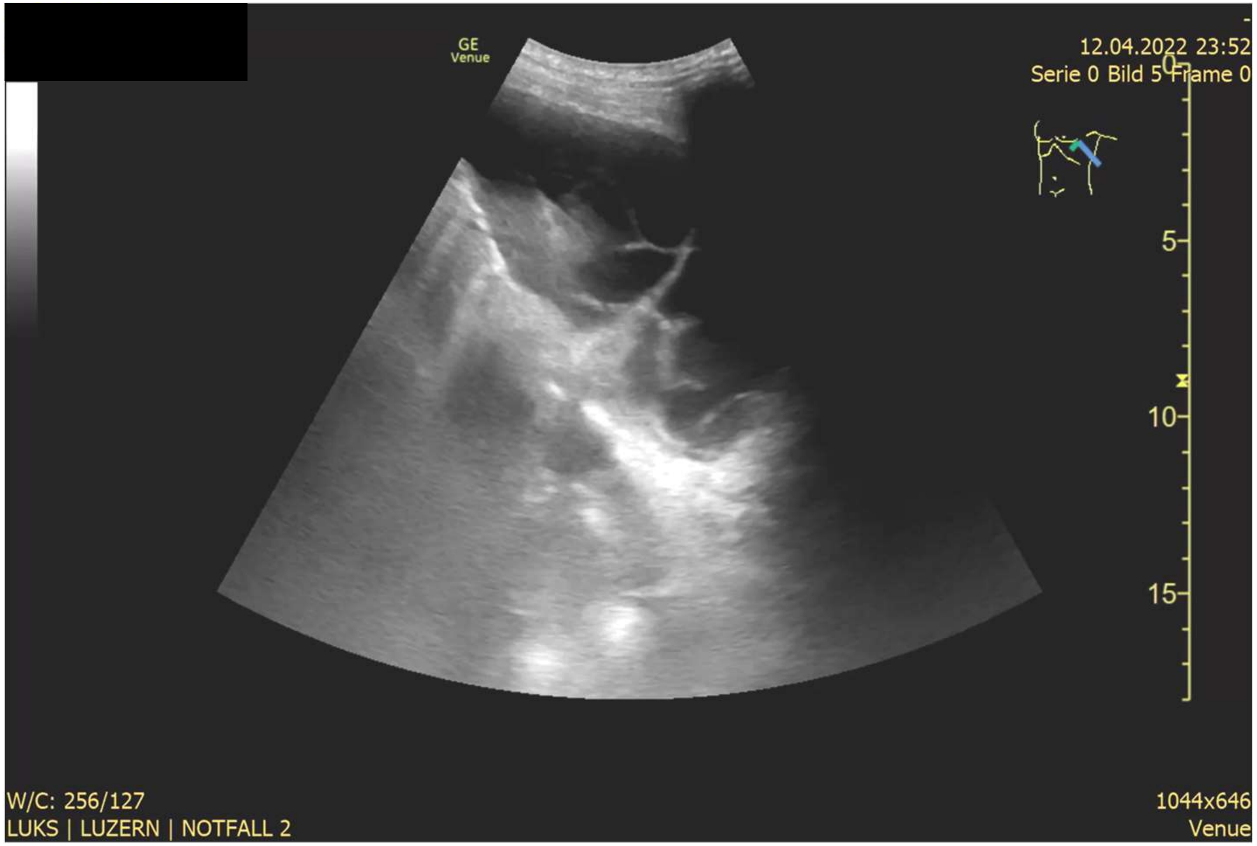
luzerner kantonsspital
LUZERN SURSEE WOLHUSEN

Universitäres Lehr- und Forschungsspital

POCUS TTE / Thorax

Lungenultraschall

Sonographie der Artefakte


[redacted]
GE
Venue
12.04.2022 23:52
Serie 0 Bild 5 Frame 0
0
5
10
15
W/C: 256/127
LUKS | LUZERN | NOTFALL 2
1044x646
Venue

