L’échographie pulmonaire

pour le kinésithérapeute

Dr Aymeric LE NEINDRE, *PT, PhD*
Paris Saint-Joseph Hospital, Pulmonary Rehabilitation Department, Paris, France
Forcilles’ Hospital-Cognacq-Jay Foundation, Clinical Research Department, Férolles-Attilly, France

Lien d’intérêt

Un intérêt gr

Use of thoracic ultrasound by physiotherapists: a scoping review of the literature

therapy

Journal of Clinical Ultrasound

Sonography and other Imaging Techniques

Received: 19 December 2019 | Revised: 10 April 2020 | Accepted: 22 April 2020

DOI: 10.1002/jcu.22860

Check for updates

CASE REPORT

WILEY

herapy

Lung ultrasound as a tool to guide respiratory physiotherapy

Sc,

Critical care

Rui Vieira MD[1] | Elena S

Joseph dos Santos PT MSc[2]

Thorax

Original research

Thoracic ultrasound influences physiotherapist's clinical decision-making in respiratory management of critical care patients: a multicentre cohort study

Aymeric Le Neindre [1,2] Louise Hansell,[3,4] Johan Wormser,[5] Andreia Gomes Lopes,[6] Carlos Diaz Lopez,[7] Christophe Romanet,[5] Gerald Choukroun,[8] Maxime Nguyen [9] François Philippart,[5] Pierre-Grégoire Guinot,[9] Hergen Buscher,[10,11] Bélaid Bouhemad,[2,9] George Ntoumenopoulos[12]

Lung Ultrasoun

Manjush Karthika, Du

RESPIRATORY CARE • FEBRUARY 2019 VOL 64 NO 2

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n: a case

ulos, BSPT, PhD[4]

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JOURNAL HOM

f respiratory

ung ultrasound training and its adoption in critical care

View all authors and affiliations

Volume 30, Issue 2 | https://doi.org/10.1177/1742271X211034199

AUSTRALIAN PHYSIOTHERAPY ASSOCIATION

Journal of PHYSIOTHERAPY

journal homepage: www.elsevier.com/locate/jphys

Research

Lung ultrasound has greater accuracy than conventional respiratory assessment tools for the diagnosis of pleural effusion, lung consolidation and collapse: a systematic review

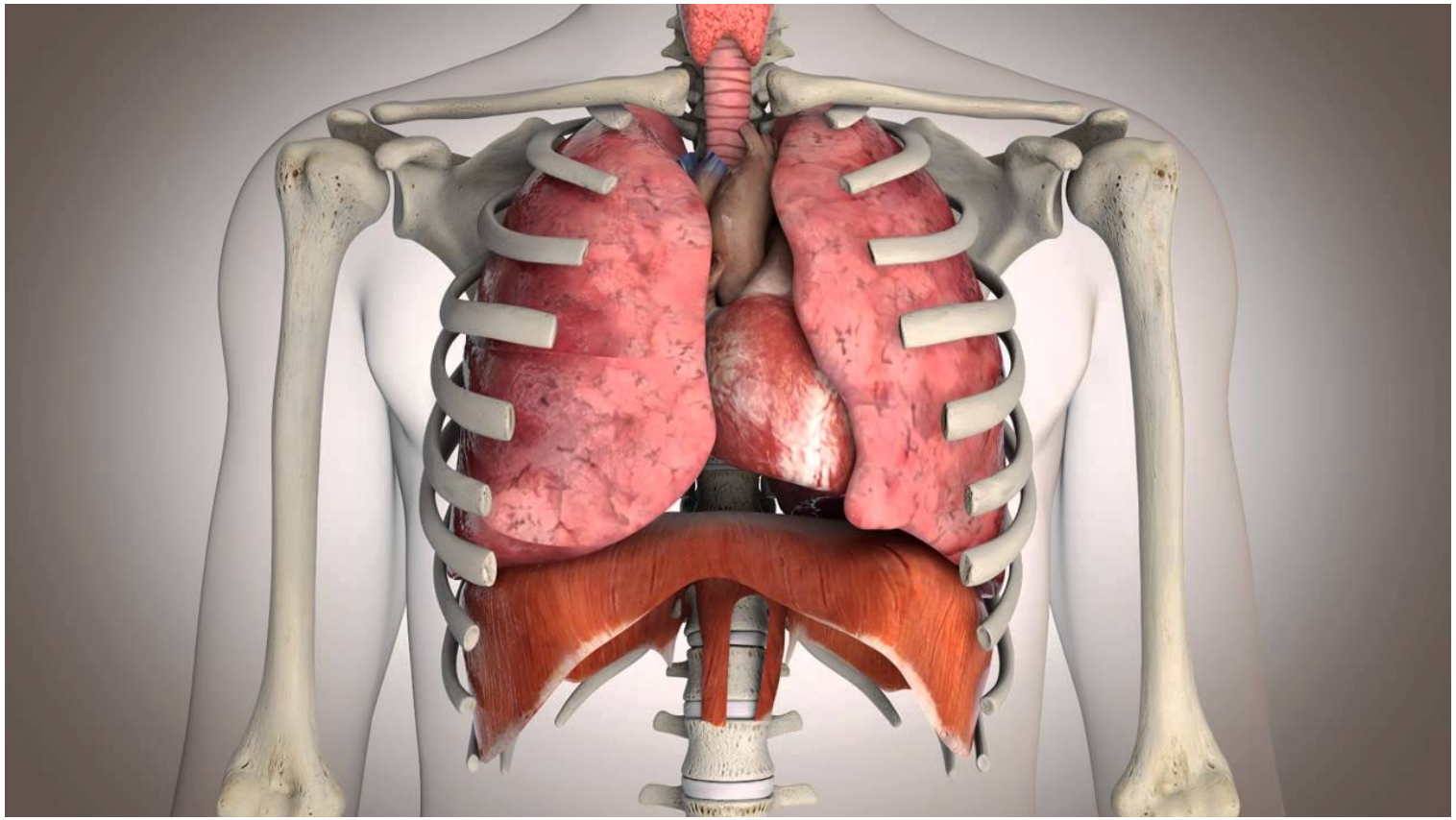
Louise Hansell [a,b], Maree Milross [a], Anthony Delaney [c,d,e,f], David H Tian [g], George Ntoumenopoulos [h]

Table 3
Pooled results for the diagnostic accuracy of CXR and LUS in the diagnosis of consolidation and pleural effusion, using CT as the reference standard.

Pathology	Test	Sensitivity *(%)* (95% CI)	Specificity *(%)* (95% CI)	DOR	AUC
Consolidation	CXR	53 (35 to 70)	78 (53 to 91)	4.29	0.69
	LUS	92 (78 to 97)	92 (70 to 98)	160.22	0.96
Pleural effusion	CXR	42 (32 to 53)	81 (67 to 90)	2.79	0.57
	LUS	91 (83 to 96)	92 (82 to 97)	134.61	0.96

AUC = area under the curve, CT = computed tomography, CXR = chest radiograph, DOR = diagnostic odds ratio, LUS = lung ultrasound.

