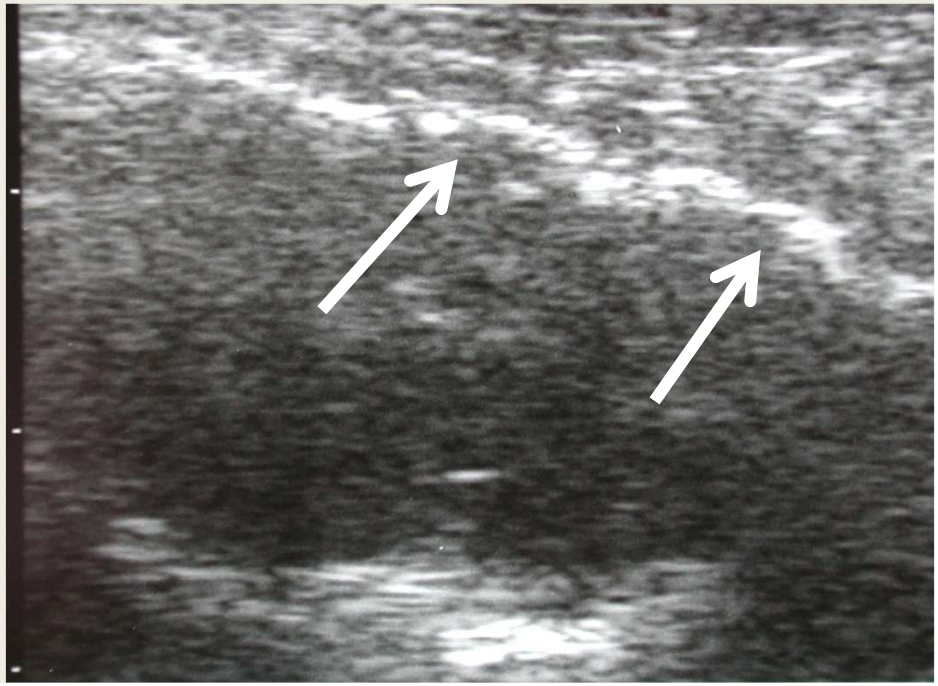
9

Ultrasonically guided aspiration biopsy in osteolytic bone lesions of the chest wall

