



# POCUS pleury a plic, co nám ukáže a co neukáže

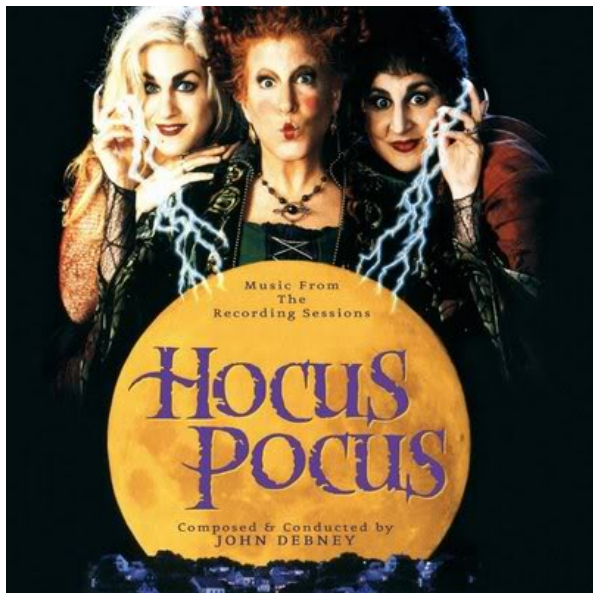
MUDr. Petr Vojtíšek



KLINIKA ANESTEZIOLOGIE, PERIOPERAČNÍ A INTENZIVNÍ MEDICÍNY  
FAKULTY ZDRAVOTNICKÝCH STUDIÍ UNIVERZITY J. E. PURKYNĚ V ÚSTÍ NAD LABEM  
A KRAJSKÉ ZDRAVOTNÍ, a. s. – MASARYKOVY NEMOCNICE V ÚSTÍ NAD LABEM, o. z.



# POCUS není HOKUS POKUS... (cit. Roman Škulec)



....ale TVRDÁ DATA !

# Někde je třeba začít

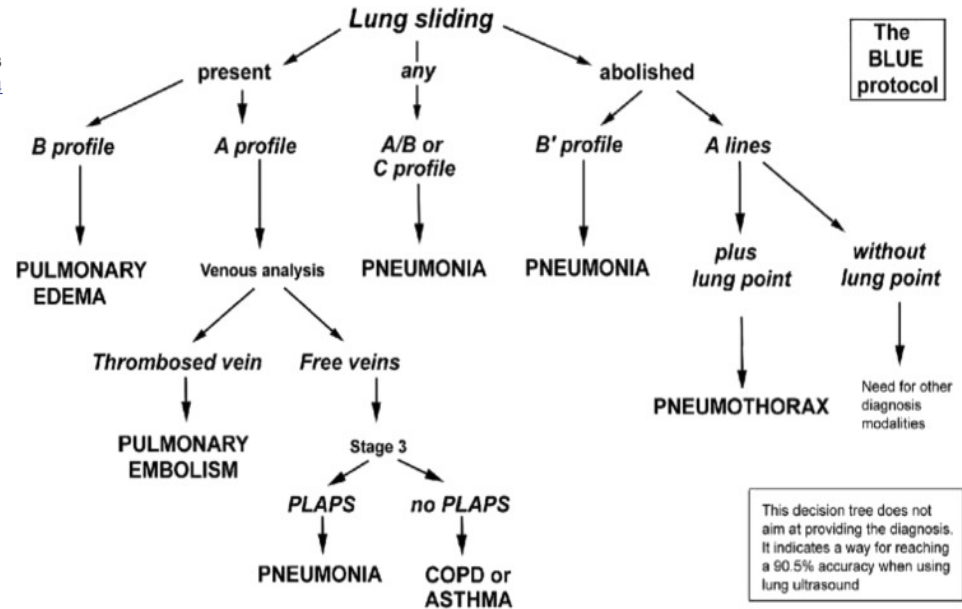


[Chest](#). 2008 Jul; 134(1): 117-125.  
Published online 2008 Apr 10. doi: [10.1378/chest.07-2800](https://doi.org/10.1378/chest.07-2800)

PMCID: PMC3734893  
PMID: [18403664](https://pubmed.ncbi.nlm.nih.gov/18403664/)

Relevance of Lung Ultrasound in the Diagnosis of Acute Respiratory Failure\*

[Daniel A. Lichtenstein](#), MD, FCCP<sup>30</sup> and [Gilbert A. Mezière](#), MD



The BLUE protocol

This decision tree does not aim at providing the diagnosis. It indicates a way for reaching a 90.5% accuracy when using lung ultrasound

[Chest](#). 1995 Nov;108(5):1345-8.

**A bedside ultrasound sign ruling out pneumothorax in the critically ill. Lung sliding.**

[Lichtenstein DA](#)<sup>1</sup>, [Menu Y](#).

PMCID: PMC3750689  
PMID: 23937880

Multidiscip Respir Med. 2013; 8(1): 54.  
Published online 2013 Aug 9. doi: [10.1186/2049-6958-8-54](https://doi.org/10.1186/2049-6958-8-54)

# The role of chest ultrasonography in the r diseases: document I

## The efficacy of bedside chest ul

Mark Hew, Tunu Ren Tay  
European Respiratory Review 2016 25: 230-246; doi:

Alessandro Zanforlini, 1 Rosangela Giannuzzi, 2 Stefano Nardini,  
3 Giampietro Marchetti, 7 Salvatore Valente, 8 Riccardo Inchingolo, 8 and Andr

Approaches to point-of-care lung ultrasound.

Chest. 2013 Feb 1;143(2):415-422. doi: 10.1378/chech.12-1445.

International evidence-based recomi

Using thoracic ultrasonography to accurately

pr

International Liason C

the critically

ill

Daniel A Lichtenstein  
Annals of Intensive Care  
2014 4:1  
<https://doi.org/10.1186/2110-5820-4-1>  
© Lichtenstein, licensee  
Springer 2014  
Received: 4 July 2013  
Accepted:  
30 November 2013  
Published: 9 January 2014

Novel approaches to ultrasonography of the lung and pleural space: where are we now?