Champ d’application en kinésithérapie

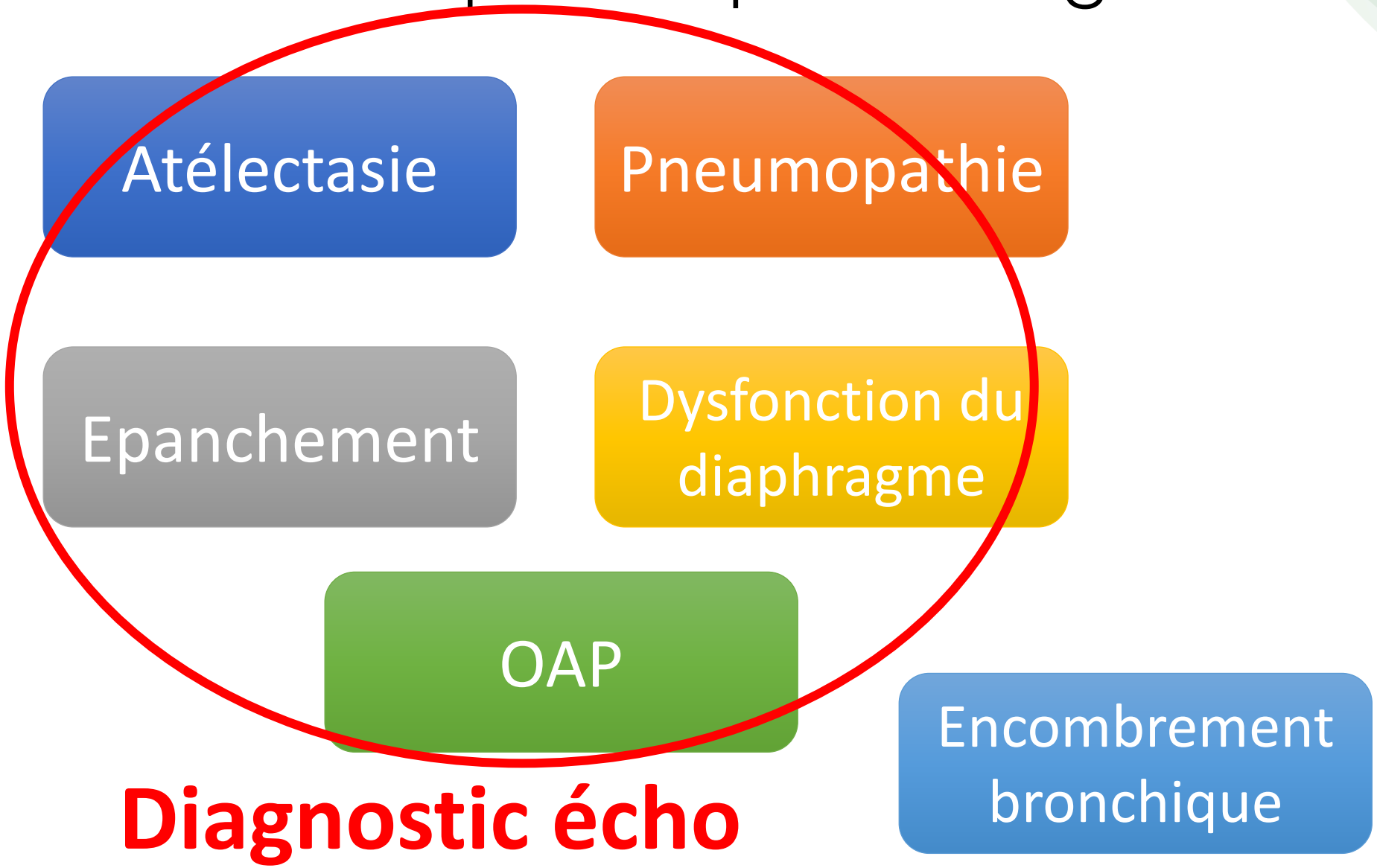


Pleura

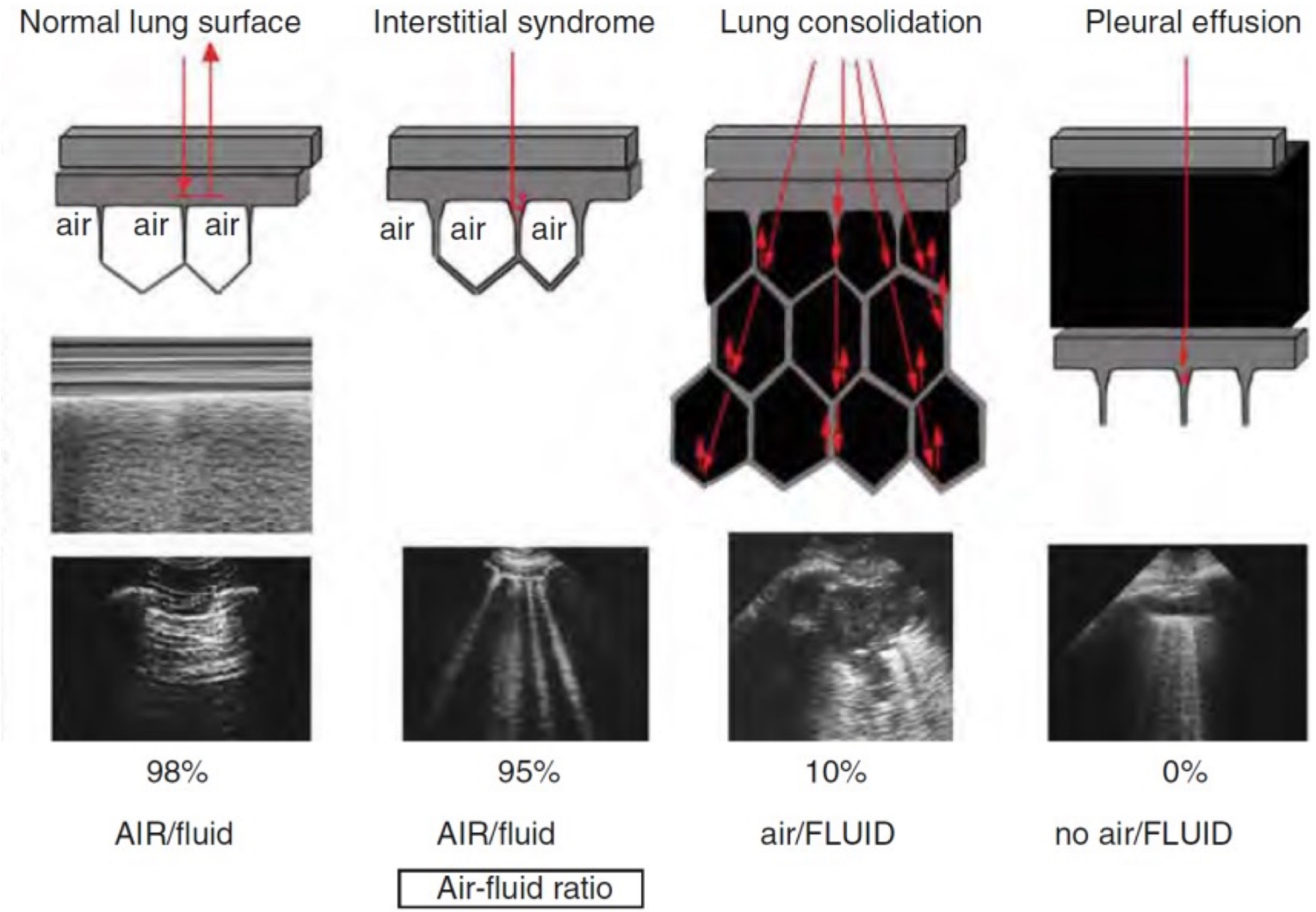
Lung

Diaphragm

Hypothèses cliniques du patient aigu

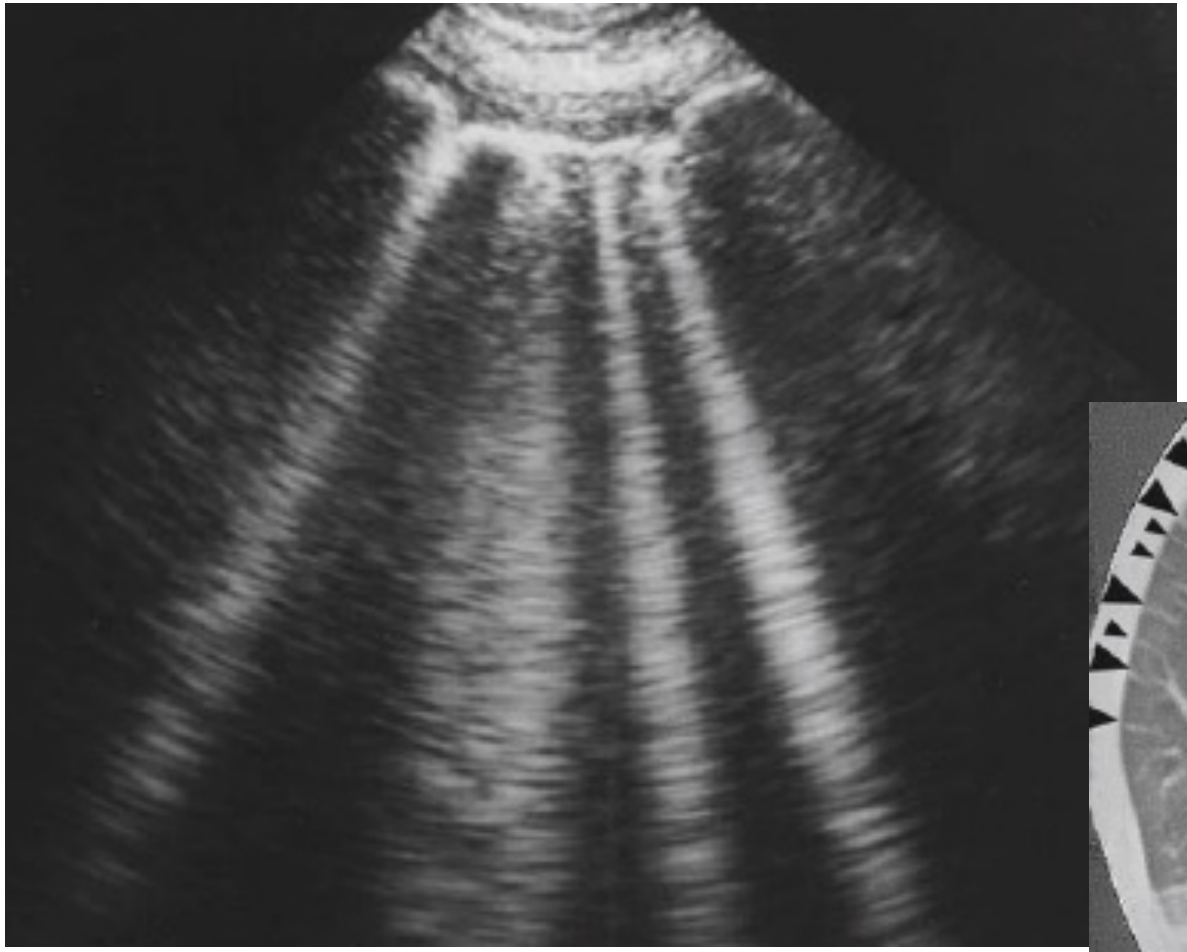


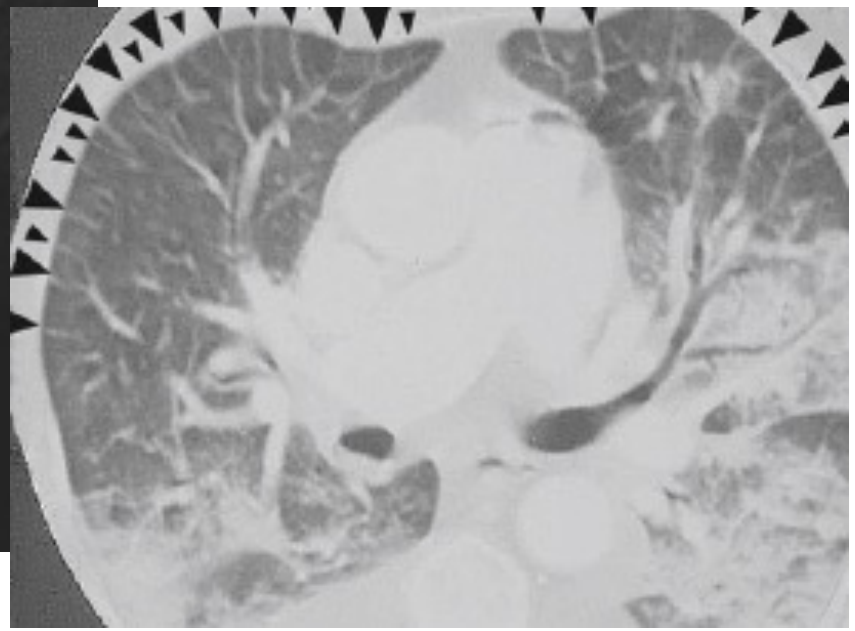
Sémiologie : points clés



Lichtenstein D. Whole Body Ultrasonography in the Critically Ill. Paris: Springer-Verlag; 2010.

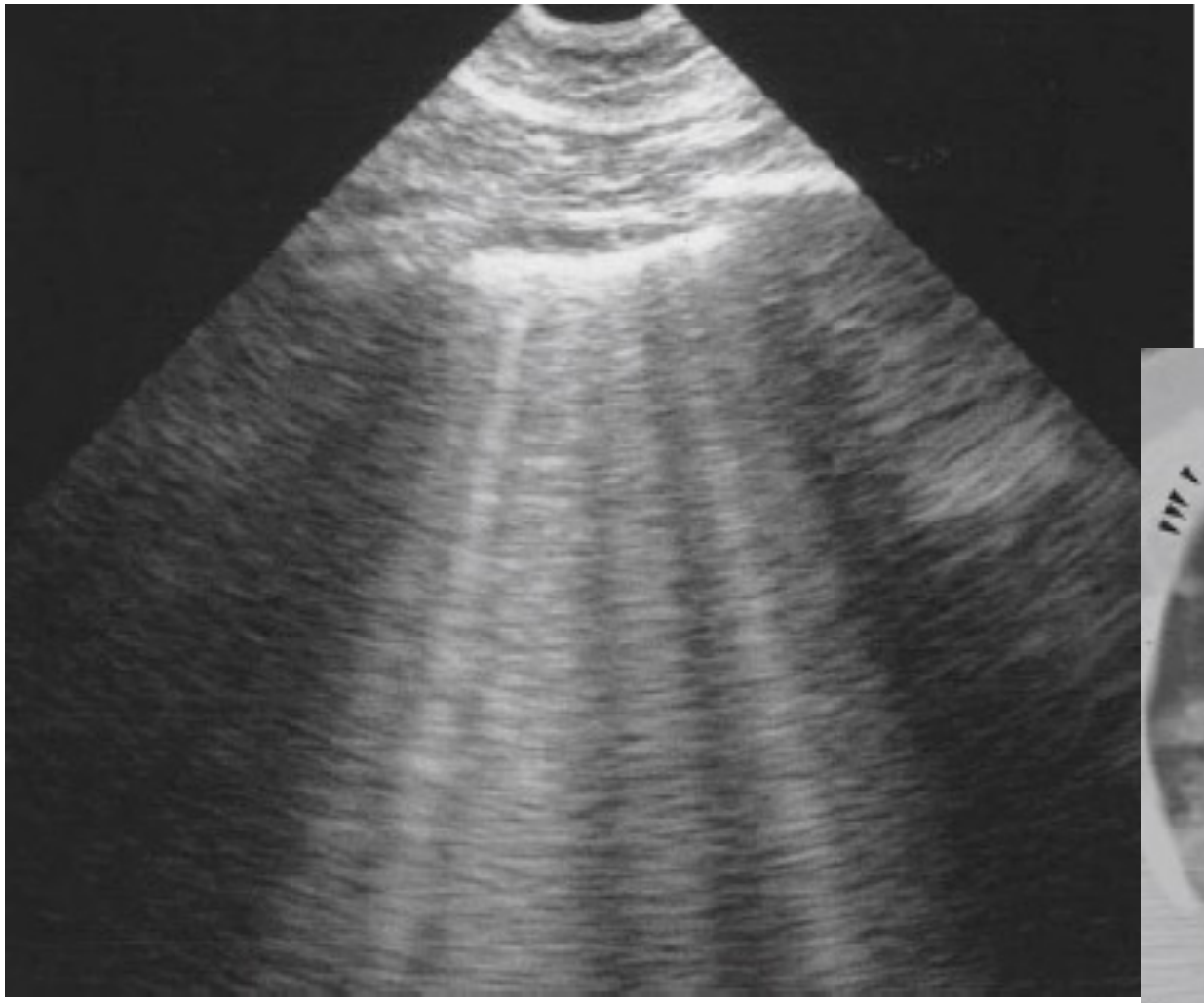
Syndrome interstitiel modéré

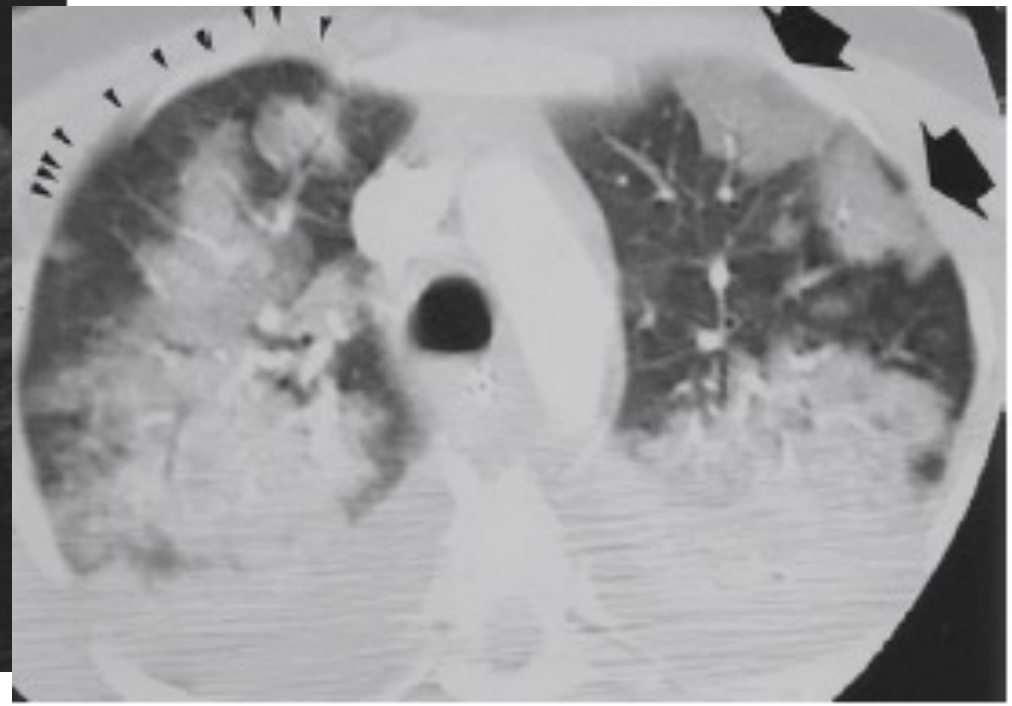




Lichtenstein D. Whole Body Ultrasonography in the Critically Ill. Paris: Springer-Verlag; 2010.

