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Review Article

Lung Ultrasound: “Healthy Bat Sign” vs. Sick Chiroptera Patterns.

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Abstract

Key learning points:

1. When presenting the lung ultrasound image, the first step in interpretation should be to assess whether it shows a healthy bat sign or a pathological one, regardless of the specific characteristics of the pathology
2. The Merlin space is a heterogeneous surface composed of two zones: a hyper-echoic twinkling white area and a hypo-echoic twinkling grey colour within a black area.
3. The normal hyper-echoic twinkling area should be considered as “the body of healthy bat sign.”
4. The healthy bat sign is when: pleural line is thin, and sliding is present. The twinkling white area is homogeneous with length 3.5-6.5 cm, with regular borders and truncated cone shape. The rib’s shadow borders are regular and extends to the same length as the normal twinkling white area.
5. When performing lung ultrasound (LU), the long and short axes must be combined.
6. Whenever we suspect for the presence of obstructive syndrome, inspiration and expiration ultrasound images must be practiced
7. The long axis, while it implies a longitudinal view of the lung, is the axis perpendicular to the space between the ribs. The short axis refers to the probe’s position, which is almost parallel to the space between the ribs.

Introduction

Aristotle was the first to discuss the concept of the mind as a "blank slate," though his theory focused more on the flexibility of the human mind than on its initial purity.

John Locke, a prominent philosopher, later developed the concept of Tabula Rasa, which means "blank slate." Locke suggested that we are all born with a mind that is free of pre-existing content, like a blank slate on which experiences and events can be written. The Romans used wax-covered wooden tablets as slates, erasing them by scraping with the flat end of a stylus, an image Locke used to illustrate the mind at birth, before it gets knowledge.

However, Locke did not specify which types of memories are stored more effectively. When considering memory types, visual memory often takes precedence. If we consider a baby's mind, infants initially experience the world primarily through vision. They do not yet understand words, but they can recognize familiar sights. This suggests that visual memory may be one of the first and most effective ways of storing information [1].

Studies show that auditory memory is reliable for immediate recall, while visual memory is more relied upon for information stored in our long-term memory [2].

While years ago, Daniel Lichtenstein had to confront opinions and resistance against the use of ultrasound in diagnosing and treating acute pulmonary diseases, it is now clear that the benefit of lung ultrasound (LU)examination in daily practice is clear, not only for pulmonologists but also for internists.

According to the study that compare LU accuracy with x-ray examination and auscultation, the auscultation has 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, can quantify the extent of lung injury [3].

In many published studies, the appearance of a normal lung is described as a bat sign: a space limited above by the pleural line, on the sides by the borders of the rib shadows, and below by the screen. This space has been called Merlin's space by Lichtenstein. Merlin space is considered homogeneous, with twinkling's that, according to many studies, are caused by pleural sliding [4-9].

From our experience, we saw that when a normal person or patient holds their breath, or in the case of pneumothorax, when pleural sliding is absent, these twinkling's do not disappear, showing that pleural sliding is not the primary cause of the scintillations. The depth setting of the curved linear probe is crucial, as a proper setting allows for a more correct assessment of the areas of Merlin space as first step.

A depth of 16-18 cm on the curved transducer is reasonable. At this depth, we can visualize not only the pleural surface but also deeper structures, allowing us to see the normal or abnormal structure of the Merlin space. This depth enables us to assess pathology extending beneath the pleural surface and deeper. If a more detailed evaluation of the pleural surface is needed, a depth of 6-10 cm is best.

The density of Merlin's space is not homogeneous. The structure of Merlin's space consists of a hyper-echoic twinkling white area that starts from the pleural line and descends downward in a truncated cone shape, bounded laterally by rib shadows, bellow by a hypo-echoic twinkling gray colour within black area. This hypo-echoic twinkling gray colour within black area is bounded below by the screen and above by a hyper-echoic twinkling white area. The hypo-echoic twinkling gray colour within black area is not bordered by the ribs' shadows, which is an another feature that distinguishes it from the hyper echoic twinkling white area. This feature has its importance because the extension of rib's shadow to the bottom of the screen is abnormal and sign of "sick bat".

According to Lichtenstein and other authors, the "bat sign" is a configuration composed of the ribs and their shadows, standing for the bat's wings, and the pleural line, representing its body. When examining the bat's wings from beginning to end (where the beginning is the ribs and the extension are the shadows of the ribs), the body cannot be depicted as a simple line but rather as a truncated cone with its base at the pleural line. Thus, the bat's body aligns with the hyper-echoic, twinkling area in the Merlin space. Therefore, it is crucial not only to see the bat's wings but also its body. Recognizing the normal appearance of the bat's body (hyper echoic twinkling white area) along with the bat sign (ribs's line and shadow, pleural line) is essential for early detection of injuries, known as "sick bat," in the lungs.

Therefore, we suggest defining the Merlin space as follows: The Merlin space is the hyper-echoic twinkling white area below the pleural line, delimited laterally by rib shadows and inferiorly by the hypo-echoic twinkling black area extending to the bottom of the screen. This definition more accurately reflects the real presentation of the Merlin space and helps in understanding the changes it undergoes in abnormal lung conditions (Figure 1).

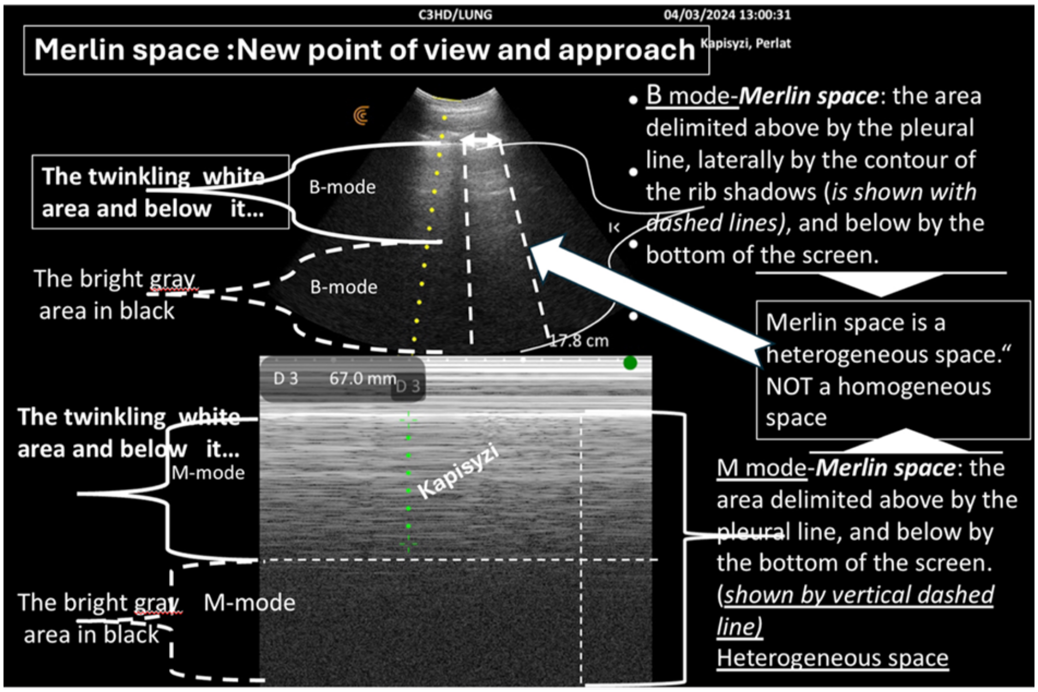
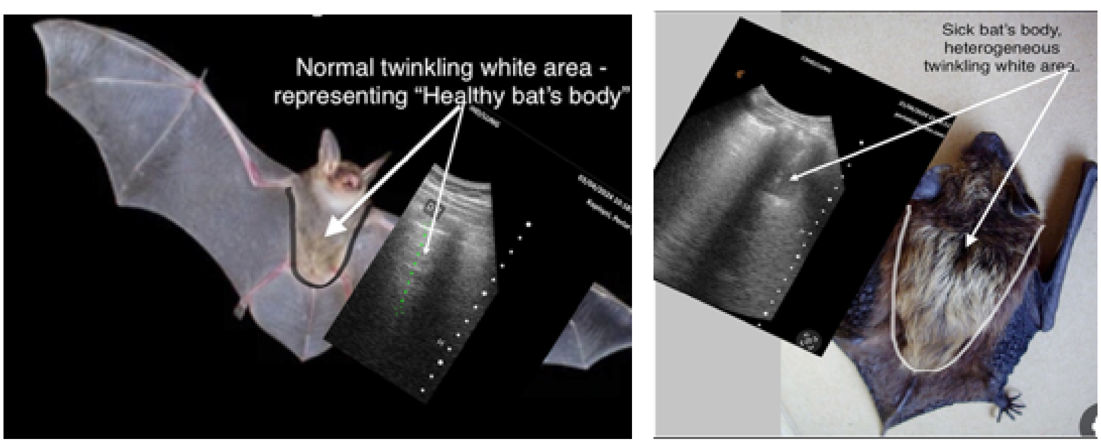


Figure 1: New concept of Merlin space [10].

Knowing this normal structure which to our knowledge has not been described in this way in details but Merlin's space has been considered homogeneous—allows us to use ultrasound to discern when "something" is not normal at the lung periphery. If we are not familiar with the "healthy bat" image, it will not be easy to recognize the "sick bat's" images with various diseases, especially in the initial stages.

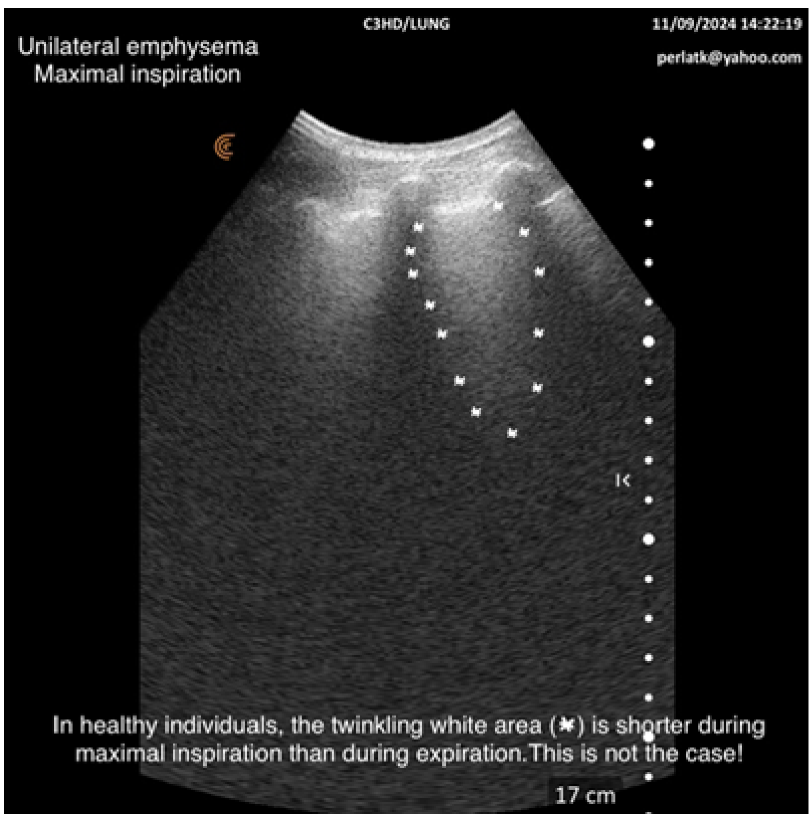


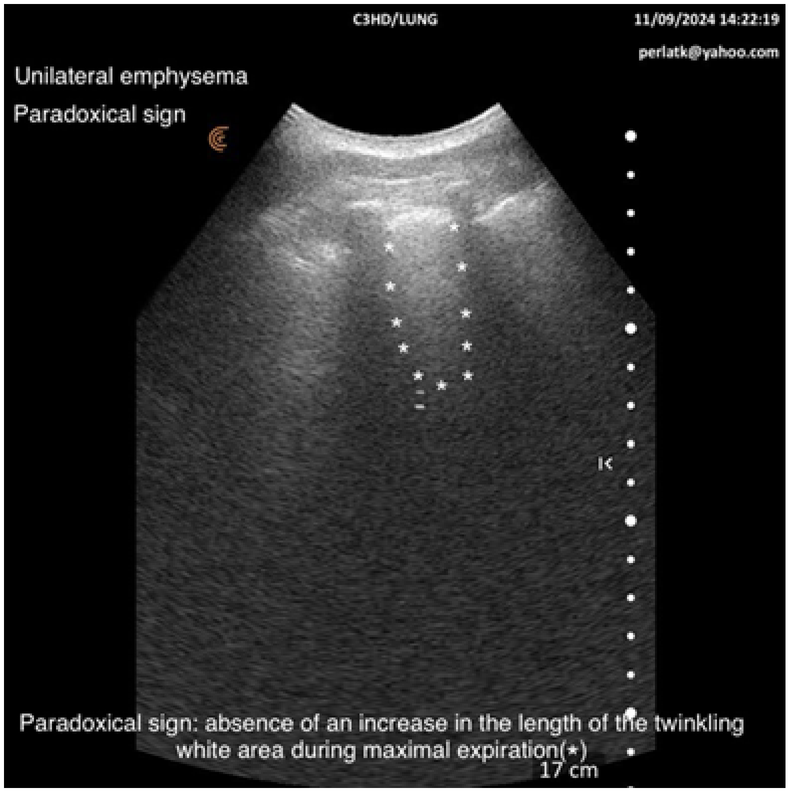
Since the alveoli at the apices of the lungs are more expanded than those at the bases, and the air interstitial tissue ratio at the interface is greater, this results in the twinkling white area of the Merlin space being less dense and having a shorter length. Given that the alveoli in the middle and caudal regions of the lungs are less expanded due to increased trans pulmonary pressure, the air/tissue ratio at the air–interstitial tissue interface is smaller than in the apices, resulting in the twinkling white area of the Merlin space being denser and longer. Typically, the length of the hyper-echoic twinkling area ranges from 3.5 cm to 6.5 cm. This area is a result of reverberations, scattering, and reflections of ultrasound passing through the secondary lobule and both pleurae [10].