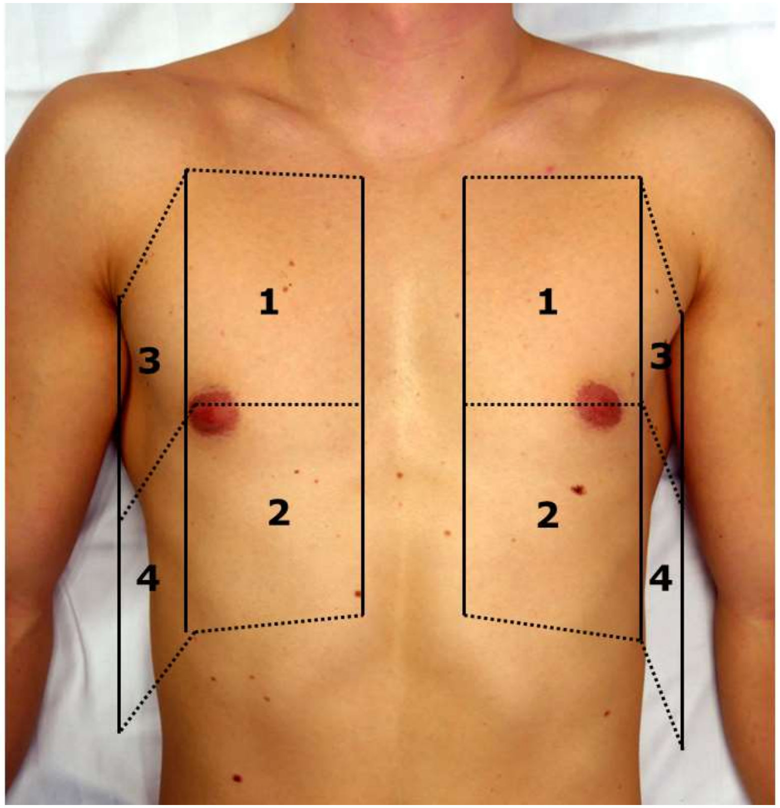
Stefan Venturini

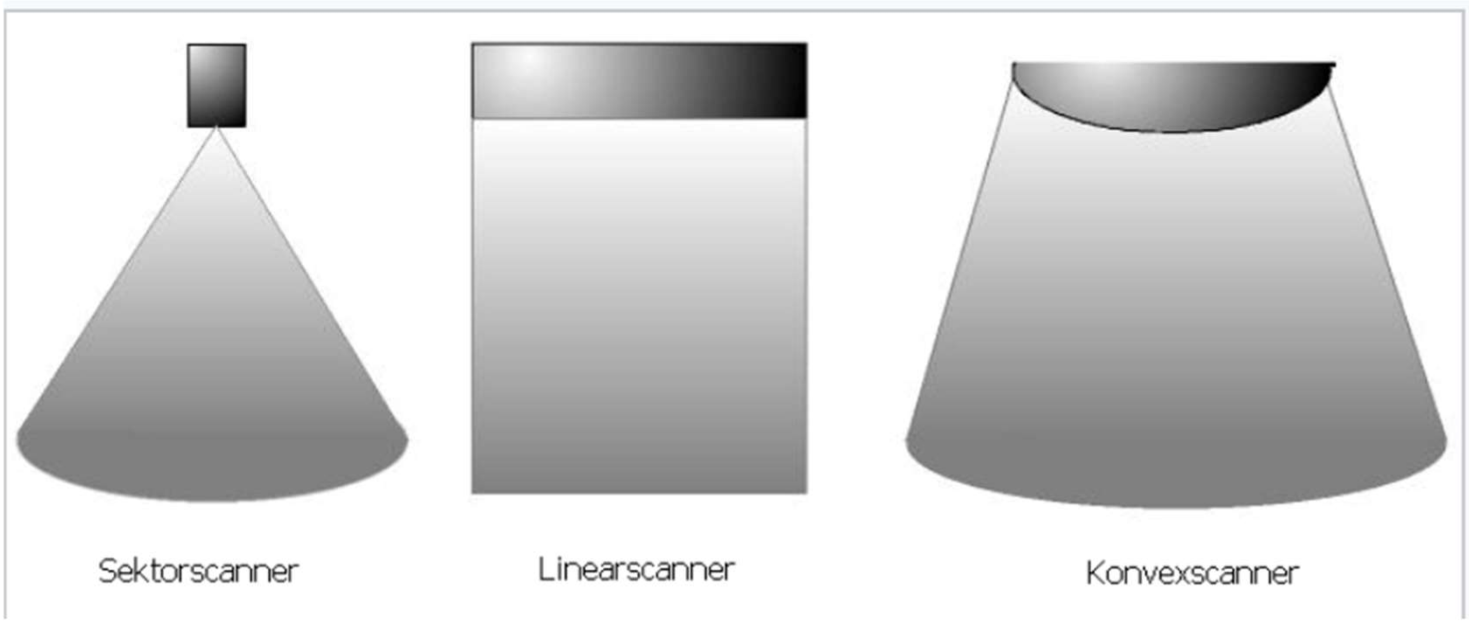
herzlich, kompetent, vernetzt

Inhalt des Vortrags

- Grundlagen der Lungensonographie
- Pneumothorax Diagnostik
- Pleuraerguss
- ABC Profil

Grundlagen

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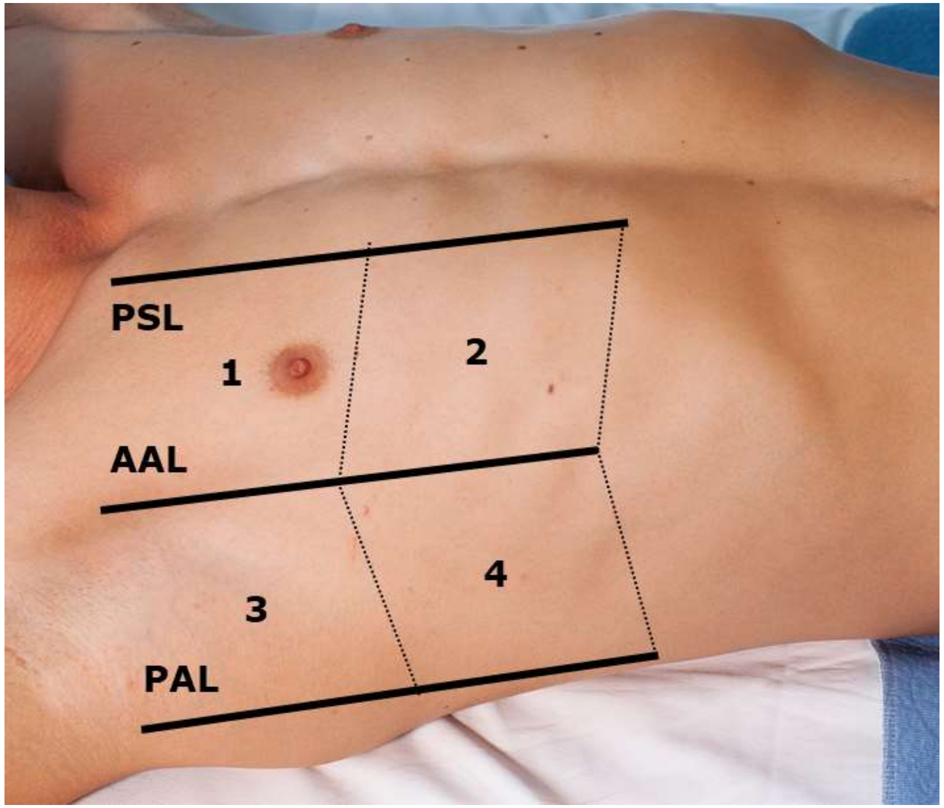
Linearscanner
Konvexscanner