Practical approach  
A Miller MBChB  
Consultant Inten  
Wolverhampton

Department, Royal Wolverhampton Hospitals, New Cross Hospital,  
Breda, 2011 3, 100-111; doi: 10.1186/2074735-04117

ound: from accuracy to outcomes

ing positive

PLA Education, 16(2): 39-43 (2016)  
doi: 10.1007/s12012-016-0012-2  
Advance Access Publication Date: 19 June 2015

Better With Ultrasound  
Pleural Procedures in Critically Ill Patients  
Scott L Milligan, MD  
Seth Koenig, MD  
Primary Medicine  
DOI: <https://doi.org/10.1016/j.ccr.2017.06.043>

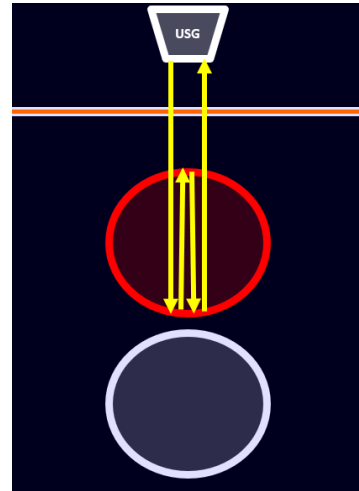


Concetti

Dean A, Tsung JW, Soldat  
Noble VE, Via G, Dean A, Neri L, Storti E,  
Kreutz B, Seibel A, and (CC-BY)

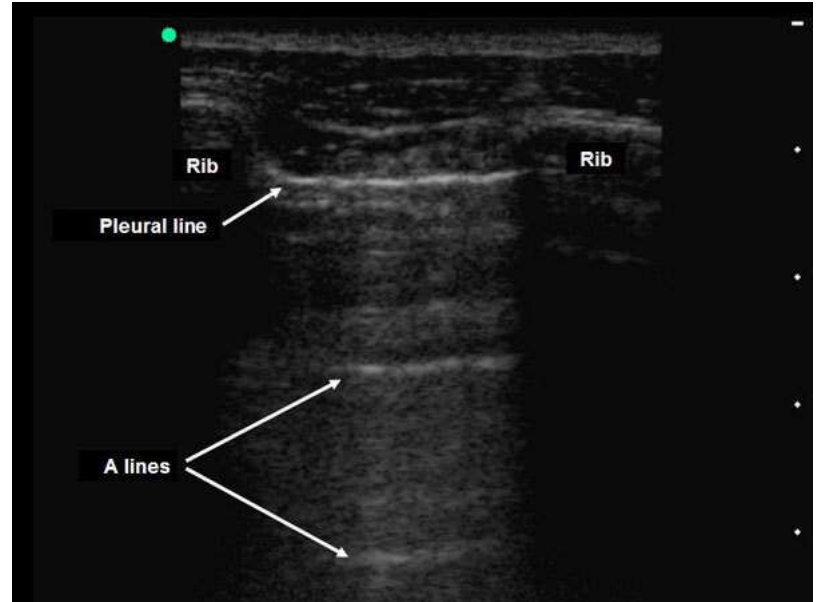
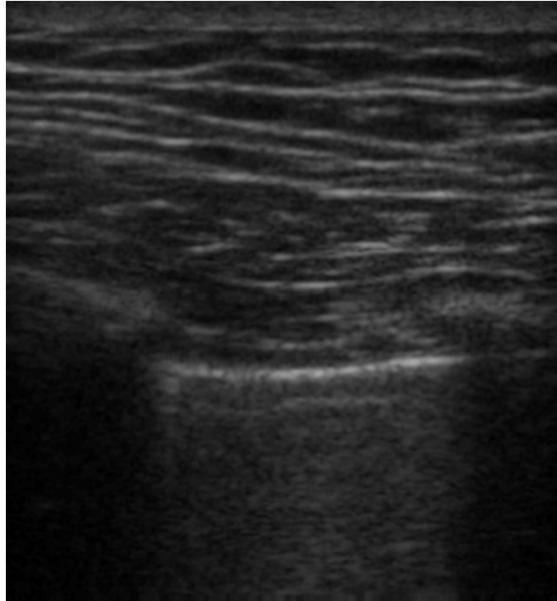
# Proč je vůbec ultrazvuk plic možný

- Tradiční ultrasonografie zobrazuje **REÁLNÉ** struktry
- Plicní ultrasonografie zobrazuje často **ARTEFAKTY**
- Nicméně tyto artefakty jsou natolik specifické, že jsou diagnostické
- Fenomén reverberace
- V případě konzolidace plicní tkáně či tekutiny v pleurálním prostoru se jedná již o „běžný“ UZ



