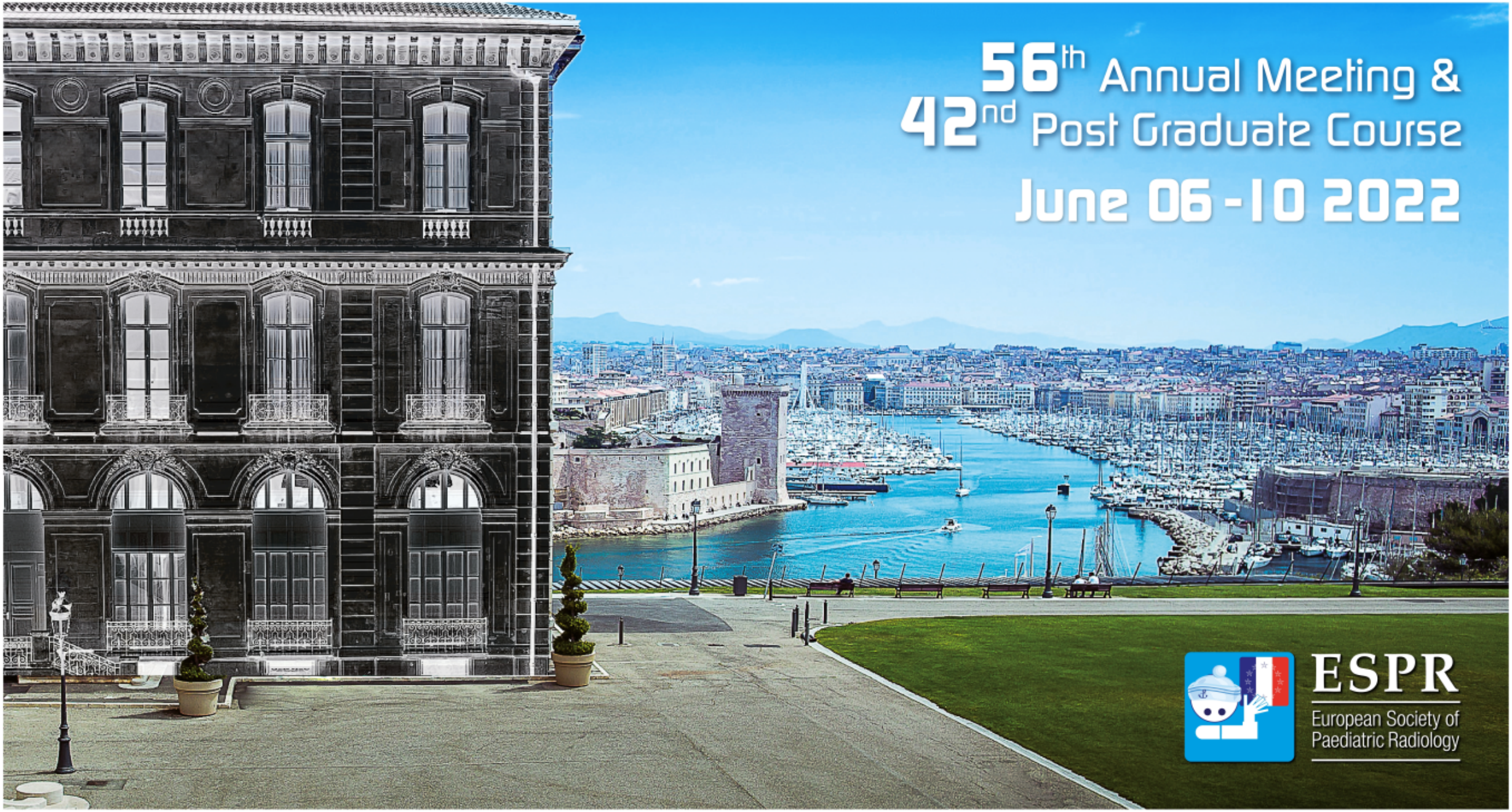
56th Annual Meeting &
42nd Post Graduate Course
June 06 -10 2022
ESPR
European Society of
Paediatric Radiology

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56th Annual Meeting &
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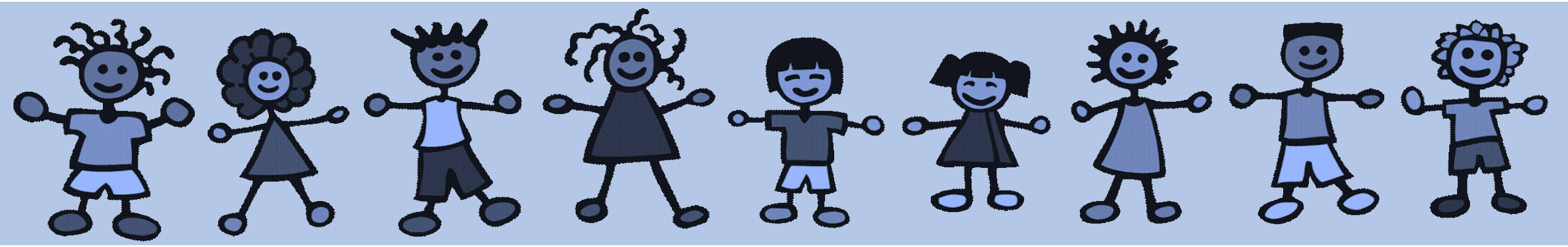
NEONATAL CHEST ULTRASOUND



Lovrenski Jovan
ESPR Cardiothoracic Taskforce
Radiology Department, Institute for Children and Adolescents
Health Care of Vojvodina
Faculty of Medicine, University of Novi Sad, Serbia

Where were we?

1. Copetti R, Cattarossi L, Macagno F, Violino M, Furlan R (2008) Lung ultrasound in respiratory distress syndrome: a useful tool for early diagnosis. Neonatology 94:52-59

2. Avni EV, Braude P, Pardou A, Matos C (1990) Hyaline membrane disease in the newborn: diagnosis by ultrasound. Pediatr Radiol 20:143-46

3. Copetti R, Cattarossi L (2007) The 'Double lung point': an ultrasound sign diagnostic of transient tachypnea of the newborn. Neonatology 91:203–209

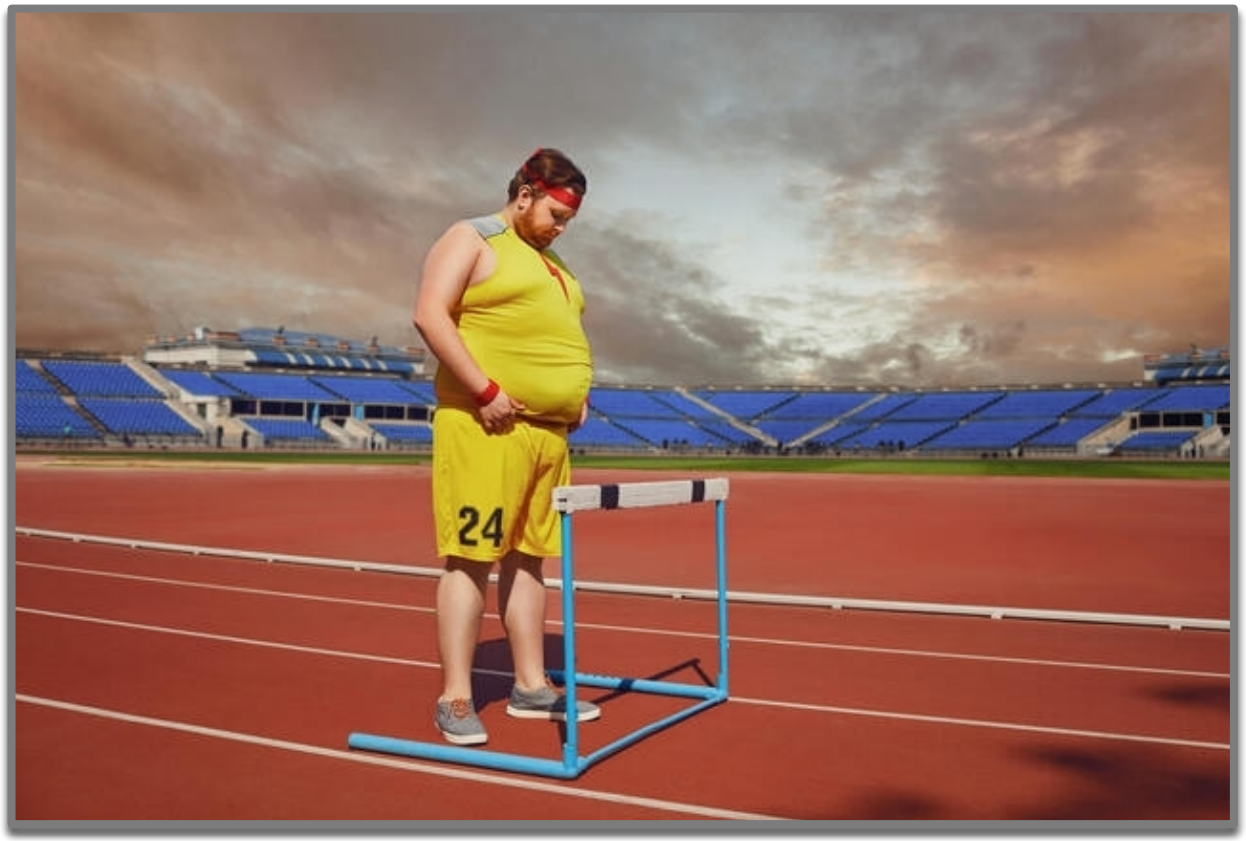
4. Avni EF, Cassart M, de Maertelaer V, Rypens F, Vermeylen D, Gevenois PA (1996) Sonographic prediction of chronic lung disease in the premature undergoing mechanical ventilation. Pediatr Radiol 26:463–469

5. Bober K, Swietliński J (2006) Diagnostic utility of ultrasonography for respiratory distress syndrome in neonates. Med Sci Monit 12:CR440–CR446

6. Pieper CH, Smith J, Brand EJ (2004) The value of ultrasound examination of the lungs in predicting bronchopulmonary dysplasia. Pediatr Radiol 34:227–231