L6-12
C5-1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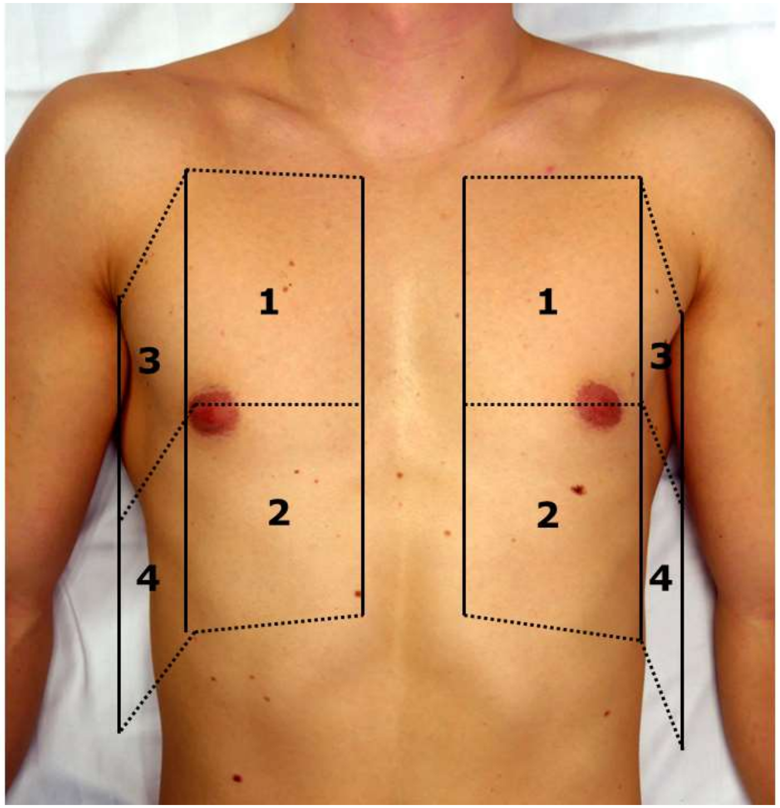
2
AAL
3
4
PAL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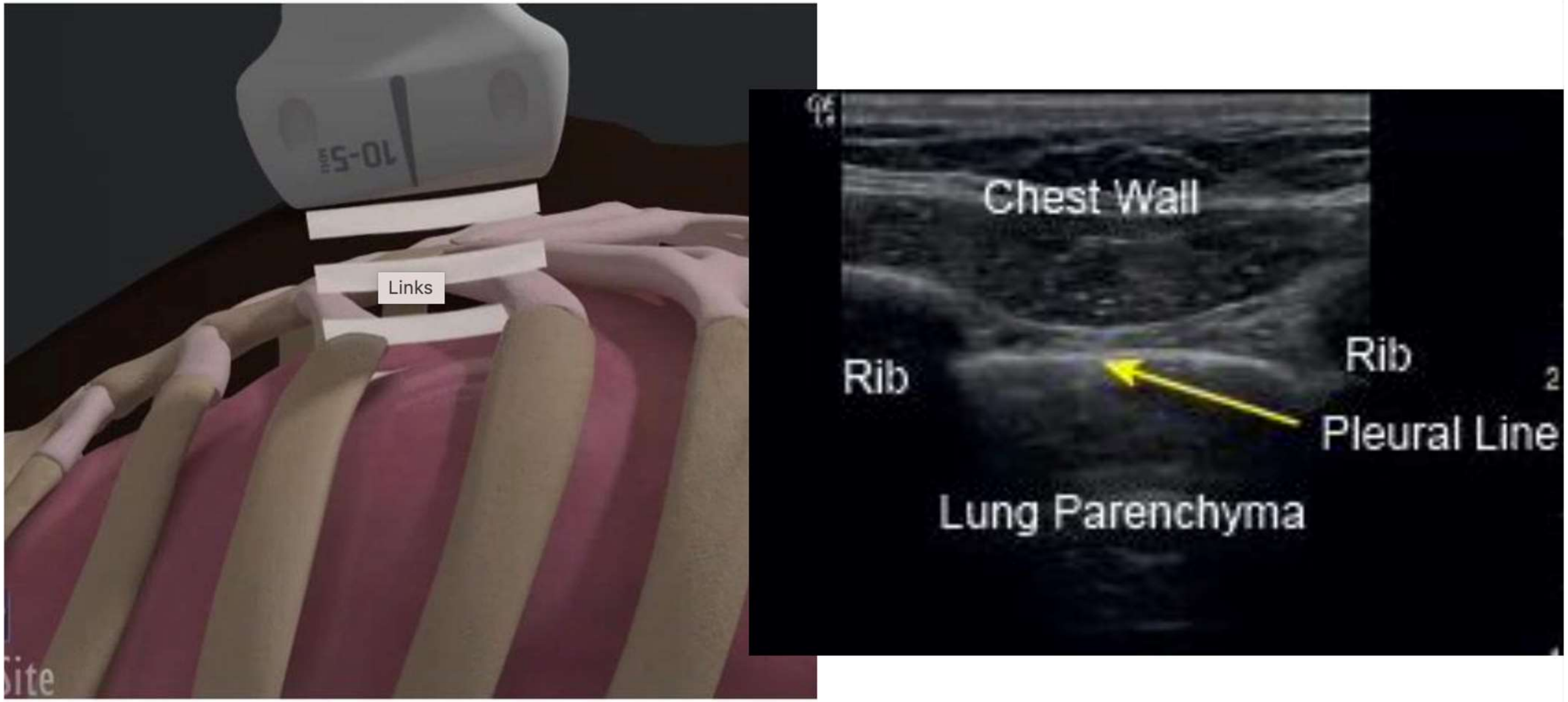
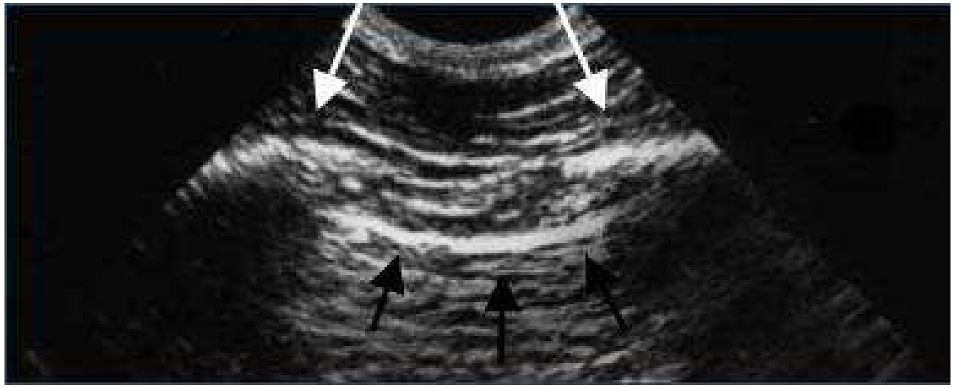
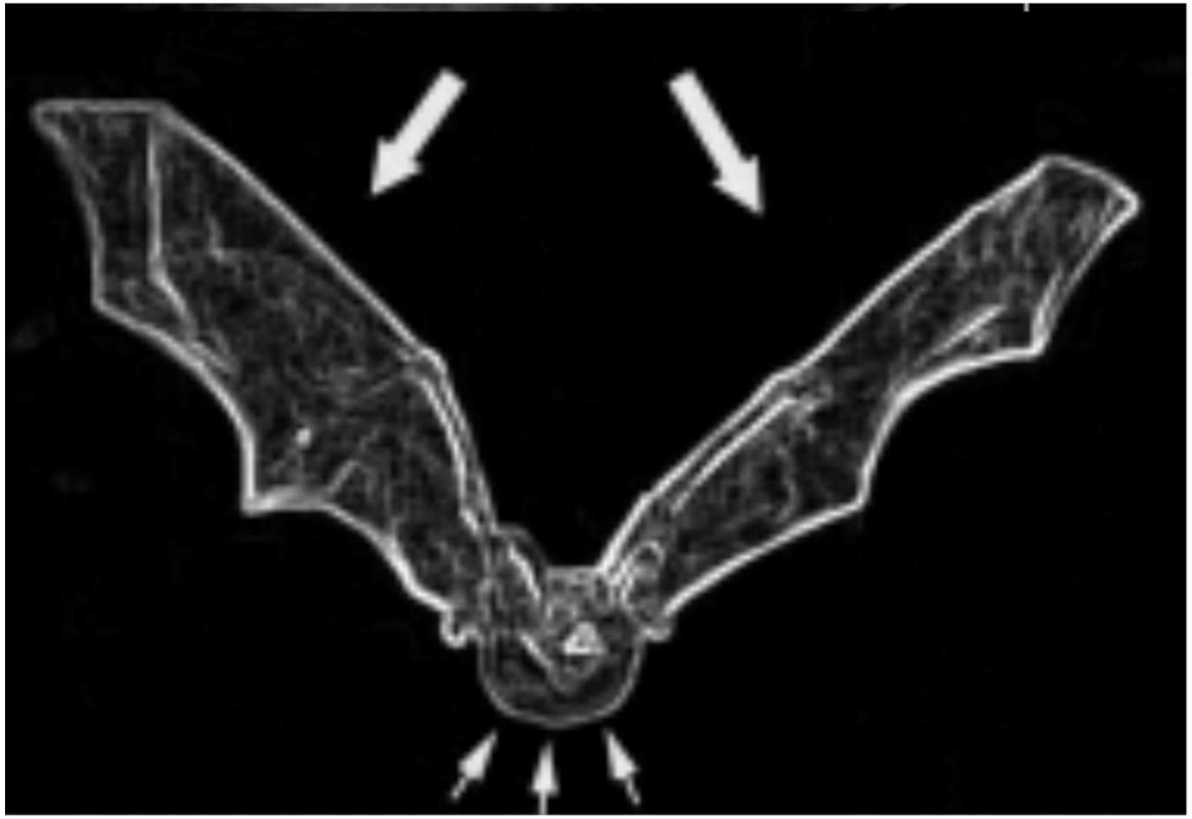
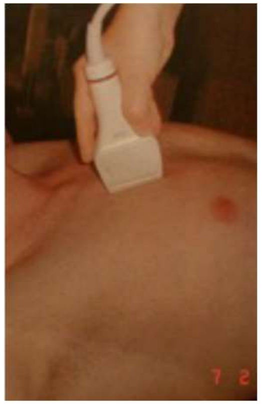