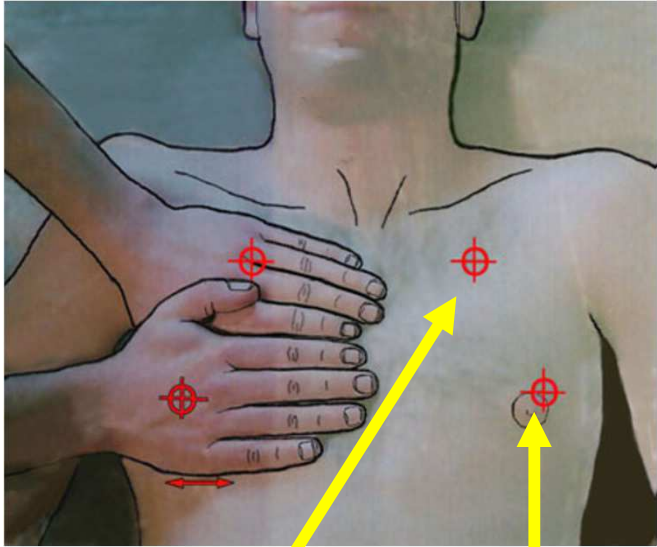
© Can Stock Photo - csp42936769

# Přímo a nepřímě zobrazené struktury



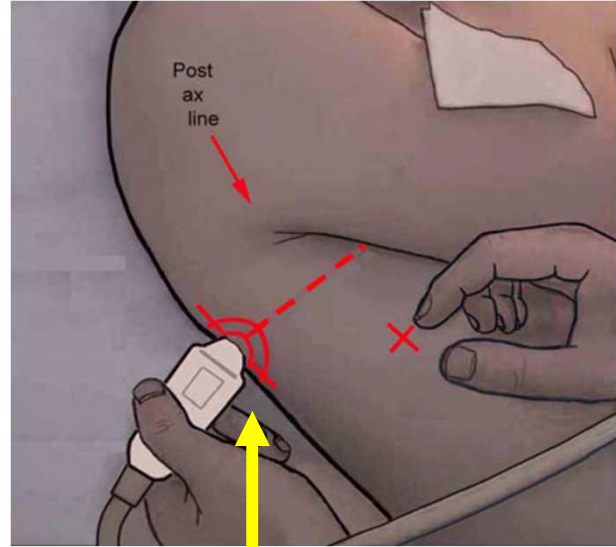


# ***BLUE*** (*Bedside lung Ultrasound in Emergency*)



**horní  
*BLUE* point**

**dolní  
*BLUE* point**

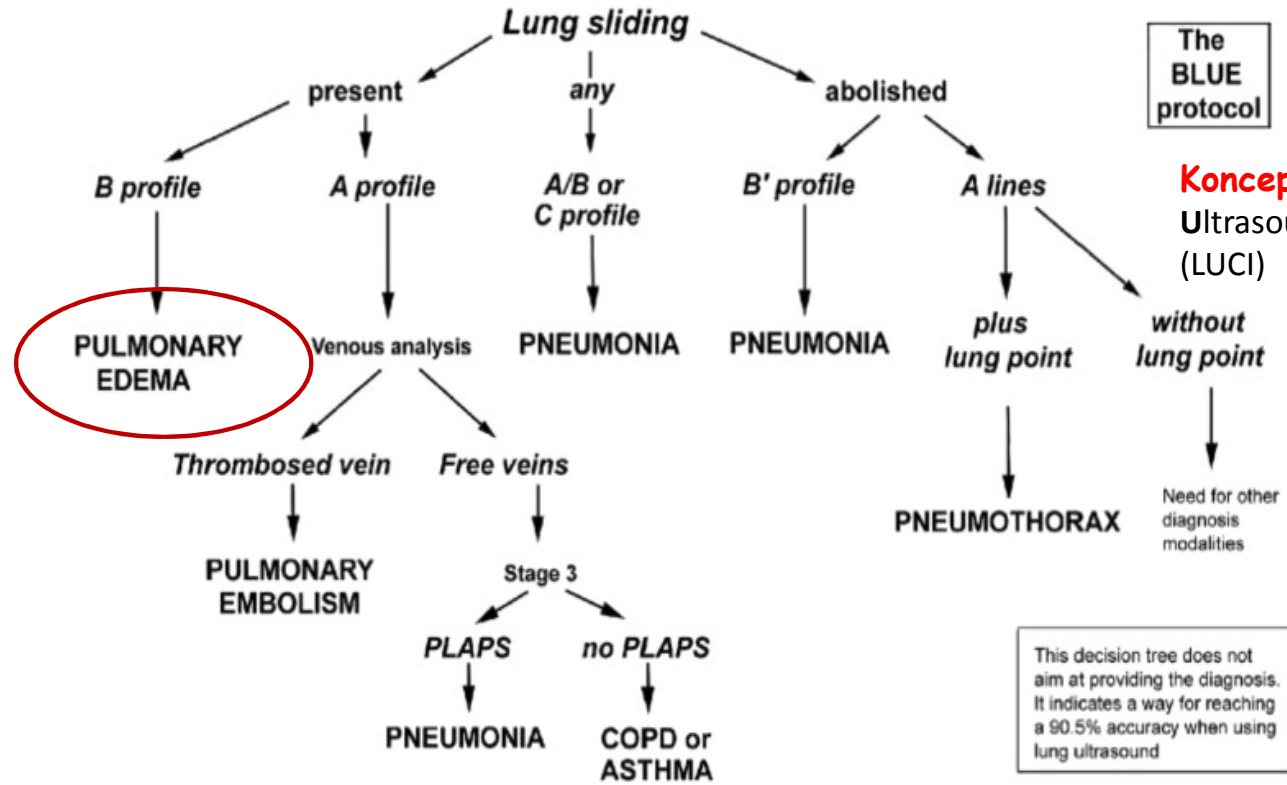


***PLAPS* point**

# Novel approaches to ultrasonography of the lung and pleural space: where are we now?

Daniel Lichtenstein

Breathe 2017 13: 100-111; DOI: 10.1183/20734735.004717



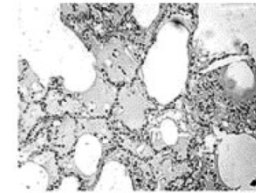
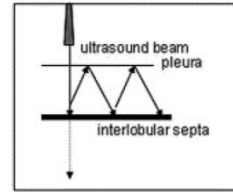
**Koncept LUCI** - Lung  
Ultrasound in the Critically ill  
(LUCI)

This decision tree does not aim at providing the diagnosis. It indicates a way for reaching a 90.5% accuracy when using lung ultrasound

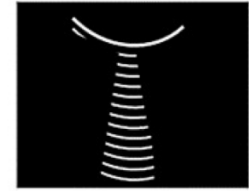


# Plicní edém

- **Přítomnost komet - také specifický artefakt**
- Komety musí splňovat řadu parametrů, především „startovat“ z pleury
- 3 a více na jeden sledovaný sektor a dechovou revolucí
- Mažou A-line
- Vazba na dechovou revoluci
- **Pozitivita - intersticiální syndrom!**



pulmonary edema



"comet-tail" artifact



[Intensive Care Medicine](#)

April 2012, Volume 38, [Issue 4](#), pp 577–591 | [Cite as](#)

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

Authors [Authors and affiliations](#)

Giovanni Volpicelli [Email author](#), Mahmoud Elbarbary, Michael Blaivas, Daniel A. Lichtenstein, Gebhard Mathis,

Andrew W. Kirkpatrick, Lawrence Melniker, Luna Gargani, Vicki E. Noble, Gabriele Via, Anthony Dean,

James W. Tsung, Gino Soldati, Roberto Copetti, Belaid Bouhemad, [show 14 more](#)

Novel approaches to ultrasonography of the lung and pleural space: where are we now?

Plicní UZ je třeba VŽDY posuzovat v souvislosti s konkrétním pacientem a klinikou!!!



[Chest](#) 2008 Jul; 134(1): 117–125  
Published online 2008 Apr 10. doi: [10.1378/chest.07-2800](https://doi.org/10.1378/chest.07-2800)

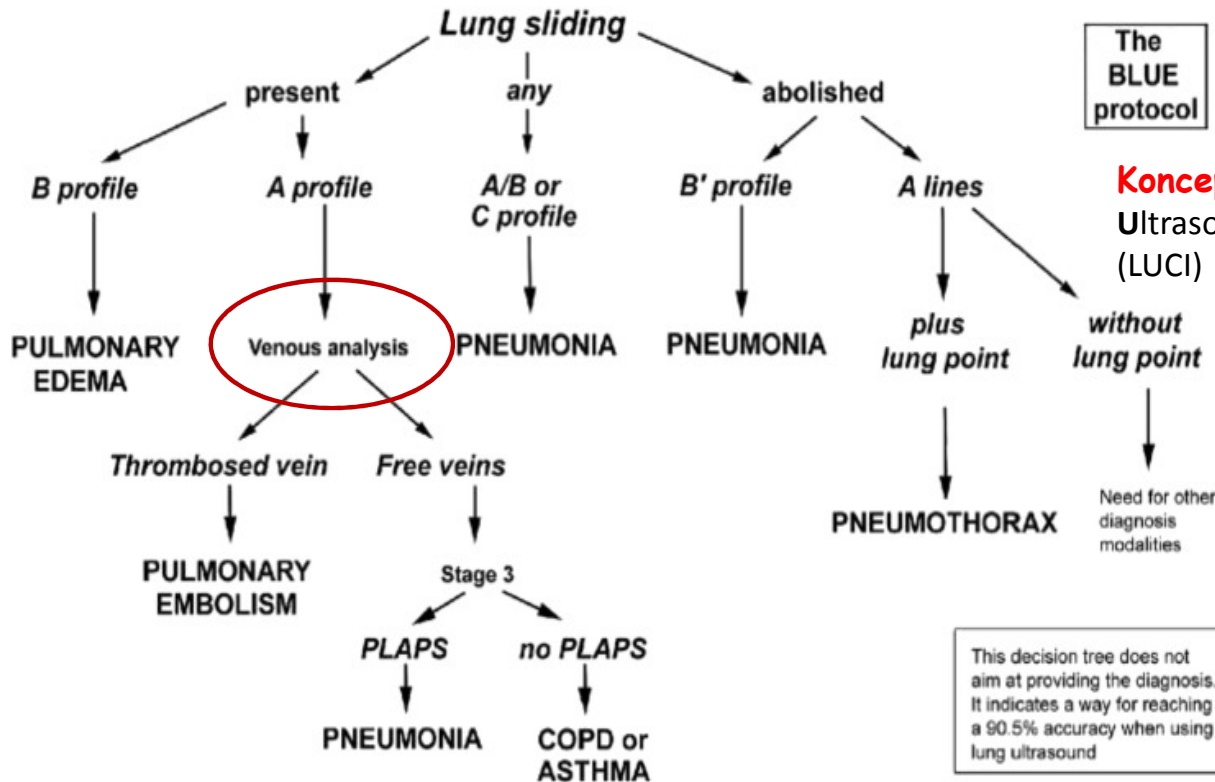
PMCID: [PMC3734893](#)  
PMID: [18403664](#)