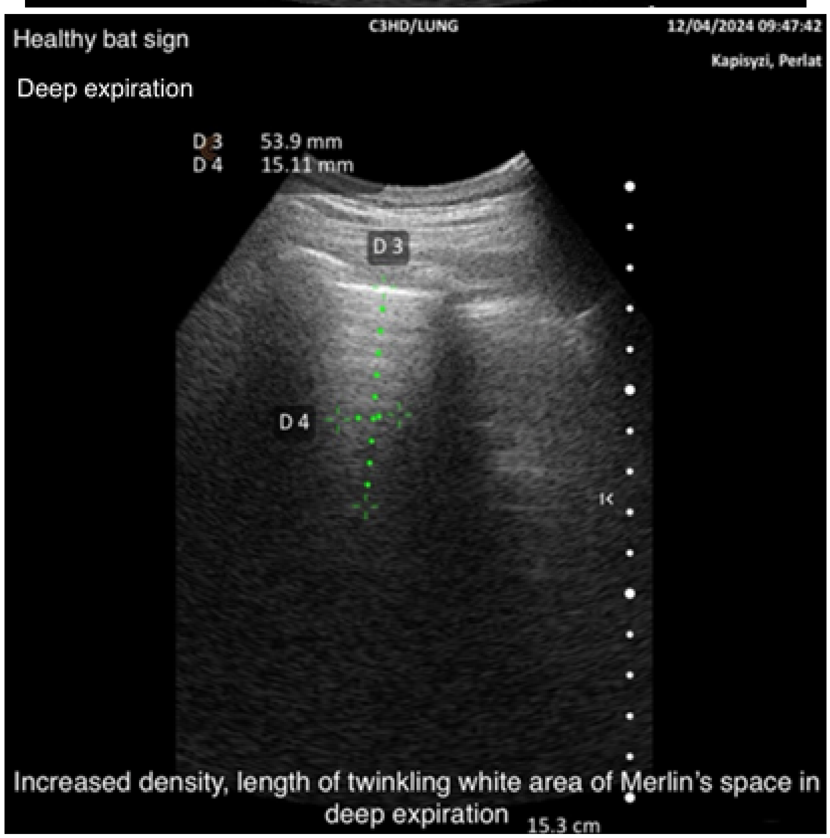
The pulmonary interstitial tissue is closely next to the visceral pleura. The density of the interstitial tissue varies from the apex to the base of the lungs and changes with different depths of breathing. The density of the interstitial tissue is distinct from that of the visceral pleura. In both healthy and diseased subjects, deep inspirations are followed by a decrease in density, shortening of the length, and a change in the shape of the Merlin space's twinkling white area. The opposite happens in deep expiration.

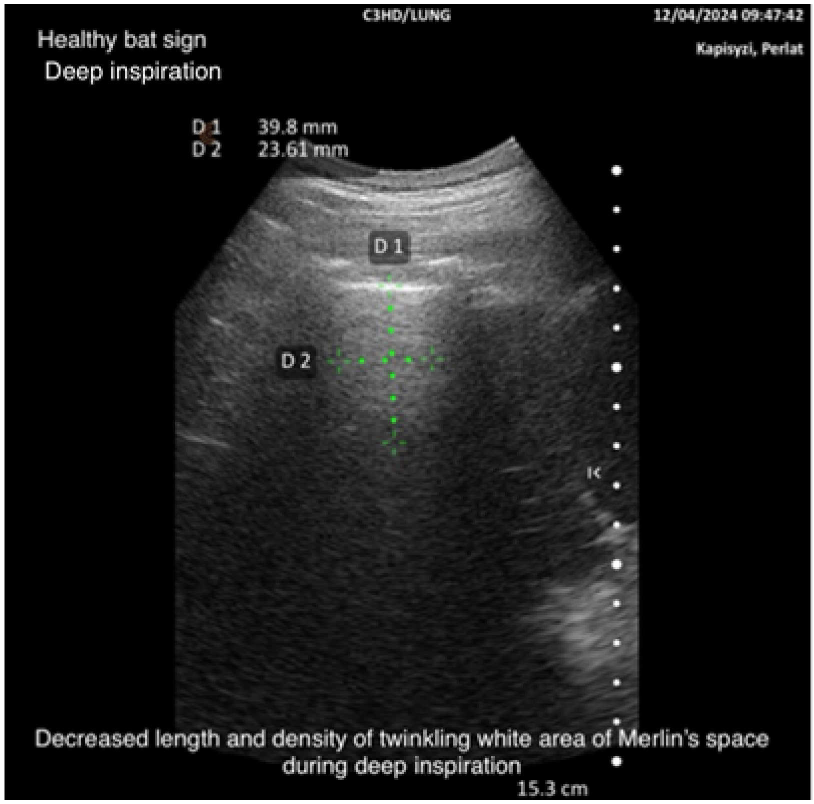
The hyper-echoic twinkling white area seen in severe air trapping is characterized by lower density at the apex and higher density at the bases compared to normal individuals or those with mild obstruction. Unlike in normal individuals or those with mild obstruction, the size of this hyper-echoic twinkling area remains consistent between maximal inspiration and expiration. Indirectly, through abnormal contour images of the twinkling white area of the Merlin space, we can deduce the presence of past or present active changes. Irregularity of the white twinkling area borders can be the only finding of lung abnormality. The homogeneity of the white twinkling area of the Merlin space is particularly important. The presence of hypo-echoic or hyper-echoic micro-densities within it should prompt consideration of post-inflammatory fibrosis or latent chronic inflammatory processes [10]. We continue to think that the hyper-echoic twinkling white part of the Merlin space is not an artifact, but a hyper-echoic density created not only by lung sliding but also by the presence of peripheral interstitial tissue in secondary lobule, which has a different impedance than the pleura itself and, of course, air. In the twinkling part, we see the A-line, but also a bright white area between them. Furthermore, in not a few cases, this hyper-echoic twinkling white space exists alone, without the A-line.

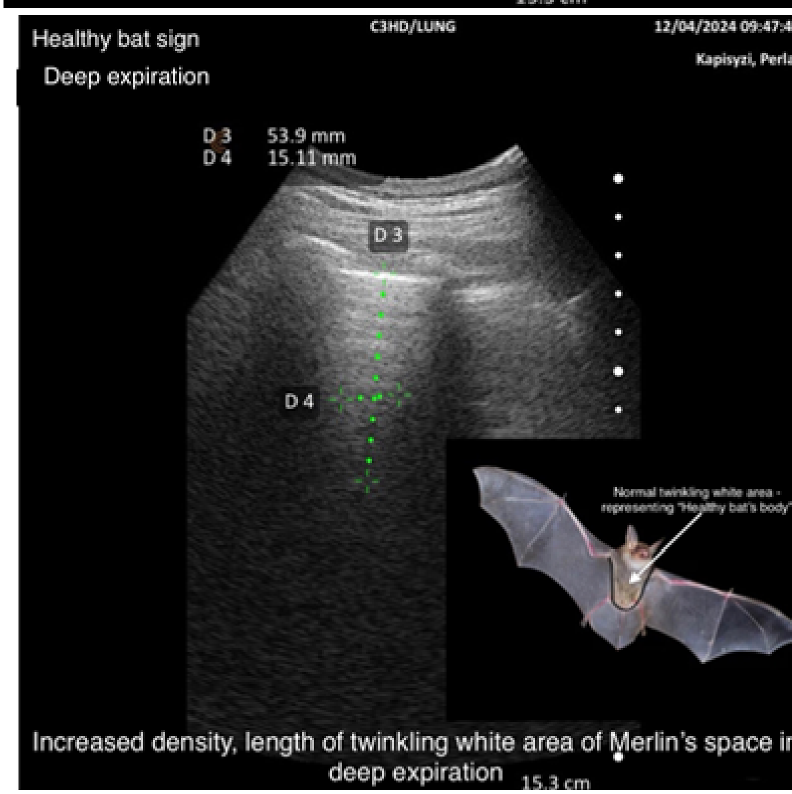
The shape, intensity, and length of the Merlin space's twinkling white area depend not only on the thickness of the thoracic wall and the angle of the ultrasound probe but also on changes in the subpleural peripheral interstitial tissue, which is thicker anteriorly than posteriorly [10].

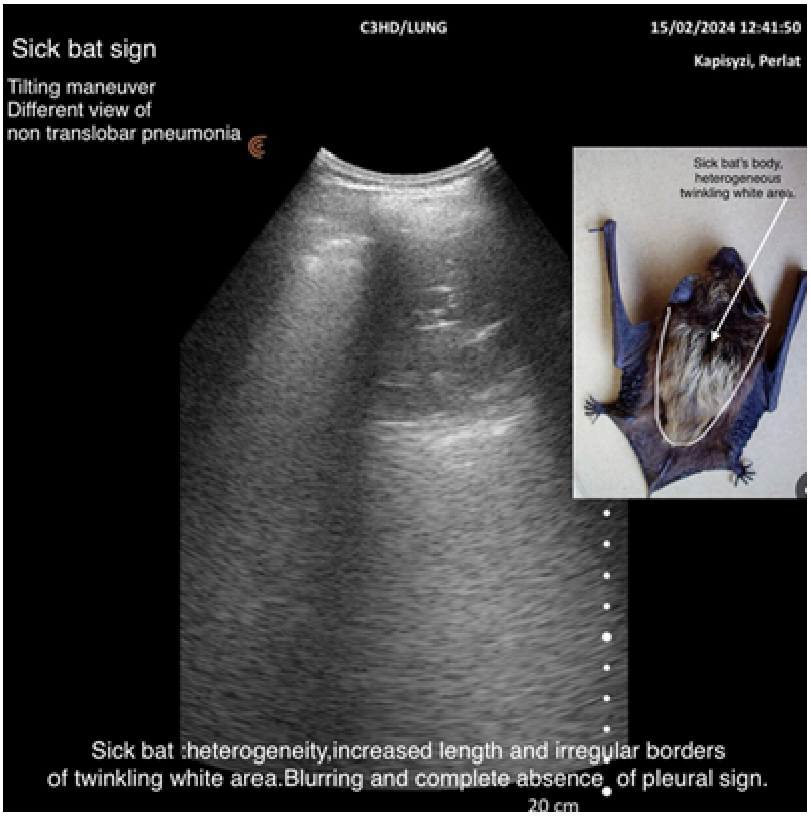



C3HD/LUNG
11/09/2024 14:22:19
perlatk@yahoo.com
Unilateral emphysema
Paradoxical sign
Paradoxical sign: absence of an increase in the length of the twinkling white area during maximal expiration(⋆)
17 cm


Healthy bat sign
C3HD/LUNG
12/04/2024 09:47:42
Kapisyzi, Perlat
Deep expiration
D 3 53.9 mm
D 4 15.11 mm
D 3
D 4
Increased density, length of twinkling white area of Merlin’s space in deep expiration
15.3 cm