Syndrome interstitiel sévère

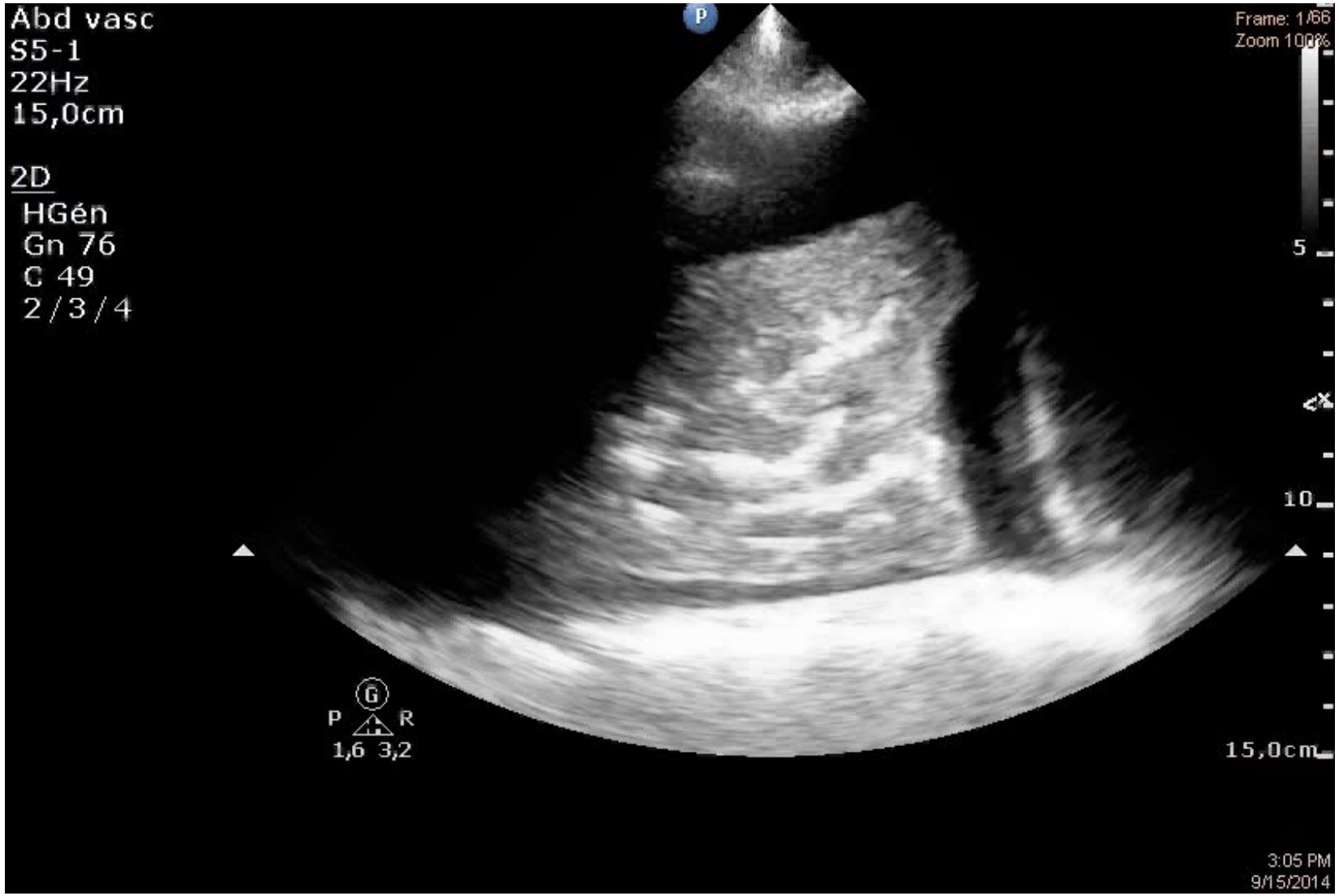




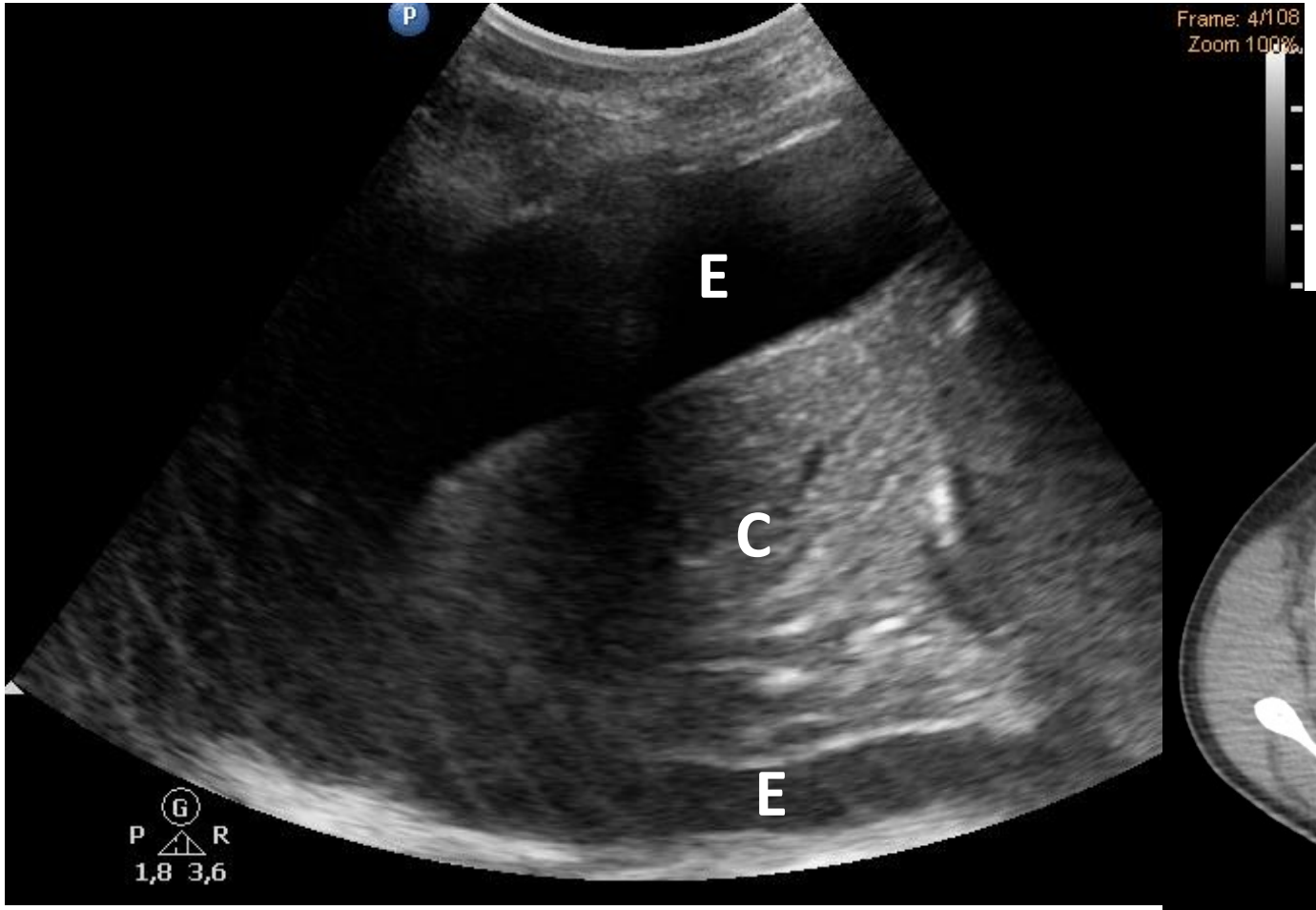
Lichtenstein D. Whole Body Ultrasonography in the Critically Ill. Paris: Springer-Verlag; 2010.

Consolidation alvéolaire partielle

Consolidation alvéolaire complète

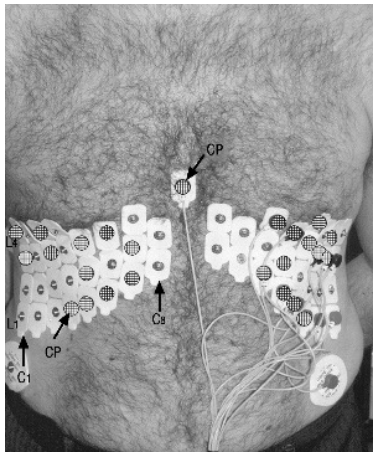


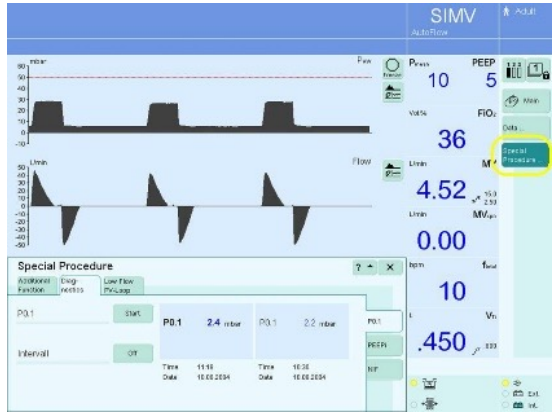
Epanchement pleural



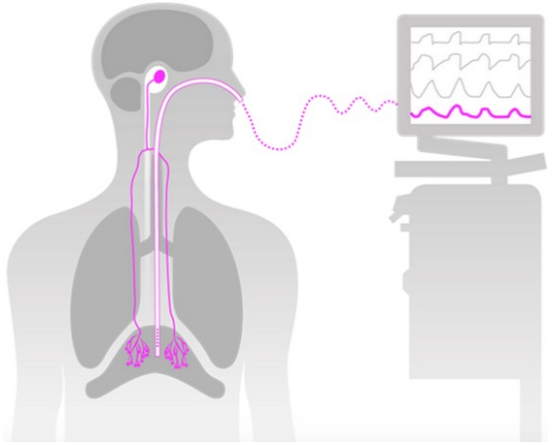
Et le diaphragme ?

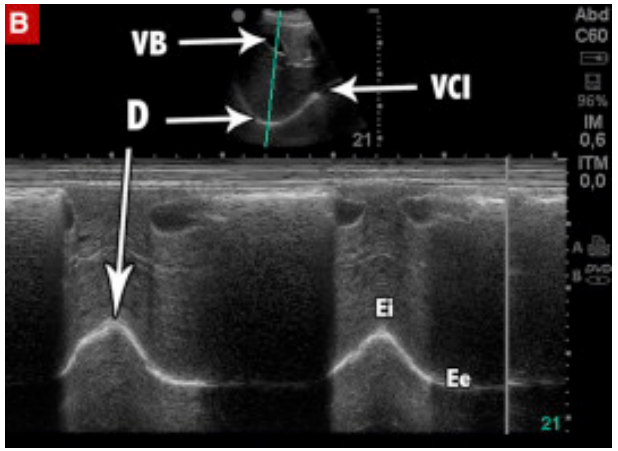
Non spécifique



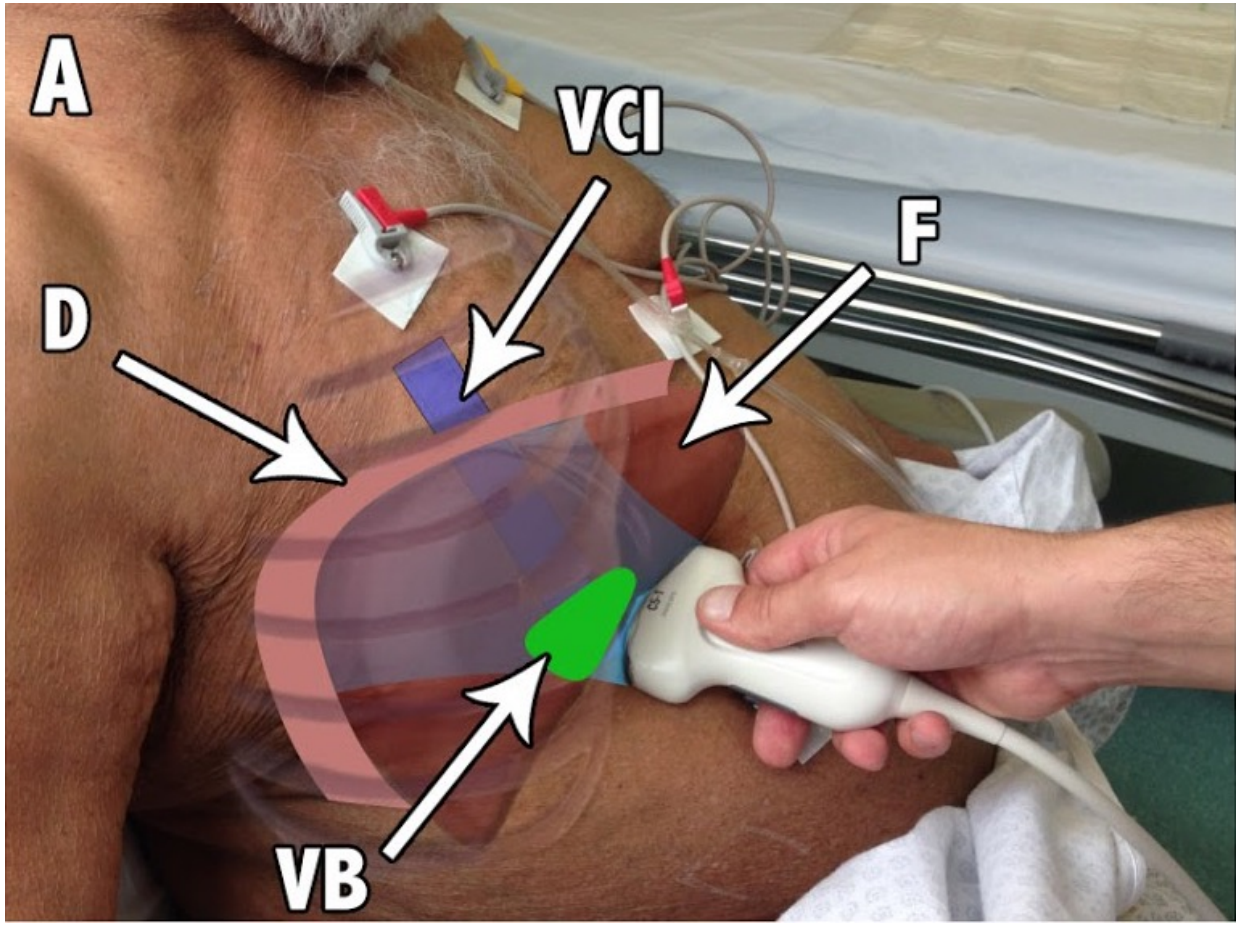


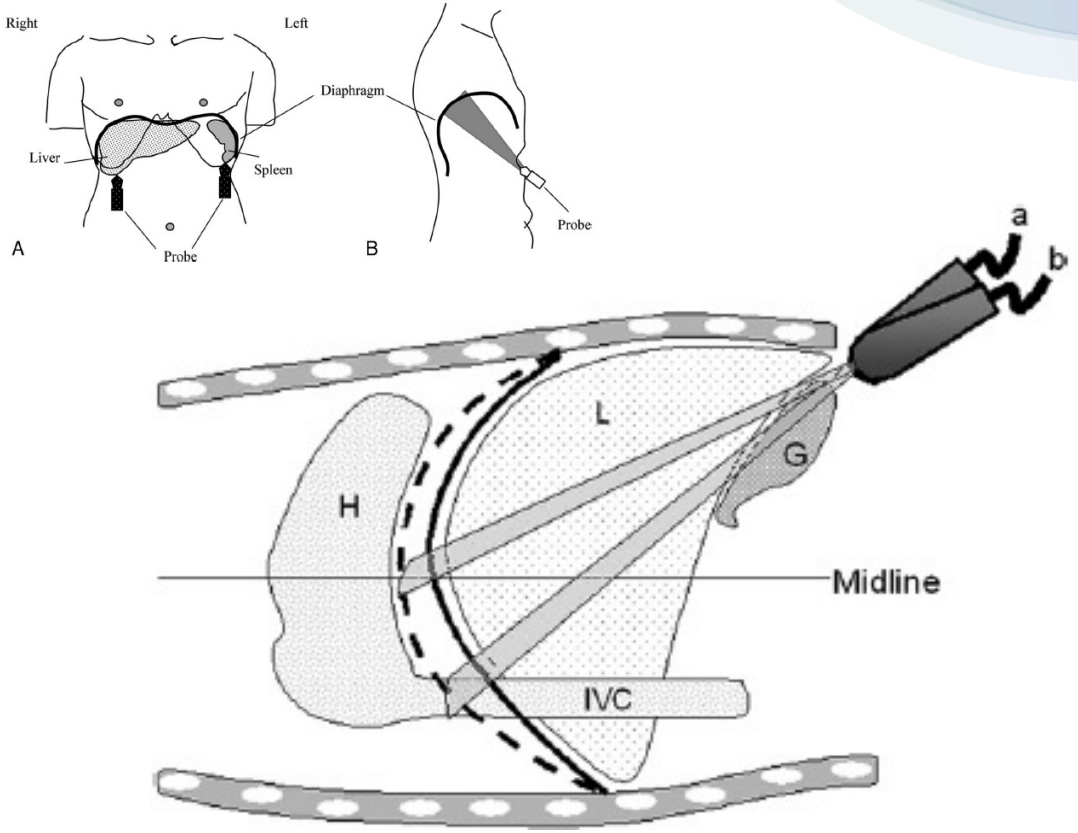
Spécifique





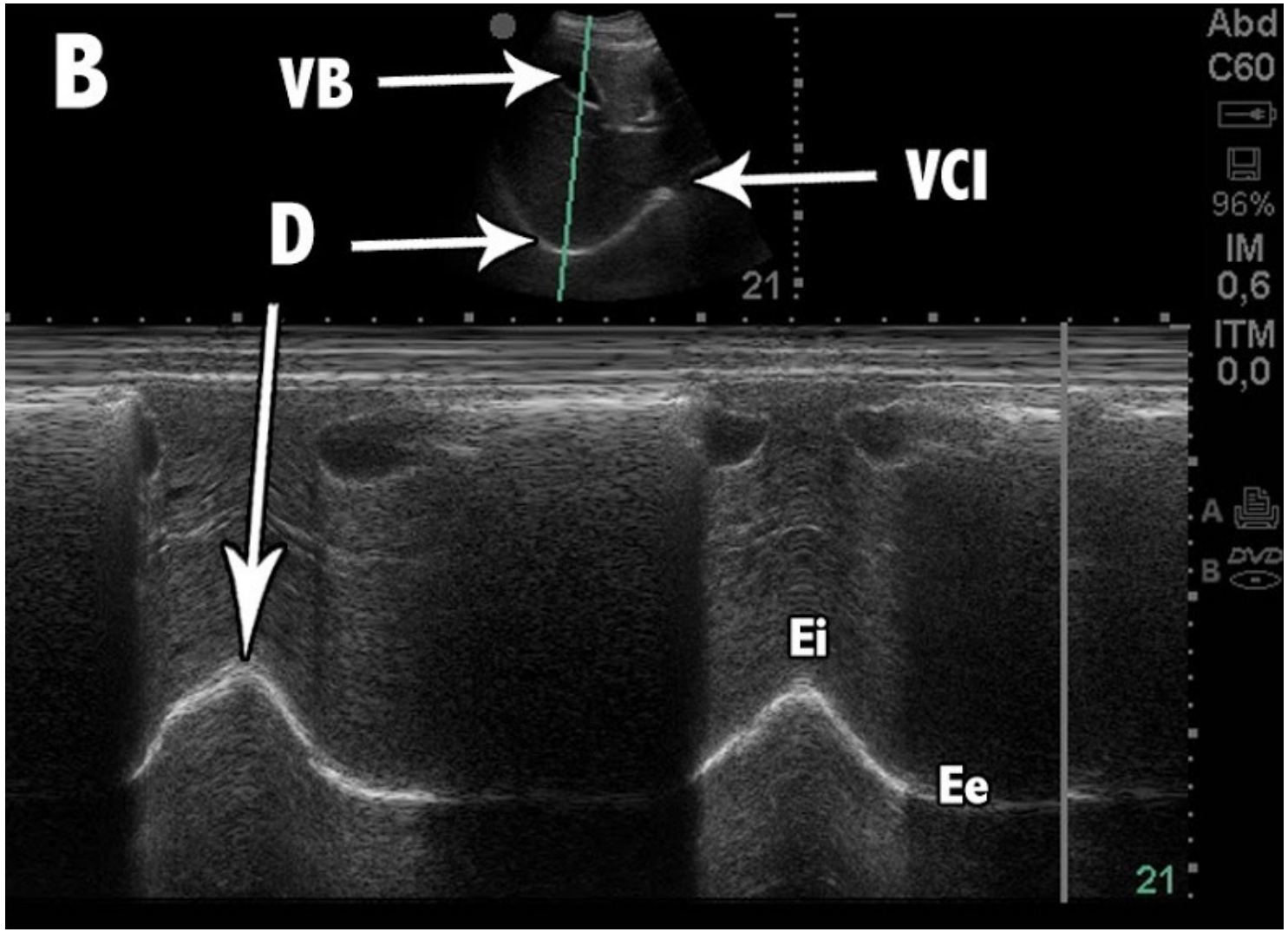
Echographie du diaphragme - Excursion





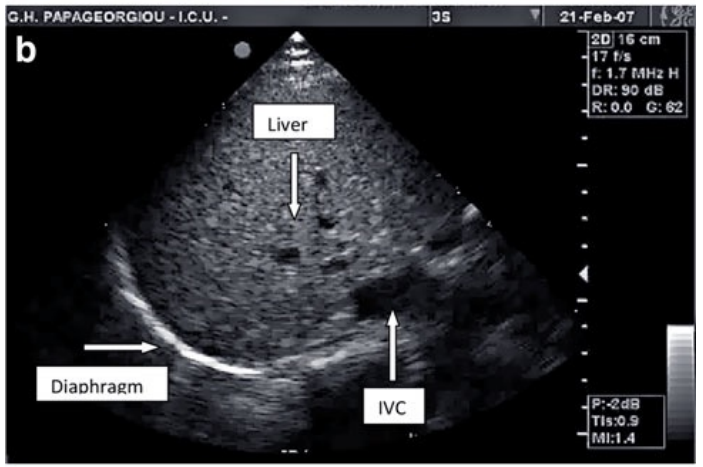
Testa A, et al. Ultrasound in Medicine and Biology. 2011