Relevance of Lung Ultrasound in the Diagnosis of Acute Respiratory Failure\*

[Daniel A. Lichtenstein](#), MD, FCCP<sup>23</sup> and [Gilbert A. Mezière](#), MD

# Novel approaches to ultrasonography of the lung and pleural space: where are we now?

Daniel Lichtenstein  
Breathe 2017 13: 100-111; DOI: 10.1183/20734735.004717



The BLUE protocol

**Koncept LUCI** - Lung Ultrasound in the Critically ill (LUCI)

This decision tree does not aim at providing the diagnosis. It indicates a way for reaching a 90.5% accuracy when using lung ultrasound

# UZ žil

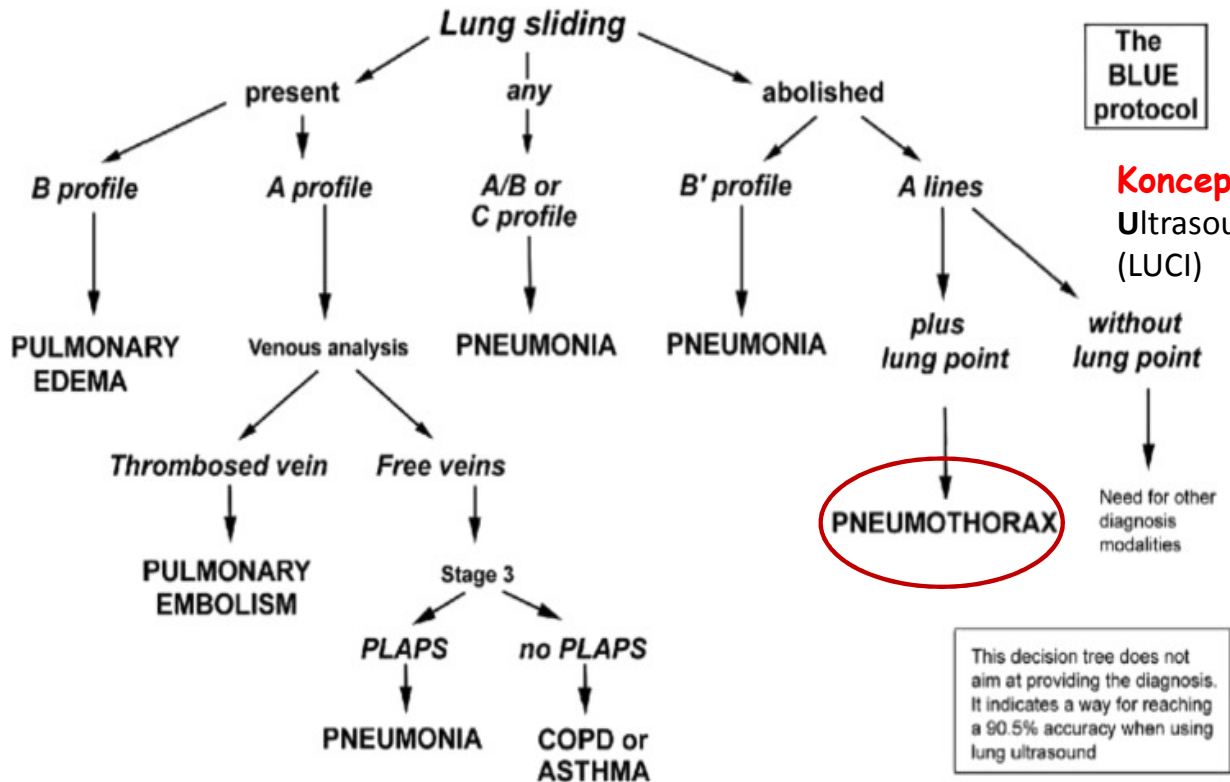


# DVT

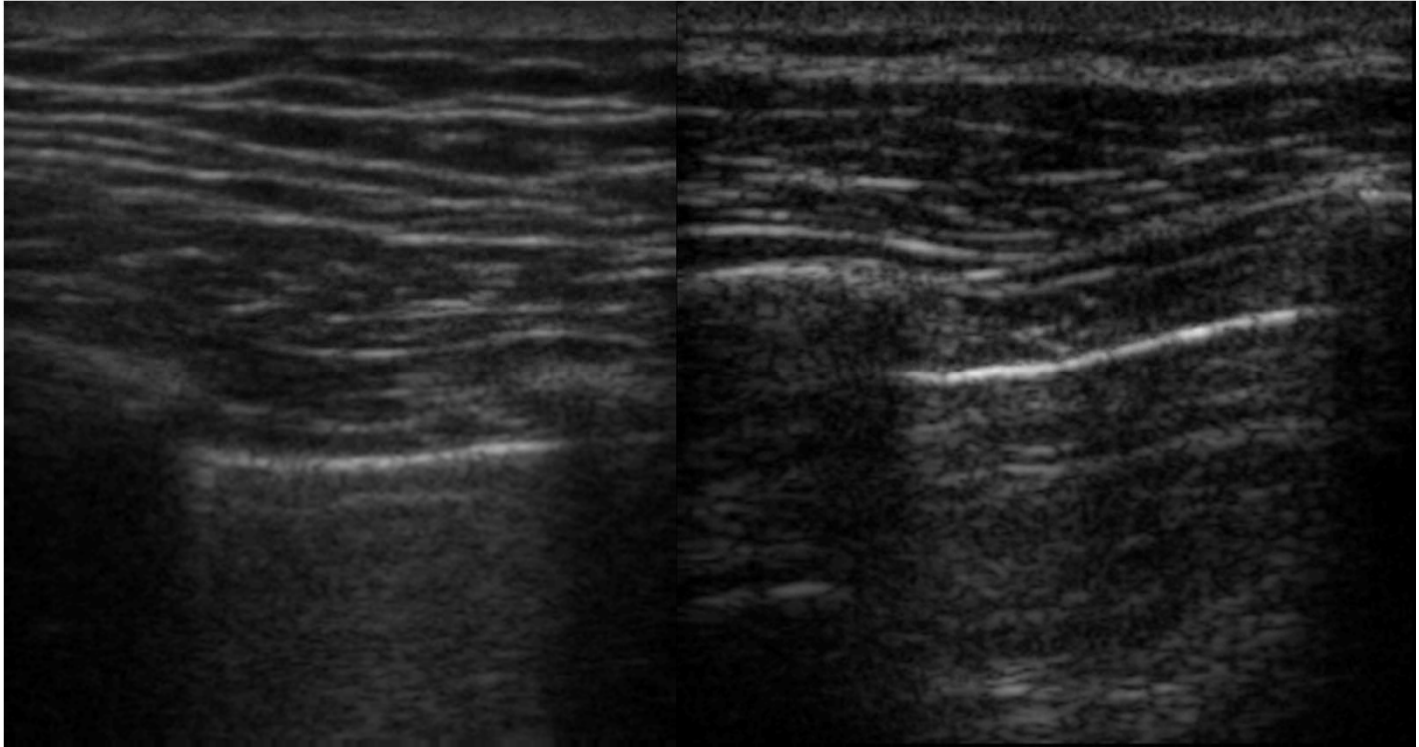
- **Není třeba dělat komplexní vyšetření žilního systému**
- **Koncept 2-points-access**
- **1. bod** - femorální žíla-velká saféna - soutok - mírně distálně
- **2. bod** - popliteální žíla +/- v centru popliteální fossy
- Přes počáteční pochybnosti a drobné záludnosti se jedná o jednoduchou a přesnou metodu ( EM US diagnostika DVT - sensitivita 95 % (95 % CI z 87-99 %) a specificity 96 % (95 % CI z 87-99 %) - všechny techniky
- Nehodnotíme lýtkové žíly, což ztěžuje porovnání s komplexním vyšetřením radiologem - pro BLUE tedy irrelevantní