Links
Chest Wall
Rib
Rib
Pleural Line
Lung Parenchyma



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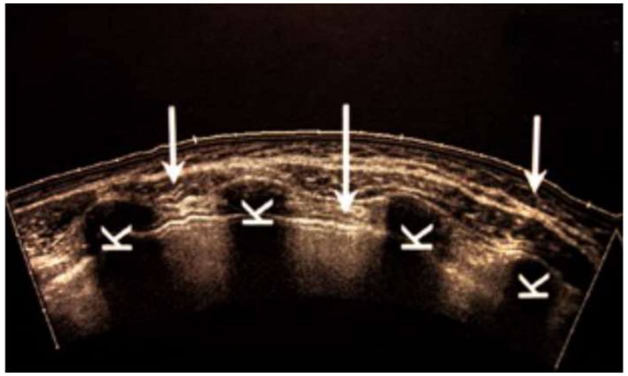
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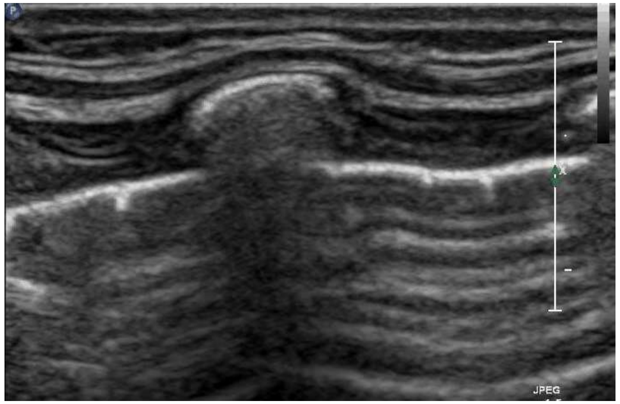
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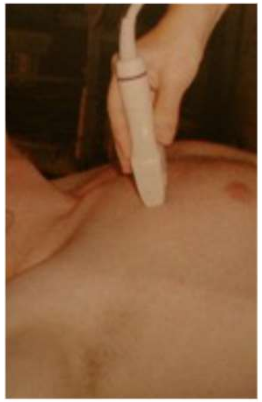