C3HD/LUNG
12/04/2024 09:47:42
Kapisyzi, Perlat
Healthy bat sign
Deep inspiration
D 1 39.8 mm
D 2 23.61 mm
D 1
D 2
Decreased length and density of twinkling white area of Merlin’s space during deep inspiration
15.3 cm


C3HD/LUNG
12/04/2024 09:47:42
Kapisyzi, Perlat
Healthy bat sign
Deep expiration
D 3 53.9 mm
D 4 15.11 mm
D 3
D 4
Normal twinkling white area - representing “Healthy bat’s body”
Increased density, length of twinkling white area of Merlin’s space in deep expiration
15.3 cm



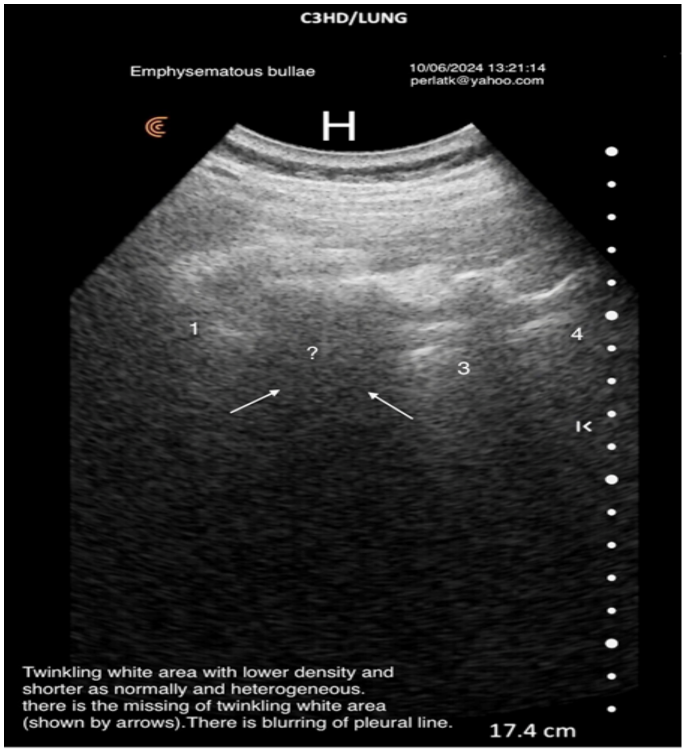
Ultrasound of the lung has its "butter side" and "seamy side."

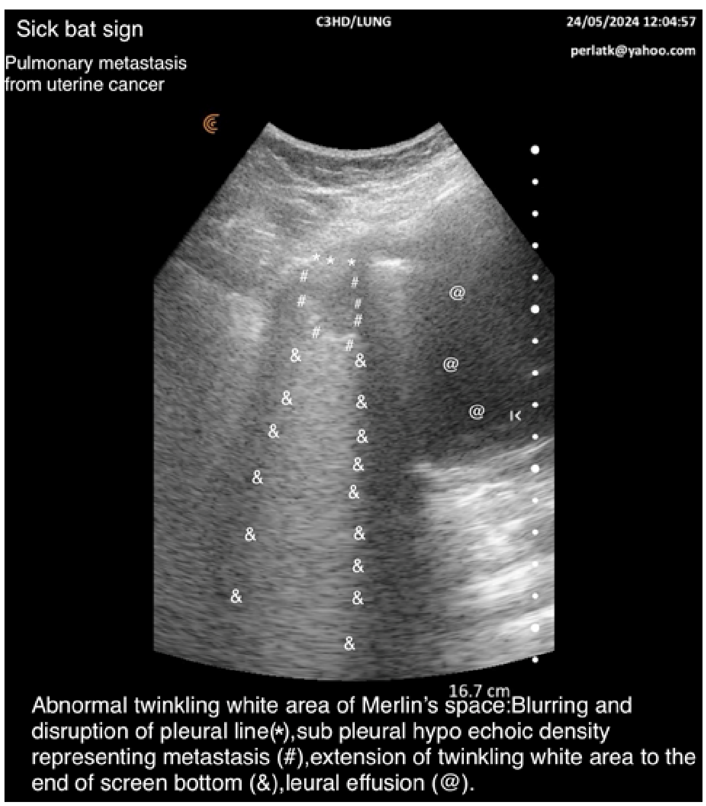
The "butter side" of LU

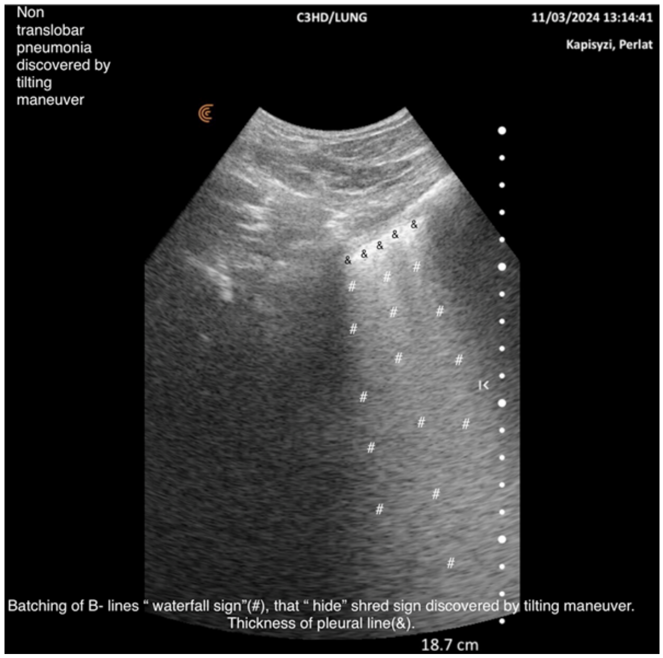
The butter side consists in the indisputable finding of lung ultrasound (LU) in acute diseases, that there is something wrong in the periphery of lung even when physical examination and X-ray did not show anything. While the x-ray had the sensitivity of 49% (95% CI, 40–58%) and specificity of 92% (86–95%), lung ultrasound had an overall sensitivity of 95% (92–96%) and specificity of 94% (90–97%) [11].

This is particularly true for ground-glass opacities, acute and chronic inflammation of the periphery of the lung (increase in the length of hyper-echoic density of the Merlin space), and minimal pleural effusion. LU also detect tiny peripheral lung inflammatory pathologies that "escape" X-ray examination. LU can help us make a brief list from a lengthy list of findings. When combined with cardiac ultrasound, we can have a more precise and early diagnosis. LU can eliminate the need for X-ray, which is not a free lunch, avoiding radiation exposure and the inconvenience of transporting patients to the radiology department, which may be far from the clinic [12-14].

The tilting technique is extremely helpful and useful for discovering more details about lung lesions. In one position of the transducer, we can get an image that differs from the one obtained from another position without displaying it. Through ultrasound, we can detect diaphragmatic paresis and paralysis in patients with respiratory failure and normal alveolar-capillary gradients or mediastinal infiltration of lung cancer.

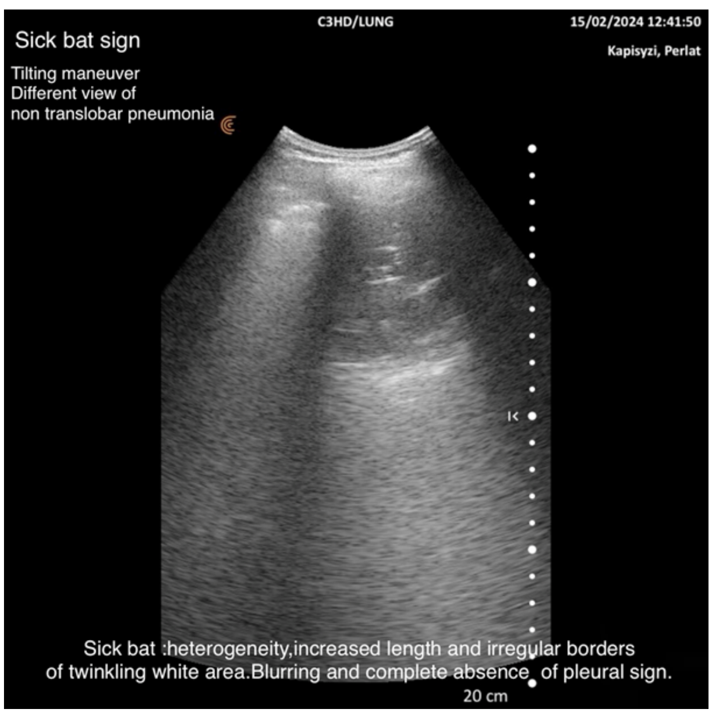

C3HD/LUNG
Emphysematous bullae
10/06/2024 13:21:14
perlatk@yahoo.com
H
1
?
3
4
Twinkling white area with lower density and
shorter as normally and heterogeneous.
there is the missing of twinkling white area
(shown by arrows).There is blurring of pleural line.
17.4 cm

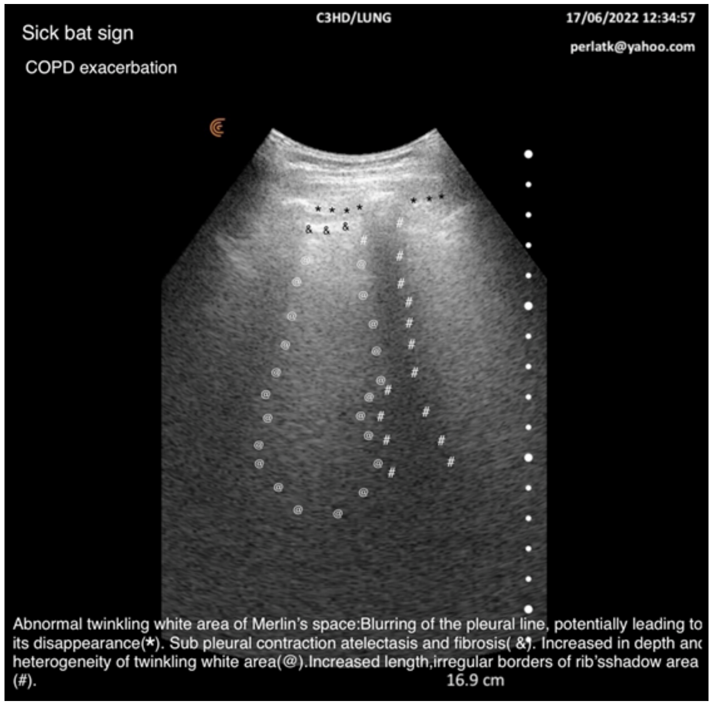

Sick bat sign
C3HD/LUNG
24/05/2024 12:04:57
perlatk@yahoo.com
Pulmonary metastasis
from uterine cancer
16.7 cm
Abnormal twinkling white area of Merlin's space:Blurring and
disruption of pleural line(*),sub pleural hypo echoic density
representing metastasis (#),extension of twinkling white area to the
end of screen bottom (&),leural effusion (@).