The beginnings

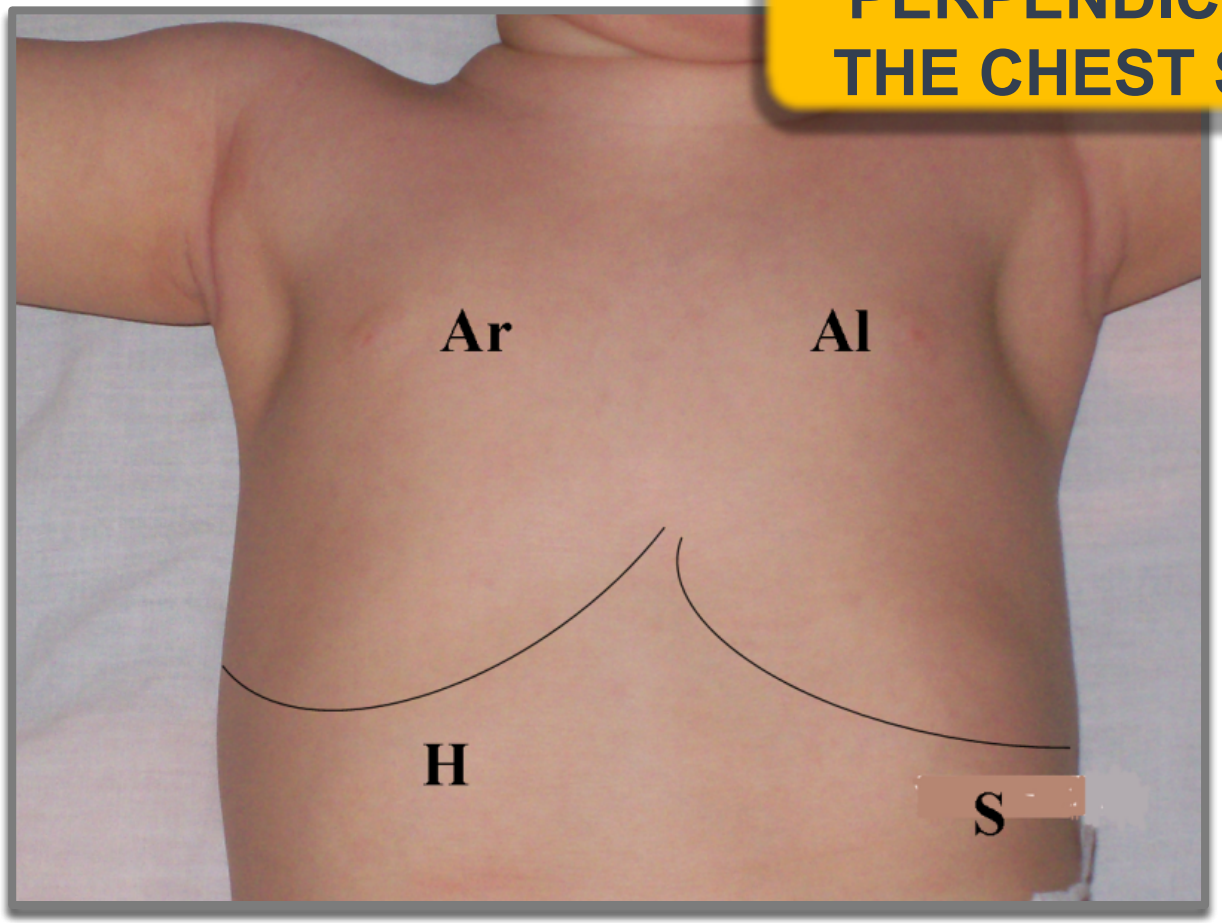
Slow start

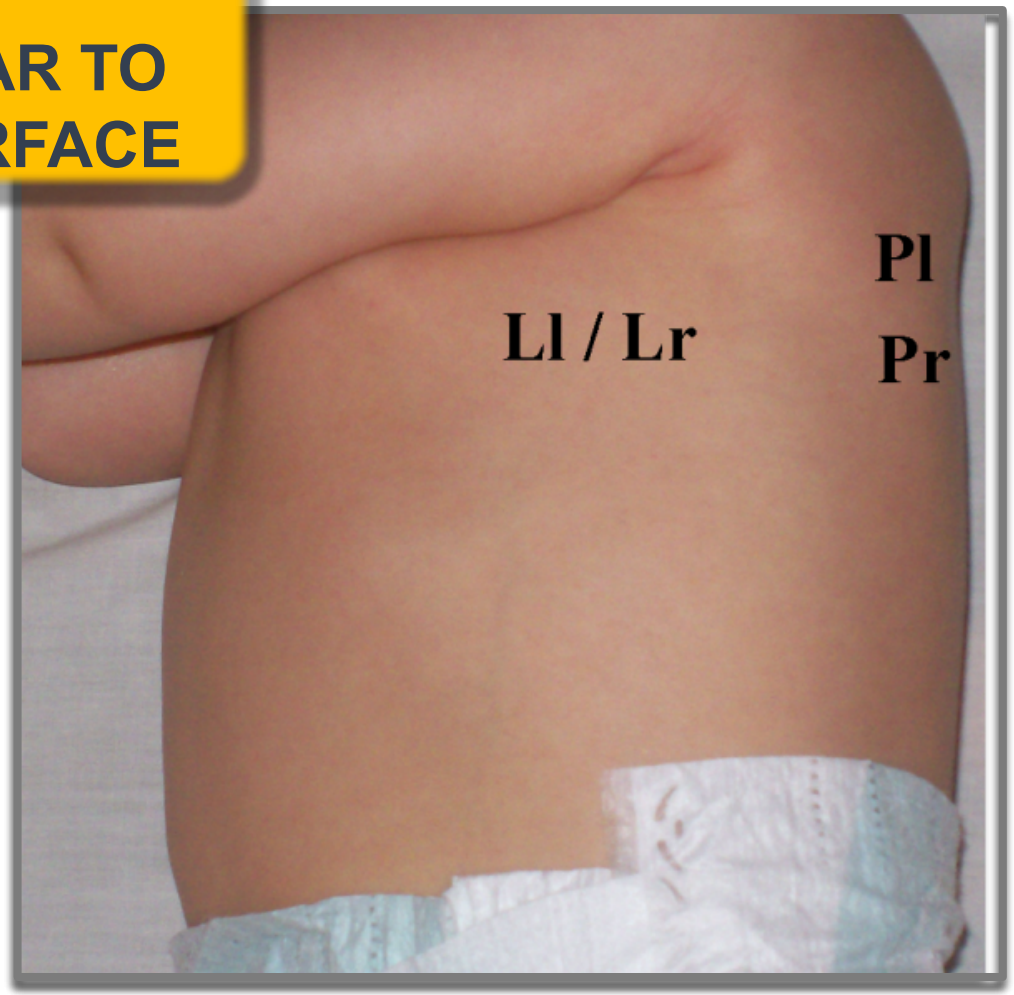


Enthusiasm

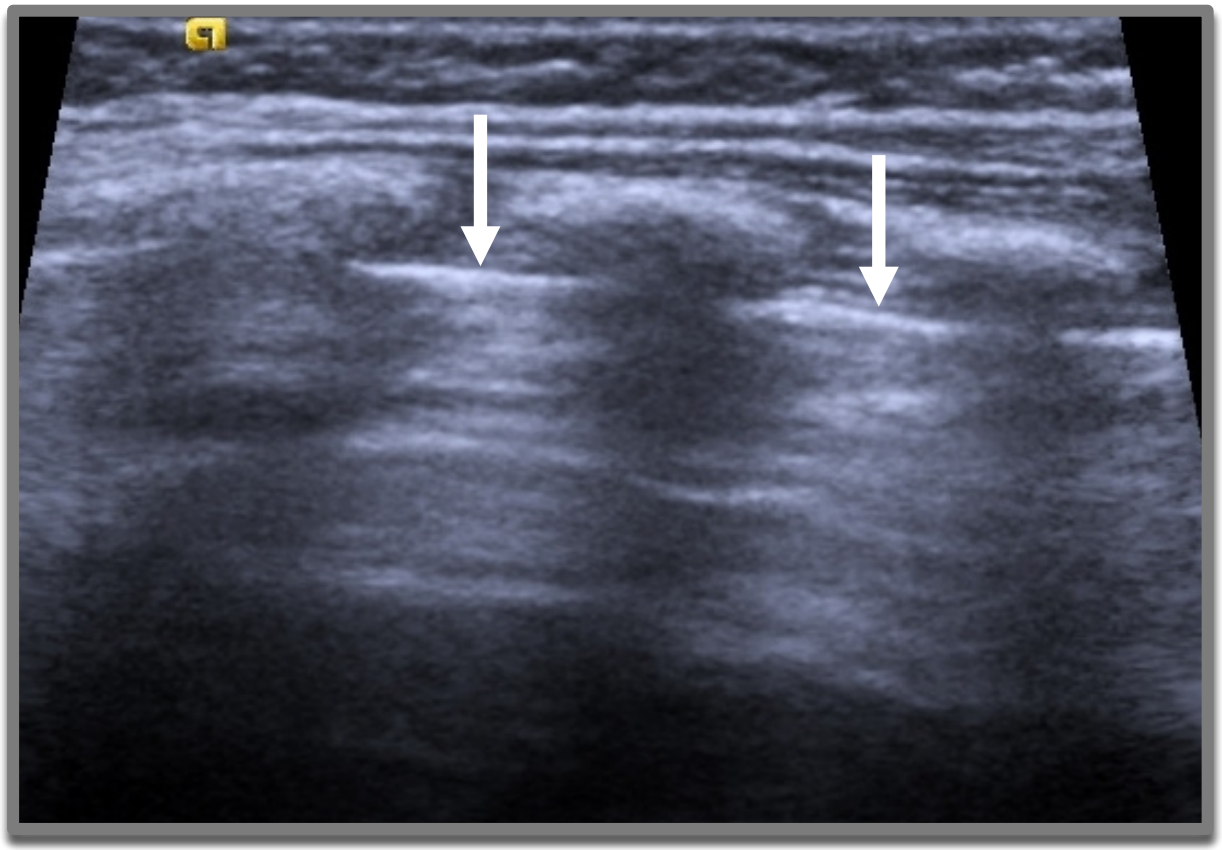
Technique

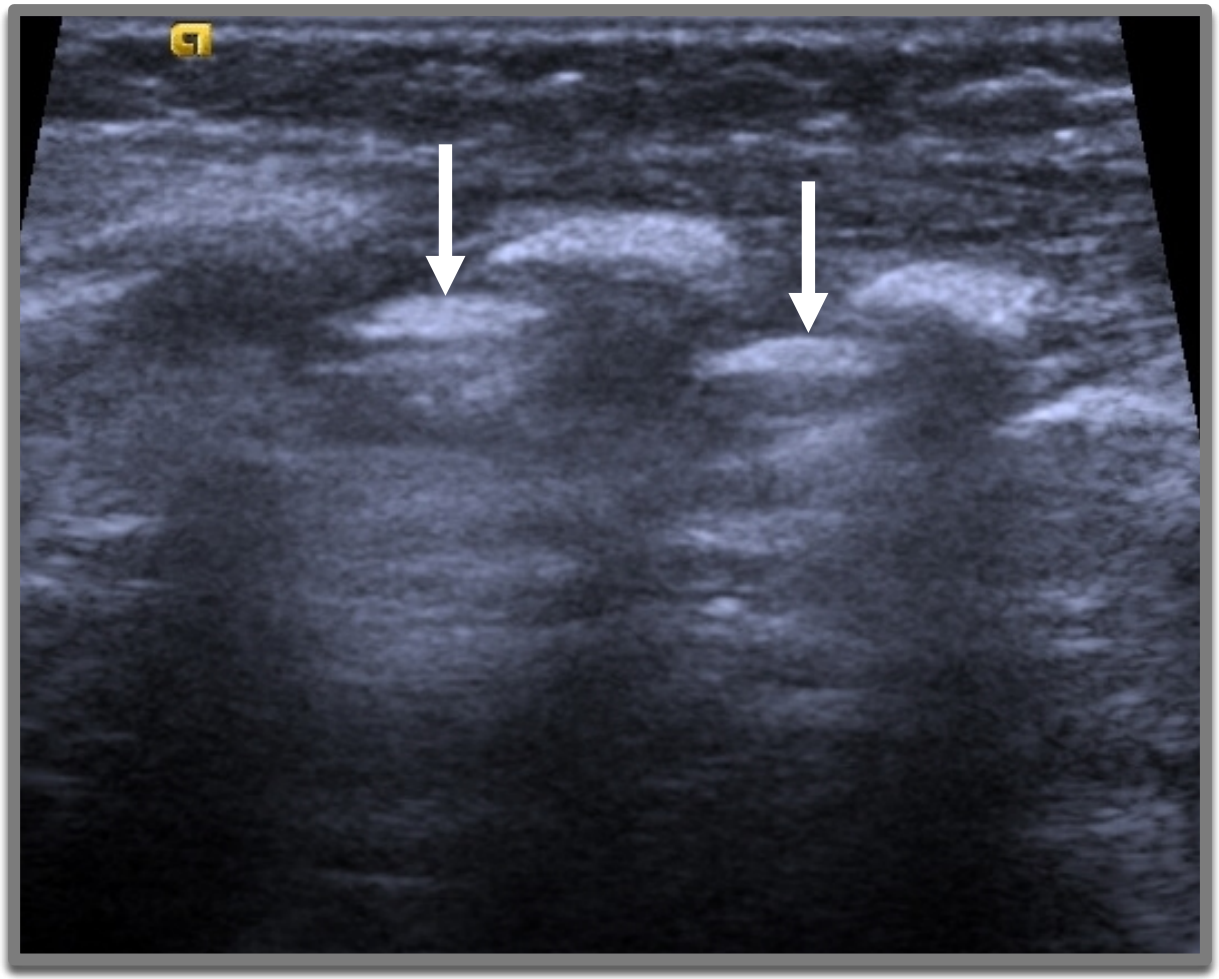
PROBE PERPENDICULAR TO THE CHEST SURFACE



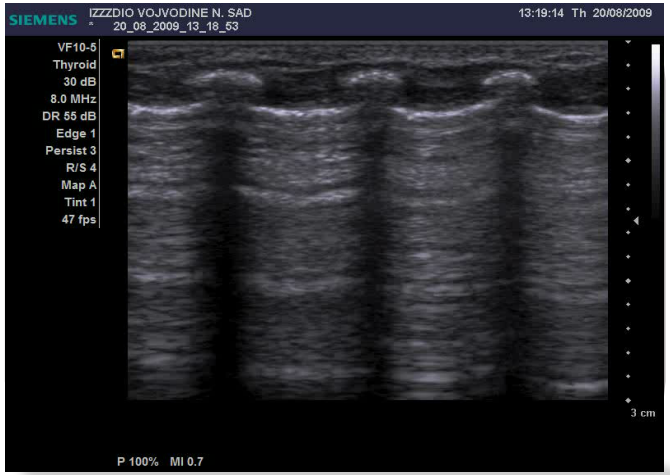


Technique

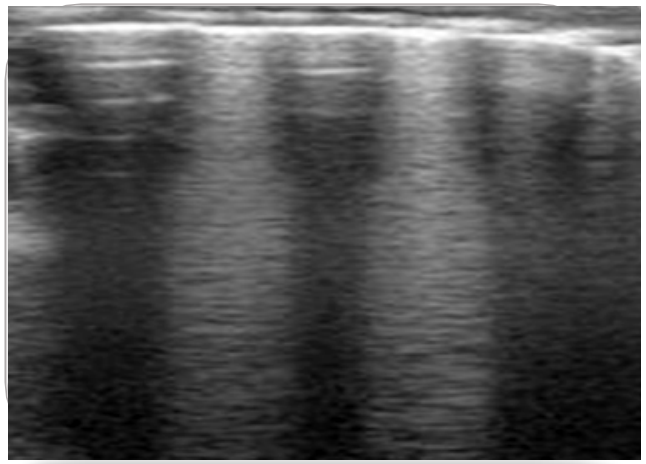




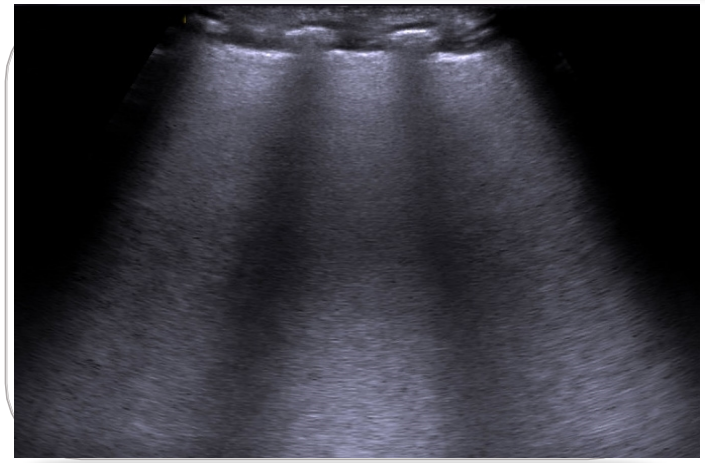
Main LUS patterns



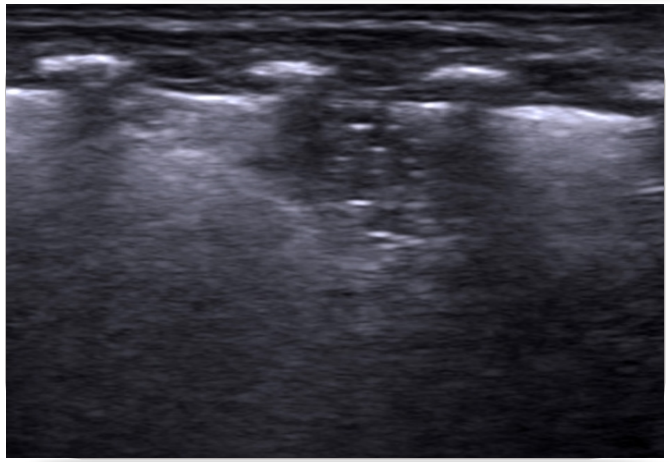
NORMAL FINDING



INTERSTITIAL EDEMA



ALVEOLAR-INTERSTITIAL EDEMA



CONSOLIDATION

Descriptive LUS

Functional LUS applications

Raimondi F, Yousef N, Migliaro F, Capasso L, De Luca D (2021) Point-of-care lung ultrasound in neonatology: classification into descriptive and functional applications. Pediatr Res 90(3):524-531

Descriptive LUS
(acquired neonatal pulmonary diseases)

RDS

TTN

MAS

Pneumonia

Atelectasis

Pneumonia

BPD

Pulmonary haemorrhage

BPD

RDS

MAS

IE/AIE
Subpleural consolidation
Pleural line abnormalities
Pleural effusion

TTN

~~Subpleural consolidation~~

Atelectasis

Pulmonary haemorrhage

Liu J et al (2019) Protocol and Guidelines for Point-of-Care Lung Ultrasound in Diagnosing Neonatal Pulmonary Diseases. J Vis Exp
Raimondi F et al (2021) Point-of-care lung ultrasound in neonatology: classification into descriptive and functional applications. Pediatr Res
Fernández LR et al(2022) Usefulness of lung ultrasound in the diagnosis and follow-up of respiratory diseases in neonates. An Pediatr (Engl Ed)