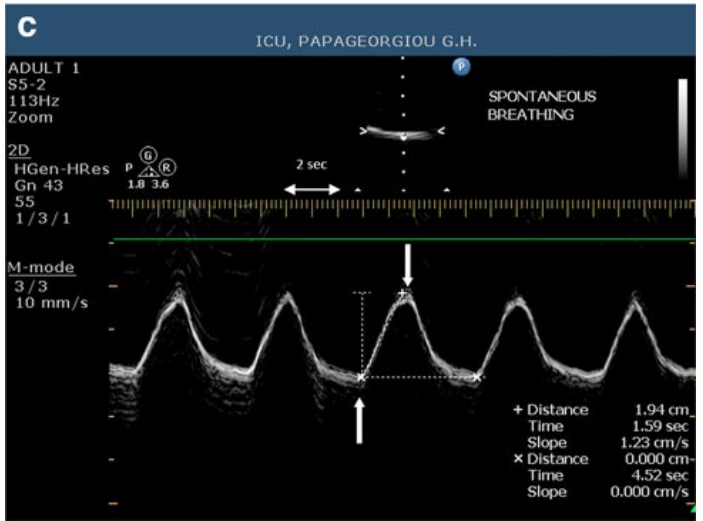
Echographie du diaphragme - Excursion



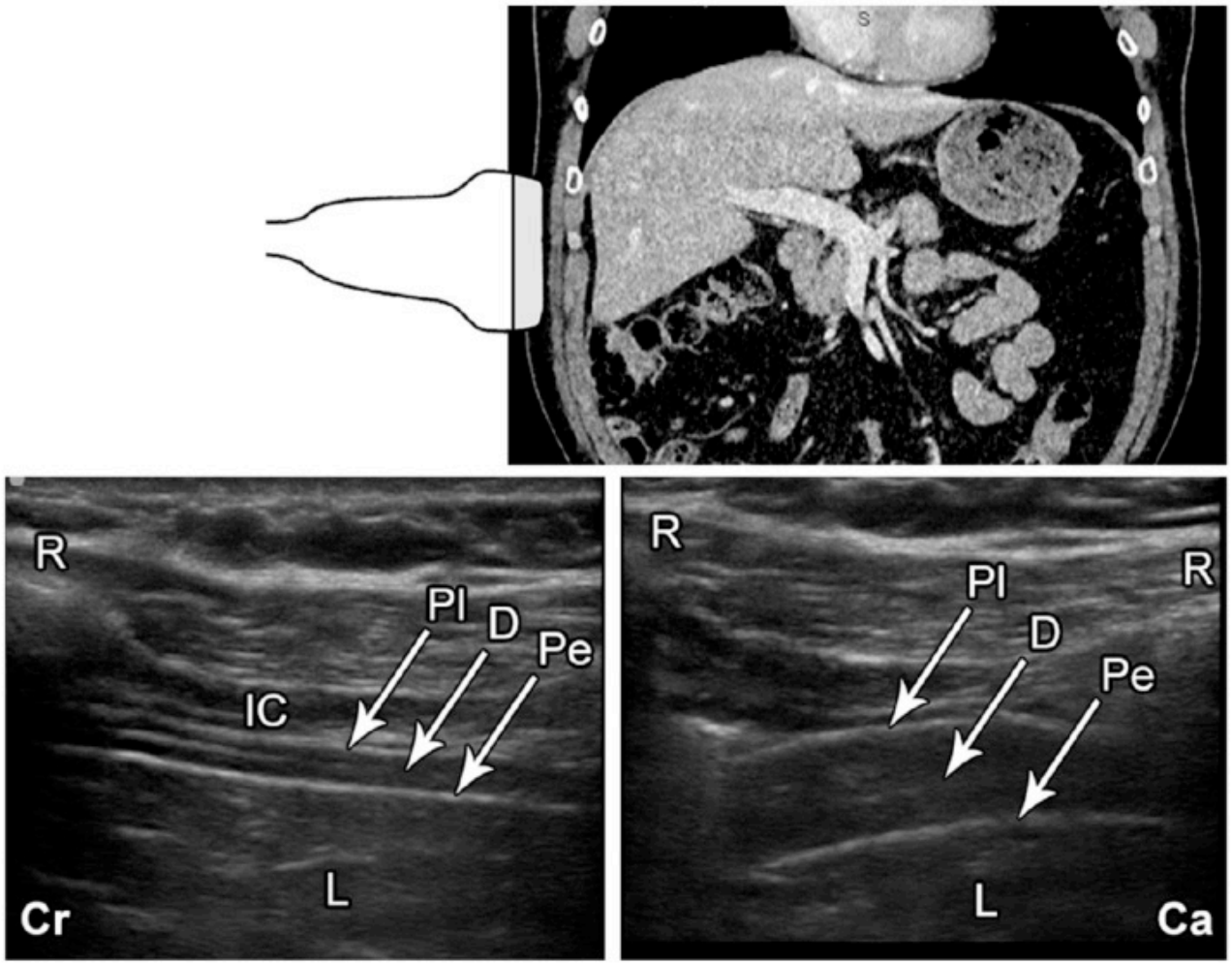
Echographie du diaphragme - Excursion

Matamis et al 2013





Echographie du diaphragme - Epaississement



Le Neindre A, *et al.* Diaphragm function in patients with sepsis and septic shock: A longitudinal ultrasound study. *Australian Critical Care* 2022

Echographie du diaphragme - Epaississement

Amélioration du diagnostic en kinésithérapie

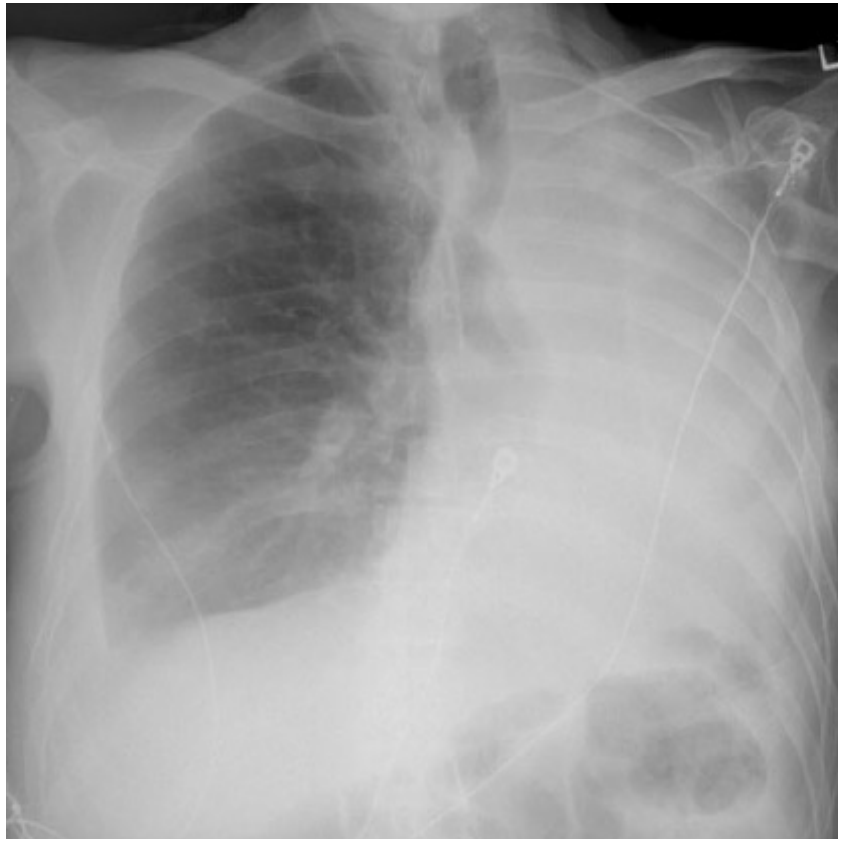
Opacité radiologique : ex d'un cas clinique

Physiotherapist-initiated lung ultrasound to improve intensive care management of a deteriorating patient and prevent intubation: a case report

Maja Leech, BS, MPT[1], Bernie Bissett, BSPT (Hons)[1,2], Marta Kot, MD, PgDipEcho[3], and George Ntoumenopoulos, BSPT, PhD[4]

PHYSIOTHERAPY THEORY and PRACTICE

CASE REPORT



Diagnostic radiologique : atélectasie

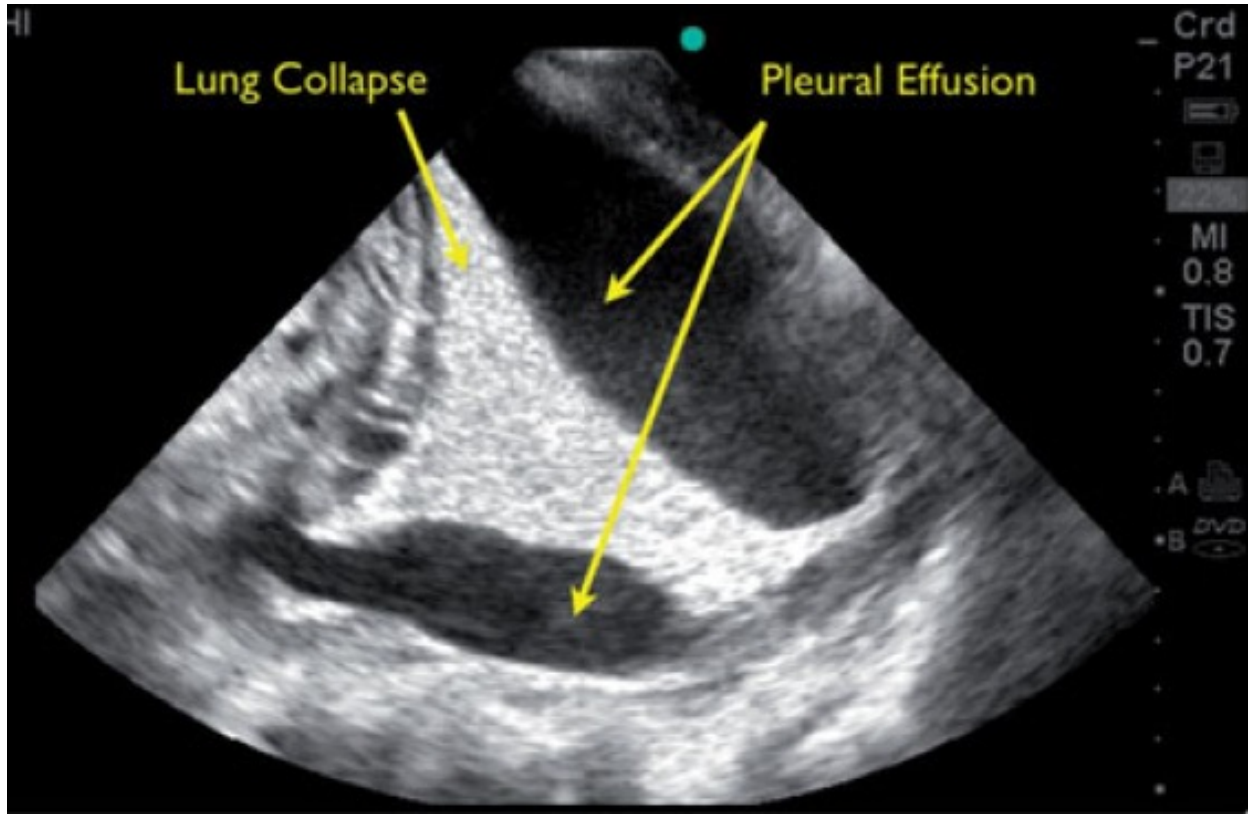
Opacité radiologique : ex d'un cas clinique

Physiotherapist-initiated lung ultrasound to improve intensive care management of a deteriorating patient and prevent intubation: a case report

Maja Leech, BS, MPT[1], Bernie Bissett, BSPT (Hons)[1,2], Marta Kot, MD, PgDipEcho[3], and George Ntoumenopoulos, BSPT, PhD[4]