Targhetta R, Balmes P, Marty-Double C, Mauboussin JM, Bourgeois JM, Pourcelot L

Chest. 1993;103(5):1403-8

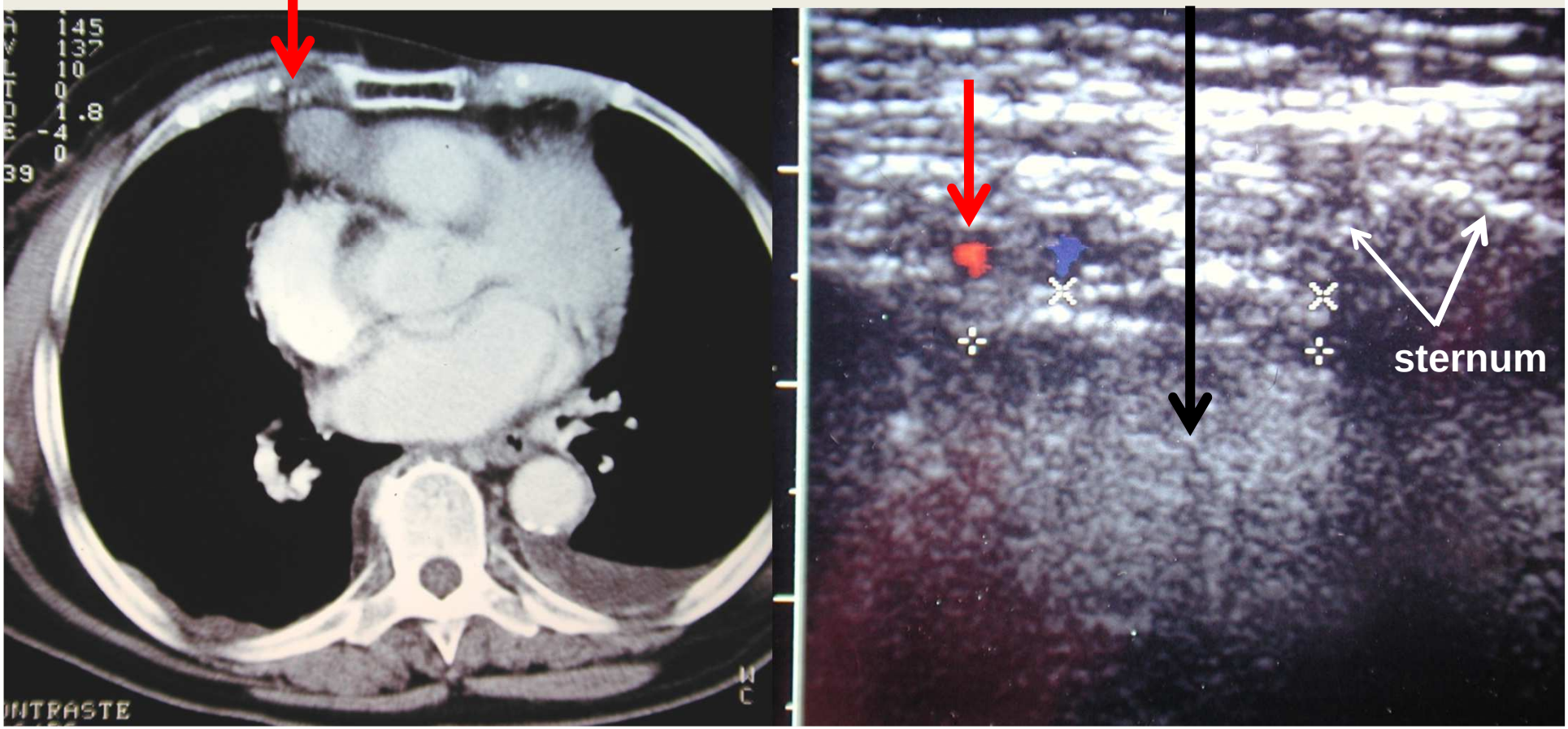




Sonographic Guidance in Diagnosing Anterior Mediastinal Mass: Importance of Visualizing Internal Mammary Vessels

Repérage vaisseaux 10

R Targhetta et al. J Clin Ultrasound 1993;21:203-6



Intensive Care Med (2012) 38:577–591
DOI 10.1007/s00134-012-2513-4

2012

11

Giovanni Volpicelli
Mahmoud Elbarbary
Michael Blaivas
Daniel A. Lichtenstein
Gebhard Mathis

International evidence-based recommendations for point-of-care lung ultrasound

International Liaison Committee on Lung Ultrasound (ILC-LUS) for the International Consensus Conference on Lung Ultrasound (ICC-LUS)

Level	Points[b]	Quality	Interpretation
A	≥4	High	Further research is very unlikely to change our confidence in the estimate of effect or accuracy
B	3	Moderate	Further research is likely to have an important impact on our confidence in the estimate of effect or accuracy and may change the estimate
C[a]	≤2	Low[a]	Further research is very likely to have an important impact on our confidence in the estimate of effect or accuracy and is likely to change the estimate. Any estimate of effect or accuracy is very uncertain (very low)

This table was modified from Guyatt et al. [2]

Intensive Care Med (2012) 38:577–591
DOI 10.1007/s00134-012-2513-4

11

2012

Neonatology and Pediatrics

P-D4-S8 (strong: level A)

- The ultrasound signs of lung and pleural diseases described in adults are also found in pediatric patients.

P-D4-S9 (strong: level A)

- Lung ultrasound is as accurate as chest radiography in diagnosis of pneumonia in pediatric patients.

Lung consolidation

B-D3-S8 (strong: level A)

- Lung ultrasound should be used in the evaluation of lung consolidation because it can differentiate consolidations due to pulmonary embolism, pneumonia, or atelectasis.
- In opacities identified by chest radiography, lung ultrasound should be used because it is more accurate than chest radiography in distinguishing between effusion and consolidation.

RL-D2-S2 (strong: level A)

- Lung ultrasound is able to monitor aeration changes and the effects of therapy in a number of acute lung diseases, including the following:
  - Acute pulmonary edema
  - Acute respiratory distress syndrome
  - Acute lung injury
  - Community-acquired pneumonia
  - Ventilator-associated pneumonia

Interstitial syndrome

B-D2-S1 (strong: level A)

- Multiple B-lines are the sonographic sign of lung interstitial syndrome.