# Novel approaches to ultrasonography of the lung and pleural space: where are we now?

Daniel Lichtenstein  
Breathe 2017 13: 100-111; DOI: 10.1183/20734735.004717

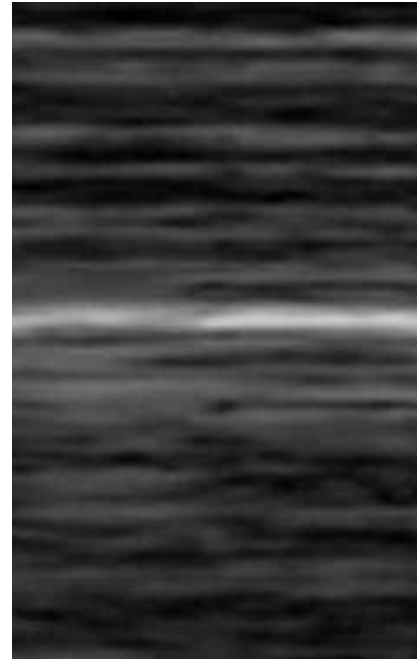
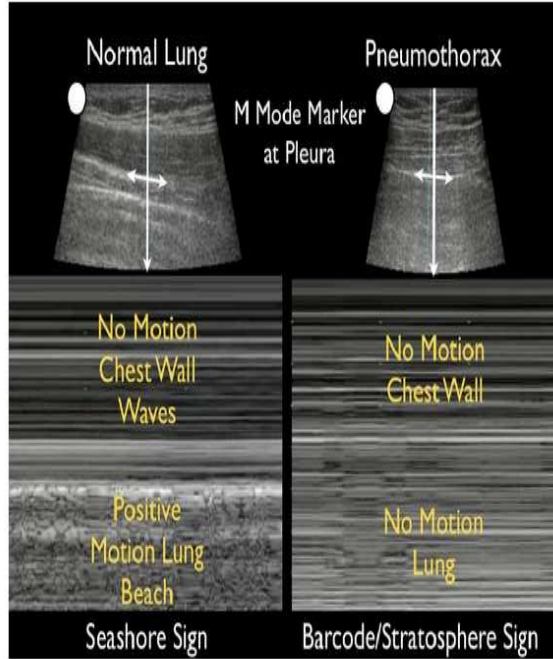
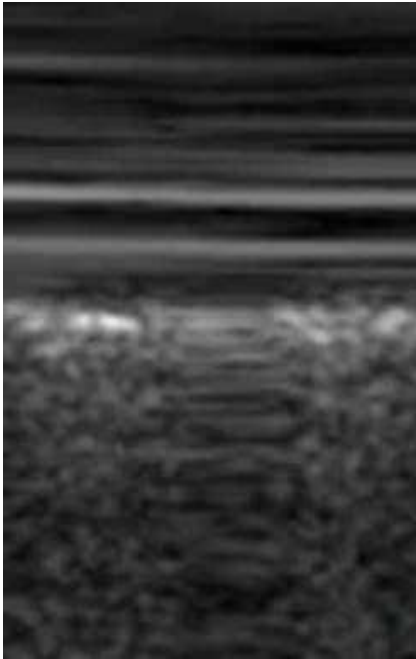


# Pneumothorax



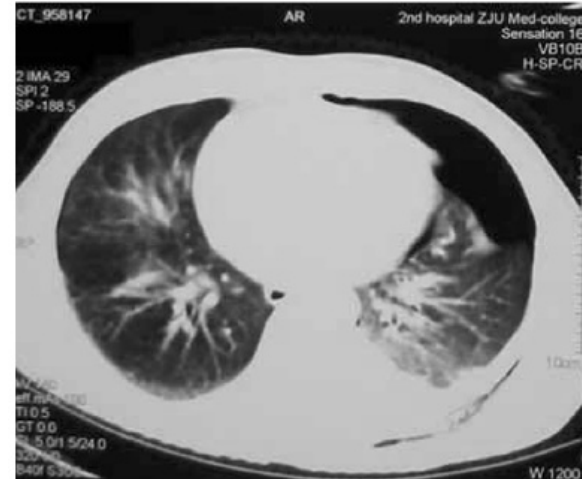
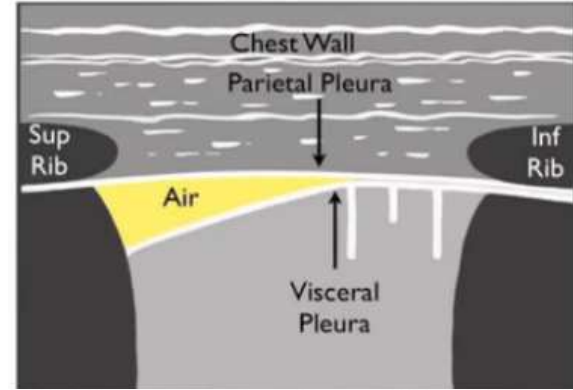


# Pneumothorax



# PNO

- **negativní prediktivní hodnota 99%**
- **specificita 60 - 99%**
- **Oslabení / absence slidingu:**
  - a) pneumonie
  - b) atelektáza
  - c) bezdeší
  - d) pleur. adheze
  - e) intubace do bronchu
  - f) těžká ARDS
  - g) plicní fibróza



[J Emerg Trauma Shock](#). 2012 Jan-Mar; 5(1): 76-81.  
doi: [10.4103/0974-2700.93116](#)