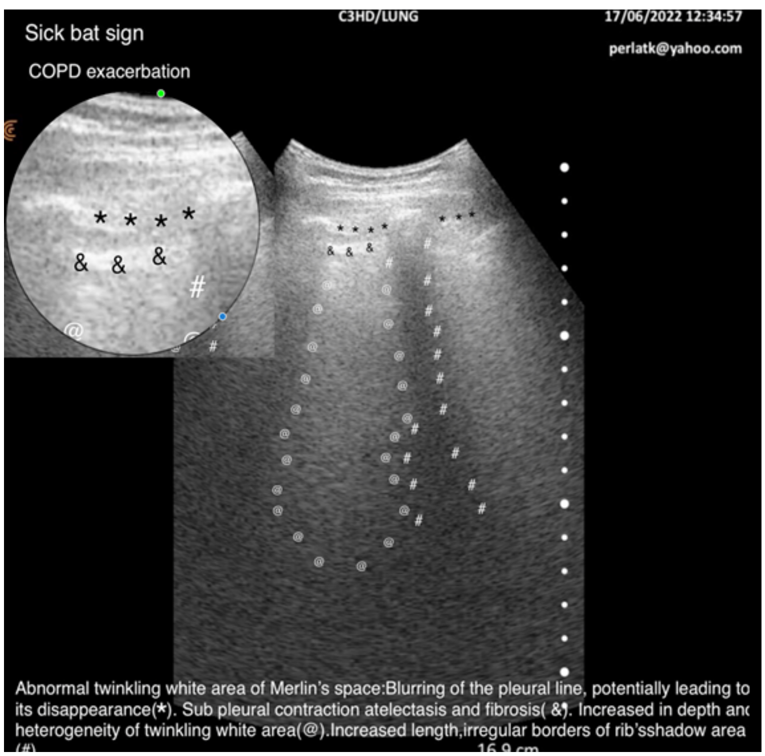

Non translobar pneumonia discovered by tilting maneuver
C3HD/LUNG
11/03/2024 13:14:41
Kapisyzi, Perlat
Batching of B- lines “ waterfall sign”(#), that “ hide” shred sign discovered by tilting maneuver.
Thickness of pleural line(&).
18.7 cm


Tiltin procedure
Sick bat sign.
Non translobar pneumonia
C3HD/LUNG
11/03/2024 13:14:41
Kapisyzi, Perlat
Shred sign(&), thickened bitten,blurring of pleural line(*),heterogeneity and increased length of the twinkling white area(#), revealed by the tilting maneuver.
18.7 cm


Sick bat sign
C3HD/LUNG
15/02/2024 12:41:50
Kapisyzi, Perlat
Non translobar pneumonia
Sick bat :heterogeneity,increased length and irregular borders
of twinkling white area.Blurring and absence the part of pleural sign.
16.5 cm


Sick bat sign
C3HD/LUNG
15/02/2024 12:41:50
Kapisyzi, Perlat
Tilting maneuver
Different view of
non translobar pneumonia
Sick bat :heterogeneity,increased length and irregular borders
of twinkling white area.Blurring and complete absence of pleural sign.
20 cm





LU can help diagnose COPD in smoker patients with more than 20 pack-years. The length of Merlin's space hyper echoic twinkling white area is increased in acute exacerbation of COPD and asthma. The length of Merlin's space hyper echoic twinkling white area is increased in cases of lung cancer, atelectasis, and subacute or post-inflammatory events. The dilemma lies in distinguishing between increased Merlin's space hyper echoic twinkling white area or posterior enhancement. Merlin's space hyper echoic twinkling white area length is decreased in cases of severe obstruction of COPD and asthma in stable condition due to increased alveolar air trapping.

When increased Merlin's space length is found in obstructive syndromes (such as COPD and asthma), we must consider subacute or acute concomitant inflammation, whether due to infection, autoimmune causes, or malignancy.

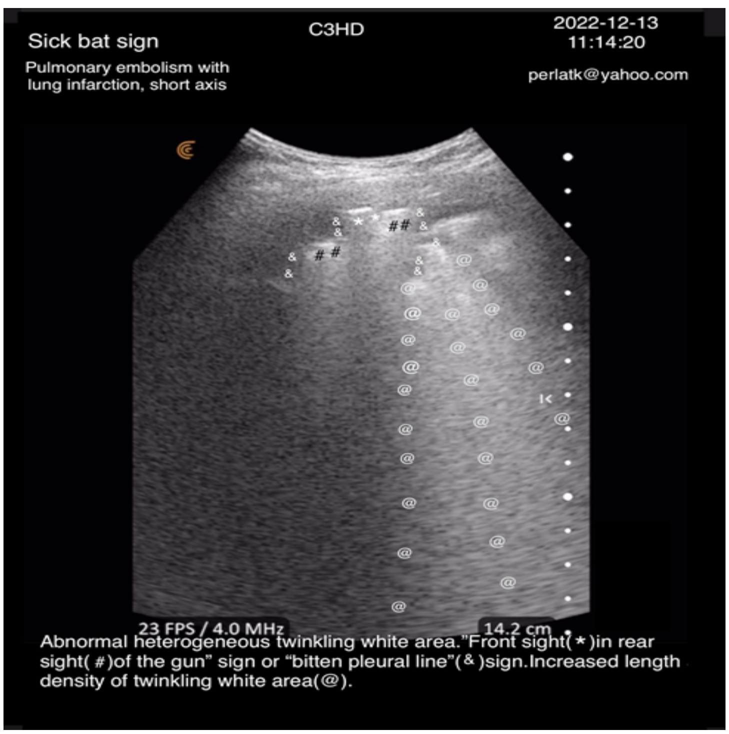
The length and width of the hyper-echoic twinkling white area of Merlin space, as well as the rib's hypo-echoic shadow, also depend on the angle of the probe. The length of Merlin's space hyper-echoic twinkling white area is longer in the longitudinal axis than in the short one. Shaggy, irregular borders of Merlin's space's hyper-echoic twinkling white area are characteristic of lung cancer, pneumonia, chronic inflammation, or post inflammatory residue.

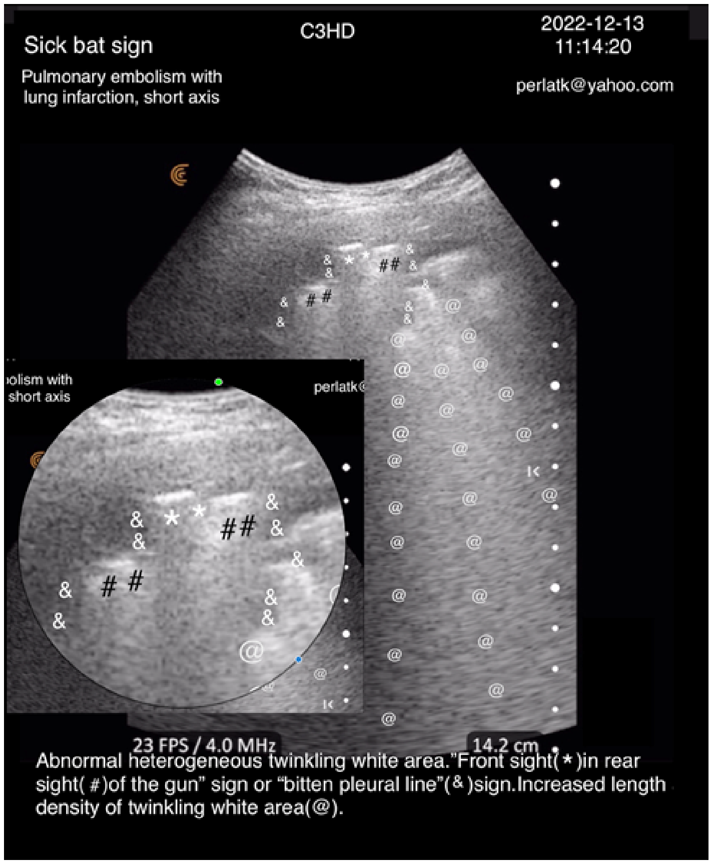
Irregularity in the rib's acoustic shadow of Merlin space is another indirect sign of an abnormality, whatever its nature.

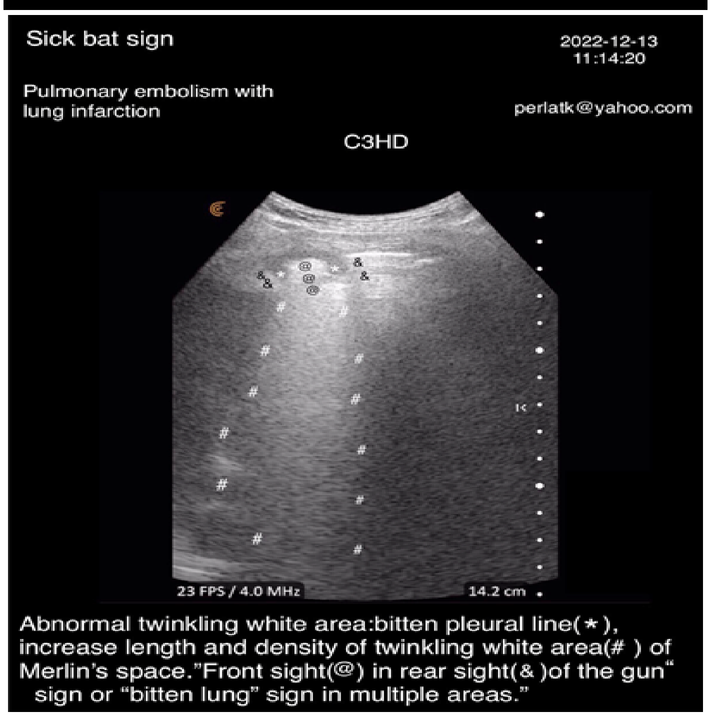
When we are in front of a waterfall hyper-echoic density image, let's try to "dig" by tilting to discover if there is a hypo-echoic densities inside the hyper echoic density. By finding the waterfall sign, we may trace the real lesion. Thus, the waterfall sign may be the only sign of pulmonary damage, or it may be a secondary, accompanying sign.

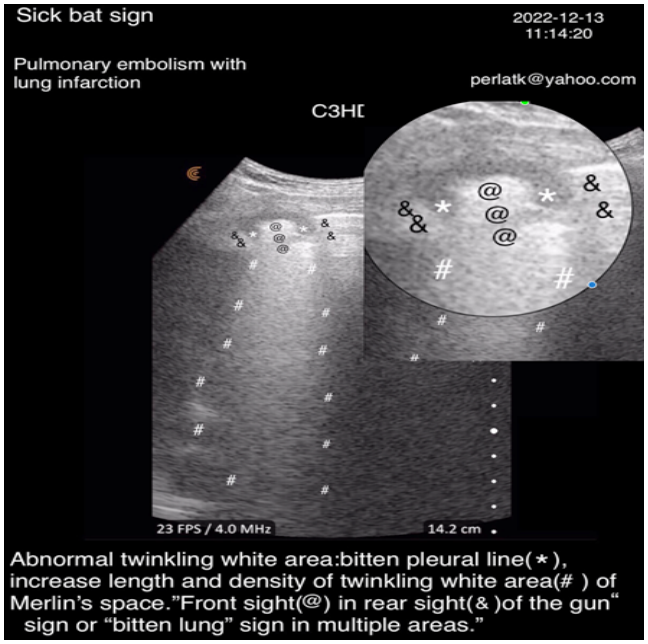
What is our diagnostic approach in the case of peripheral hypo-echoic densities?

Differential diagnosis must be done according to the location, shape, size, and structure of the hypo-echoic density. C-lines usually appear in diffuse lung diseases and chronic inflammatory conditions or as residual fibrotic lesions. Multiple larger hypo-echoic densities, resembling "deep bites" of lung periphery and sometimes looking like a "front sight in rear sight" of a gun, suggest lung infarcts due to pulmonary embolism.

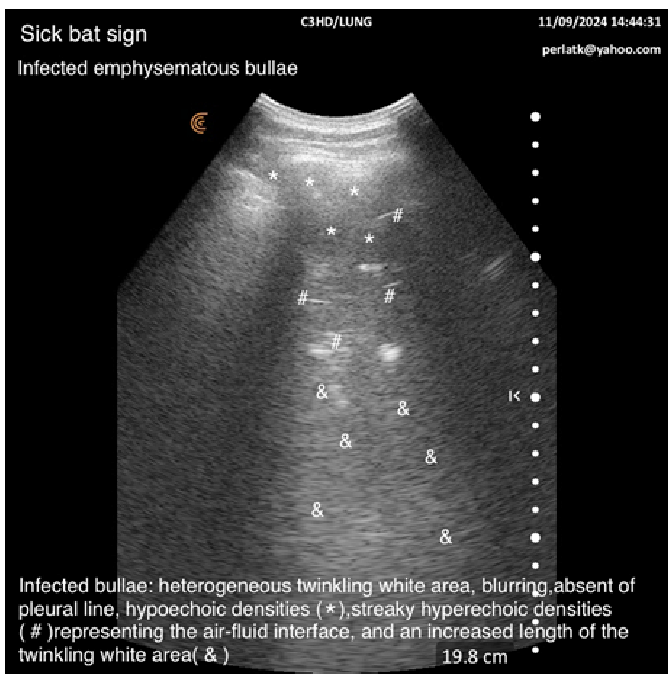


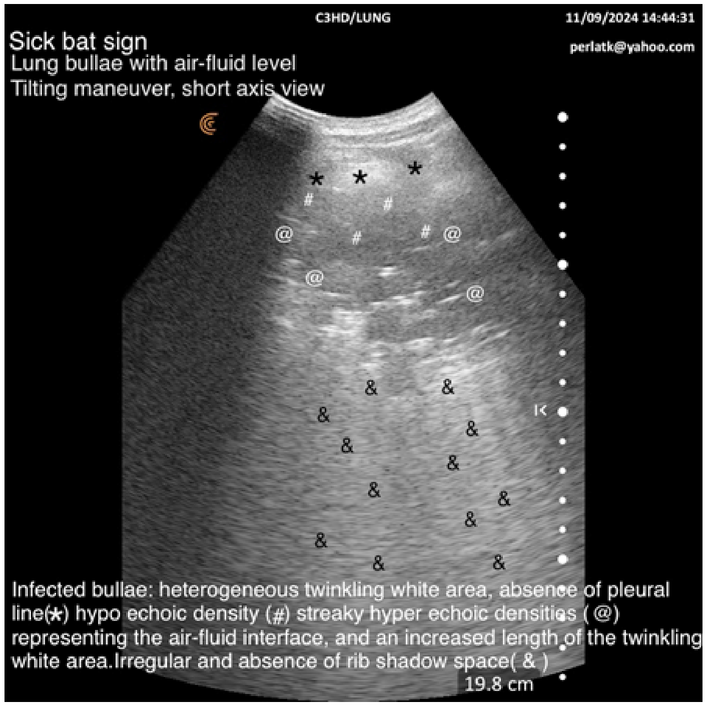

Sick bat sign
C3HD
2022-12-13
11:14:20
Pulmonary embolism with
lung infarction, short axis
perlatk@yahoo.com
23 FPS / 4.0 MHz
14.2 cm
Abnormal heterogeneous twinkling white area."Front sight(*)in rear sight(#)of the gun" sign or "bitten pleural line"(&)sign.Increased length density of twinkling white area(@).