B-D2-S2 (strong: level A)

- In the evaluation of interstitial syndrome, the sonographic technique ideally consists of scanning eight regions, but two other methods have been described:
  - A more rapid anterior two-region scan may be sufficient in some cases.
  - The evaluation of 28 rib interspaces is an alternative.
- A positive region is defined by the presence of three or more B-lines in a longitudinal plane between two ribs.

B-D4-S1 (strong: level A)

- In patients with cardiogenic pulmonary edema, semi-quantification of disease severity may be obtained by evaluating the number of B-lines as this is directly proportional to the severity of congestion.

B-D4-S2 (strong: level A)

- In patients with cardiogenic pulmonary edema, B-lines should be evaluated because it allows monitoring of response to therapy.

Anesthesiology 2004; 100:9–15

Comparative Diagnostic Performances of Auscultation, Chest Radiography, and Lung Ultrasonography in Acute Respiratory Distress Syndrome

Daniel Lichtenstein, M.D.,* Ivan Goldstein, M.D.,† Eric Mourgeon, M.D.,† Philippe Cluzel, M.D., Ph.D.,‡ Philippe Grenier, M.D.,§ Jean-Jacques Rouby, M.D., Ph.D.‖

12

2004 VS RX/auscultation

Background: Lung auscultation and bedside chest radiography are routinely used to assess the respiratory condition of ventilated patients with acute respiratory distress syndrome (ARDS). Clinical experience suggests that the diagnostic accuracy of these procedures is poor.

Methods: This prospective study of 32 patients with ARDS and 10 healthy volunteers was performed to compare the diagnostic accuracy of auscultation, bedside chest radiography, and lung ultrasonography with that of thoracic computed tomography. Three pathologic entities were evaluated in 384 lung regions (12 per patient): pleural effusion, alveolar consolidation, and alveolar–interstitial syndrome.

Results: Auscultation had a diagnostic accuracy of 61% for pleural effusion, 36% for alveolar consolidation, and 55% for alveolar–interstitial syndrome. Bedside chest radiography had a diagnostic accuracy of 47% for pleural effusion, 75% for alveolar consolidation, and 72% for alveolar–interstitial syndrome. Lung ultrasonography had a diagnostic accuracy of 93% for pleural effusion, 97% for alveolar consolidation, and 95% for alveolar–interstitial syndrome. Lung ultrasonography, in contrast to auscultation and chest radiography, could quantify the extent of lung injury. Interobserver agreement for the ultrasound findings as assessed by the κ statistic was satisfactory: 0.74, 0.77, and 0.73 for detection of alveolar–interstitial syndrome, alveolar consolidation, and pleural effusion, respectively.

Conclusions: At the bedside, lung ultrasonography is highly sensitive, specific, and reproducible for diagnosing the main lung pathologic entities in patients with ARDS and can be considered an attractive alternative to bedside chest radiography and thoracic computed tomography.

This article is accompanied by an Editorial View. Please see: Hubmayr RD: The times are a-changin': Should we hang up the stethoscope? ANESTHESIOLOGY 2004; 100:1–2.

AT the bedside, accurate evaluation of lung pathologic entities and pulmonary aeration in critically ill patients ventilated for acute respiratory distress syndrome (ARDS) remain problematic. Auscultation, which is the first step of the clinical evaluation, can be markedly altered by the intrathoracic transmission of sounds issued from the mechanical ventilator. Technical limitations reduce the quality of bedside chest radiography, which, nevertheless, remains the daily reference for lung imaging. These limitations include movements of the chest wall, patient rotation, supine position with the x-ray film cassette placed posterior to the thorax, and an x-ray beam originating anteriorly at a shorter distance than recommended and not tangentially to the apex of the hemidiaphragm. All of these various factors contribute to poor-quality x-ray films and mistaken assessment of pleural effusion, alveolar consolidation, interstitial markings, mediastinum, and cardiac dimensions. Even with careful control of exposure factors, radiographic images remain suboptimal in more than one third of cases[1–5] and are poorly correlated to lung computed