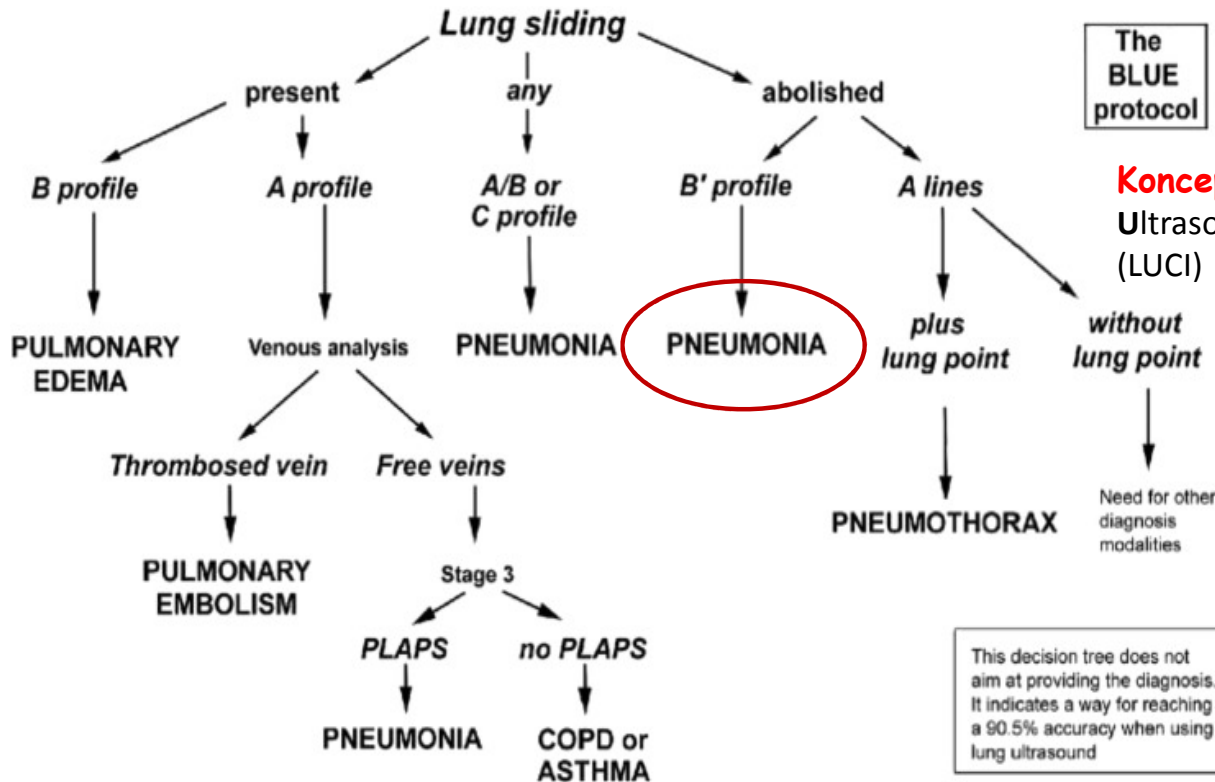
PMCID: [PMC3299161](#)  
PMID: [22416161](#)

Sonographic diagnosis of pneumothorax

[Lubna F Husain](#), [Laura Hagopian](#), [Derek Wayman](#), [William E Baker](#), and [Kristin A Carmody](#)

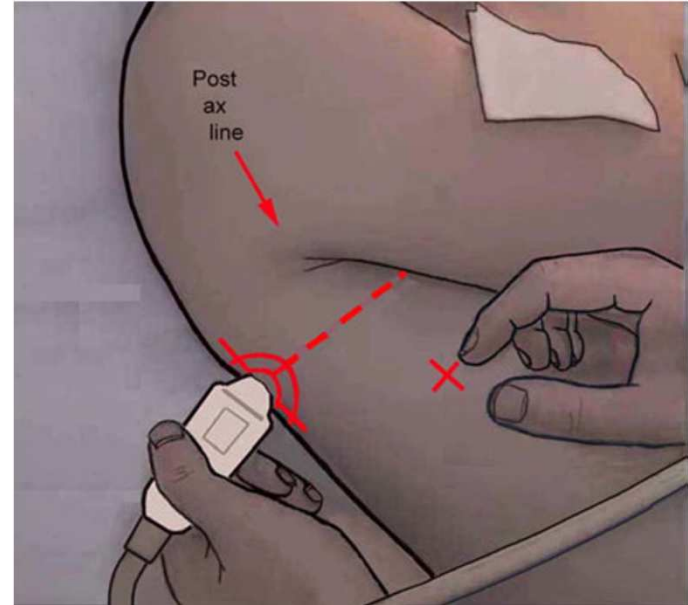
# Novel approaches to ultrasonography of the lung and pleural space: where are we now?

Daniel Lichtenstein  
Breathe 2017 13: 100-111; DOI: 10.1183/20734735.004717

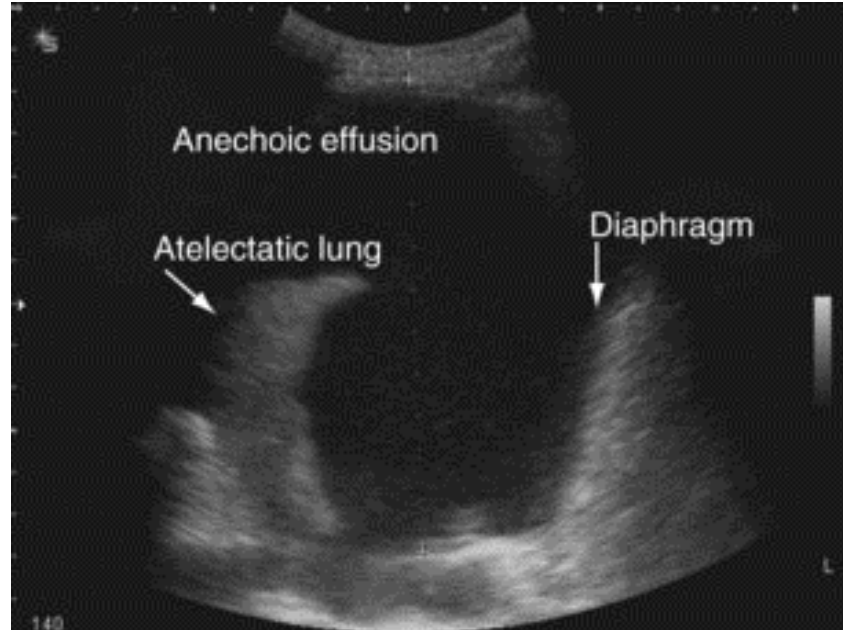
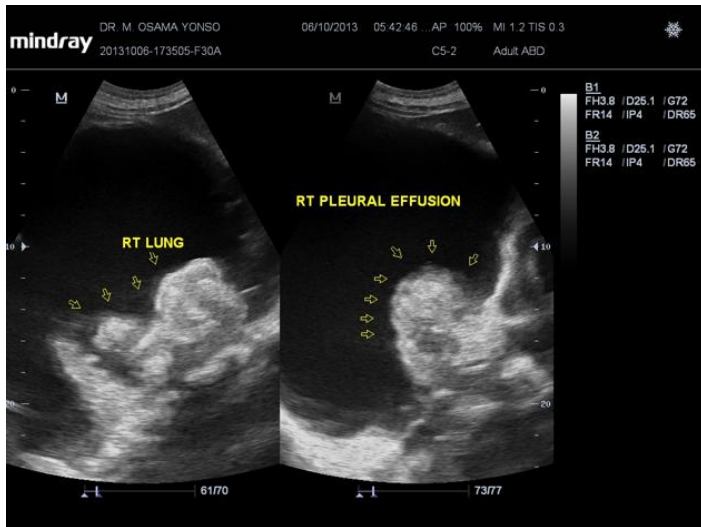