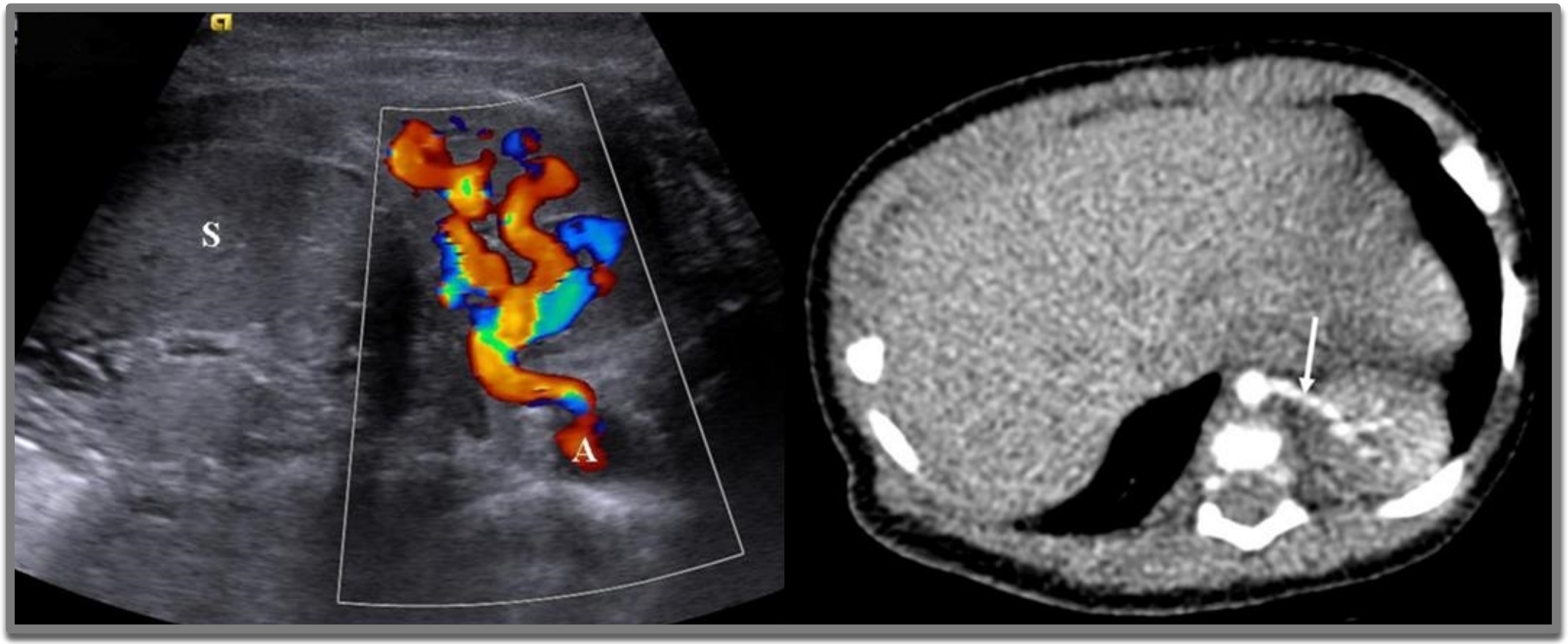
PNEUMONIA **ATELECTASIS** **HAEMORRHAGE**

Lovrenski J (2012) Lung ultrasonography of pulmonary complications in preterm infants with respiratory distress syndrome. Ups J Med Sci 117:10-17

CLINICAL / LAB – RADIOLOGICAL CORRELATION IS CRUCIAL!

LUS findings are varying between different stages / grades of the same lung disease.

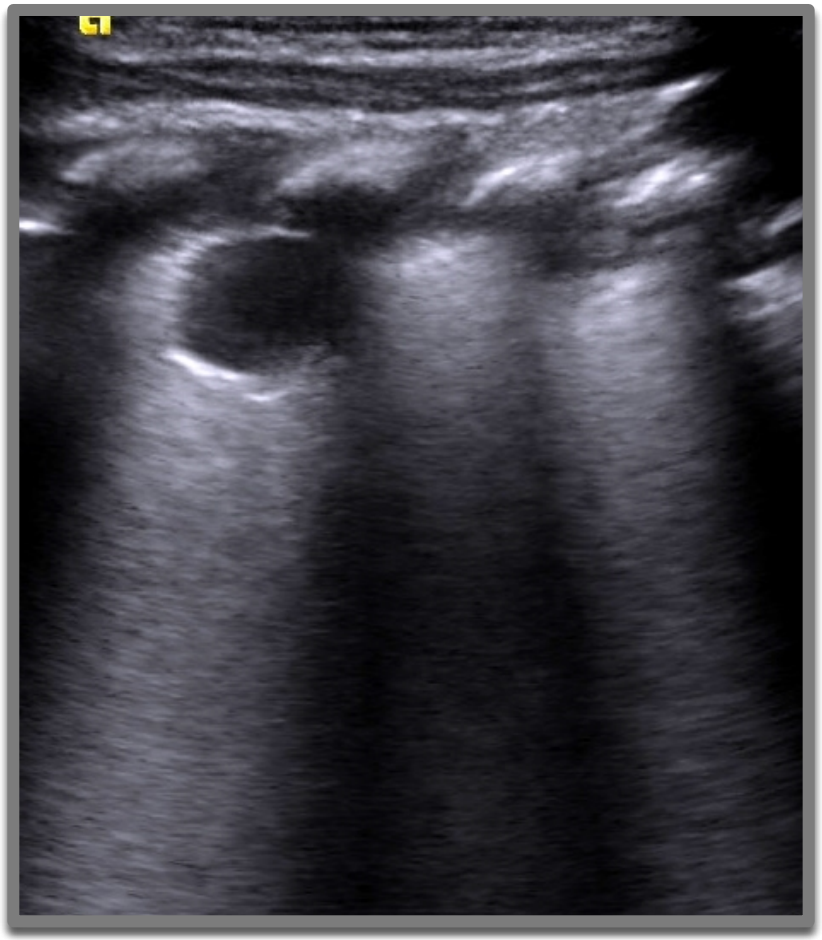
Pulmonary sequestration

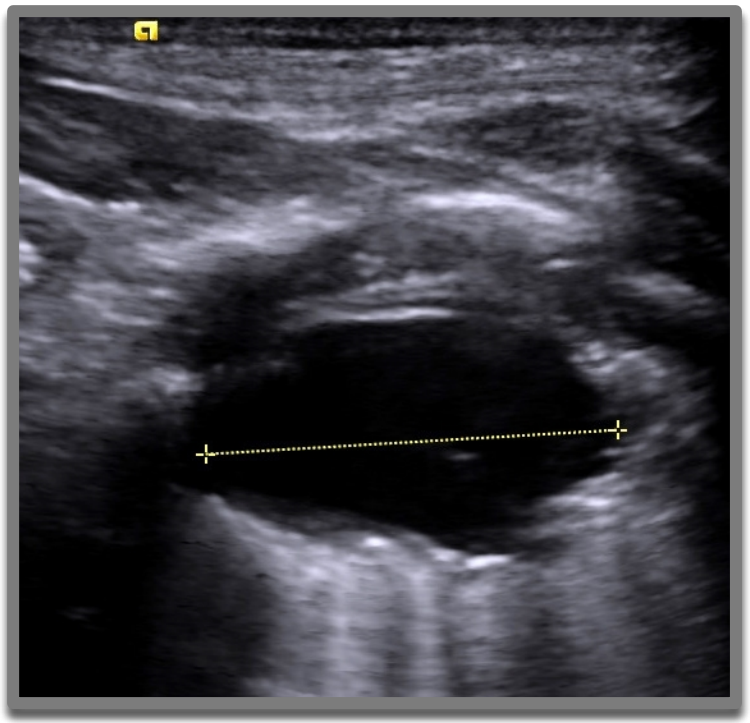


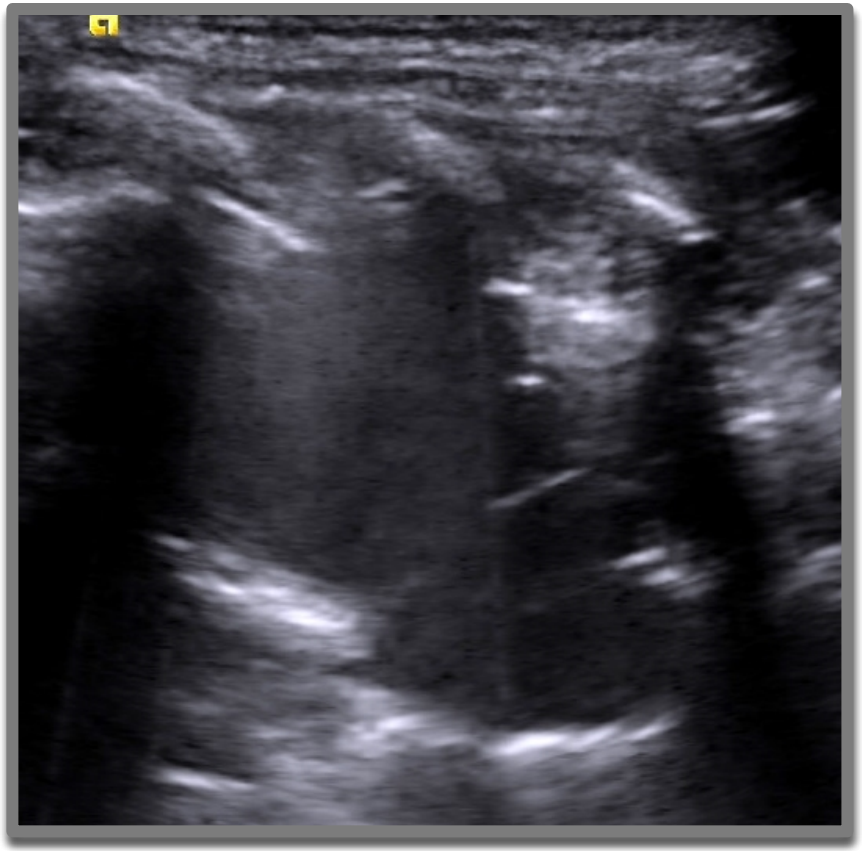
Lovrenski J (2018) Pulmonary sequestration as an incidental finding of pediatric abdominal ultrasound - two cases. Journal of Health Science and Medical Research 37(1):61-66