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VS RX/auscultation

Echo SDRA

2004

Table 1. Sensitivity and Specificity of Auscultation, Chest Radiography, and Lung Ultrasonography for Diagnosing Pleural Effusion, Alveolar Consolidation, and Alveolar–Interstitial Syndrome in 384 Lung Regions in 32 Critically Ill Patients with ARDS

	Auscultation, %	Chest Radiography, %	Lung Ultrasonography, %
Pleural effusion			
Sensitivity	42	39	92
Specificity	90	85	93
Diagnostic accuracy	61	47	93
Alveolar consolidation			
Sensitivity	8	68	93
Specificity	100	95	100
Diagnostic accuracy	36	75	97
Alveolar–interstitial syndrome			
Sensitivity	34	60	98
Specificity	90	100	88
Diagnostic accuracy	55	72	95

ARDS = acute respiratory distress syndrome.

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Can Chest Ultrasonography Replace Standard Chest Radiography for Evaluation of Acute Dyspnea in the ED?

Maurizio Zanobetti, MD; Claudio Poggioni, MD; and Riccardo Pini, MD

2011

« Raccourci » diagnostic ?

Background: We examined the concordance between chest ultrasonography and chest radiography in patients with dyspnea, using chest CT scanning as the gold standard in case of mismatch between the two modalities.
Methods: A prospective, blinded, observational study was conducted in the ED of a university-affiliated teaching hospital. All consecutive patients presenting for dyspnea during a single emergency physician shift were enrolled independently from the underlying disease. Only patients with trauma were excluded.
Results: Both ultrasonography and radiography were performed in 404 patients; CT scanning was performed in 118 patients. Ultrasound interpretation was completed during the scan, whereas the average time between radiograph request and its final interpretation was 1 h and 35 min. Ultrasonography and radiography exhibited high concordance in most pulmonary diseases, especially in pulmonary edema ($\kappa = 95\%$). For lung abnormalities such as free pleural effusion, loculated pleural effusion, pneumothorax, and lung consolidation, the concordance was similar for both left- and right-side lungs (all *P* not significant). When ultrasound scans and radiographs gave discordant results, CT scans confirmed the ultrasound findings in 63% of patients ($P < .0001$). Particularly, ultrasonography exhibited greater sensitivity than radiography in patients with free pleural effusion ($P < .0001$).
Conclusions: When performed by one highly trained physician, our study demonstrated high concordance between ultrasonography and radiography. When ultrasound scans and radiographs disagreed, ultrasonography proved to be more accurate in distinguishing free pleural effusion. Thus, considering the short time needed to have a final ultrasound report, this technique could become the routine imaging modality for patients with dyspnea presenting to the ED.

CHEST 2011; 139(5):1140–1147

Abbreviations: EP = emergency physician; PE = pulmonary embolism; PTX = pneumothorax

The Effect of Point-of-Care Ultrasonography on Imaging Studies in the Medical ICU

A Comparative Study

Margarita Oks, MD; Krystal L. Cleven, MD; Jose Cardenas-Garcia, MD; Jennifer Ann Schaub, MD; Seth Koenig, MD, FCCP; Rubin I. Cohen, MD, FCCP; Paul H. Mayo, MD, FCCP; and Mangala Narasimhan, DO, FCCP

14

Réduction Imagerie RX/TDM

2014

BACKGROUND: Point-of-care ultrasonography performed by frontline intensivists offers the possibility of reducing the use of traditional imaging in the medical ICU (MICU). We compared the use of traditional radiographic studies between two MICUs: one where point-of-care ultrasonography is used as a primary imaging modality, the other where it is used only for procedure guidance.

METHODS: This study was a retrospective 3-month chart review comparing the use of chest radiographs, CT scans (chest and abdomen/pelvis), transthoracic echocardiography performed by the cardiology service, and DVT ultrasonography studies performed by the radiology service between two MICUs of similar size and acuity and staffing levels.