# PLAPS

- **Patologie diagnostikovatelné v PLAPS:**
- Výpotek
- Intersticiální syndrom
- Pneumonie
- Konsolidace plic
- PosteroLateral Alveolar and/or Pleural Syndrome

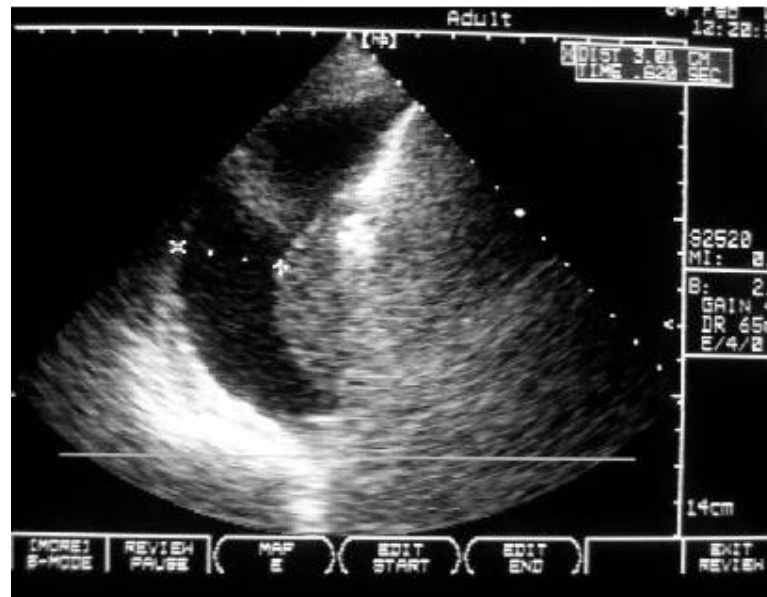


# Výpotek



# Výpotek objem

- Elevace těla - 15-45°  
(většinou 15°)
- Zadní axilární čára, kolmo na trup
- V místě největší separace
- **$V(\text{ml}) = 20 \times \text{Sep} (\text{mm})$**
- Chybovost  $\varnothing$  200ml

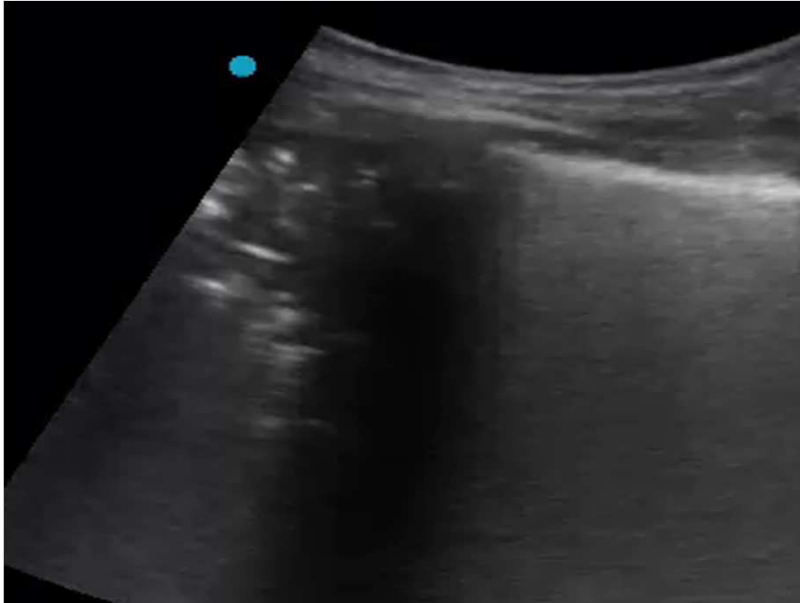


[Intensive Care Med.](#) 2006 Feb;32(2):318. doi: 10.1007/s00134-005-0024-2. Epub 2006 Jan 24.

**Ultrasound estimation of volume of pleural fluid in mechanically ventilated patients.**

Balik M<sup>1,2</sup>, Plasil P<sup>3</sup>, Waldauf P<sup>3</sup>, Pazout J<sup>3</sup>, Fric M<sup>3</sup>, Otahal M<sup>3</sup>, Pachtl J<sup>3</sup>.

# Pneumonie





# Pneumonie

- **Plicní UZ má vysokou senzitivitu (88%) i specificitu (86%) v diagnóze pneumonie u dětí ještě vyšší**
- RTG (opět v porovnání s CT) - zachytí okolo 70% pneumonií
- Obyčejně bývá oblast pneumonie ohraničená B-liniemi
- Patognomický je dynamická bronchogram ( x atelektáza)
- Umožní odhalit a lokalizovat nejen vlastní pneumonii, ale i výpotek a zároveň určit jeho kvalitu (empyém, septa,...)

[Medicine \(Baltimore\)](#). 2017 Jan; 96(3): e5713.  
Published online 2017 Jan 20. doi: [10.1097/MD.00000000000005713](https://doi.org/10.1097/MD.00000000000005713)

Lung ultrasound for the diagnosis of pneumonia in adults  
A meta-analysis

[Ling Long](#), MD, [Hao-Tian Zhao](#), MD, [Zhi-Yang Zhang](#), MD, [Guang-Ying Wang](#), MD, and [He-Ling Zhao](#), MD\*

PMCID: PMC5279077  
PMID: 28096332

[Pediatr Radiol](#). 2017; 47(11): 1412-1419.  
Published online 2017 Sep 21. doi: [10.1007/s00247-017-3910-1](https://doi.org/10.1007/s00247-017-3910-1)

Lung ultrasound for the diagnosis of community-acquired pneumonia in children

[Jacob A. M. Stadler](#),<sup>1</sup> [Savvas Andronikou](#),<sup>2,3,4</sup> and [Heather J. Zar](#)<sup>5,6</sup>

PMCID: PMC5608773  
PMID: 29043420



Original Contribution

Evaluation of lung ultrasound for the diagnosis of pneumonia in the ED

[Stefano Parlamento MD](#)<sup>\*,†</sup>, [Roberto Copetti MD](#)<sup>\*</sup>, [Stefano Di Bartolomeo MD](#)<sup>§</sup>