Diaphragmatic hernia

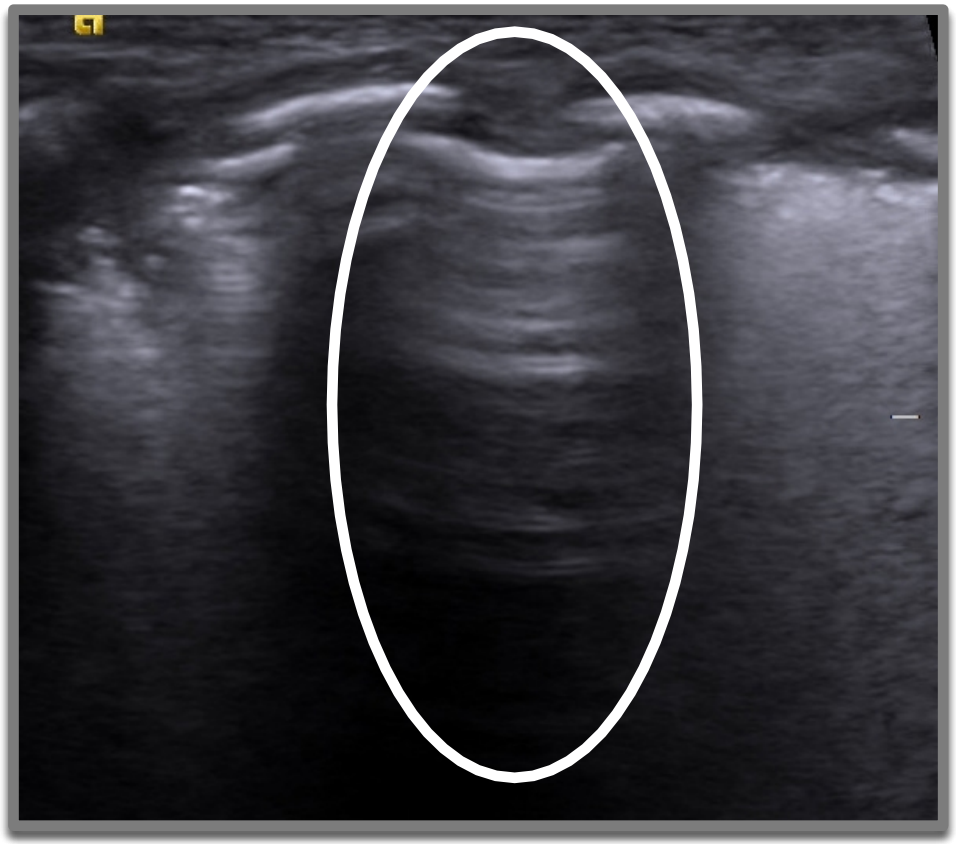
CPAM

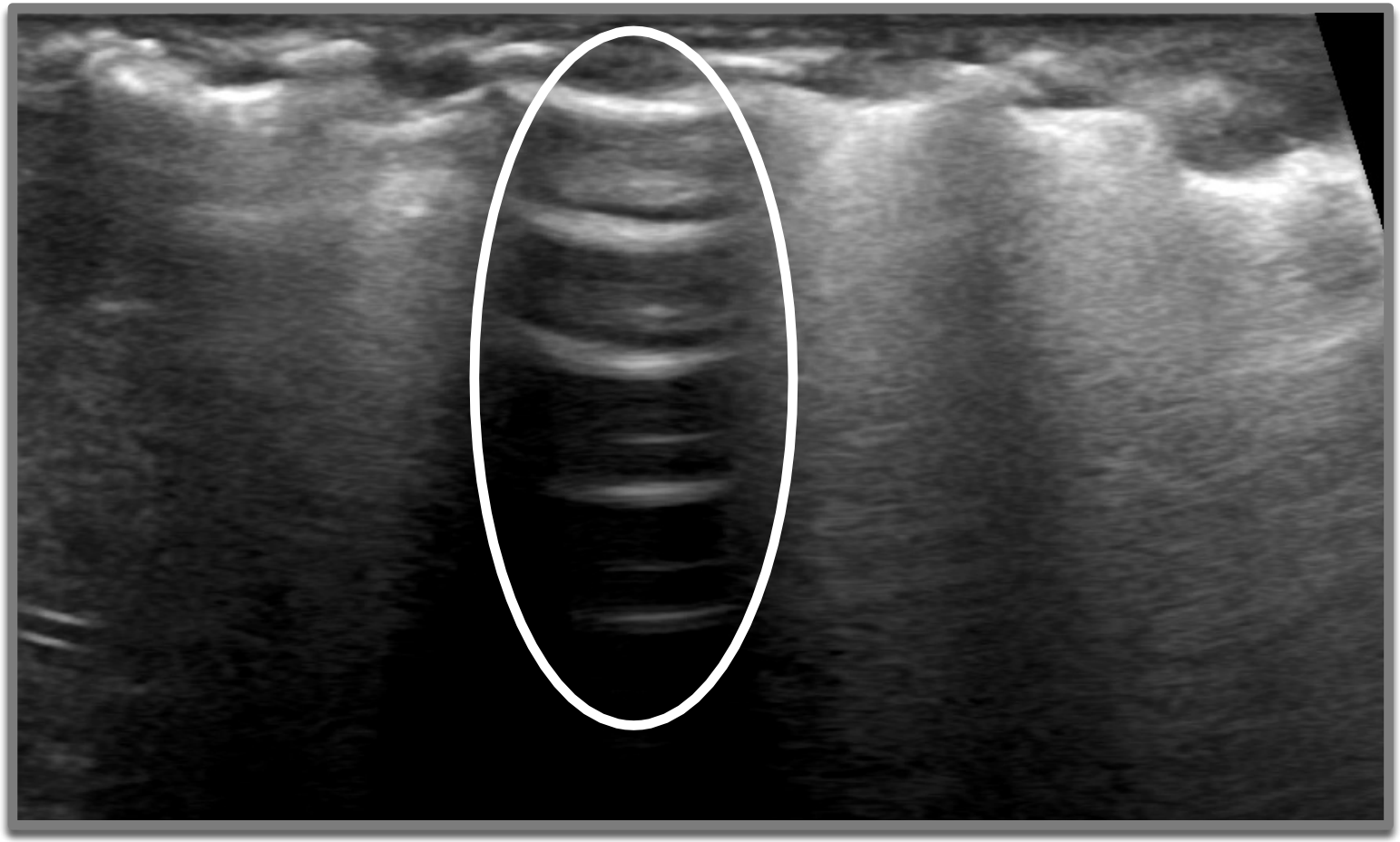




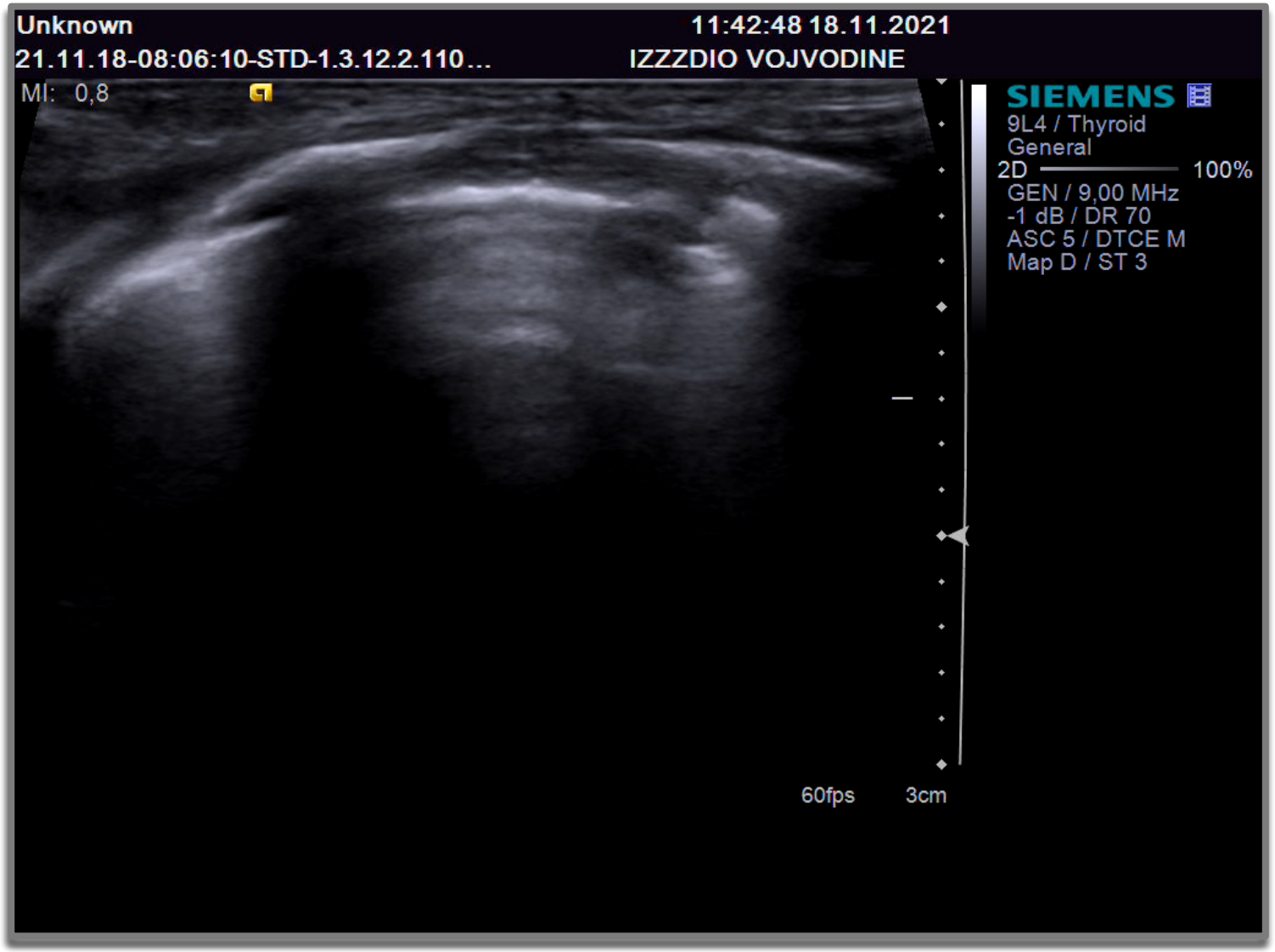


Air - filled cyst

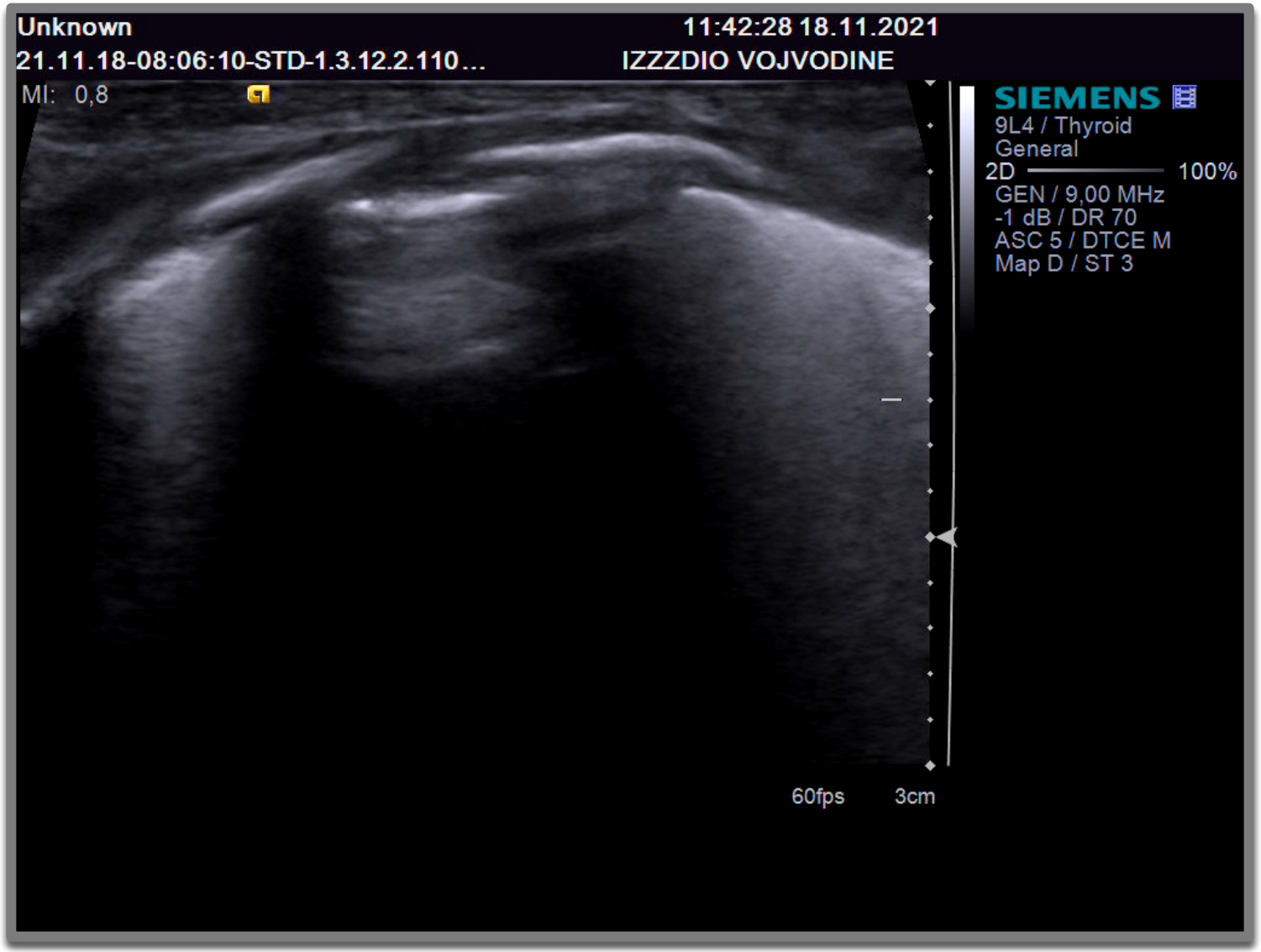




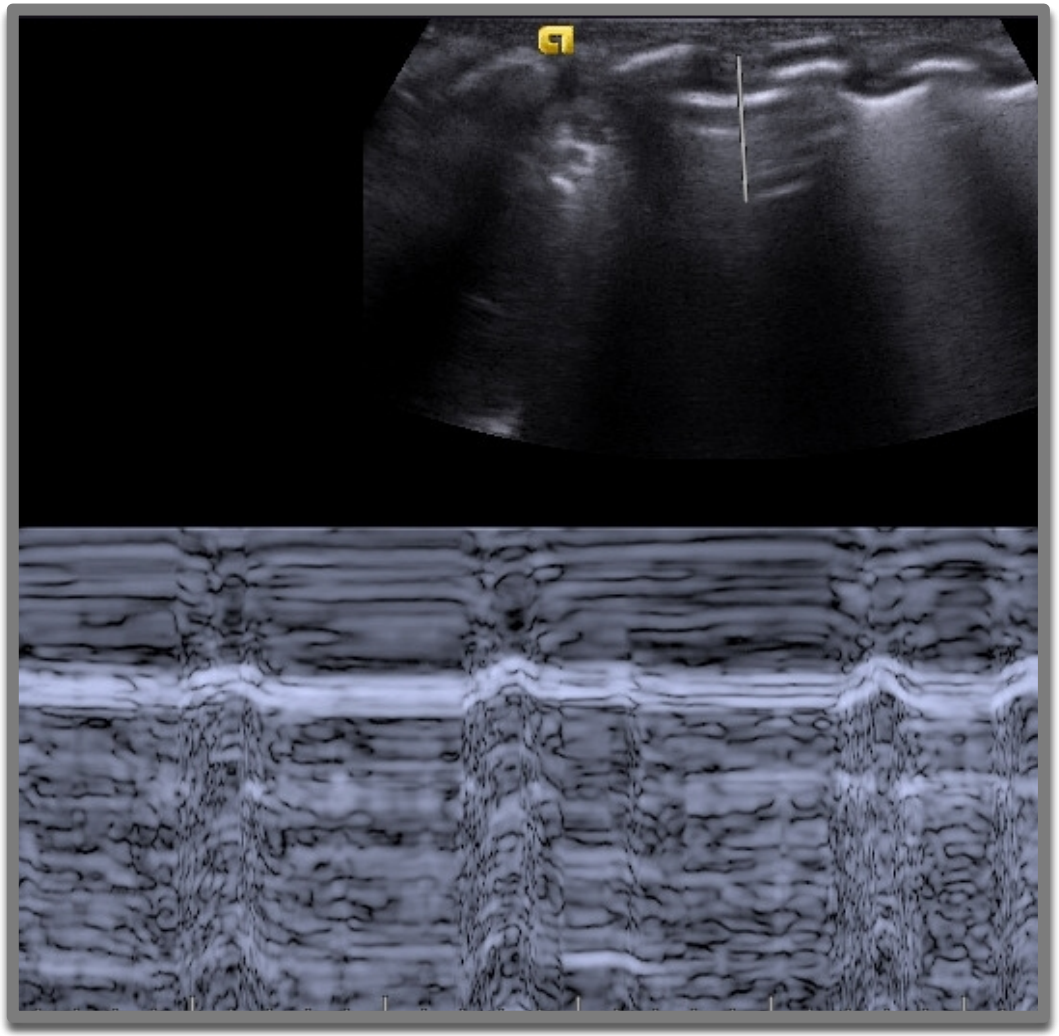
Air - filled cyst

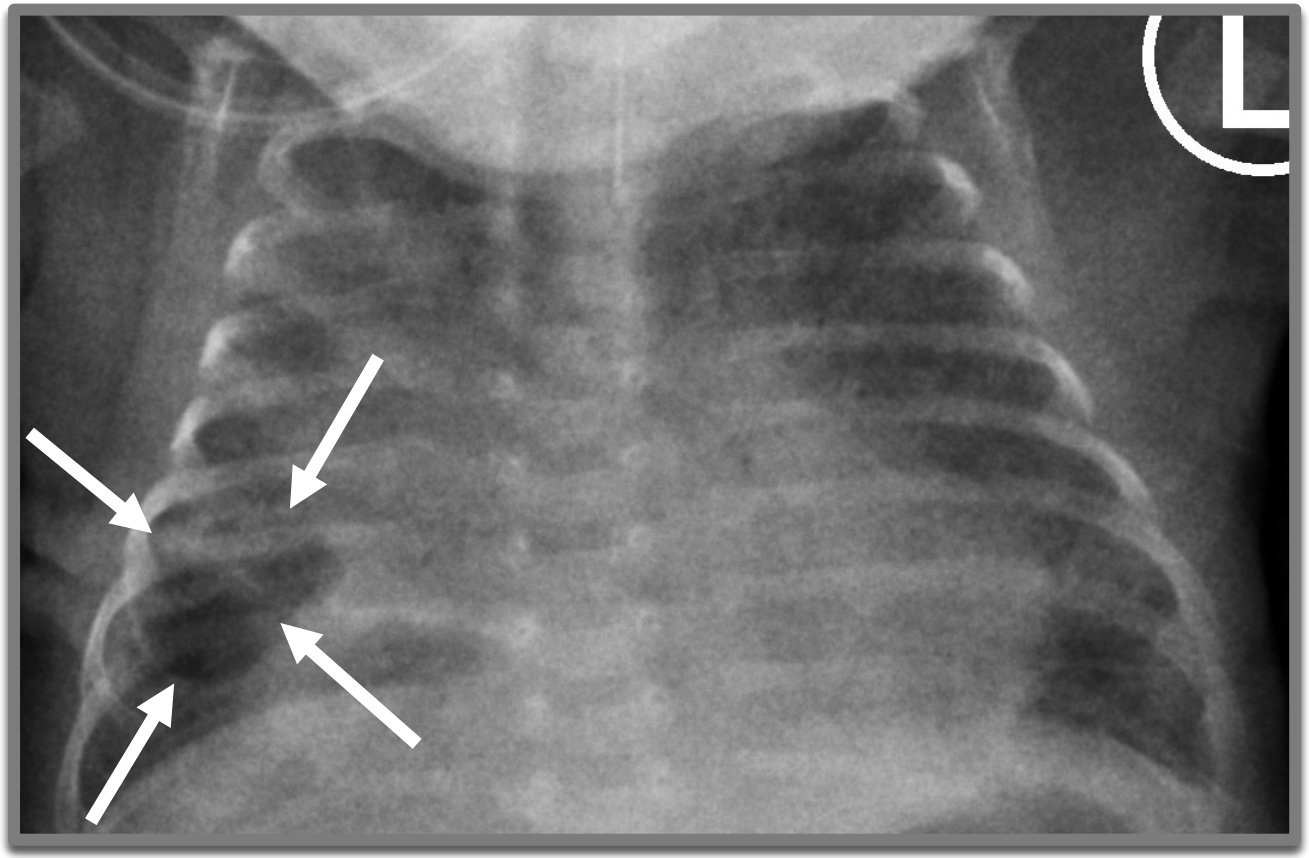


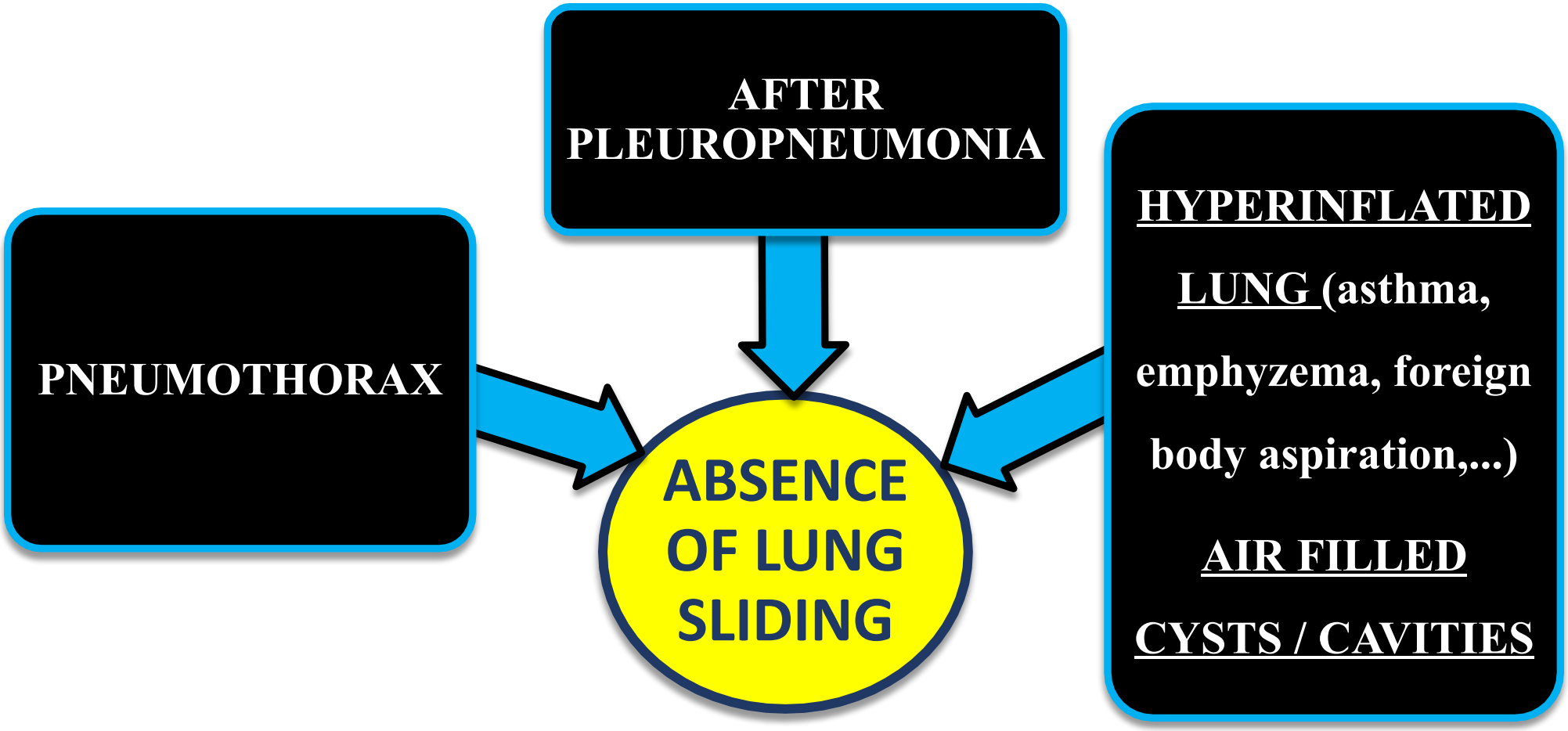
Air - filled cyst



Air - filled cyst







Lovrenski J, Vilotijević Dautović G, Lovrenski A (2019) Reduced or absent "lung sliding" - a novel lung ultrasound sign of pediatric foreign body aspiration. J Ultrasound Med 38(11):3079-3082

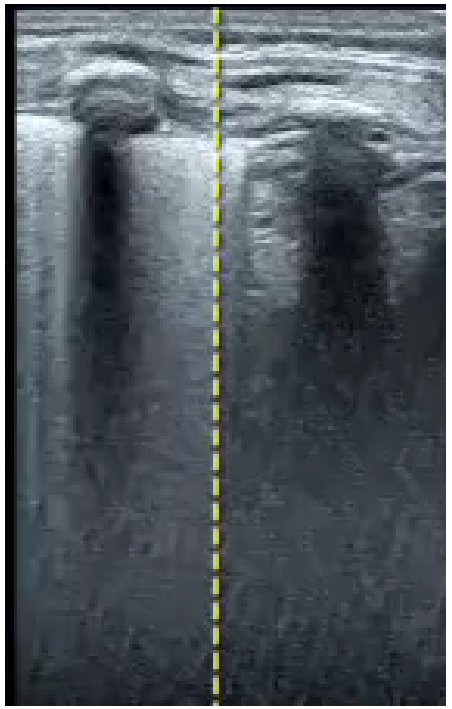
Pneumothorax

Exclude pneumothorax as a potential diagnosis.

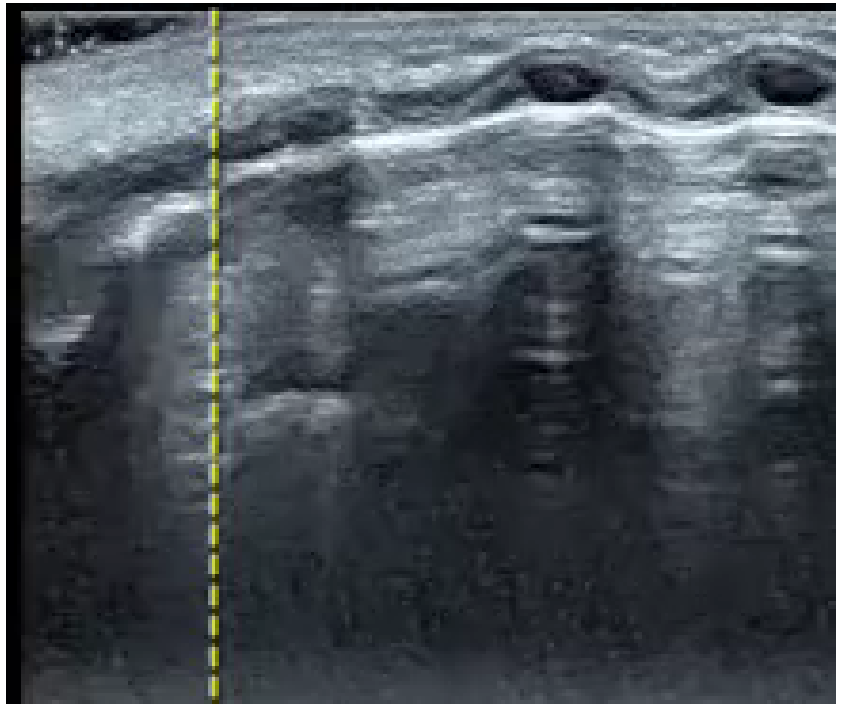
Detect lung expansion after the drainage of pneumothorax.

Lovrenski J (2012) Lung ultrasonography of pulmonary complications in preterm infants with respiratory distress syndrome. Ups J Med Sci 117:10-17

Pneumothorax



Mild – LUS signs of PTX only in anterior lung areas in supine position / „lung point“ with area of absent „lung sliding“ < 50% - generally does not require thoracocentesis.