RESULTS: Total number of admissions, patient demographics, and disease acuity were similar between MICUs. Comparing the non-point-of-care ultrasonography MICU with the point-of-care ultrasonography MICU, there were 3.75 ± 4.6 vs 0.82 ± 1.85 ($P < .0001$) chest radiographs per patient, 0.10 ± 0.31 vs 0.04 ± 0.20 ($P = .0007$) chest CT scans per patient, 0.17 ± 0.44 vs 0.05 ± 0.24 ($P < .0001$) abdomen/pelvis CT scans per patient, 0.20 ± 0.47 vs 0.02 ± 0.14 ($P < .0001$) radiology service-performed DVT studies per patient, and 0.18 ± 0.40 vs 0.07 ± 0.26 ($P < .0001$) cardiology service-performed transthoracic echocardiography studies per patient, respectively.

CONCLUSIONS: The use of point-of-care ultrasonography in an MICU is associated with a significant reduction in the number of imaging studies performed by the radiology and cardiology services.

CHEST 2014; 146(6):1574-1577

Study	NSUH MICU (n = 294)	LIJ MICU (n = 328)	*P* Value
Chest radiograph	3.75 ± 4.6 (1,102)	0.82 ± 1.85 (269)	<.0001
Chest CT scan	0.10 ± 0.31 (29)	0.04 ± 0.20 (14)	.0007
Abdomen/pelvis CT scan	0.17 ± 0.44 (49)	0.05 ± 0.24 (16)	<.0001
Radiology service-performed DVT	0.20 ± 0.47 (58)	0.02 ± 0.14 (7)	<.0001
Cardiology service-performed TTE	0.18 ± 0.40 (54)	0.07 ± 0.26 (22)	<.0001

Look at the lung: can chest ultrasonography be useful in pregnancy?

15

Riccardo Inchingolo[1†], Andrea Smargiassi[1,3*†], Flaminio Mormile[1], Roberta Marra[1], Sara De Carolis[2], Antonio Lanzone[2], Salvatore Valente[1] and Giuseppe M Corbo[1]

2014

Abstract

Background: This study aimed to evaluate the clinical value of chest ultrasound (US) in the detection, diagnosis and follow-up of pathologic processes of both peripheral lung parenchyma and pleural space in pregnant women.

Findings: Pregnant women admitted to Obstetric Pathology Hospital Department for respiratory diseases were enrolled. Chest US examination was performed when there was a respiratory disease highly suggestive of pneumonia and/or pleural effusion and chest X-ray (CXR) should have been obtained. Three chest US patterns were identified: lung consolidation (LC), pleural effusion (PE) and focal sonographic interstitial syndromes (SIS). When chest US pathologic signs were reported, one or more subsequent chest US examinations were performed to follow-up the patient until their complete resolution.
Sixteen inpatients underwent 54 chest US evaluations. We identified: 9 LCs, 6 PEs and 11 SISs. Total number of CXRs was 7 (10 females avoided X-rays exposure and one underwent 2 CXR evaluations on the advice of Gynecologist). Chest US follow-up, during and after therapy, showed complete resolution of echographic patterns previously described.

Conclusions: Chest US evaluation during pregnancy is a useful diagnostic tool to detect and monitor respiratory diseases, avoiding excessive X-rays exposure.

Echographie et Poumon : Raisons → Preuves ?

1/ Territorialité : Cardiologie

2/ Développement en Réanimation

3/ Et en Néonatologie/Pédiatrie

4/ Pneumopathie (adulte)

5/ Syndrome interstitiel (adulte)

6/ Lésions pulmonaires périphériques et Ponction Echo guidée : Avantages patients

7/ Procédure post ponction autonome (pneumothorax)

8/ Performance du diagnostic d'envahissement pariétal

9/ Lyse osseuse : Diagnostic et ponction

10/ Repérage des vaisseaux facilité (écho doppler couleur)

11/ International « Evidence based recommendations »

12/ Performance Echo (VS RX/auscultation) en Réanimation

13/ Performance Echo aux Urgences : un « raccourci » diagnostic ?

14/ Réduction importante du nombre de RX/TDM (Soins Intensifs)

15/ Femme enceinte

« Une nouvelle imagerie… en <u>première intention</u> ou pour <u>compléter</u> les informations apportées par la radiologie…

… Il sera bientôt <u>difficilement imaginable</u> devant une pathologie pulmonaire de se passer de l'analyse échographique tant sont précieux et précis les renseignements fournis par cet examen rapide et sûr »

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