PHYSIOTHERAPY THEORY and PRACTICE

CASE REPORT



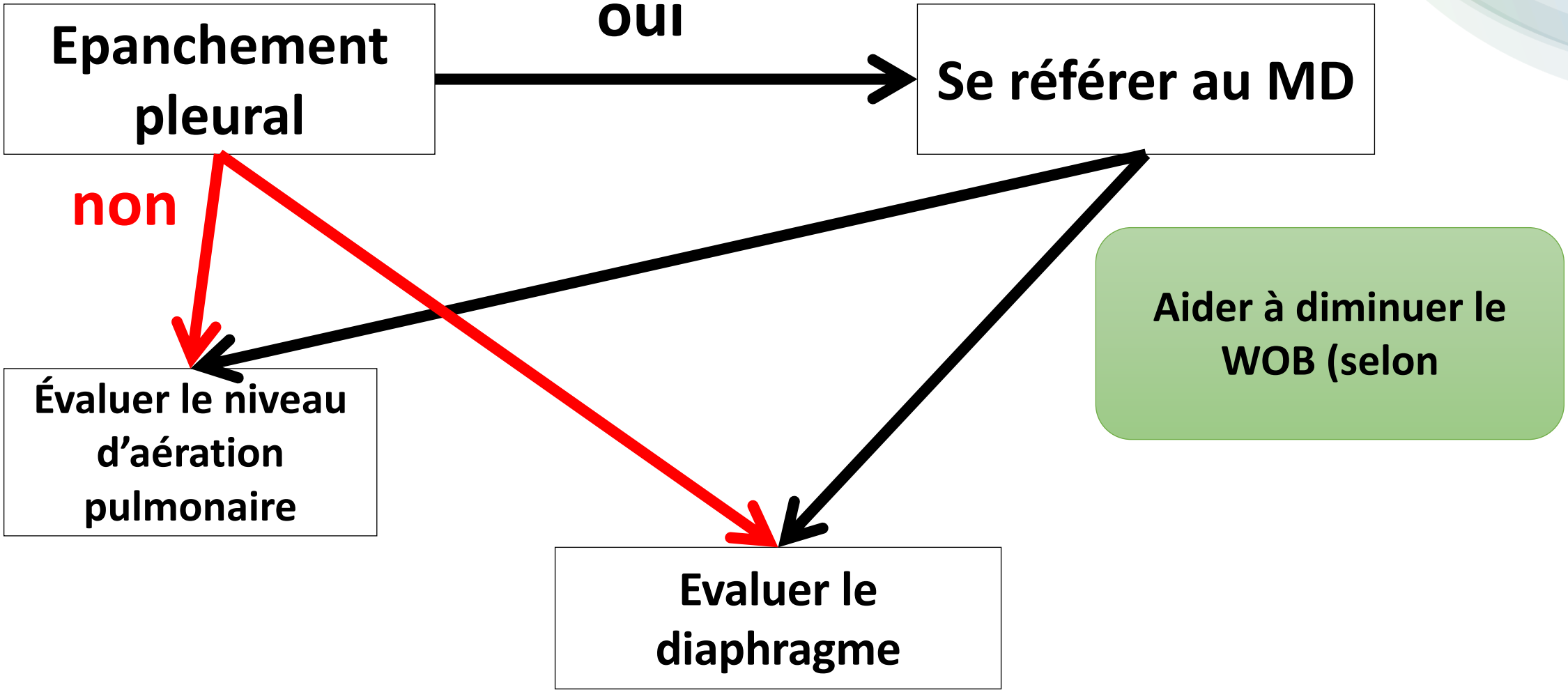
Diagnostic écho :
Épanchement pleural

Situation clinique typique

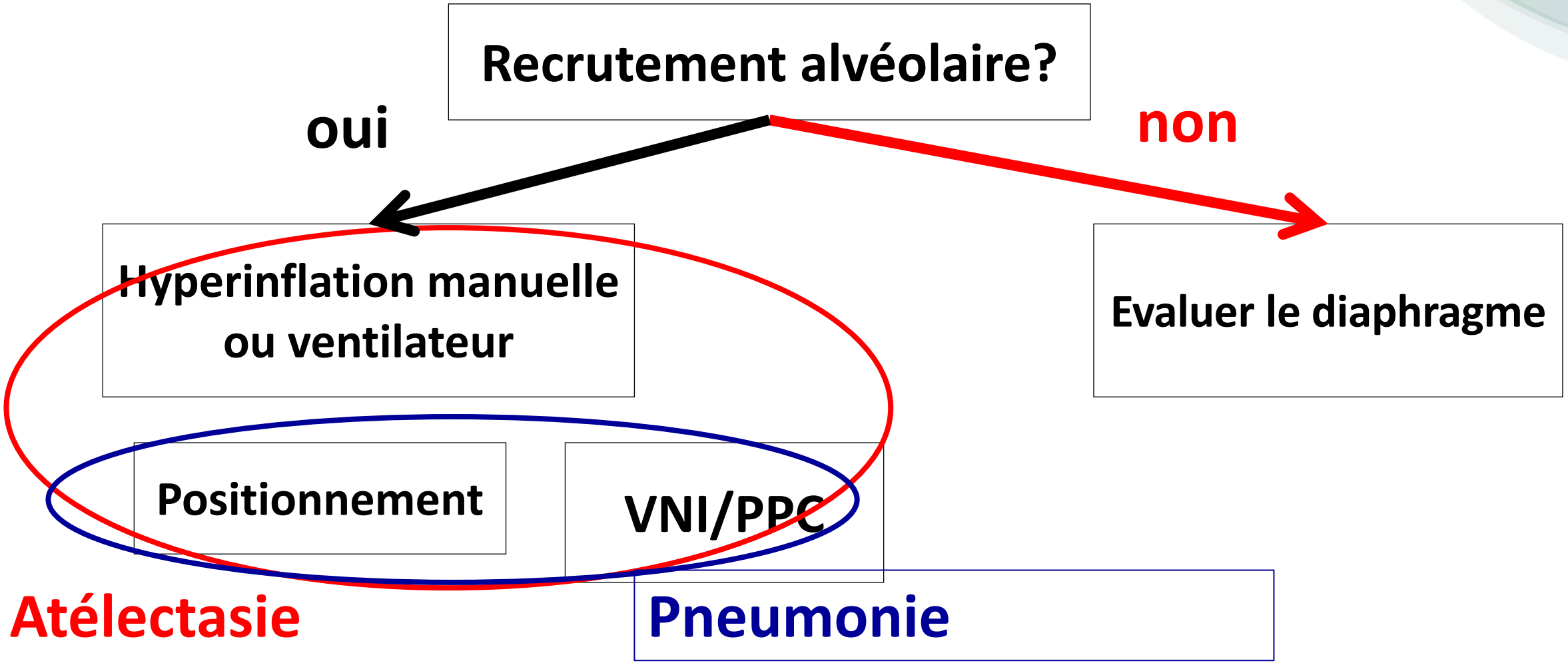
- Patient avec symptômes respiratoires aigus
  - Abolition du murmure vésiculaire
  - Matité
  - Diminution de la mobilité thoracique
- Localisé aux bases pulmonaires
- +/- opacités radiologiques

Selot Kinésither Rev 2017

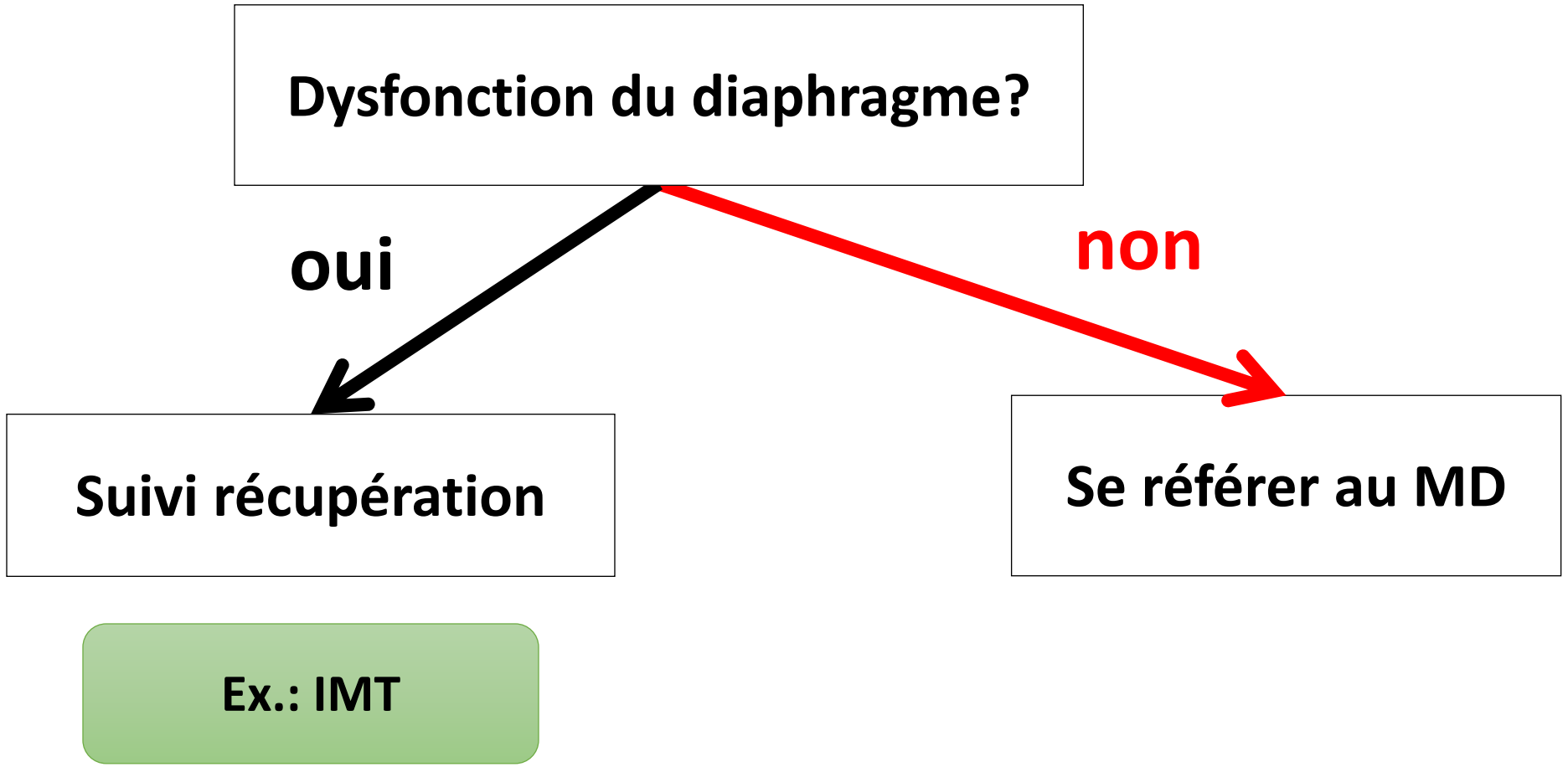
Epanchement pleural ?



Evaluation du niveau d'aération



Fonction diaphragmatique



Guider la kinésithérapie respiratoire

Monitoring de l'aération pulmonaire

Bedside Ultrasound Assessment of Positive End-Expiratory Pressure–induced Lung Recruitment

Belaïd Bouhemad[1], Hélène Brisson[1], Morgan Le-Guen[1], Charlotte Arbelot[1], Qin Lu[1], and Jean-Jacques Rouby[1]

AMERICAN JOURNAL OF RESPIRATORY AND CRITICAL CARE MEDICINE VOL 183 2011

Ultrasound assessment of antibiotic-induced pulmonary reaeration in ventilator-associated pneumonia*

Bélaïd Bouhemad, MD, PhD; Zhi-Hai Liu, MD; Charlotte Arbelot, MD; Mao Zhang, MD; Fabio Ferarri, MD, PhD; Morgan Le-Guen, MD; Martin Girard, MD; Qin Lu, MD, PhD; Jean-Jacques Rouby, MD, PhD

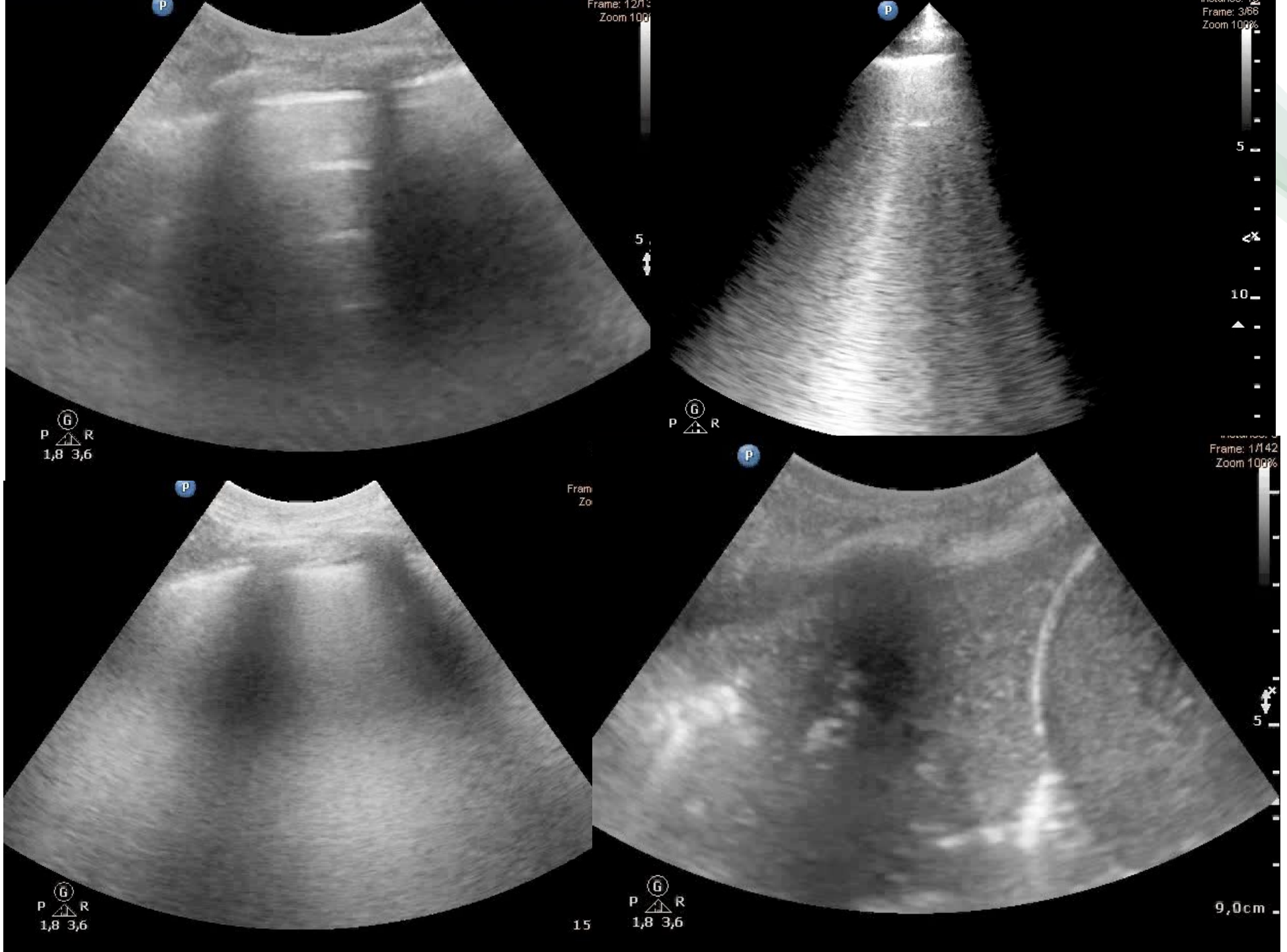
Crit Care Med 2010 Vol. 38, No. 1

Ultrasound Assessment for Extravascular Lung Water in Patients Undergoing Hemodialysis*

Time Course for Resolution

CHEST / 135 / 6 / JUNE, 2009

Vicki E. Noble, MD, RDMS; Alice F. Murray, MBChB; Roberta Capp, MD; Mary H. Sylvia-Reardon, RN; David J. R. Steele, MD; and Andrew Liteplo, MD, RDMS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Frame: 3/66
Zoom 100%
5
10
Frame: 1/142
Zoom 100%
9,0cm
15

CASE REPORT

Chest ultrasounds to guide manual reexpansion of a postoperative pulmonary atelectasis: a case report

F. CAVALIERE, D. BIASUCCI, R. COSTA, M. SOAVE, G. ADDABBO, R. PROIETTI

Institute of Anaesthesia and Intensive Care of the Catholic University of the Sacred Heart, Rome, Italy