Moderate – LUS signs of PTX in anterior and lateral lung areas in supine position / „lung point“ with area of absent „lung sliding“ > 50% - decision based on clinical condition.

Liu J et al (2020) International Expert Consensus and Recommendations for Neonatal Pneumothorax Ultrasound Diagnosis and Ultrasound-guided Thoracentesis Procedure. J Vis Exp 12;(157)

Pneumothorax

- **Severe – LUS signs of PTX in anterior, lateral and posterior lung areas, absence of „lung point“ sign – IMMEDIATE thoracocentesis.**
- **Needle / chest tube insertion within the area where „lung sliding“ is absent.**
- **A real-time visualization of postprocedural lung re-expansion.**

Liu J et al (2020) International Expert Consensus and Recommendations for Neonatal Pneumothorax Ultrasound Diagnosis and Ultrasound-guided Thoracentesis Procedure. J Vis Exp 12;(157)

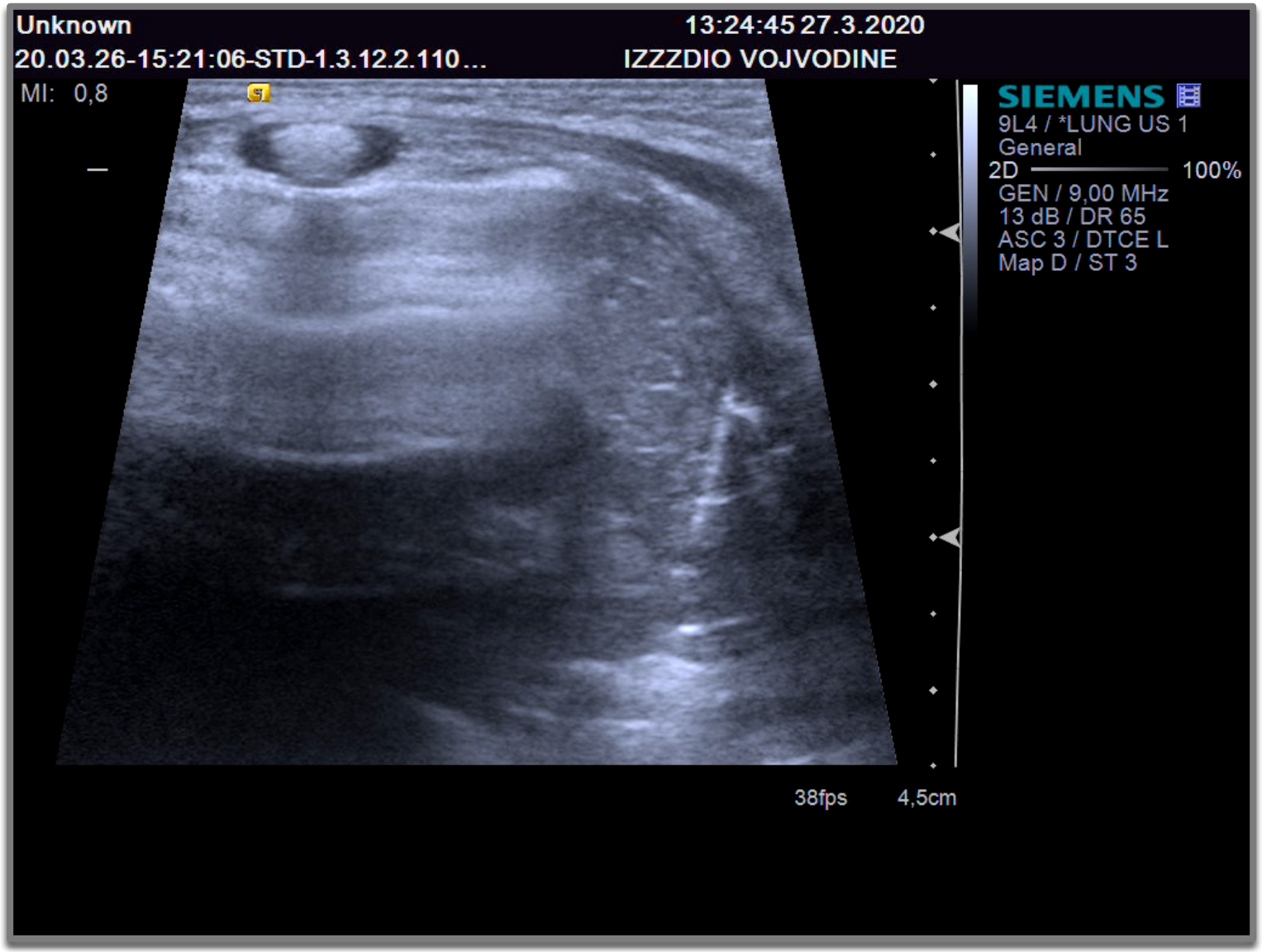
Time frame

After sudden decompensation of neonates, an average time for LUS was 5.3 ± 5.6 minutes vs. 19 ± 11.7 minutes for a CXR.