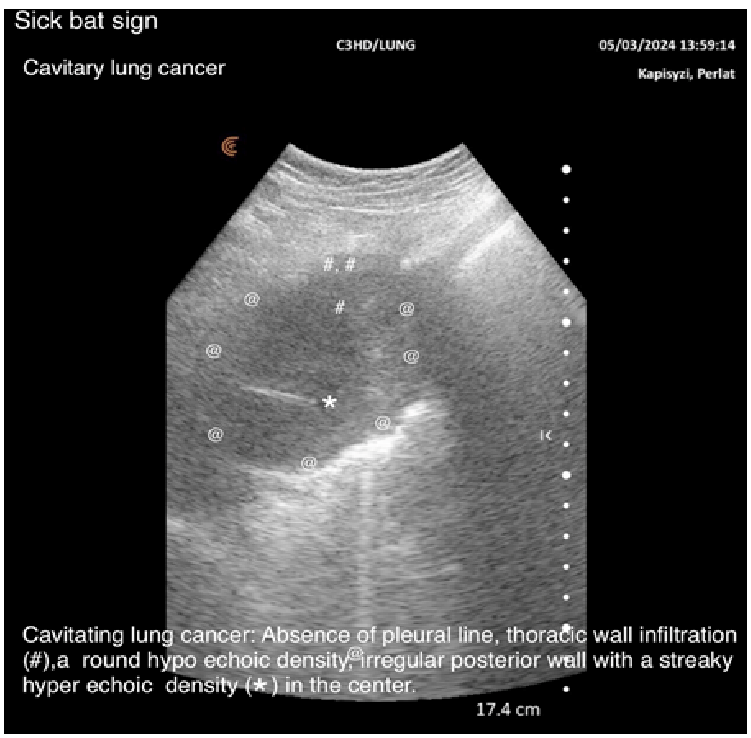

Sick bat sign
2022-12-13
11:14:20
Pulmonary embolism with
lung infarction
perlatk@yahoo.com
C3HD
23 FPS / 4.0 MHz
14.2 cm
Abnormal twinkling white area:bitten pleural line(*), increase length and density of twinkling white area(#) of Merlin's space."Front sight(@) in rear sight(&)of the gun" sign or "bitten lung" sign in multiple areas."

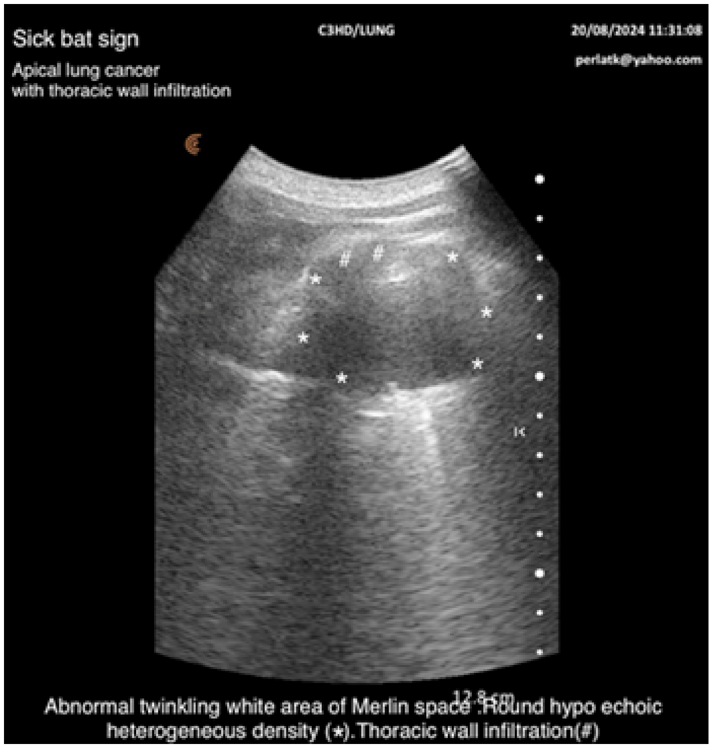


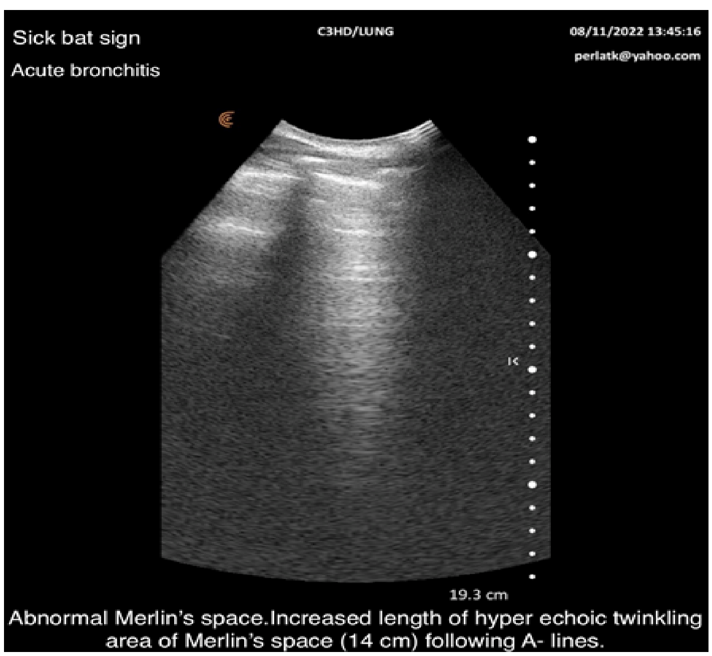
Peripheral sizable round hypo-echoic densities suggest the possibility of peripheral tumors, which must be differentiated from lobulated pleural effusion or cystic formation using Doppler mode. Doppler ultrasound showing vascularization of hypo-echoic densities, along with heterogeneity, supports a diagnosis of lung tumor.

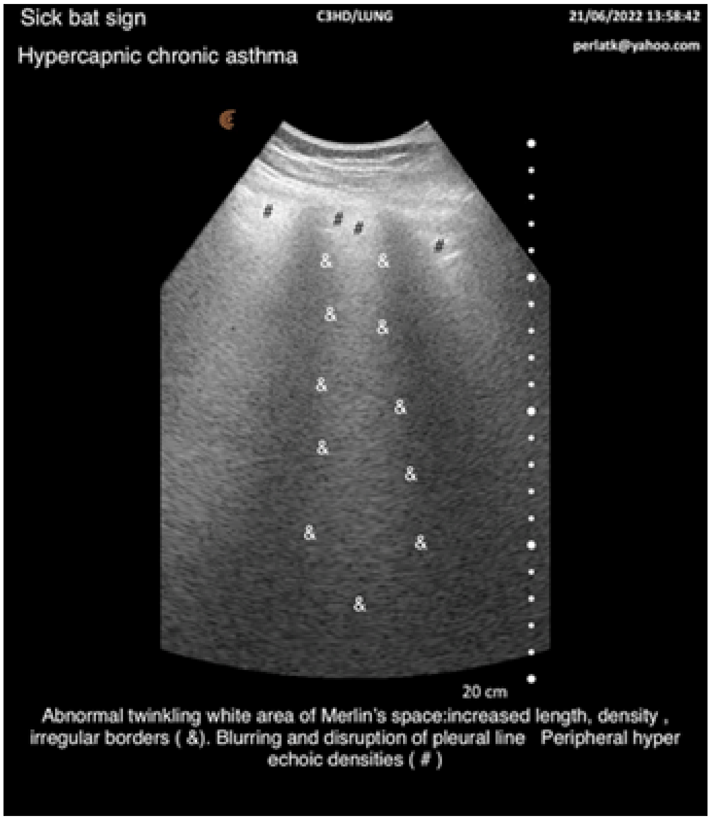


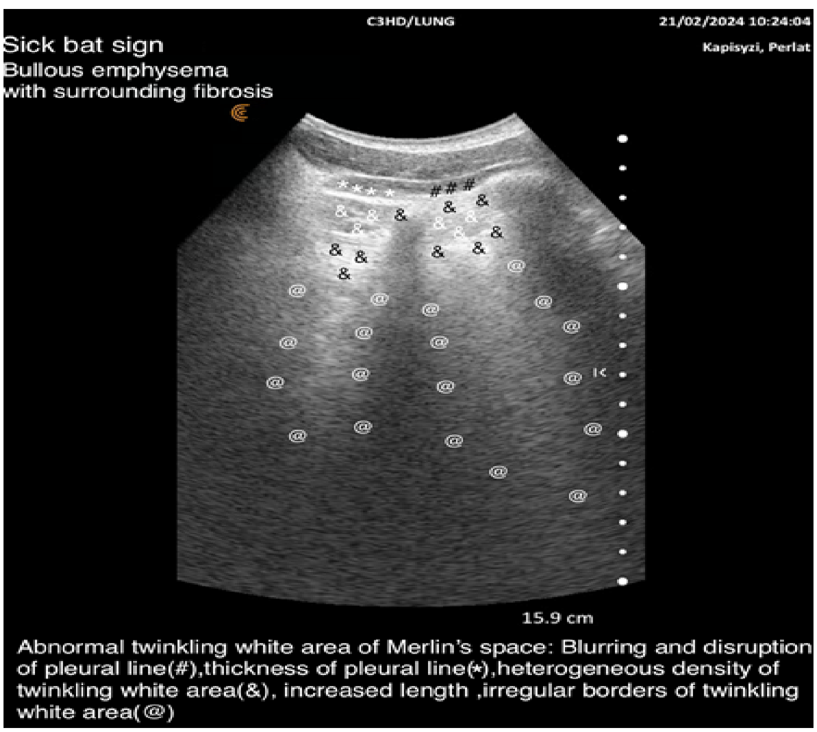

C3HD/LUNG
11/09/2024 14:44:31
perlatk@yahoo.com
Sick bat sign
Lung bullae with air-fluid level
Tilting maneuver, short axis view
Infected bullae: heterogeneous twinkling white area, absence of pleural line(*) hypo echoic density (#) streaky hyper echoic densities (@) representing the air-fluid interface, and an increased length of the twinkling white area.Irregular and absence of rib shadow space(&)
19.8 cm

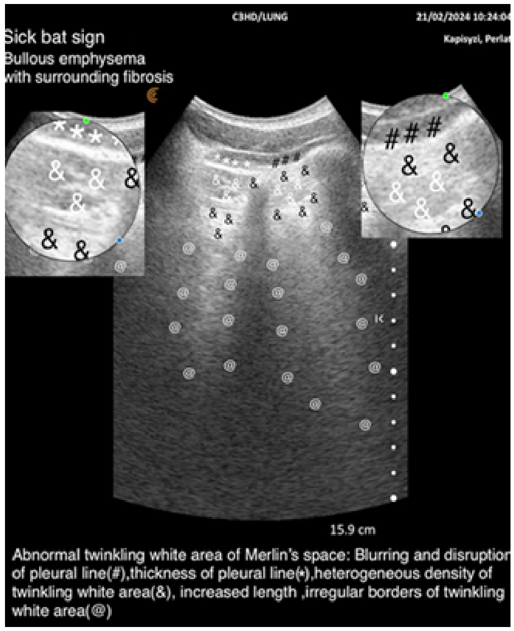

Sick bat sign
C3HD/LUNG
05/03/2024 13:59:14
Cavitary lung cancer
Kapisyzi, Perlat
Cavitating lung cancer: Absence of pleural line, thoracic wall infiltration (#),a round hypo echoic density, irregular posterior wall with a streaky hyper echoic density (*) in the center.
17.4 cm


Sick bat sign
C3HD/LUNG
20/08/2024 11:31:08
perlatk@yahoo.com
Apical lung cancer
with thoracic wall infiltration
12.8 cm
Abnormal twinkling white area of Merlin space .Round hypo echoic
heterogeneous density (★).Thoracic wall infiltration(#)


Sick bat sign
C3HD/LUNG
08/11/2022 13:45:16
perlatk@yahoo.com
Acute bronchitis
19.3 cm
Abnormal Merlin's space.Increased length of hyper echoic twinkling
area of Merlin's space (14 cm) following A- lines.