<sup>\*</sup>Emergency Department, S. Antonio Abate Hospital, 33028 Tolmezzo, Italy  
<sup>†</sup>Unit of Hygiene and Epidemiology, University of Udine, 33100 Udine, Italy



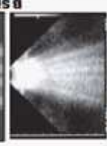
www.elsevier.com/locate/ajem

# Pulmonary Ultrasound

## B Sign

### B Line

Pulmonary Edema - Some Fluid

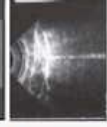


Sensitivity: 97%



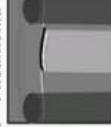
## Comets

Normal



## C Line

Pneumonia



Specificity: 100%

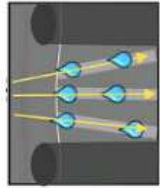


## A Lines

Normal/Dry or PTX

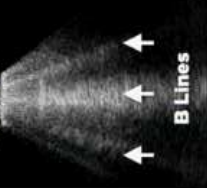


PTX = Pneumothorax

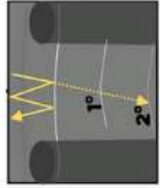


## B Lines

Rib

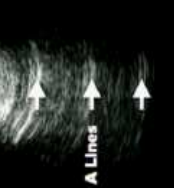


## Edema

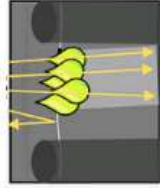


## A Lines

Pleure



## Dry Lungs



## C Lines

Consolidation

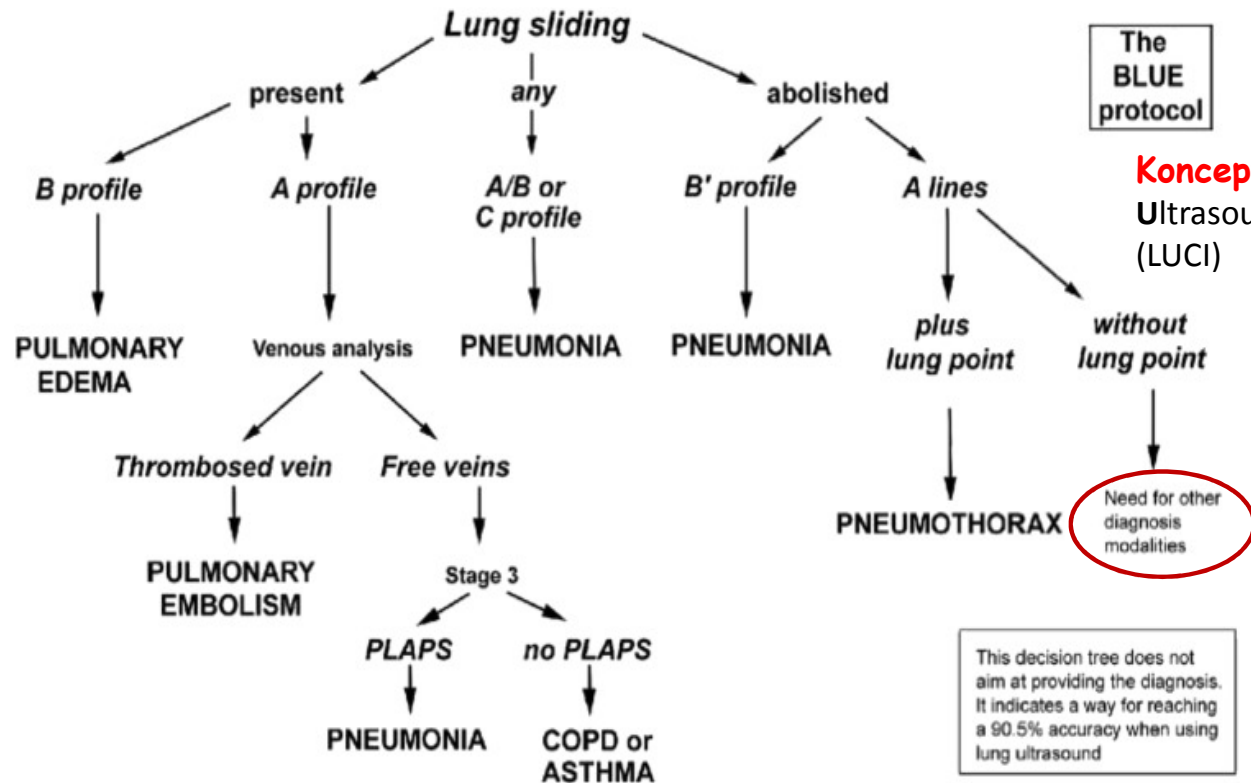


## Consolidation (Pneumonia)

A THICK, IRREGULAR PLEURAL LINE COMBINED WITH A THICK, VERTICAL HYPER-ECHOIC STRIPE IS A C LINE. "AIR BRONCHOGRAMS" FURTHER CONFIRM THE DIAGNOSIS OF PNEUMONIA.

# Novel approaches to ultrasonography of the lung and pleural space: where are we now?

Daniel Lichtenstein  
Breathe 2017 13: 100-111; DOI: 10.1183/20734735.004717



The BLUE protocol

**Koncept LUCI** - Lung Ultrasound in the Critically ill (LUCI)

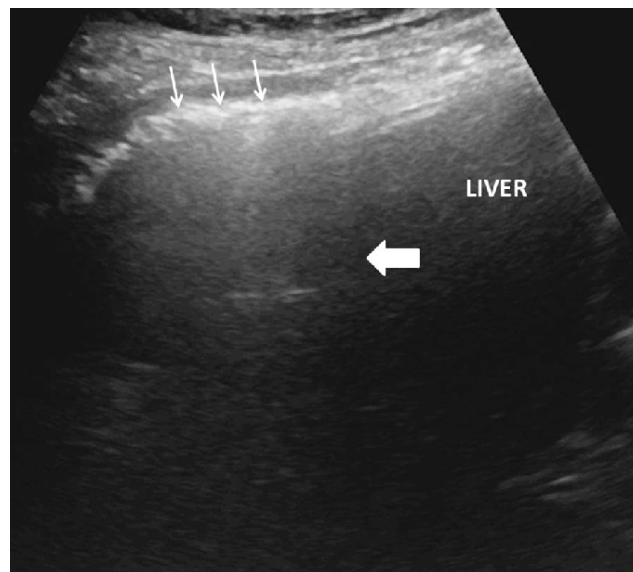
This decision tree does not aim at providing the diagnosis. It indicates a way for reaching a 90.5% accuracy when using lung ultrasound

# Závěr

## Plicní ultrazvuk

- EBM metoda, která má silnou oporu v odborné literatuře
- Snadno naučitelný
- Všechny nálezy vždy komparovat s klinickým stavem!
- Bez známých NÚ (x RTG, CT)
- Opakovatelný a spolehlivý
- Bed-side

## Podkožní emfyzém !!!



The efficacy of bedside chest ultrasound: from accuracy to outcomes

# Děkuji za pozornost