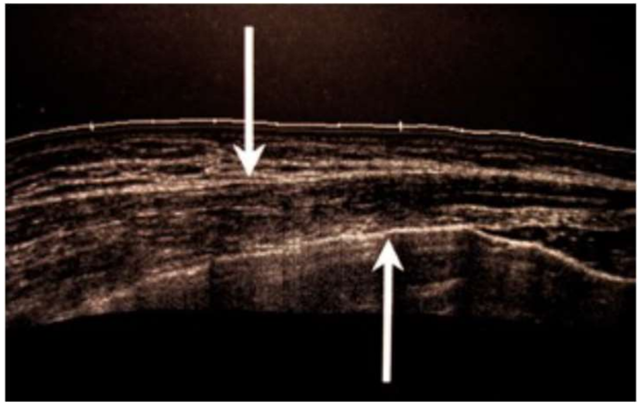

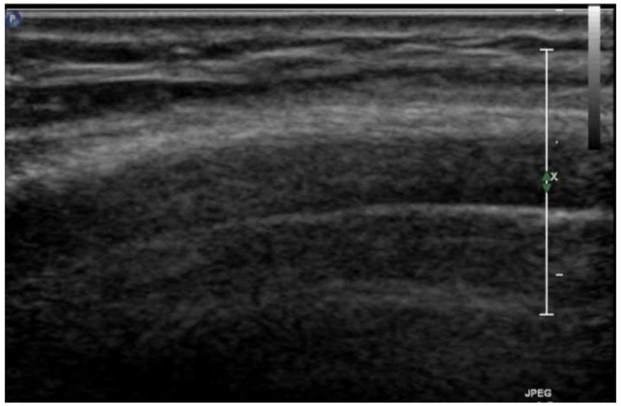
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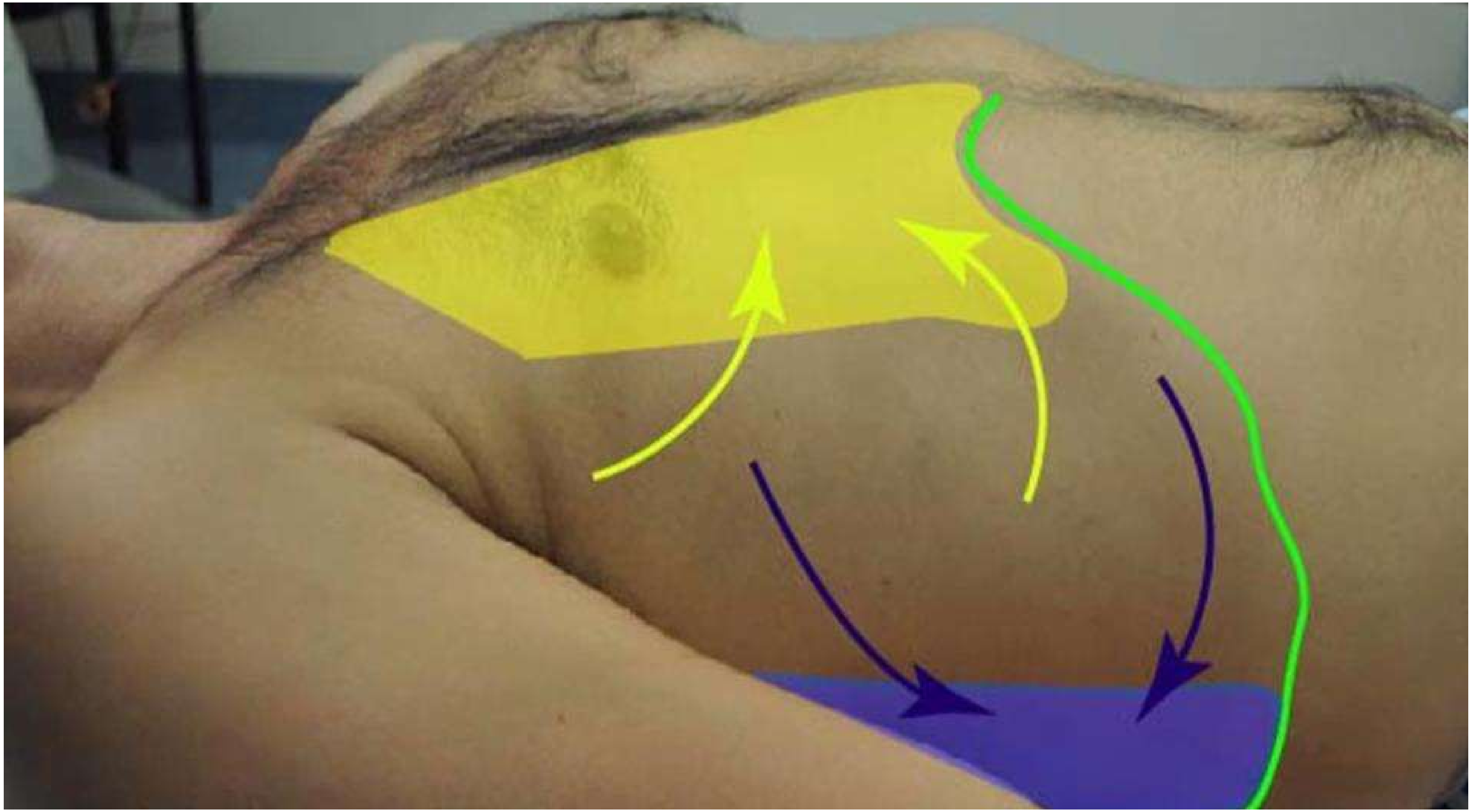
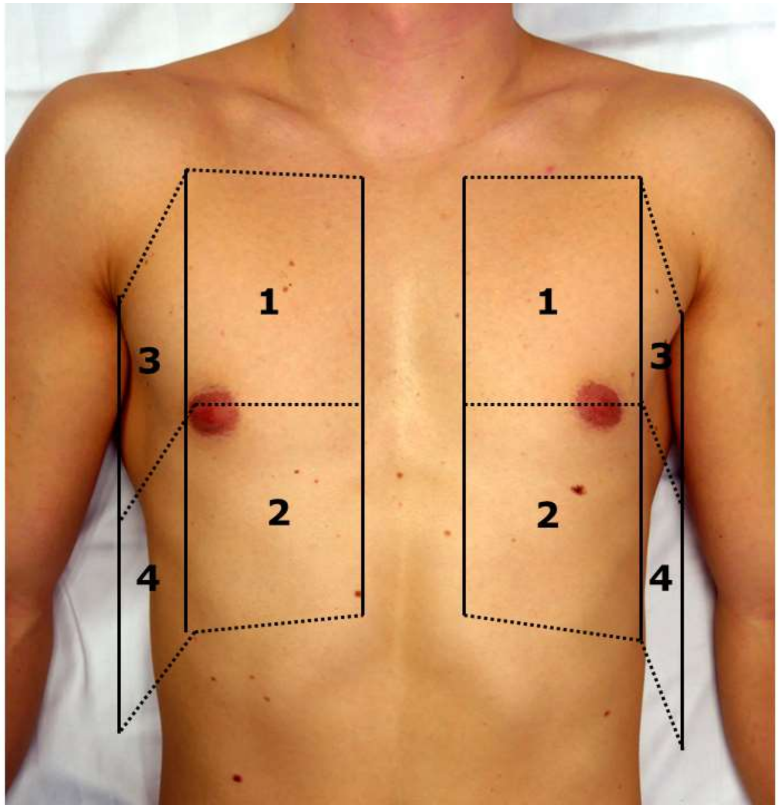