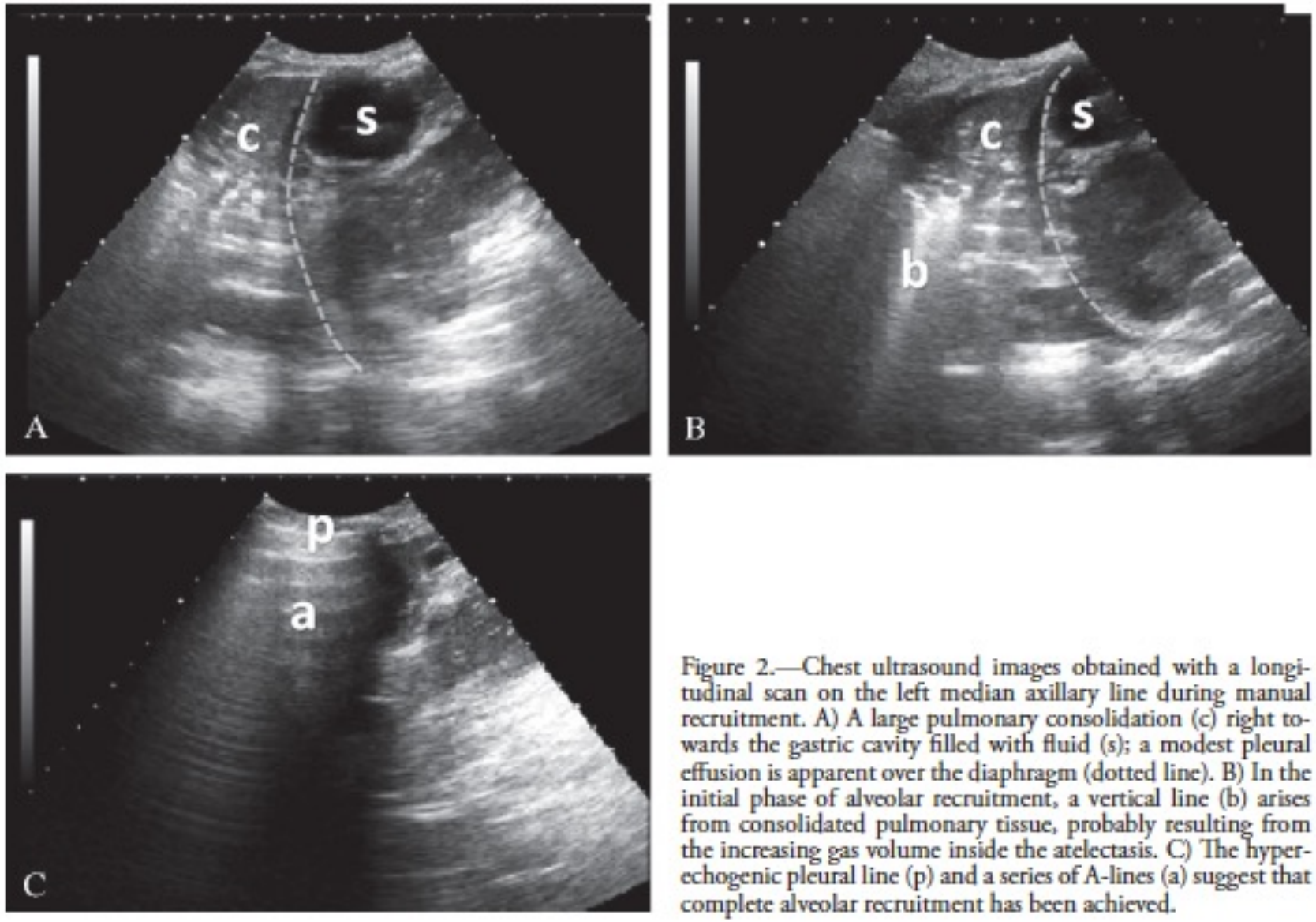
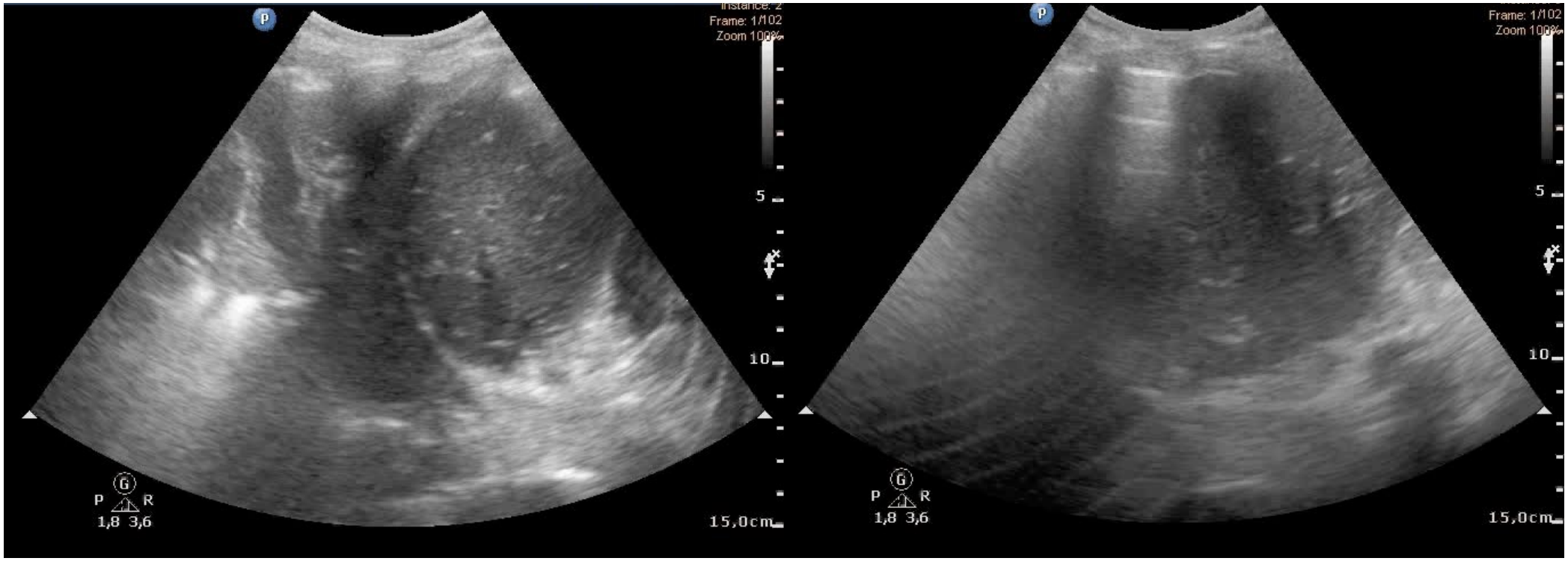


Figure 2.—Chest ultrasound images obtained with a longitudinal scan on the left median axillary line during manual recruitment. A) A large pulmonary consolidation (c) right towards the gastric cavity filled with fluid (s); a modest pleural effusion is apparent over the diaphragm (dotted line). B) In the initial phase of alveolar recruitment, a vertical line (b) arises from consolidated pulmonary tissue, probably resulting from the increasing gas volume inside the atelectasis. C) The hyperechogenic pleural line (p) and a series of A-lines (a) suggest that complete alveolar recruitment has been achieved.

Traitement par KR d'une atélectasie

Diagnostic **Monitoring**



Lobe inférieur gauche – vue longitudinale

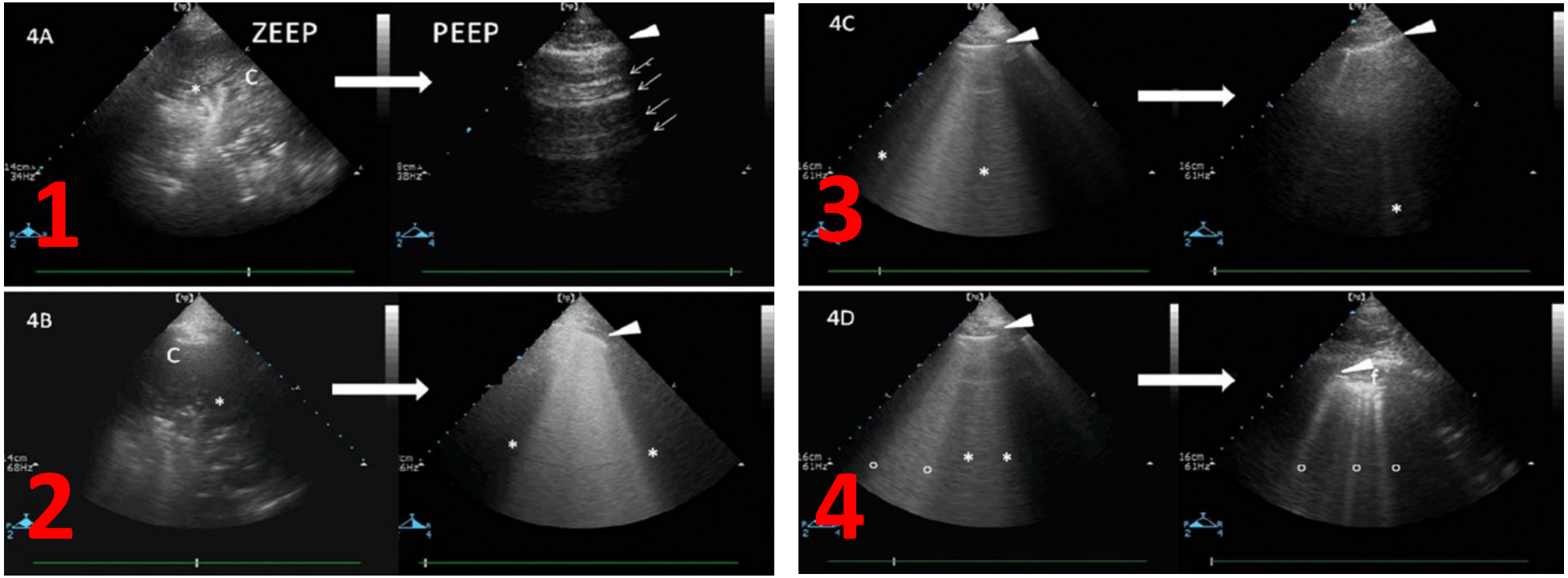
Consolidation **Ré-aération pulmonaire**

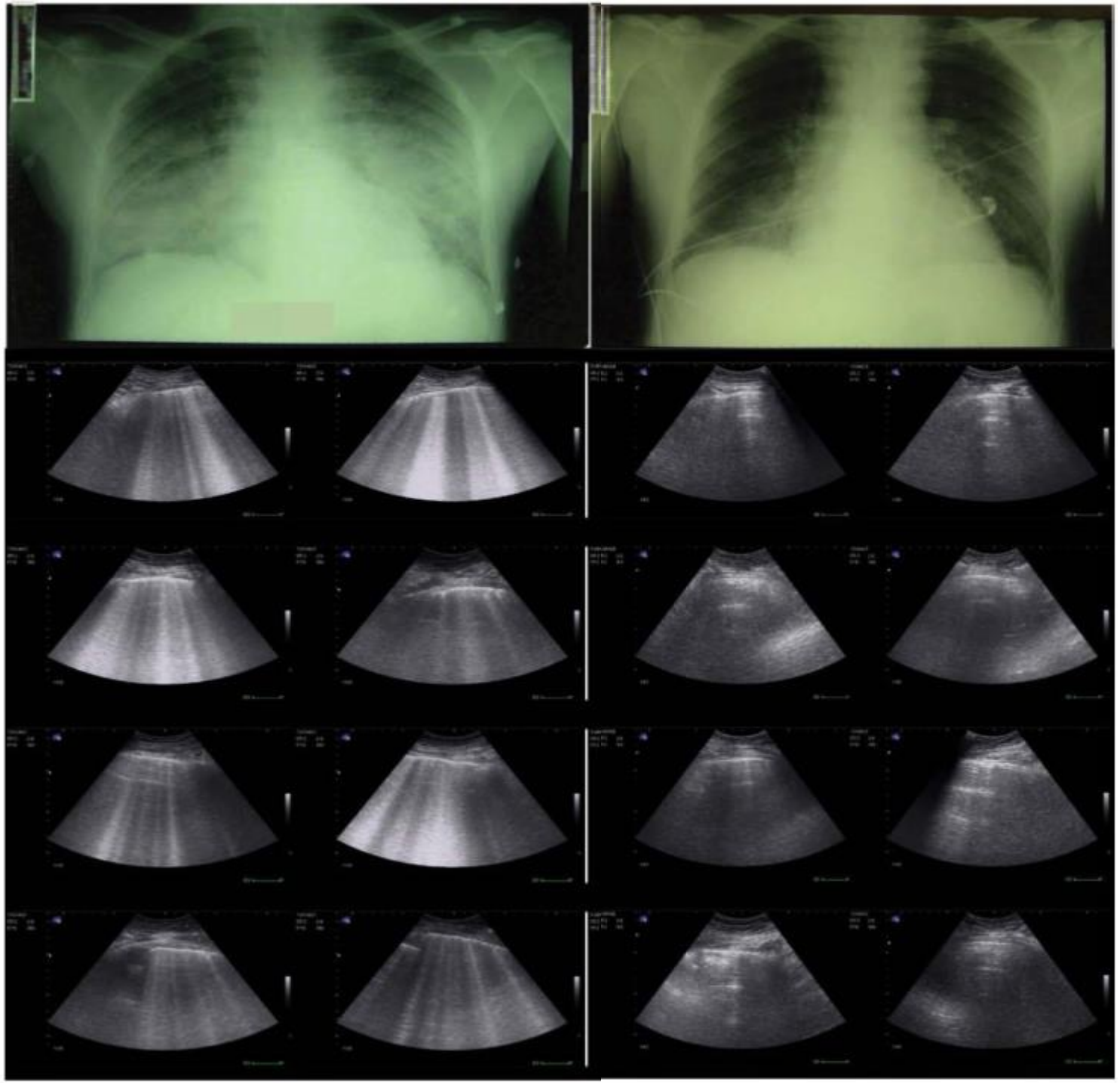
Monitoring échographique du ecrutement alvéolaire

Bedside Ultrasound Assessment of Positive End-Expiratory Pressure–induced Lung Recruitment

Belaïd Bouhemad[1], Hélène Brisson[1], Morgan Le-Guen[1], Charlotte Arbelot[1], Qin Lu[1], and Jean-Jacques Rouby[1]

AMERICAN JOURNAL OF RESPIRATORY AND CRITICAL CARE MEDICINE VOL 183 2011





Volpicelli et al 2013
OAP cardiogénique massif

- **Pre Rx diffuse B lines**
- **4 wks post Rx - resolution**

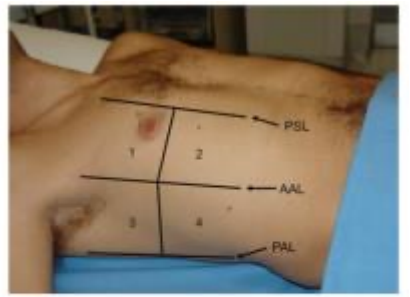
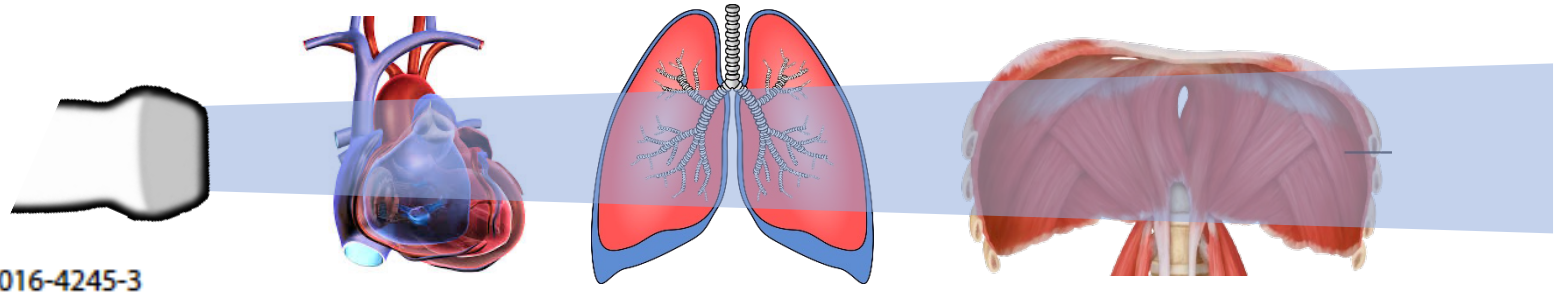


Fig. 2 The four chest areas per side considered for complete eight-zone lung ultrasound examination. These areas are used to evaluate for the presence of interstitial syndrome. Areas *1* and *2* denote the upper anterior and lower anterior chest areas, respectively. Areas *3* and *4* denote the upper lateral and basal lateral chest areas, respectively. *PSL* parasternal line, *AAL* anterior axillary line, *PAL* posterior axillary line (modified from Volpicelli et al. [19])

Sevrage de la ventilation mécanique



Intensive Care Med
DOI 10.1007/s00134-016-4245-3

REVIEW

Ultrasonography evaluation during the weaning process: the heart, the diaphragm, the pleura and the lung