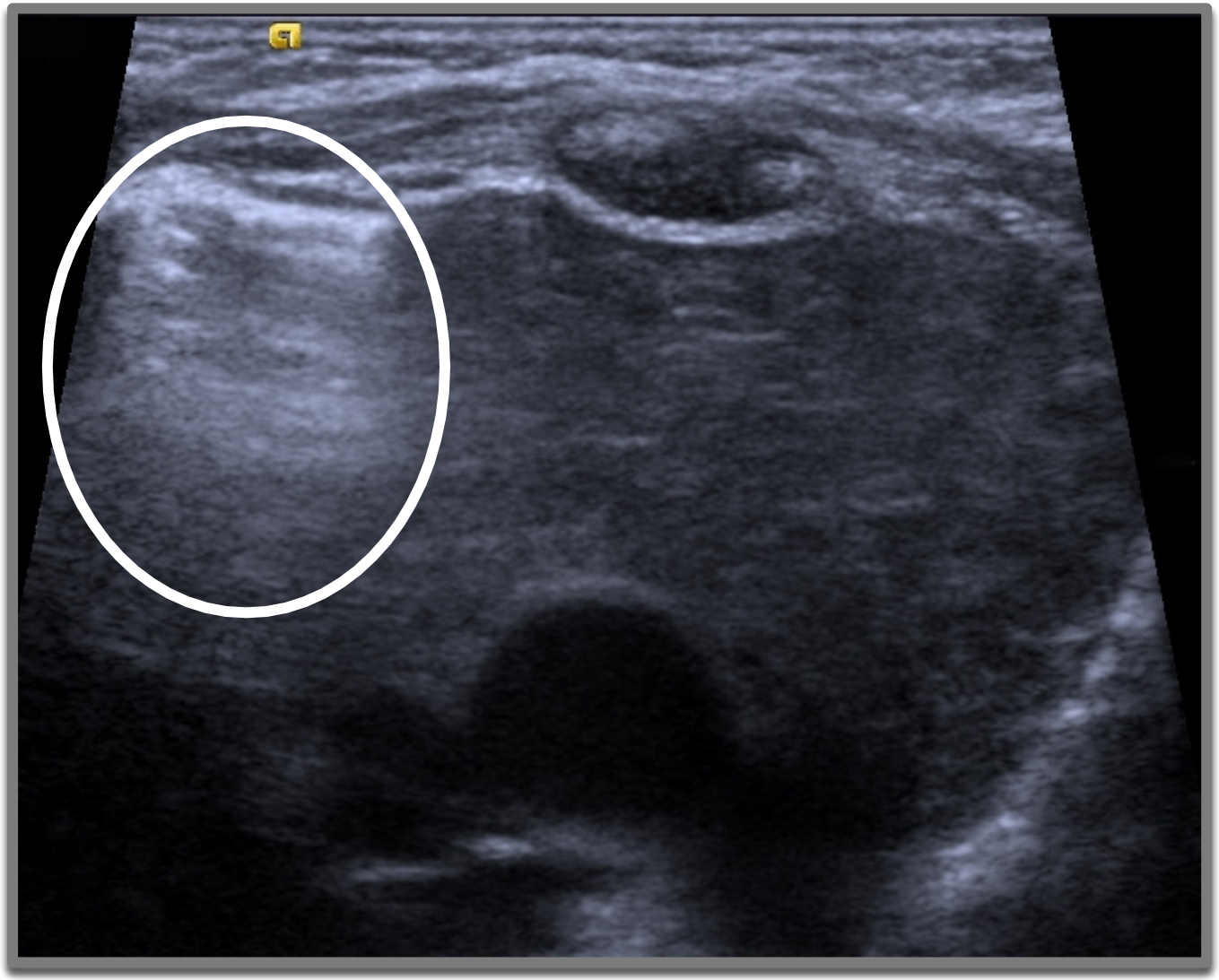
LUS outperformed clinical evaluation and reduced time to imaging diagnosis and drainage.

Raimondi F et al; Lung Ultrasound in the Crashing Infant (LUCI) Protocol Study Group (2016) Lung Ultrasound for Diagnosing Pneumothorax in the Critically Ill Neonate. J Pediatr 175:74-78.e1

Hyperinflation (25d, RSV bronchiolitis)



Hyperinflation



Functional LUS

TO PREDICT THE NEED FOR SURFACTANT REPLACEMENT THERAPY

TO PREDICT THE NEED FOR INTUBATION

TO PREDICT THE DEVELOPMENT OF BPD

Raimondi F, Yousef N, Migliaro F, Capasso L, De Luca D (2021) Point-of-care lung ultrasound in neonatology: classification into descriptive and functional applications. Pediatr Res 90(3):524-531

Functional LUS

Earlier surfactant therapy

↓

Reduced oxygen exposure early in life

↓

The need for increasing respiratory support and NICU admission

↓

Prediction of BPD from 7th to 14th day of life

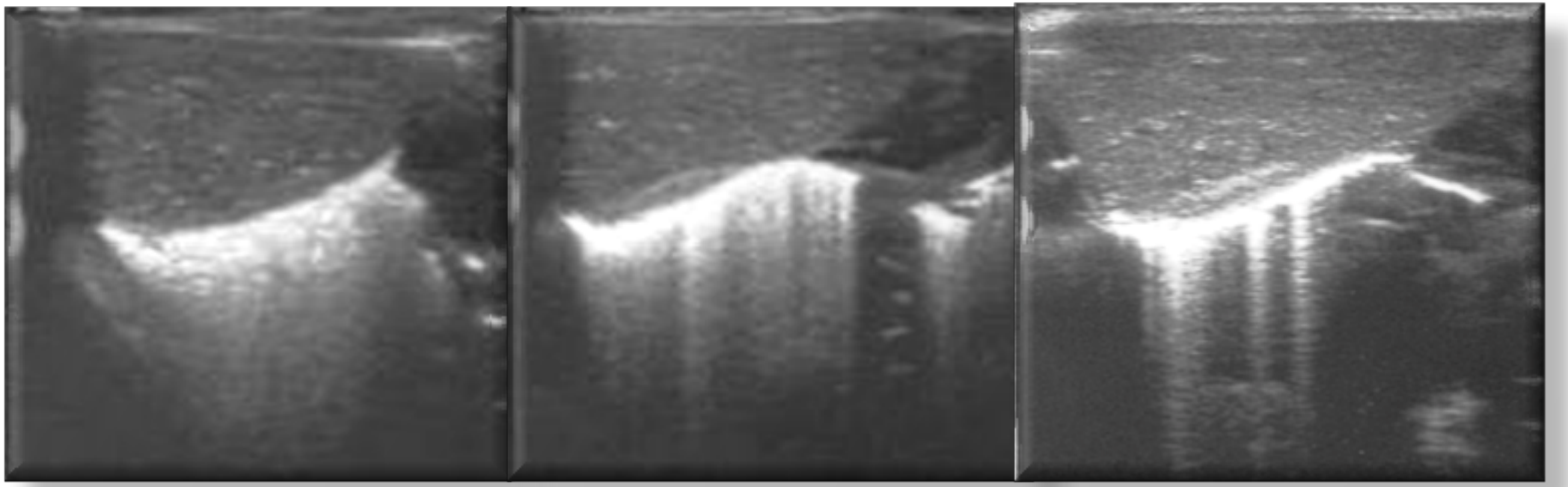
↓

Help clinicians to make more targeted therapeutic choices

Corsini I, Ficial B, Ciarcià M, Capasso L, Migliaro F, Rodriguez-Fanjul J, Clemente M, Raimondi F, Dani C (2022) Lung ultrasound scores in neonatal clinical practice: A narrative review of the literature. Pediatr Pulmonol. Epub ahead of print.

Surfactant replacement therapy effects

Transhepatic right lung base area

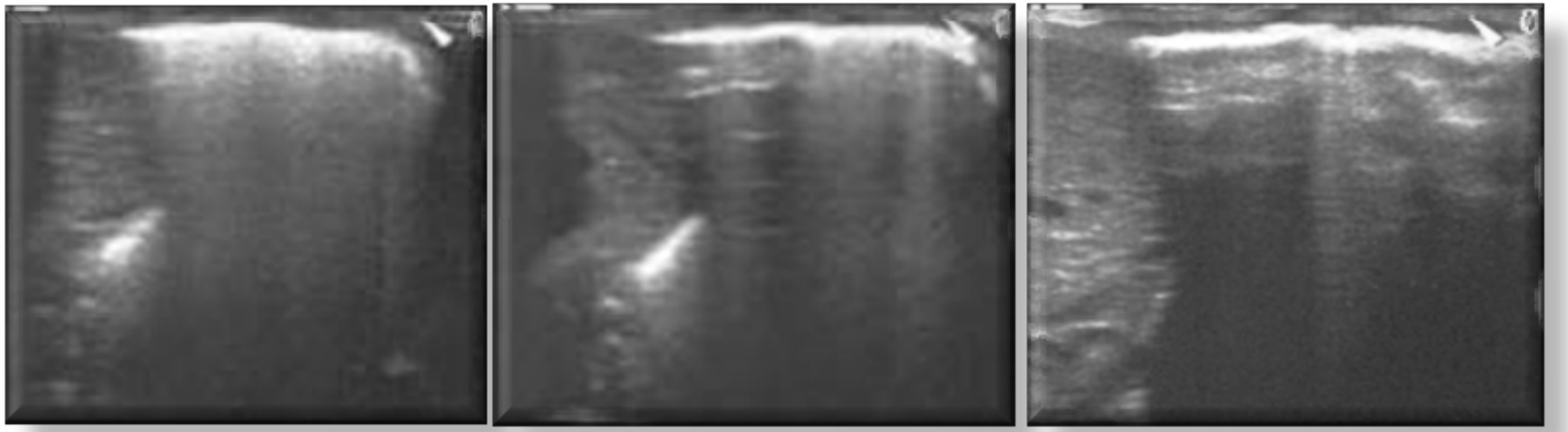


Before surfactant | After 0.5h | After 18h

Lovrenski J, Sorantin E, Stojanović S, Doronjski A, Lovrenski A (2015) Evaluation of surfactant replacement therapy effects – a new potential role of lung ultrasound. Srp Arh Celok Lek 43(11-12):669-675

Surfactant replacement therapy effects

Right anterior lung area



Before surfactant | After 0.5h | After 18h

Lovrenski J, Sorantin E, Stojanović S, Doronjski A, Lovrenski A (2015) Evaluation of surfactant replacement therapy effects – a new potential role of lung ultrasound. Srp Arh Celok Lek 43(11-12):669-675

BPD vs. BPD complicated with pneumonia

Continuous LUS follow-up (a great variety of findings).

Increase in number and extension of subpleural consolidations in correlation with clinical findings.

Lovrenski J (2012) Lung ultrasonography of pulmonary complications in preterm infants with respiratory distress syndrome. Ups J Med Sci 117:10-17

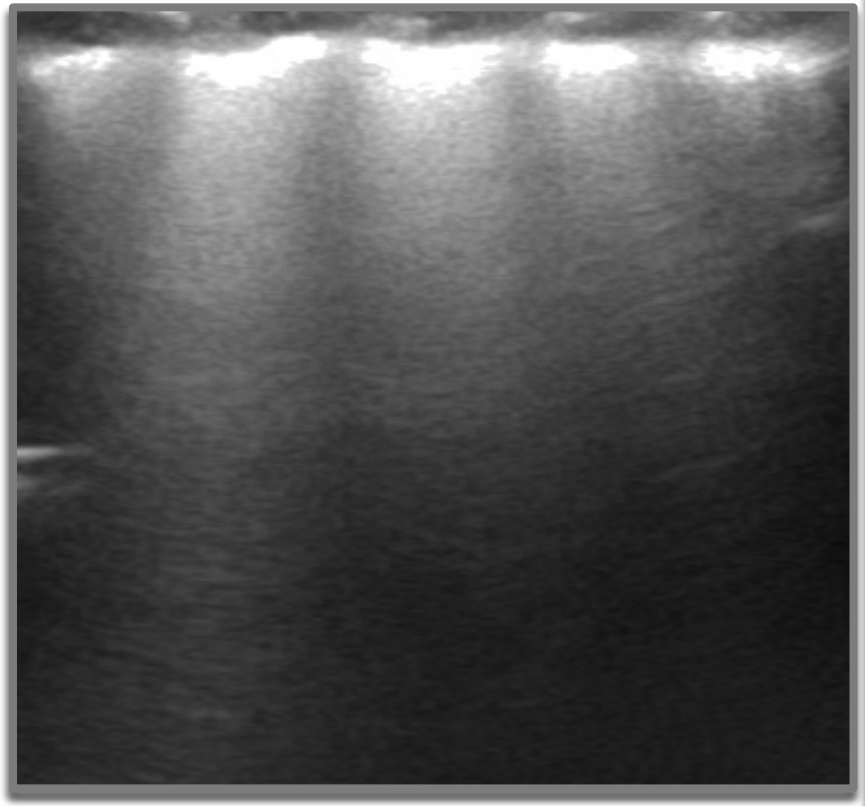
The impact of position on the LUS findings