Pneumothorax

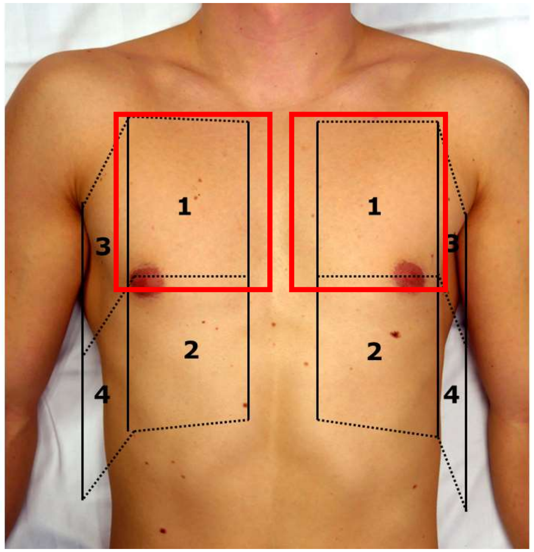


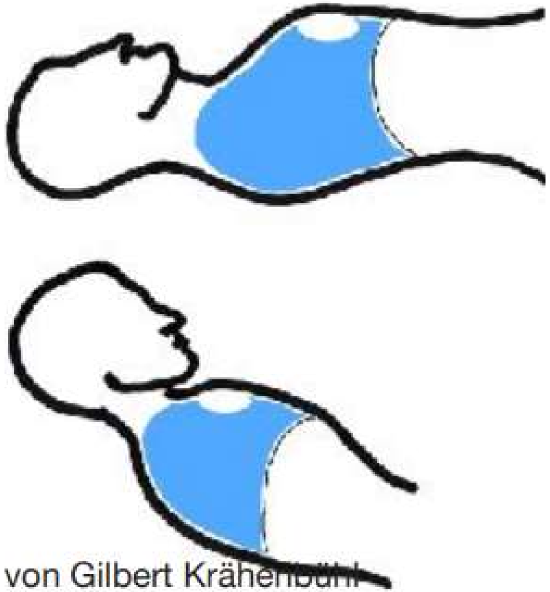
Pneumothorax

- Luft im Pleuraspalt
- spontan vs. traumatisch

- Luft steigt auf → Suche am höchsten (ventralsten) Punkt

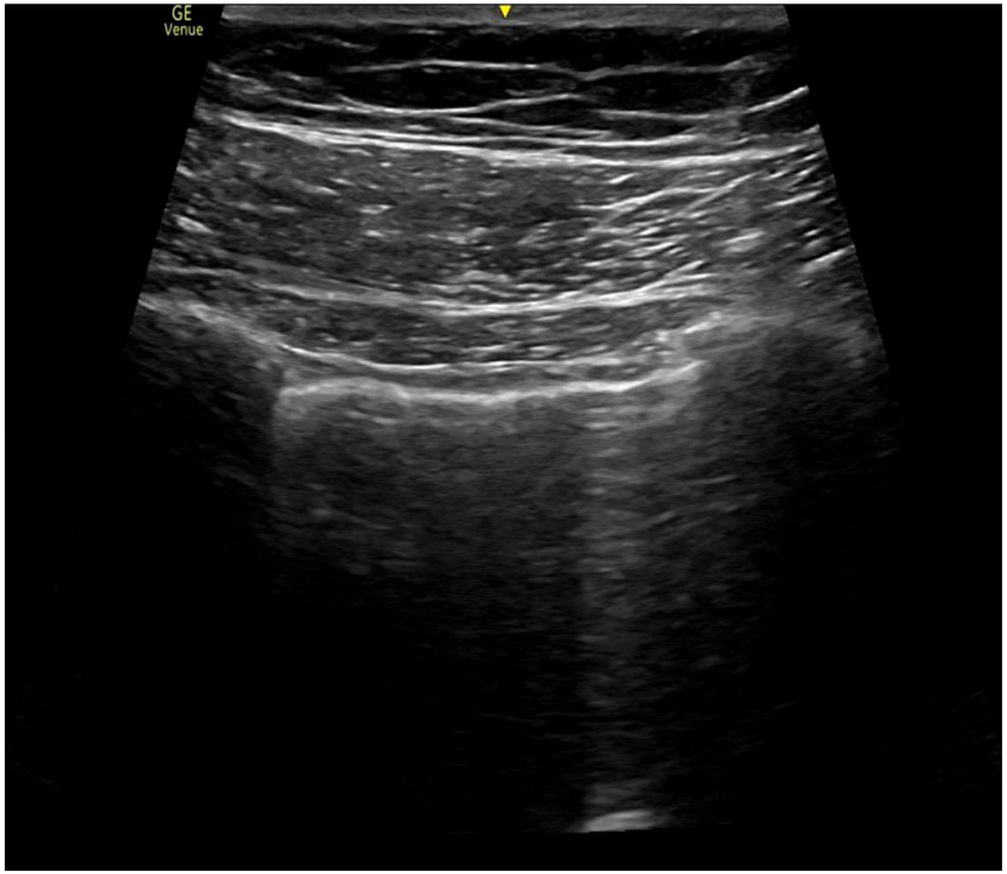
→ im Liegen 3. oder 4. ICR zwischen Parasternal- und Medioclavicularlinie