P. Mayo[1*], G. Volpicelli[2], N. Lerolle[3], A. Schreiber[4], P. Doelken[5] and A. Vieillard-Baron[6,7,8]

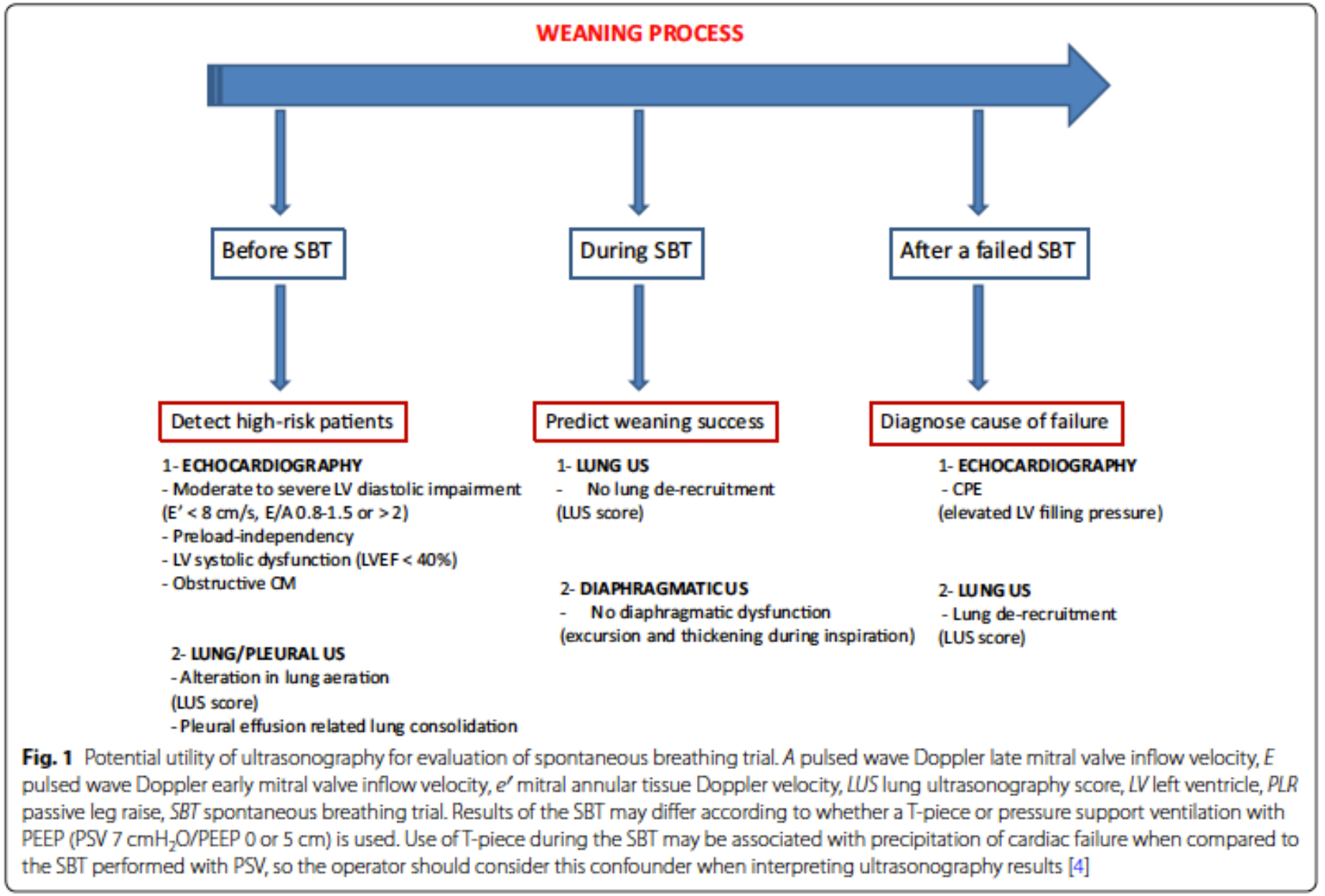


Fig. 1 Potential utility of ultrasonography for evaluation of spontaneous breathing trial. *A* pulsed wave Doppler late mitral valve inflow velocity, *E* pulsed wave Doppler early mitral valve inflow velocity, *e'* mitral annular tissue Doppler velocity, *LUS* lung ultrasonography score, *LV* left ventricle, *PLR* passive leg raise, *SBT* spontaneous breathing trial. Results of the SBT may differ according to whether a T-piece or pressure support ventilation with PEEP (PSV 7 cmH_2O/PEEP 0 or 5 cm) is used. Use of T-piece during the SBT may be associated with precipitation of cardiac failure when compared to the SBT performed with PSV, so the operator should consider this confounder when interpreting ultrasonography results [4]

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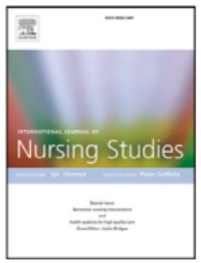
journal homepage: www.elsevier.com/ijns



Diagnostic accuracy of diaphragm ultrasound to predict weaning outcome: A systematic review and meta-analysis

Aymeric Le Neindre[a,b,*], François Philippart[c], Marta Luperto[d], Johan Wormser[c], Johanna Morel-Sapene[f], Serge L. Aho[g], Silvia Mongodi[h], Francesco Mojoli[h,i], Belaid Bouhemad[b,e]

[a] Respiratory Intensive Care and Research Units, Hôpital Forcilles, Férolles-Attilly, France
[b] LNC UMR1231, University of Bourgogne Franche-Comté, Dijon, France
[c] Medical and Surgical Intensive Care Unit, Groupe Hospitalier Paris Saint-Joseph, Paris, France
[d] Intensive Care Unit, Hôpital Antoine Béclère, Clamart, France
[e] Department of Anesthesiology and Intensive Care, University Hospital of Dijon, Dijon, France
[f] Medical Intensive Care Unit, Carmas Research Group, Henri Mondor Universitary Hospital, Creteil, France
[g] Service d'Epidémiologie et d'Hygiène Hospitalières, University Hospital of Dijon, Dijon, France
[h] Anesthesia and Intensive Care, Fondazione IRCCS Policlinico San Matteo, Pavia, Italy
[i] Department of Clinical-Surgical, Diagnostic and Pediatric Sciences-Anesthesia, Intensive Care and Pain Therapy, University of Pavia, Pavia, Italy

Sevrage de la ventilation mécanique

A

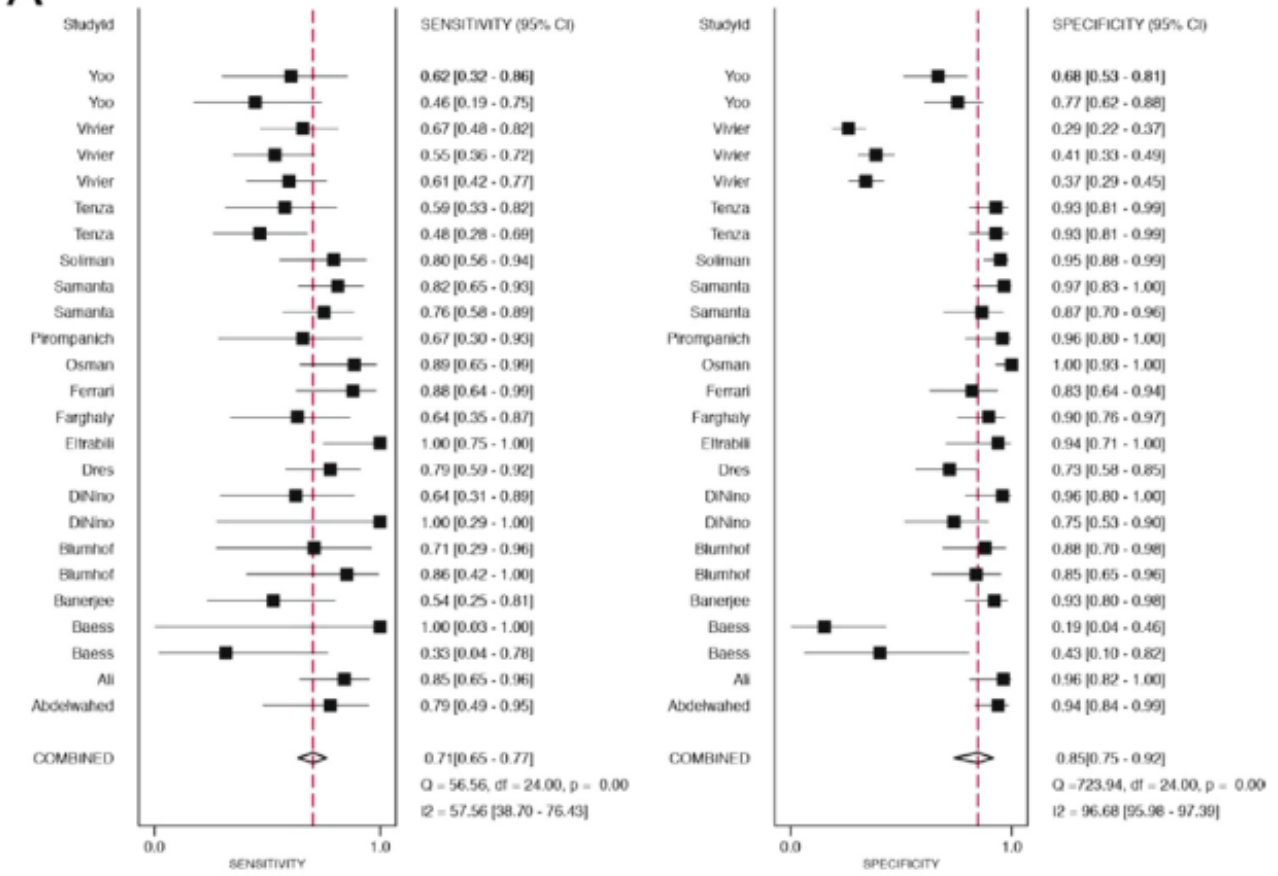


Fig. 3. Forest plot of sensitivity and specificity
(A) Forest plot of sensitivity and specificity for diaphragm thickening fraction
(B) Forest plot of sensitivity and specificity for diaphragm excursion.

Sevrage de la ventilation mécanique

B

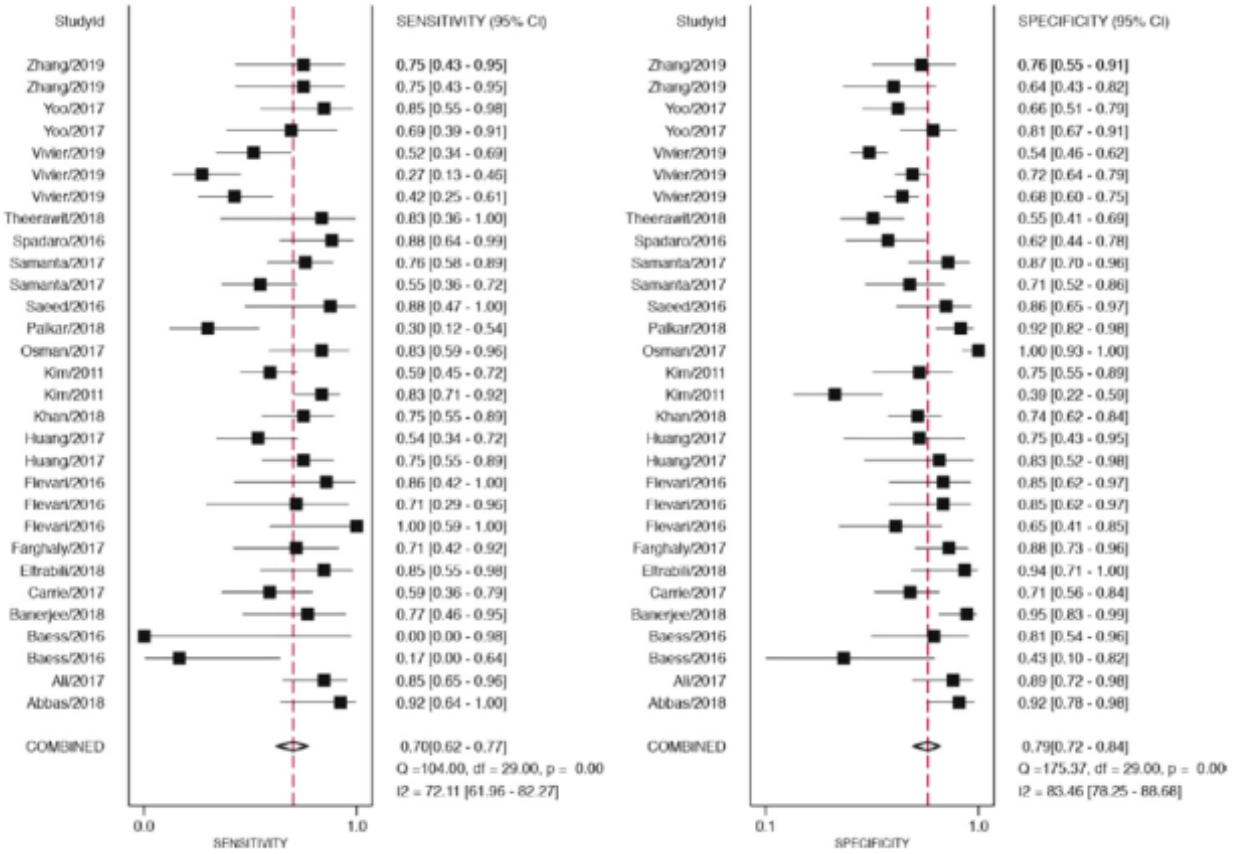


Fig. 3. Forest plot of sensitivity and specificity
(A) Forest plot of sensitivity and specificity for diaphragm thickening fraction
(B) Forest plot of sensitivity and specificity for diaphragm excursion.

Quel impact de l'échographie en kinésithérapie respiratoire ?

Critical care

Original research

Thoracic ultrasound influences physiotherapist's clinical decision-making in respiratory management of critical care patients: a multicentre cohort study

Aymeric Le Neindre ,[1,2] Louise Hansell,[3,4] Johan Wormser,[5] Andreia Gomes Lopes,[6] Carlos Diaz Lopez,[7] Christophe Romanet,[5] Gerald Choukroun,[8] Maxime Nguyen ,[9] François Philippart,[5] Pierre-Grégoire Guinot,[9] Hergen Buscher,[10,11] Bélaid Bouhemad,[2,9] George Ntoumenopoulos[12]

Thorax

Quel impact de l'échographie en kinésithérapie respiratoire ?