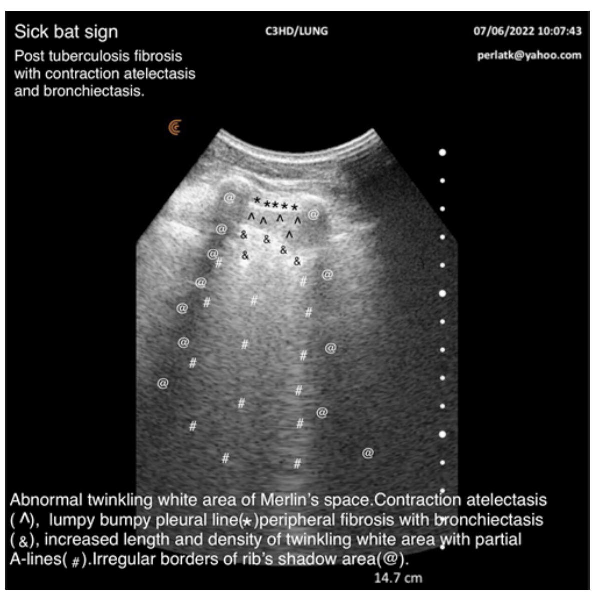

Sick bat sign
Hypercapnic chronic asthma
C3HD/LUNG
21/06/2022 13:58:42
perlatk@yahoo.com
20 cm
Abnormal twinkling white area of Merlin's space:increased length, density , irregular borders (&). Blurring and disruption of pleural line Peripheral hyper echoic densities (#)

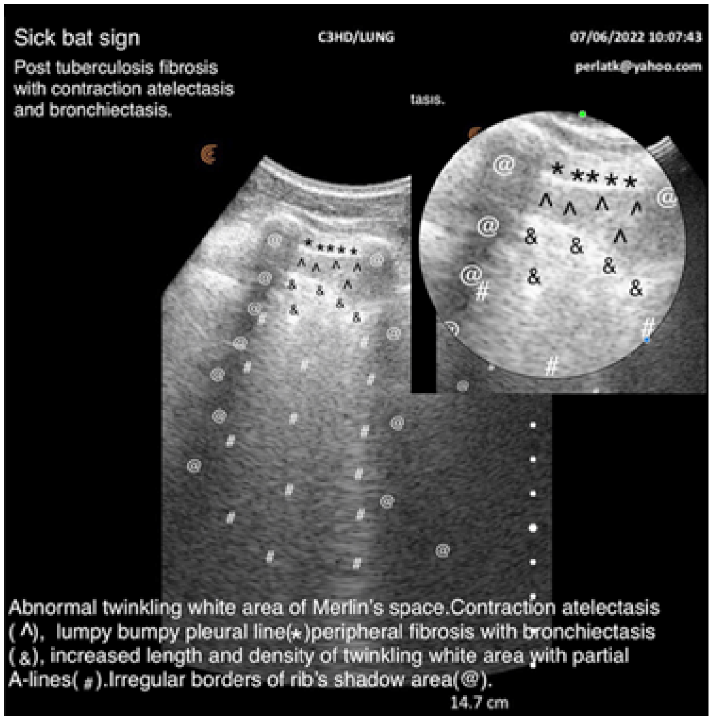

C3HD/LUNG
21/02/2024 10:24:04
Kapisyzi, Perlat
Sick bat sign
Bullous emphysema
with surrounding fibrosis
15.9 cm
Abnormal twinkling white area of Merlin's space: Blurring and disruption of pleural line(#),thickness of pleural line(*),heterogeneous density of twinkling white area(&), increased length ,irregular borders of twinkling white area(@)



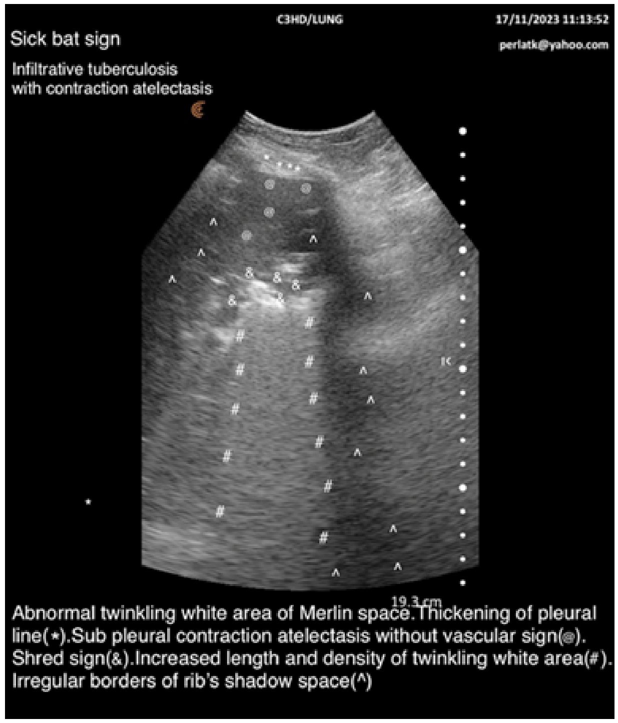
There are three types of atelectasis: 1- obstructive atelectasis, 2- contraction atelectasis, and 3- compressive atelectasis. Each has different ultrasound presentations [15]. Obstructive atelectasis appears as a hyper-echoic density, light gray in colour, with tubular hypo-echoic densities representing the vascular tree inside lung tissue. During deep breathing, discrete hyper-echoic densities, like small dots, may appear, standing for air in the bronchi.

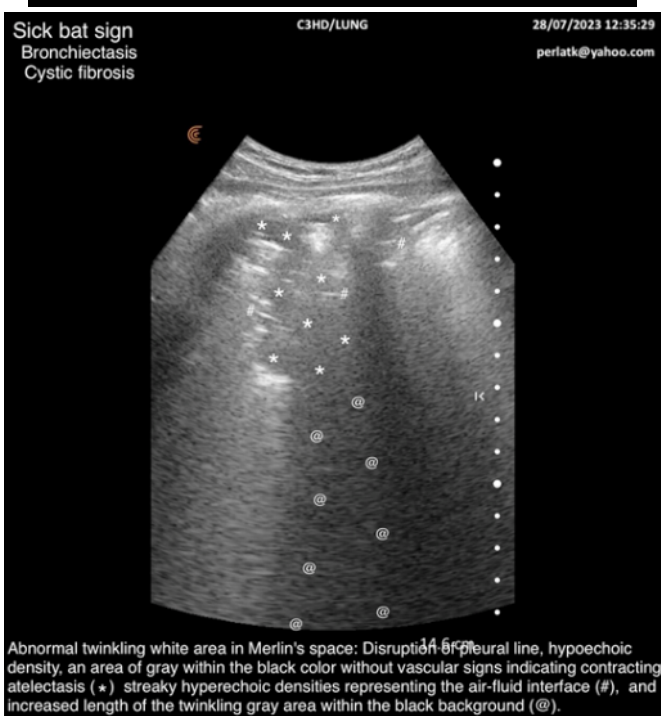
Compressive atelectasis has a similar appearance but moves like a jellyfish during respiration, hence the “jellyfish sign.”

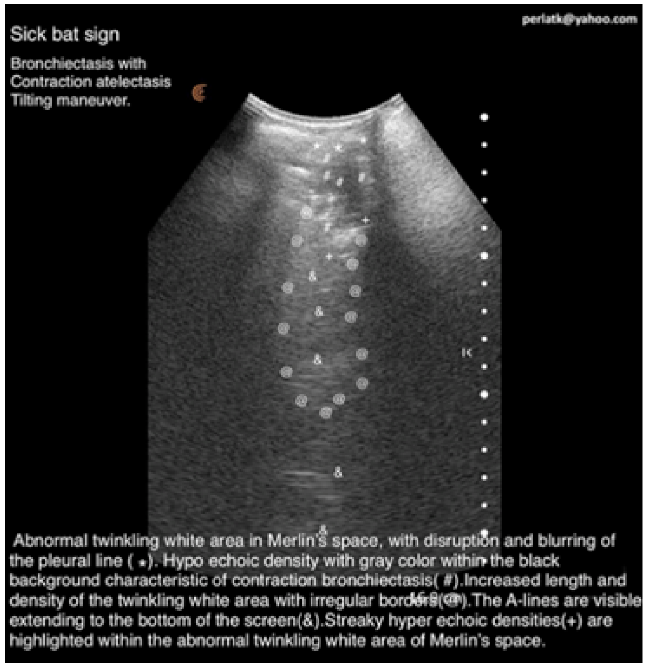



Sick bat sign
C3HD/LUNG
07/06/2022 10:07:43
perlatk@yahoo.com
Post tuberculosis fibrosis
with contraction atelectasis
and bronchiectasis.
Abnormal twinkling white area of Merlin’s space.Contraction atelectasis (^), lumpy bumpy pleural line(*)peripheral fibrosis with bronchiectasis (&), increased length and density of twinkling white area with partial A-lines(#).Irregular borders of rib’s shadow area(@).
14.7 cm


Sick bat sign
Apical tuberculosis
C3HD/LUNG
27/06/2022 09:45:07
perlatk@yahoo.com
Abnormal twinkling white area of Merlin’s space:Blurring and disappearance of pleural line(*).Heterogeneous,increased length with irregular borders of twinkling area(#) along with irregular rib’s shadow(&).


C3HD/LUNG
17/11/2023 11:13:52
perlatk@yahoo.com
Sick bat sign
Infiltrative tuberculosis
with contraction atelectasis
19.3 cm
Abnormal twinkling white area of Merlin space.Thickening of pleural line(*).Sub pleural contraction atelectasis without vascular sign(@). Shred sign(&).Increased length and density of twinkling white area(#). Irregular borders of rib's shadow space(^)

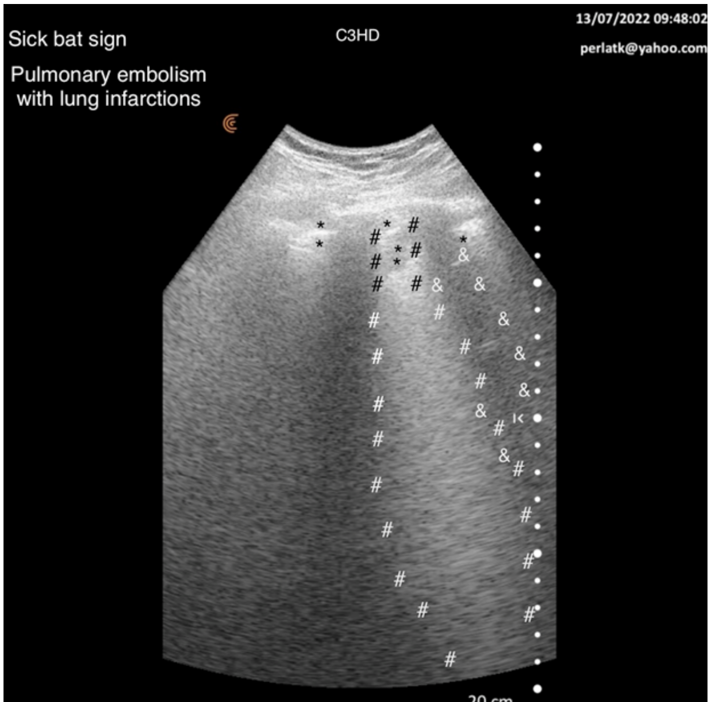

Sick bat sign
Bronchiectasis
Cystic fibrosis
C3HD/LUNG
28/07/2023 12:35:29
perlatk@yahoo.com
14.6 cm
Abnormal twinkling white area in Merlin's space: Disruption of pleural line, hypoechoic density, an area of gray within the black color without vascular signs indicating contracting atelectasis (*) streaky hyperechoic densities representing the air-fluid interface (#), and increased length of the twinkling gray area within the black background (@).