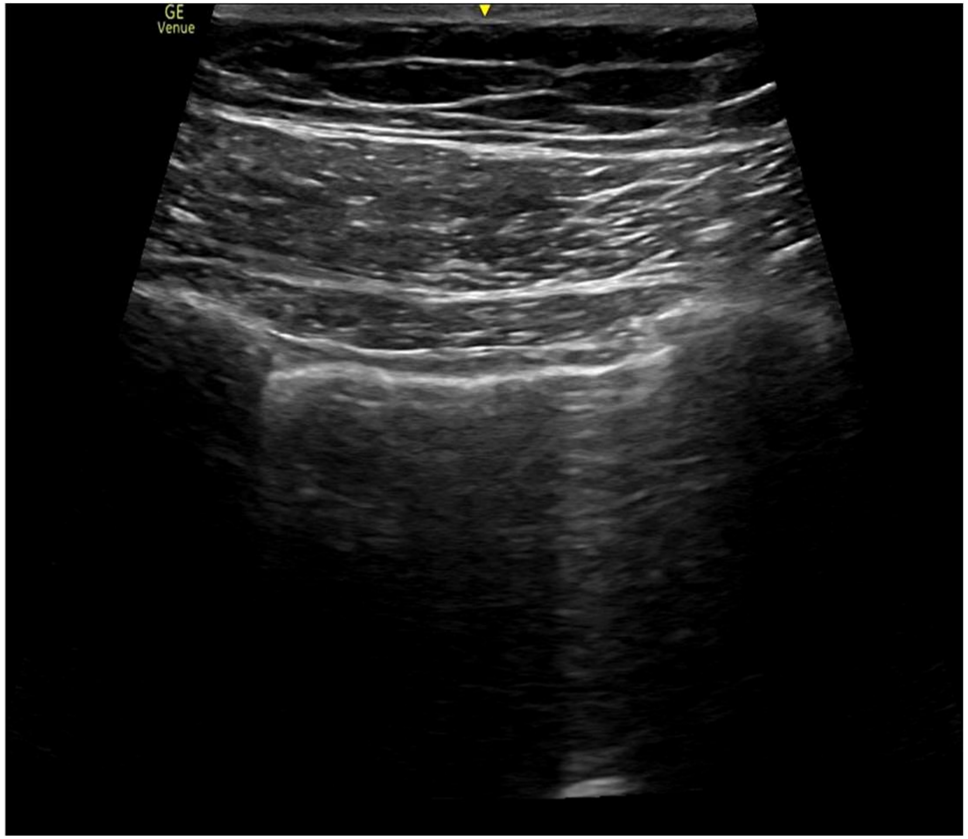
von Gilbert Krähenbühl

Pneumothorax Diagnostik



Lungengleiten: atemsynchrone Bewegung der Pleura visceralis gegenüber Pleura parietalis («Ameisenlaufen»)