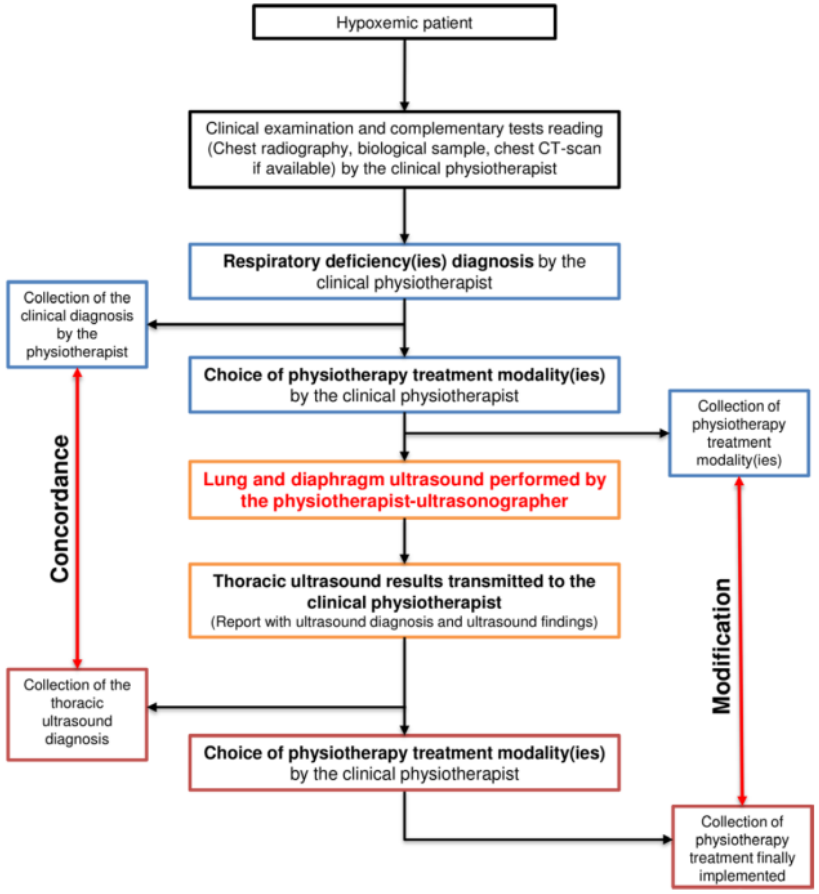
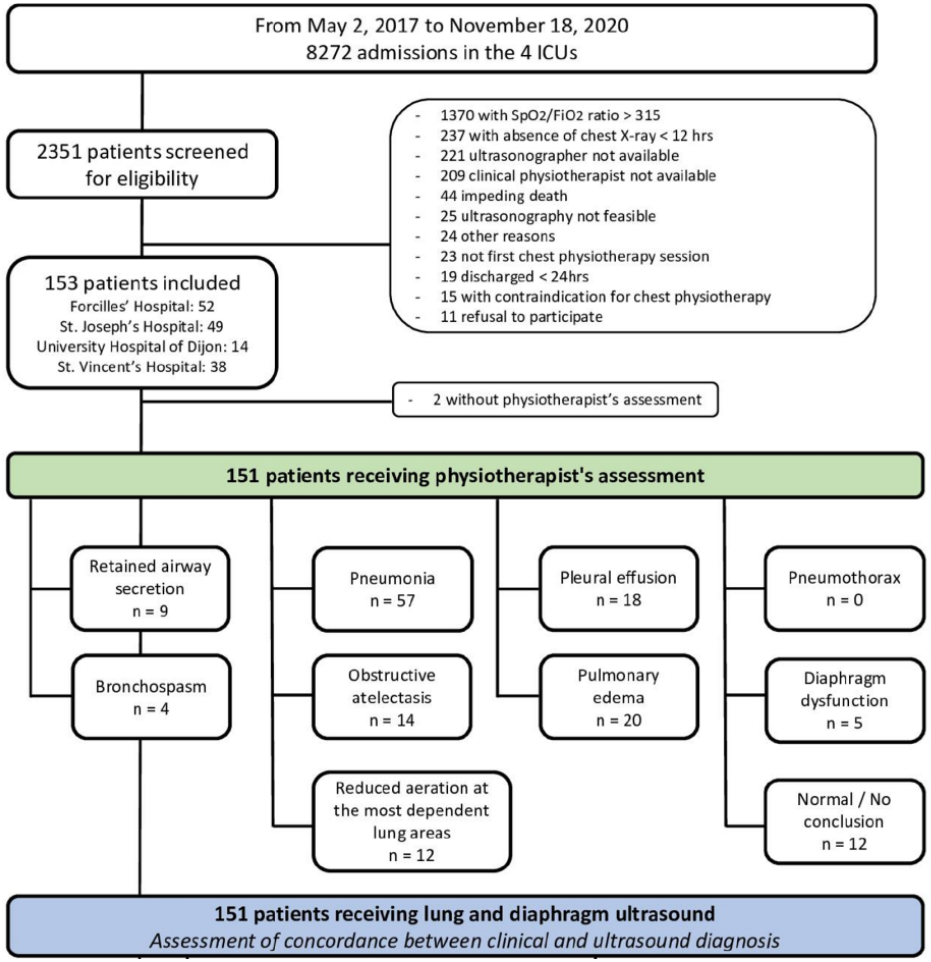


Figure 2 Detailed study flow and timing.



Quel impact de l'échographie en kinésithérapie respiratoire ?

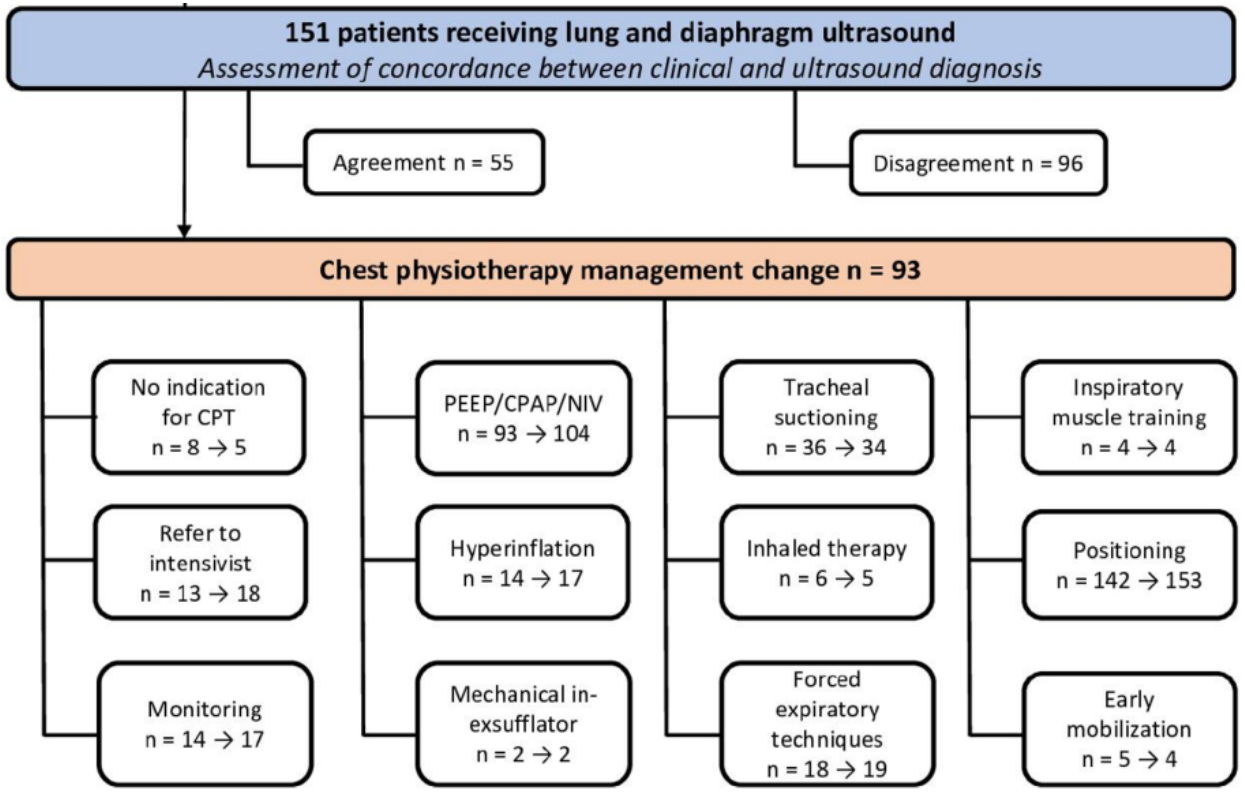


Figure 3 Study flow chart. Arrows indicate change in chest physiotherapy treatment frequencies after thoracic ultrasound. CPAP, continuous positive airway pressure; CPT, chest physiotherapy; ICU, intensive care unit; NIV, non-invasive ventilation; PEEP, positive end-expiratory pressure.

Quel impact de l'échographie en kinésithérapie respiratoire ?

Variable		N	Odds ratio	p
CHD	no	106	Reference	
	yes	30	0.25 (0.07, 0.74)	0.017
Certainty	no	51	Reference	
	yes	85	3.28 (1.30, 8.71)	0.014
Reason for	respiratory	81	Reference	
admission	medical	36	0.68 (0.25, 1.78)	0.436
	surgical	19	0.12 (0.02, 0.60)	0.019
Clinical	alveolar	70	Reference	
diagnosis	no parenchymal	22	0.06 (0.01, 0.26)	<0.001
	no ventilation	44	0.26 (0.09, 0.69)	0.008
Heart rate		136	1.02 (1.00, 1.04)	0.115

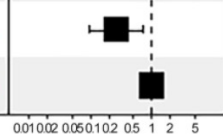


Figure 4. Forest Plot of Multivariate Analysis of Factors Potentially Associated with Diagnosis Concordance. Abbreviations: CHD, chronic heart disease; Certainty, Is the physiotherapist certain in his diagnosis?; Reason for admission, respiratory, surgical or medical (other medical reason); Clinical diagnosis is aggregated as alveolar (alveolar pathologies: pneumonia or edema) or no parenchymal (no parenchymal lesions: airway retained secretions, bronchospasm, normal) or no ventilation (no lung ventilation: atelectasis, effusion, pneumothorax, reduced aeration at the most dependent parts, diaphragm dysfunction).

Quel impact de l'échographie en kinésithérapie respiratoire ?

Table 2 Reasons for major change of chest physiotherapy treatment

Treatment change considered as major	n=38 (41)
Alveolar recruitment vs ACT, n (%)	4 (4)
No CPT vs CPT, n (%)	2 (2)
Change of laterocubitus side, n (%)	8 (9)
Refer to MD vs CPT, n (%)	9 (10)
Alveolar recruitment vs inhaled therapy, n (%)	1 (1)
CPT vs no CPT, n (%)	11 (12)
IMT added to initial treatment, n (%)	3 (3)

Finally implemented versus initially planned chest physiotherapy treatment.
ACT, airway clearance techniques; CPT, chest physiotherapy; IMT, inspiratory muscles training; MD, medical doctor.

Avantages et limites

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The Ultrasound Journal

REVIEW Open Access

A proposed framework for point of care lung ultrasound by respiratory physiotherapists: scope of practice, education and governance

Mike Smith[1*], Simon Hayward[2] and Sue Innes[3]

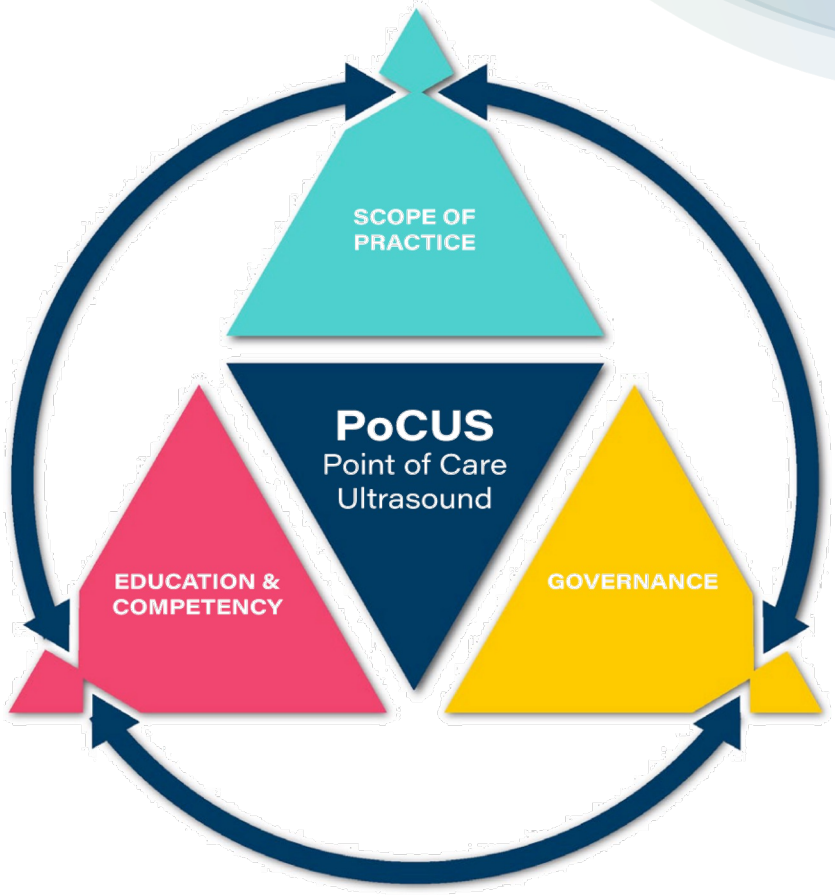

Fig. 1 PoCUS framework triangle. Concept by Dr Mike Smith (Cardiff University, UK), created by Dan Molloy (freshwater.media), copyright 2021 Dr Mike Smith

Avantages et limites

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Research paper

Barriers and facilitators to achieving competence in lung ultrasound: A survey of physiotherapists following a lung ultrasound training course

Louise Hansell, BSc Physiotherapy [a, b, *], Maree Milross, PhD [b], Anthony Delaney, FCICM, PhD [a, c, d, e, f], David H. Tian, PhD [g], Arvind Rajamani, FCICM, PhD [h], George Ntoumenopoulos, PhD [i]

Table 4
Barriers to gaining competence in LUS for participants who had performed at least 1 LUS (n = 20).

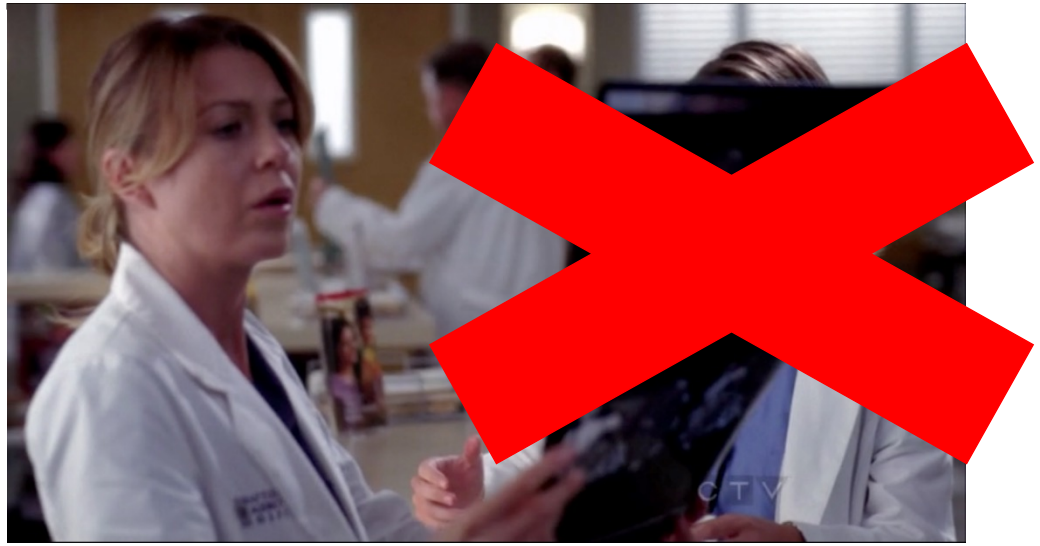
Data presented as *n* (%)	
Unable to devote adequate time to performing LUS due to clinical load	11 (55)
Lack of supervision	10 (50)
Insufficient training	6 (30)
Lacking confidence in skill	5 (25)
Ultrasound machine onsite, but not available to physiotherapist	3 (15)
LUS for physiotherapists not supported by medical staff	2 (10)
No ultrasound machine available	0
Patients unavailable or not willing to participate	0
Other	
Unaware of requirements to gain competency	2 (10)
Not working in a clinical physiotherapy environment	2 (10)
Suitable probes not available	1 (5)

LUS, lung ultrasound.

Avantages

- Non invasive
- Absence de radiation
- Répétable
- Précision augmentée comparé à la RX thoracique dans la plupart des pathologies respiratoires aigues
- Outils clinique et de recherche

Conclusion



Avez-vous des questions ?

aymeric.leneindre@gmail.com