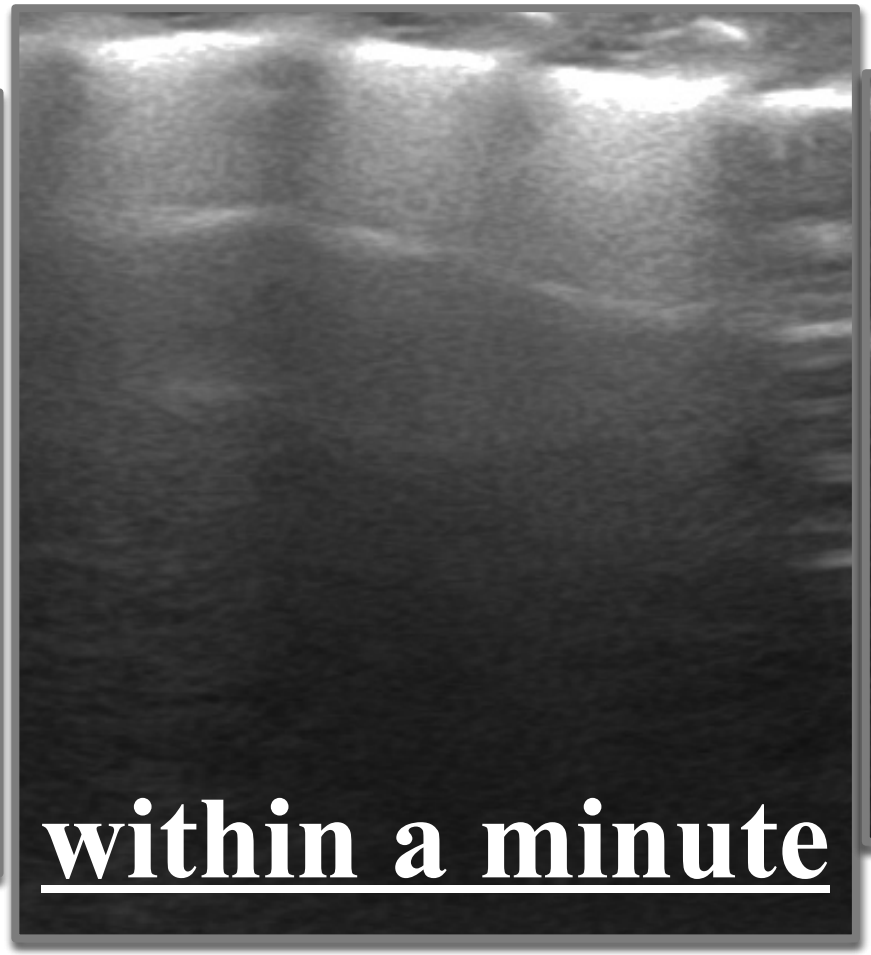
Normal LUS findings dominate anterior lung areas ($p<0.05$)

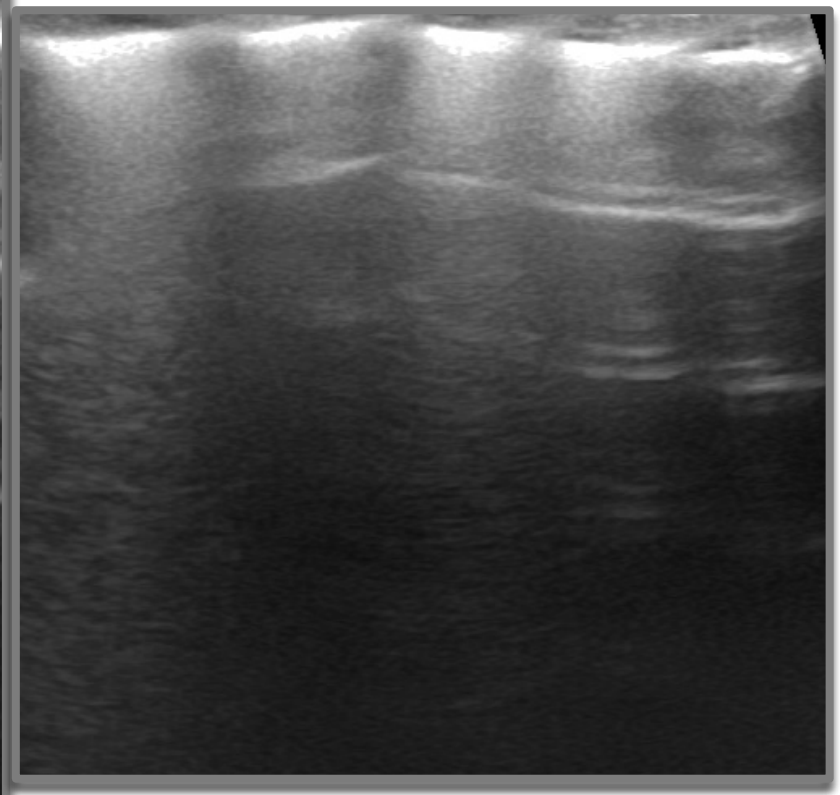
AIE and subpleural consolidations dominate posterior lung areas ($p<0.05$)

Lovrenski J (2012) Lung ultrasonography of pulmonary complications in preterm infants with respiratory distress syndrome. Ups J Med Sci 117:10-17

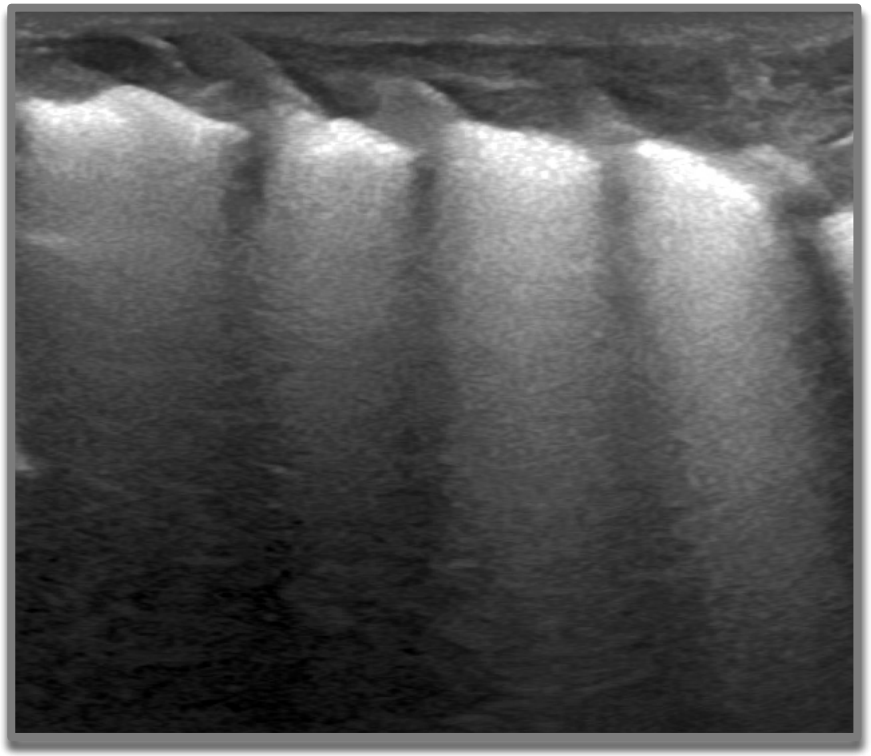
After surfactant (day 1) – left posterior lung area