In contraction atelectasis, hyper-echoic densities are combined with hypo-echoic areas, and these densities are heterogeneous due to chronic contractive inflammation of lung tissue. Unlike obstructive atelectasis, its colour ranges from solid gray to black, and the vascular tree's hypo-echoic densities are absent.

By determining the dilatation of the inferior vena cava and assessing the presence or absence of collapse, lung ultrasound can narrow down a lengthy list of diagnostic possibilities or help of showing comorbidities. LU findings are particularly useful when combined with each other specifically lung, heart, and abdominal ultrasounds [16,17].

For tracheal infiltration, ultrasound can detect septal rocket B-lines without the deletion of the A-line.



Abnormal twinkling white area of Merlin’s space: Heterogeneous,increased length and density of twinkling white area (#) Pleural line distribution is observed, accompanied by multiple hypoechoic densities typical of pulmonary infarction(⋆).Irregular border of rib’s shadows space(&).

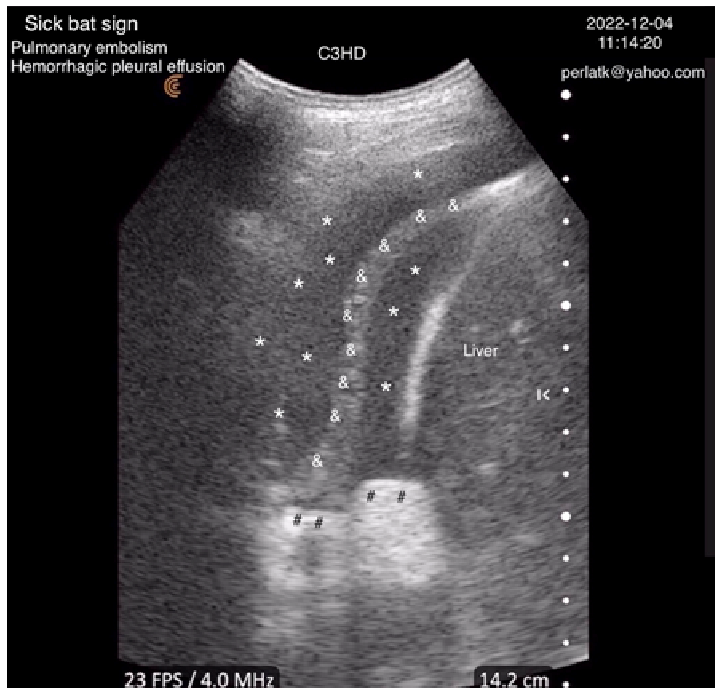
Pulsating of lung in LU may be an indirect sign of atelectasis, lung consolidation caused by inflammatory, malignant processes or absence of normal lung ventilation. The presence of lung pulse rules out the diagnosis of pneumothorax [18].

The absence of a sinusoid sign in M-mode in cases of pleural effusion is a sign of fibroproductive pleural effusion or an echinococcal cyst mimicking pleural effusion. The combination of the jellyfish sign with hyper-echoic densities in pleural effusion, reduced diaphragmatic movements, or lung hepatization is characteristic of malignant, parapneumonic effusion or empyema.

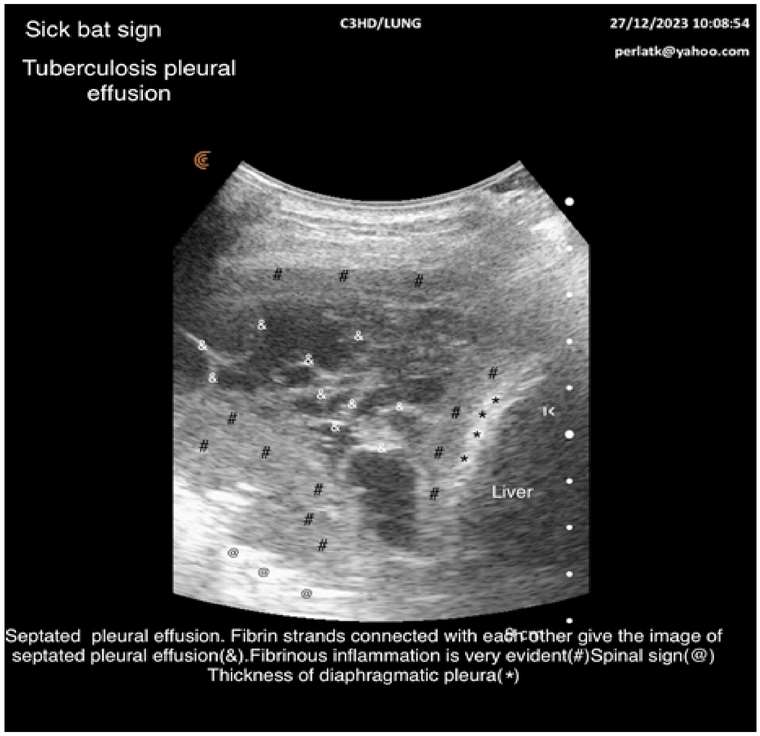
Alternating hyper-echoic and hypo-echoic densities within the pleural space suggest the diagnosis of septated effusion characteristic of empyema, chylothorax, malignancy, or pulmonary echinococcosis.

Lung ultrasound (LU) has an irreplaceable value in diagnosing echinococcal cysts in the first stage, where its sensitivity and specificity are higher than those of computed tomography (CT). The double-layered wall sign and the identification of “sand” inside the cyst are pathognomonic findings for the diagnosis of echinococcal cysts in the early stage.

In the ultrasound examination of the superior lobes, particularly in the posterior regions, signs such as pleural thickening, the delineation between the parietal and visceral pleura, C-lines, B-lines, and an increase in the density and length of hyper-echoic twinkling white areas should primarily suggest active tuberculosis or post-tubercular fibrosis.

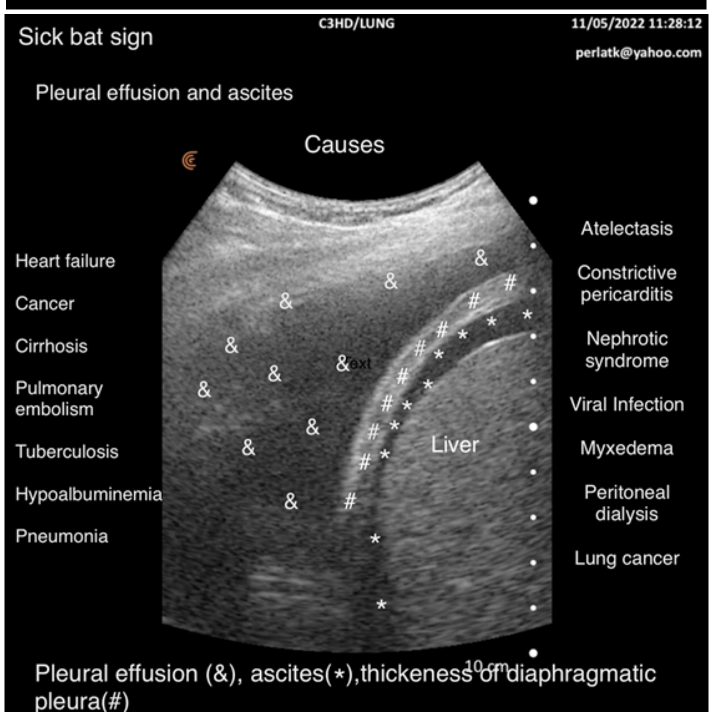


Pleural effusion.Hyper echoic density suggests hemorrhagic type(⋆). Compression atelectasis.Jellyfish sign(&).Spinal sign(#)

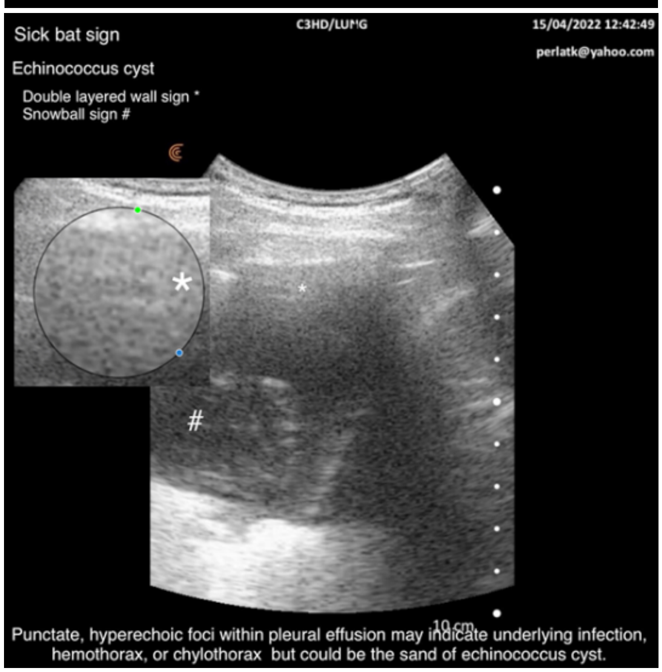

Sick bat sign
Tuberculosis pleural effusion
C3HD/LUNG
27/12/2023 10:08:54
perlatk@yahoo.com
Liver
Septated pleural effusion. Fibrin strands connected with each other give the image of septated pleural effusion(&).Fibrinous inflammation is very evident(#)Spinal sign(@) Thickness of diaphragmatic pleura(*)


Sick bat sign
Pleural effusion:Empyema
C3HD/LUNG
05/04/2022 13:11:19
perlatk@yahoo.com
10 cm
Hyper echoic pleural effusion fibrin-purulent stage .Fibrinous strands(*)and " honeycomb" (#)that create.

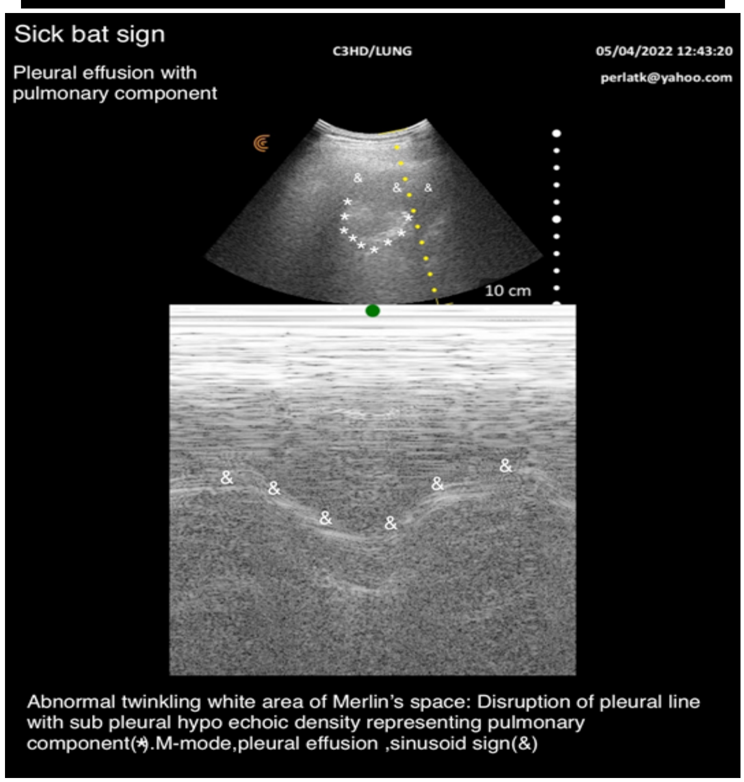

Sick bat sign
C3HD/LUNG
22/09/2023 12:58:51
perlatk@yahoo.com
Mesothelioma
17.1 cm
Septated pleural effusion.Fibrin strands simulate "honeycomb "(&).
Fibrinous inflammation is highlighted(#).Quad sign present(@).


Sick bat sign
C3HD/LUNG
11/05/2022 11:28:12
perlatk@yahoo.com
Pleural effusion and ascites
Causes
Heart failure
Cancer
Cirrhosis
Pulmonary embolism
Tuberculosis
Hypoalbuminemia
Pneumonia
Atelectasis
Constrictive pericarditis
Nephrotic syndrome
Viral Infection
Myxedema
Peritoneal dialysis
Lung cancer
Liver
Pleural effusion (&), ascites(*),thickeness of diaphragmatic pleura(#)

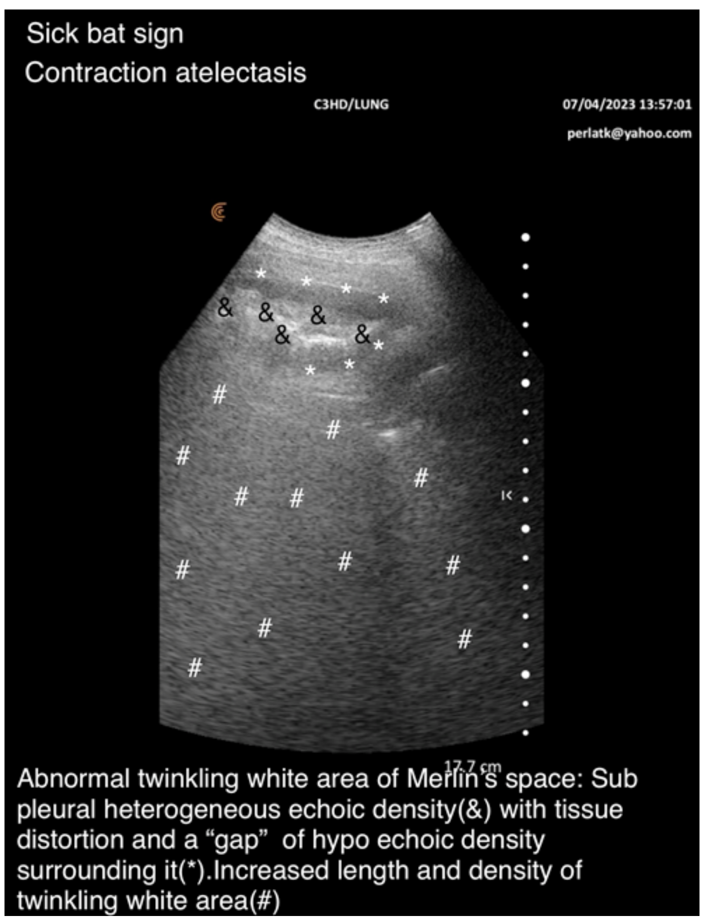

C3HD/LUNG
16/06/2022 13:05:23
Sick bat sign
perlatk@yahoo.com
Malignant pleural effusion
18.8 cm
Lobular pleural thickening(*): Mesothelioma,pleural metastasis more rarely empyema.Spinal sign(&).Pleural effusion(#).Thickness of diaphragmatic pleura(@)

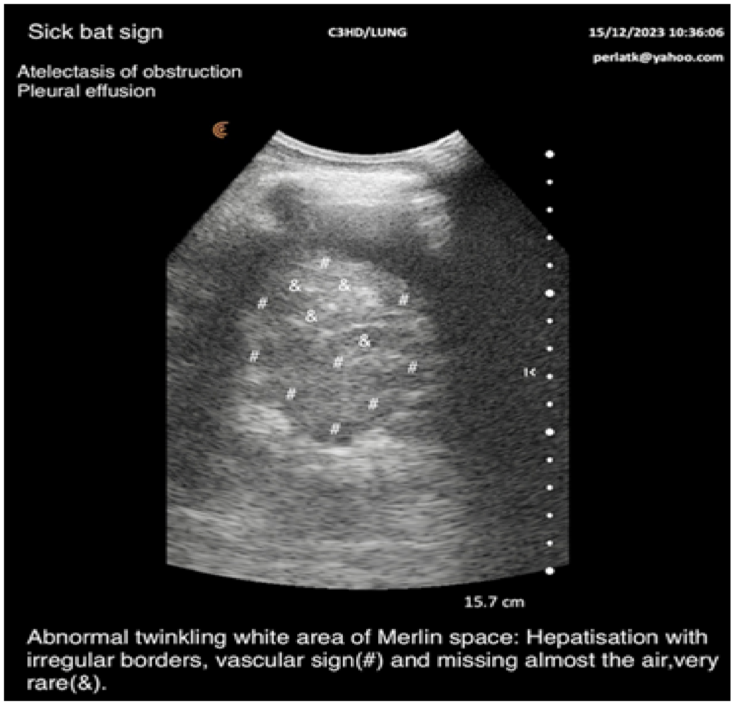

Sick bat sign
C3HD/LUNG
15/04/2022 12:42:49
perlatk@yahoo.com
Echinococcus cyst
Double layered wall sign *
Snowball sign #
10 cm
Punctate, hyperechoic foci within pleural effusion may indicate underlying infection, hemothorax, or chylothorax but could be the sand of echinococcus cyst.

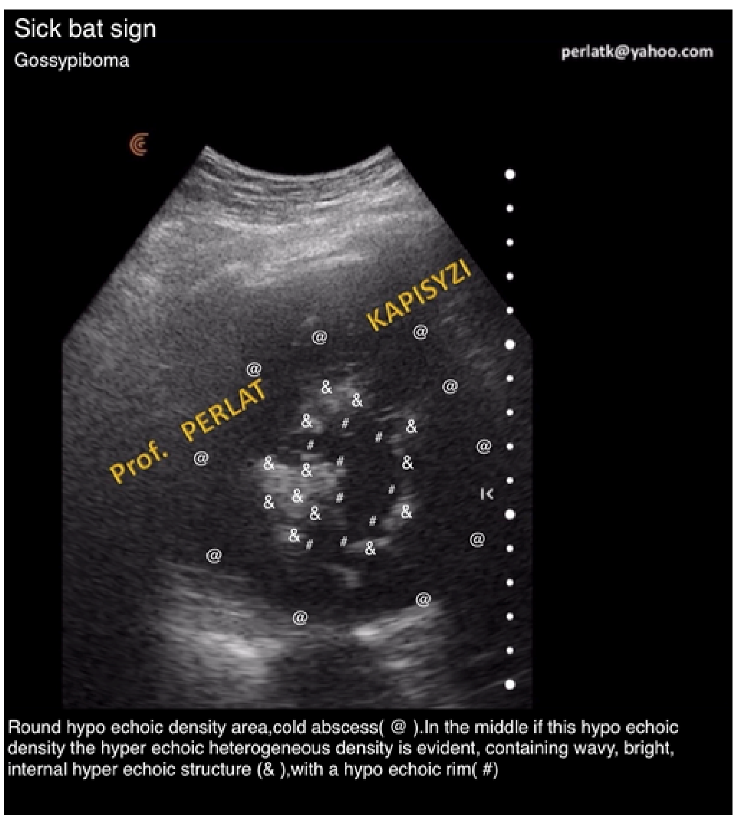

Sick bat sign
C3HD
19/12/2022
13:20:11
Lung alveolar
echinococcus
perlatk@yahoo.com
14.7 cm
22 FPS. 4.0MHz
Heterogeneous septated echoic densities (&)characteristic for multiple echonococcus cysts.(#)

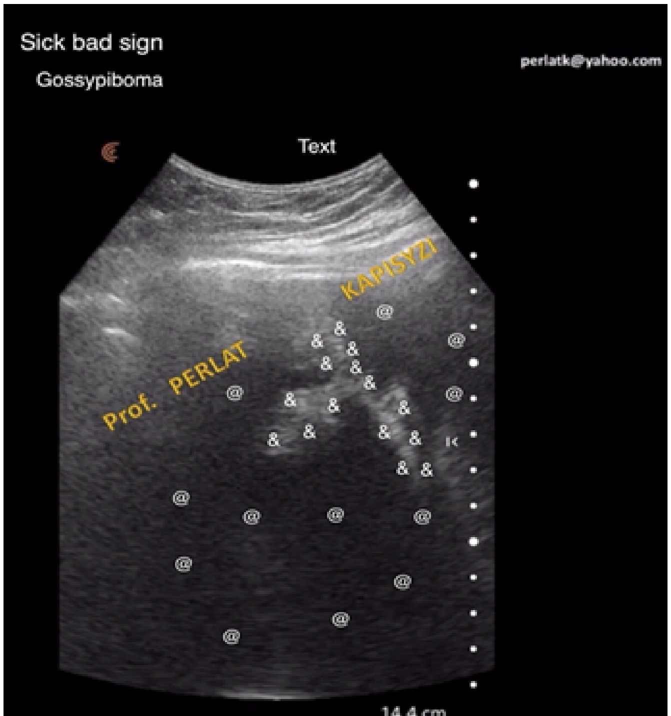

Sick bat sign
C3HD/LUNG
05/04/2022 12:43:20
Pleural effusion with
pulmonary component
perlatk@yahoo.com
10 cm
Abnormal twinkling white area of Merlin's space: Disruption of pleural line with sub pleural hypo echoic density representing pulmonary component(*).M-mode,pleural effusion ,sinusoid sign(&)


Sick bat sign
Mediastinum tumor
C3HD/LUNG
31/03/2022 12:28:47
perlatk@yahoo.com
10 cm
Abnormal twinkling white area of Merlin space: Mediastinum mass (@),pericardial metastasis (#),pericardial effusion (&),pleural effusion(★)


Sick bat sign
Contraction atelectasis
C3HD/LUNG
07/04/2023 13:57:01
perlatk@yahoo.com
17.7 cm
Abnormal twinkling white area of Merlin's space: Sub pleural heterogeneous echoic density(&) with tissue distortion and a "gap" of hypo echoic density surrounding it(*).Increased length and density of twinkling white area(#)


Sick bat sign
C3HD/LUNG
15/12/2023 10:36:06
perlatk@yahoo.com
Atelectasis of obstruction
Pleural effusion
15.7 cm
Abnormal twinkling white area of Merlin space: Hepatisation with irregular borders, vascular sign(#) and missing almost the air,very rare(&).


Sick bat sign
Gossypiboma
perlatk@yahoo.com
Prof. PERLAT
KAPISYZI
Round hypo echoic density area,cold abscess(@).In the middle if this hypo echoic density the hyper echoic heterogeneous density is evident, containing wavy, bright, internal hyper echoic structure (&),with a hypo echoic rim(#)



A hypoechoic area is seen,cold abscess(@), within which a highly echogenic formation is observed in the shape of an inverted letter 'Y'- Gossypiboma(&)

Whenever we diagnose an intrathoracic formation in a patient who has undergone surgical intervention, Gossypiboma should be included in the shortlist of differential diagnosis. Postoperative follow-up with thoracic ultrasound examination can be a new effective approach to detecting gossypiboma and late postoperative complications, avoiding radiation exposure through radiography or CT [19].

The seamy side of LU

There are many aspects of the limitations (seamy side) of lung ultrasound. LU is inferior to X-ray (Rtg) in detecting nodular lesions that are small, distant from the thoracic wall or located behind the scapula. In smoker patients, combining LU and X-ray is indispensable, as LU can reveal advanced chronic inflammation or acute issues at the lung periphery and X-ray find out lesions which are far from periphery.

However, lung ultrasound cannot as precisely find out and figure out the nature of lung lesions in distant from periphery of the chest wall, such as round densities, cavitated densities, bronchiectasis, or emphysematous bullae, as X-ray can.

Mediastinal tumors that do not enlarge enough the mediastinum or are not next to the anterior chest wall are almost impossible to detect via ultrasound [20,21].

Methodologies for Using Lung Ultrasound

Pulmonary ultrasound is used in two distinct scenarios:

a) Urgent Cases: Following the POCUS protocol outlined by Daniel A. Lichtenstein and Gilbert A. Mezière [22].

b) Non-Urgent Cases: In the second scenario, the methodology differs slightly from the first. It involves examining the entire thoracic surface by sliding the probe and using both long-axis and short-axis views.

This method must be practiced for patients with pulmonary complaints. Using these positions together improves the accuracy of detecting peripheral abnormalities, lesions and assessing their characteristics.

In both scenarios, the use of long-axis and short-axis views is crucial. The longitudinal axis of the probe does not perfectly align with the longitudinal axis of lung but forms an angle. Thus, while using the long-axis view, the probe should be angled perpendicular with rib's interspace to visualize the bat sign through the rib window, rather than being aligned exactly with the lung's longitudinal axis. This angled probe position still qualifies as a long-axis view, as it closely aligns with the lung's long axis, producing images distinct from those obtained in the short-axis view abnormal findings on pulmonary ultrasound should be interpreted alongside the patient's history, physical examination, and laboratory results. These findings may indicate the need for a lung CT scan, which can help avoid exposure, save time, reduce costs, and minimize inaccuracies associated with chest radiography.

Consideration of M-mode may enhance the accuracy of B-mode ultrasound findings, though this application requires further investigation.

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