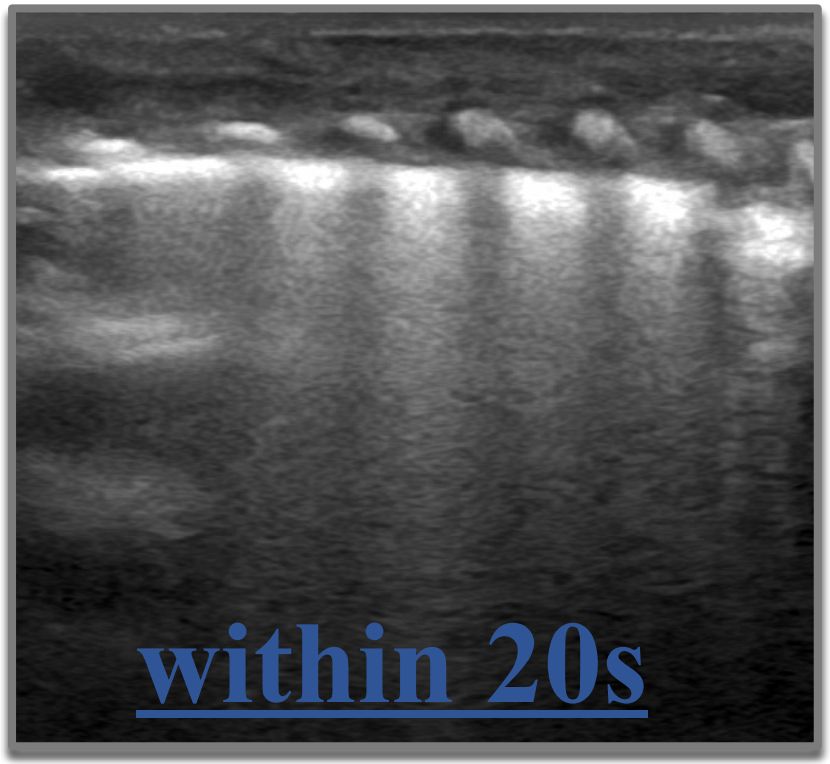


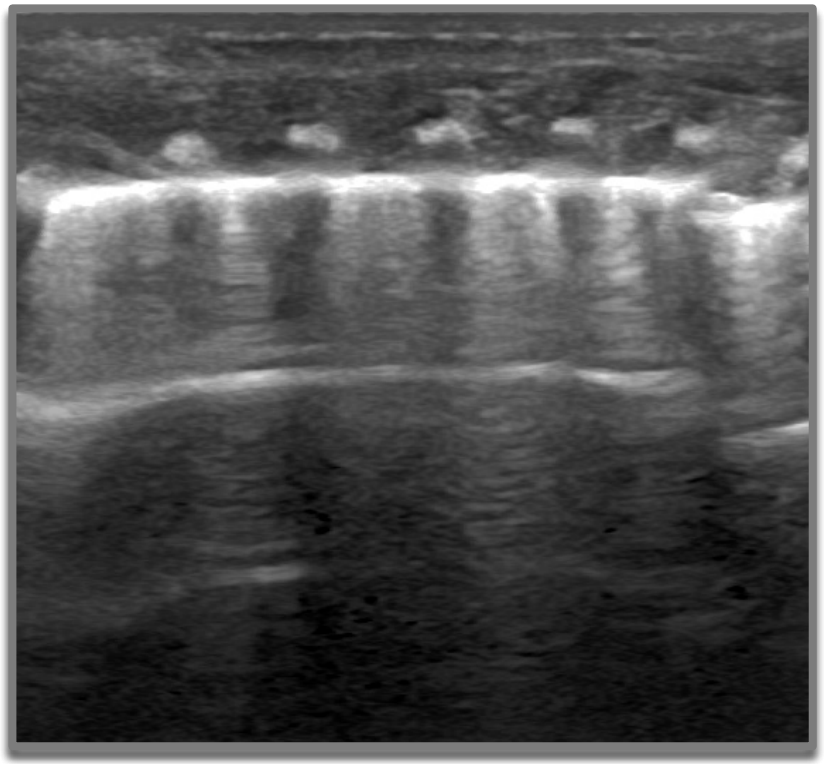




Mild RDS (day 2) – right posterior lung area





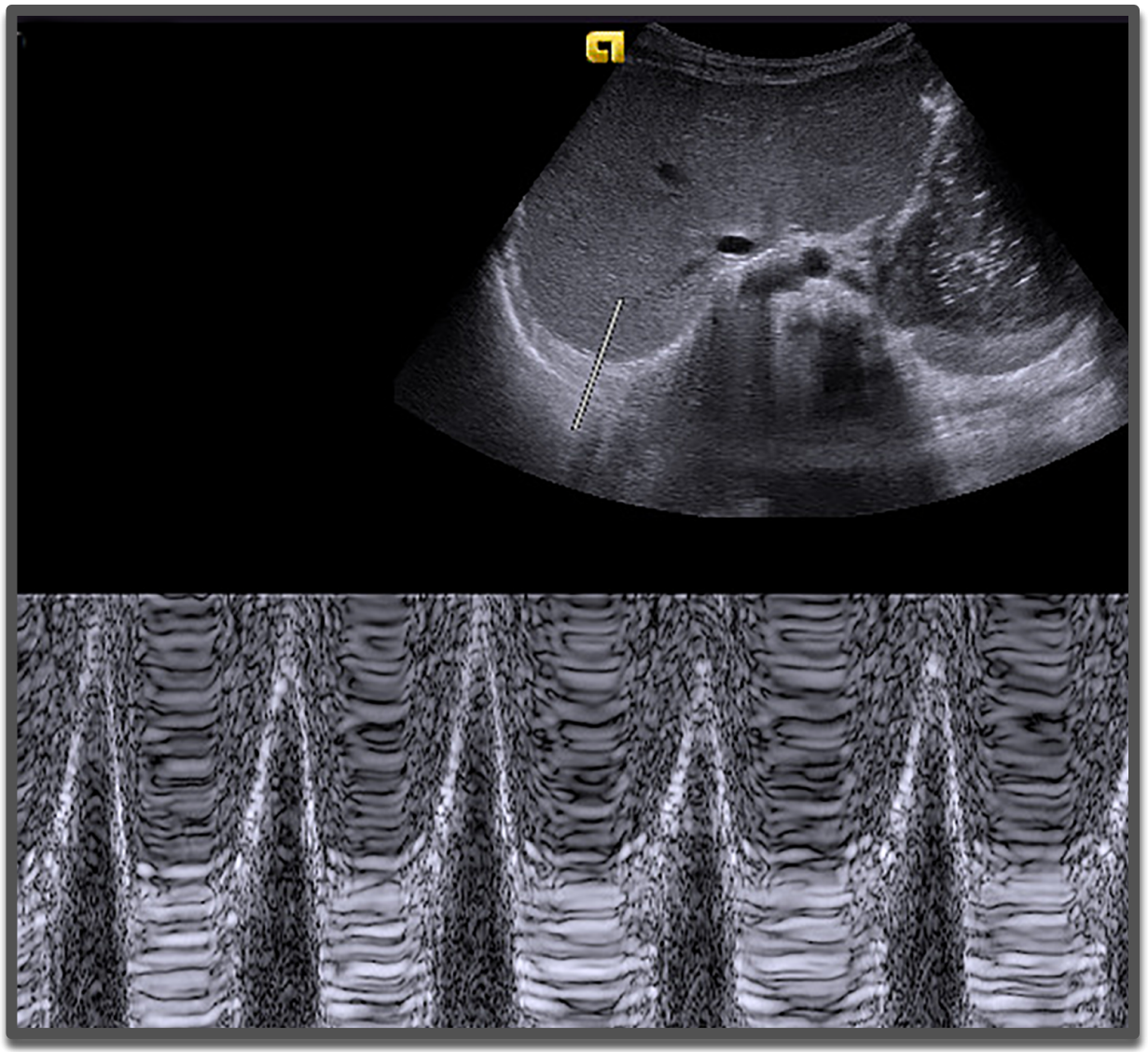


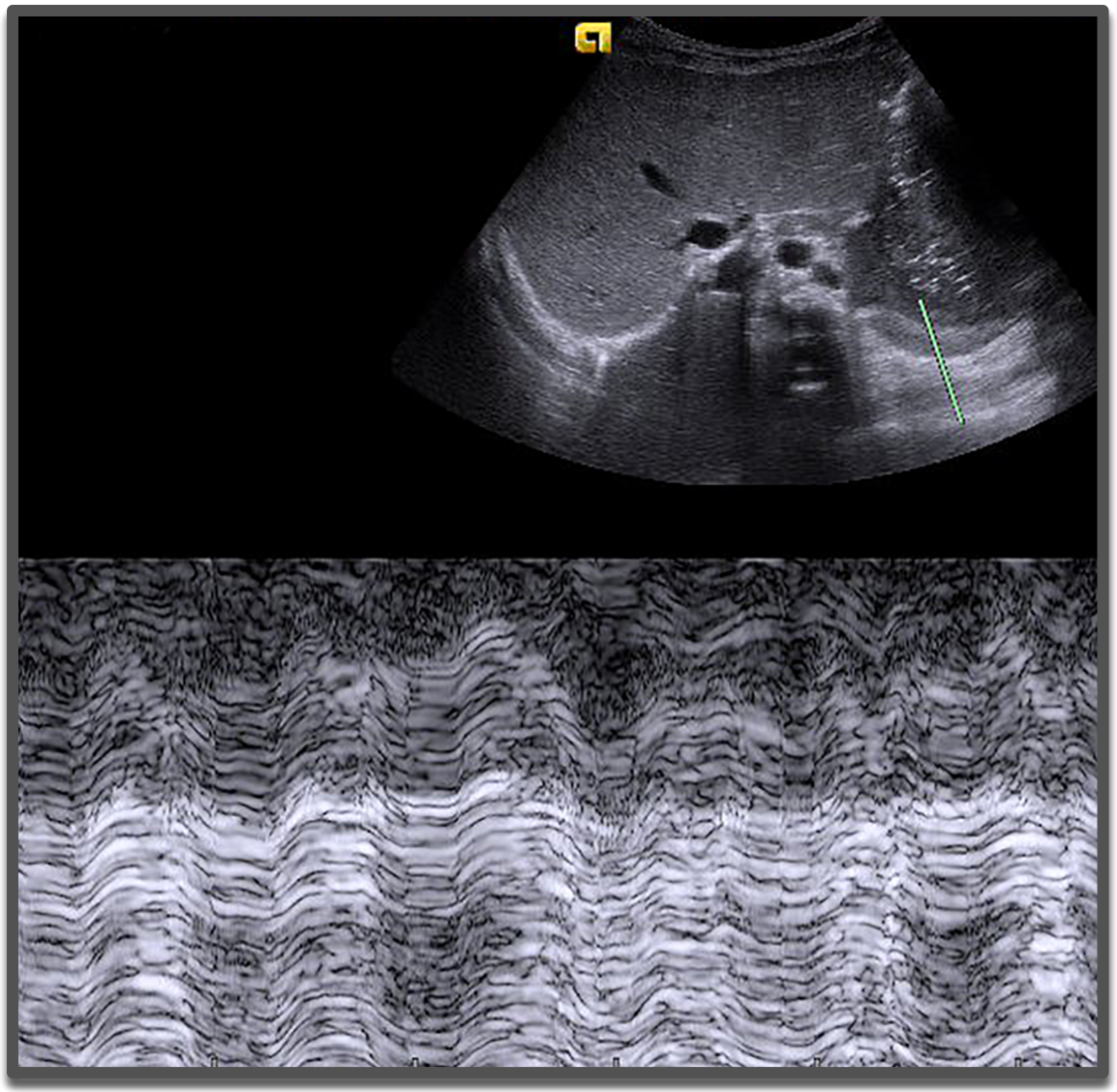
POTENTIAL FOR PULMONARY REHABILITATION BY POINTING TO THE POORLY VENTILATED AREAS AND GUIDING THE CHANGE OF THE PATIENT'S POSITION.

ESPR
European Society of Paediatric Radiology

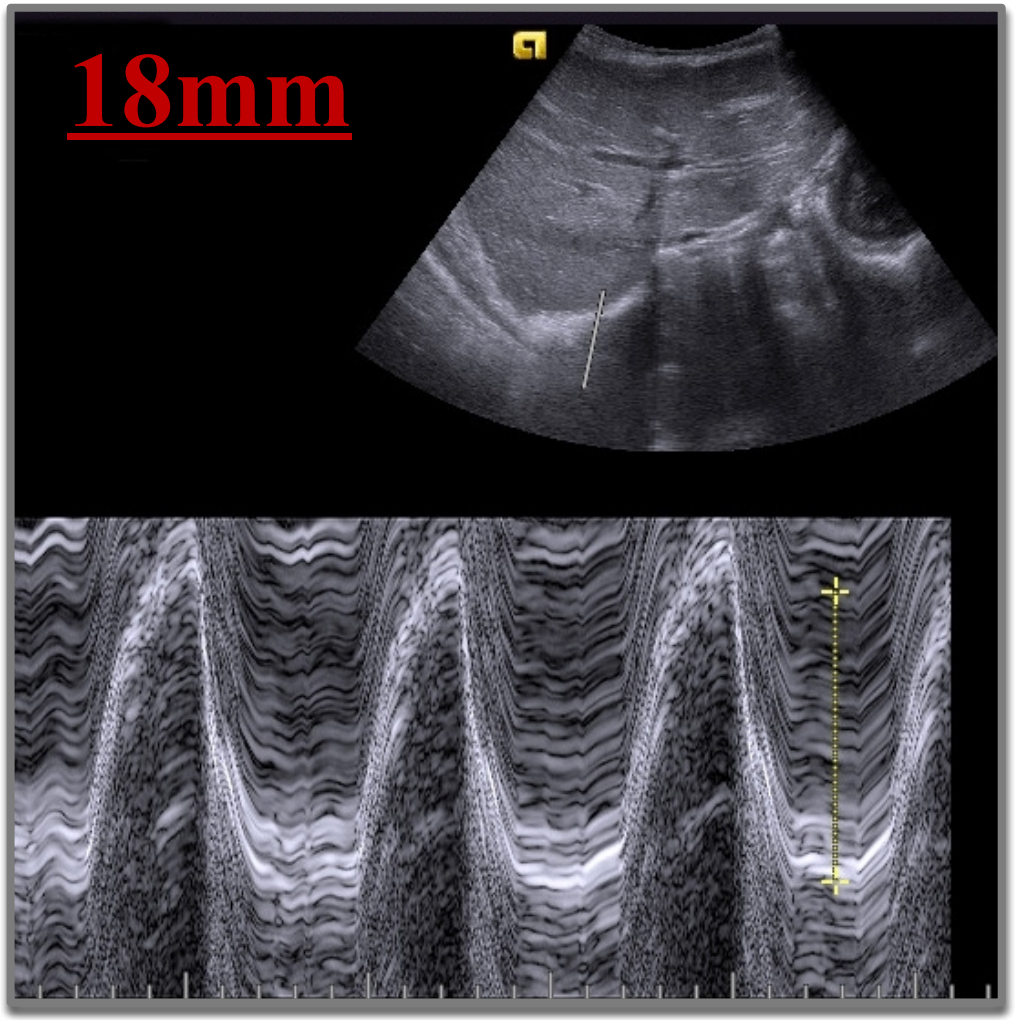
Infant after cardiac surgery

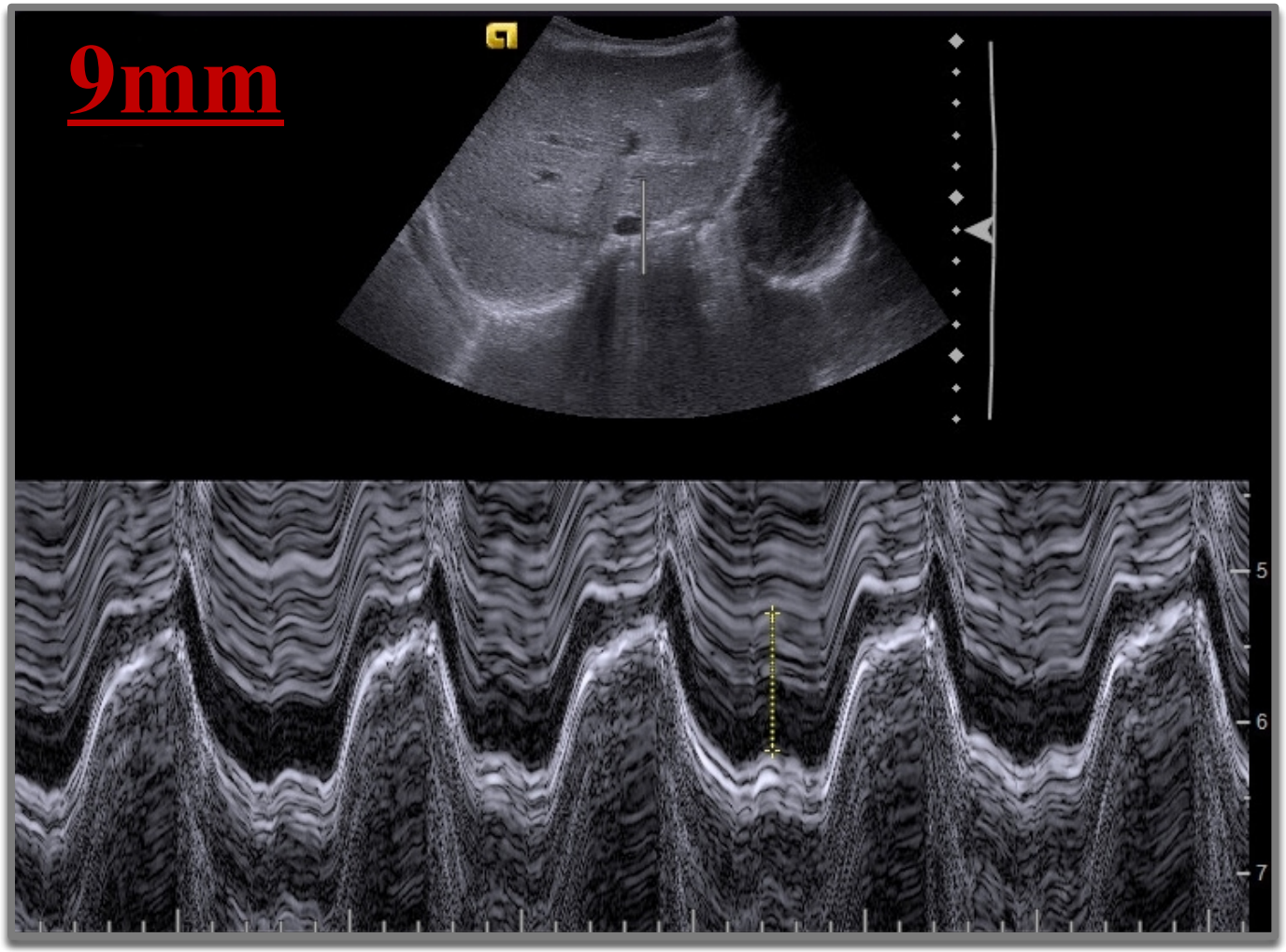
56th Annual Meeting &
42nd Post Graduate Course
June 06 - 10 2022





Infant after surgery (oesophageal atresia with TE fistula)





Drawbacks of LUS

AIR LEAK SYNDROMES APART FROM PNEUMOTHORAX / AIR FILLED CAVITIES

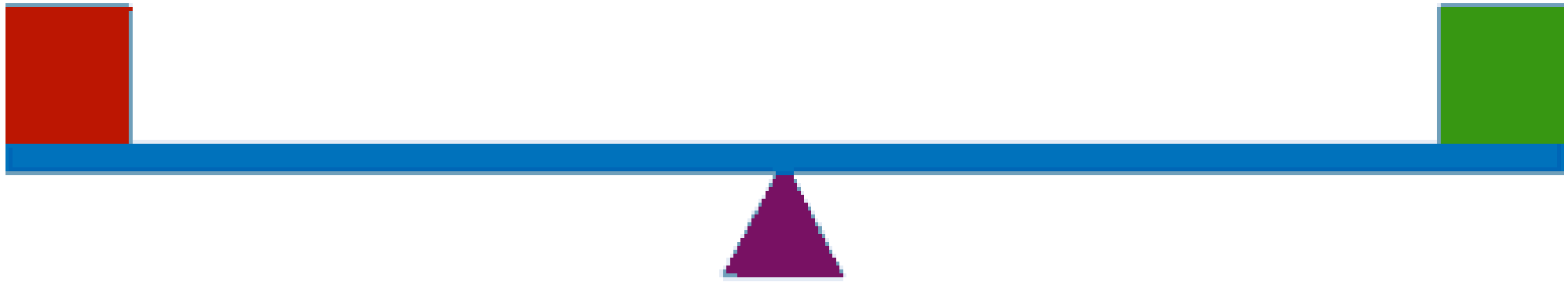
DEEP AND CENTRAL PATHOLOGY NOT ABUTTING THE PLEURA / INACCESSIBLE PARTS OF LUNGS

POSITION OF LINES AND TUBES

The dilemma

PAEDIATRIC RADIOLOGISTS

NEONATOLOGISTS



The biggest issue

- *LUS in NICUs - an Italian national survey*
- *LUS has been adopted in 82% of Italian NICUs.*
- *It is the first-choice diagnostic test in 23% of the centers surveyed.*
- *66% of respondents learned LUS technique via a self-training process, while 34% visited an expert in the field.*

Corsini I, Parri N, Ficial B et al. Lung ultrasound in Italian Neonatal Intensive Care Units: a national survey. Pediatr Pulmonol. 2022 May 30. doi: 10.1002/ppul.26025. Epub ahead of print.

J Matern Fetal Neonatal Med. 2020 Oct 9;1-8. doi: 10.1080/14767058.2020.1830369.
Online ahead of print.

Lung ultrasound completely replaced chest X-ray for diagnosing neonatal lung diseases: a 3-year clinical practice report from a neonatal intensive care unit in China

Yue-Qiao Gao [1 2], Ru-Xin Qiu [1 2], Jing Liu [1 2], Li Zhang [1 2], Xiao-Ling Ren [1 2], Sheng-Juan Qin [1 2]

Thank you for your attention!

ESPR 3-day paediatric MRI course (neuro, MSK, body)

Novi Sad, Serbia (Sheraton hotel)

7th to 9th September, 2022

Organizers: Outreach Task Force

Joanna Kasznia-Brown (UK), Jovan Lovrenski (Serbia)

esprmricourse2022@gmail.com

ESPR 2023
Belgrade, Serbia (Crown Plaza hotel)
5th to 9th June, 2023