→ Schliesst Pneumothorax aus wenn vorhanden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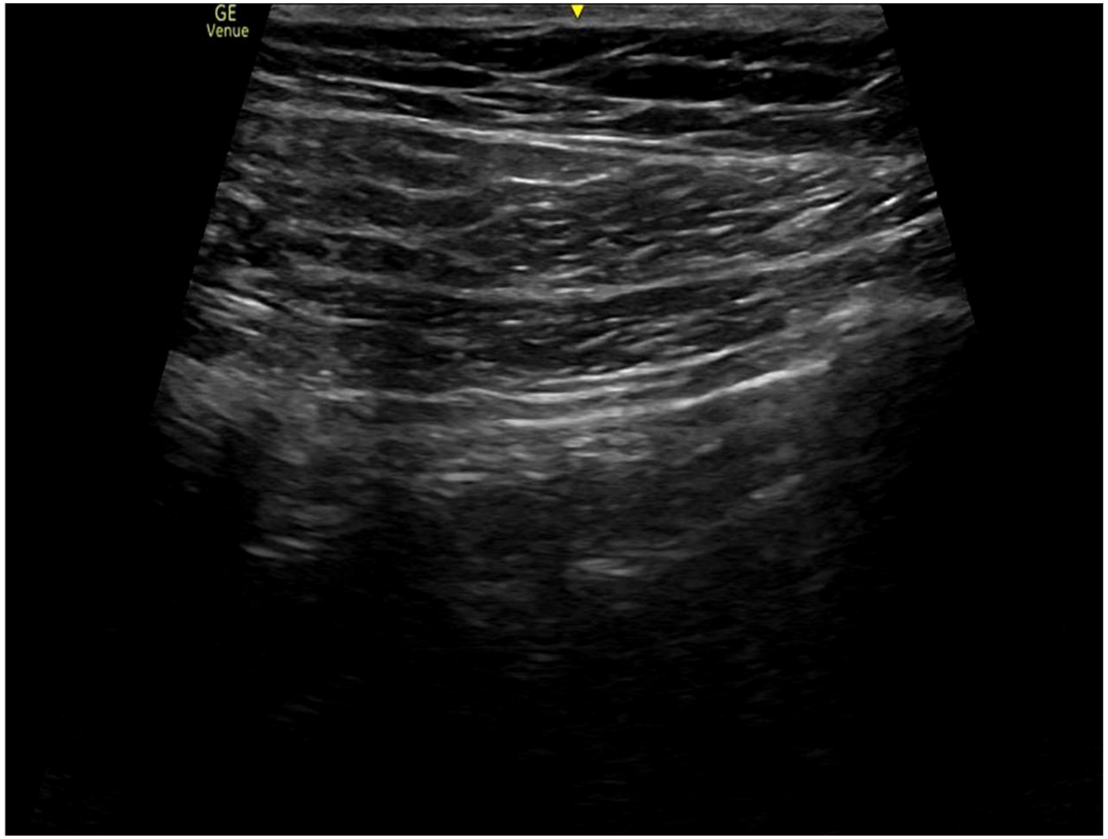
Venue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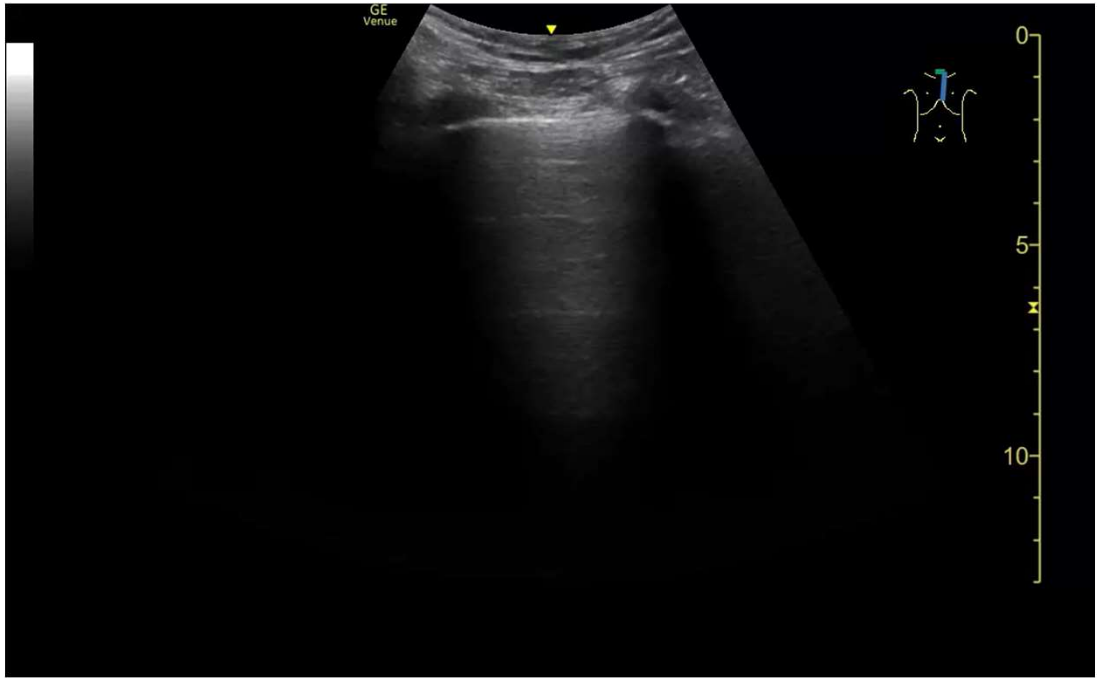
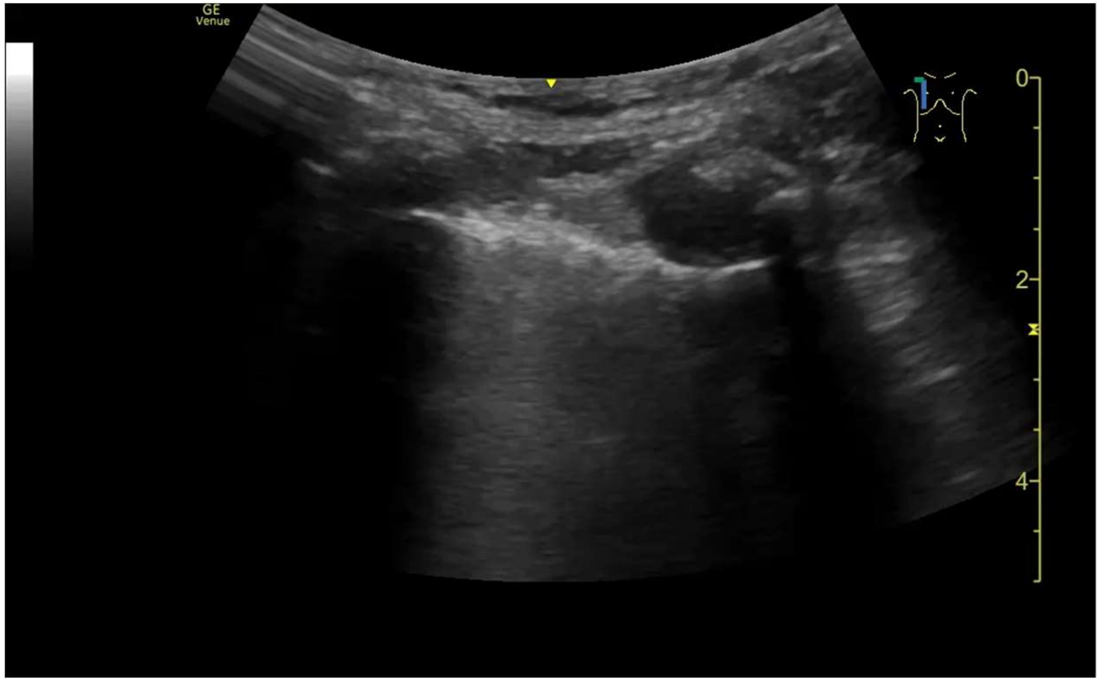
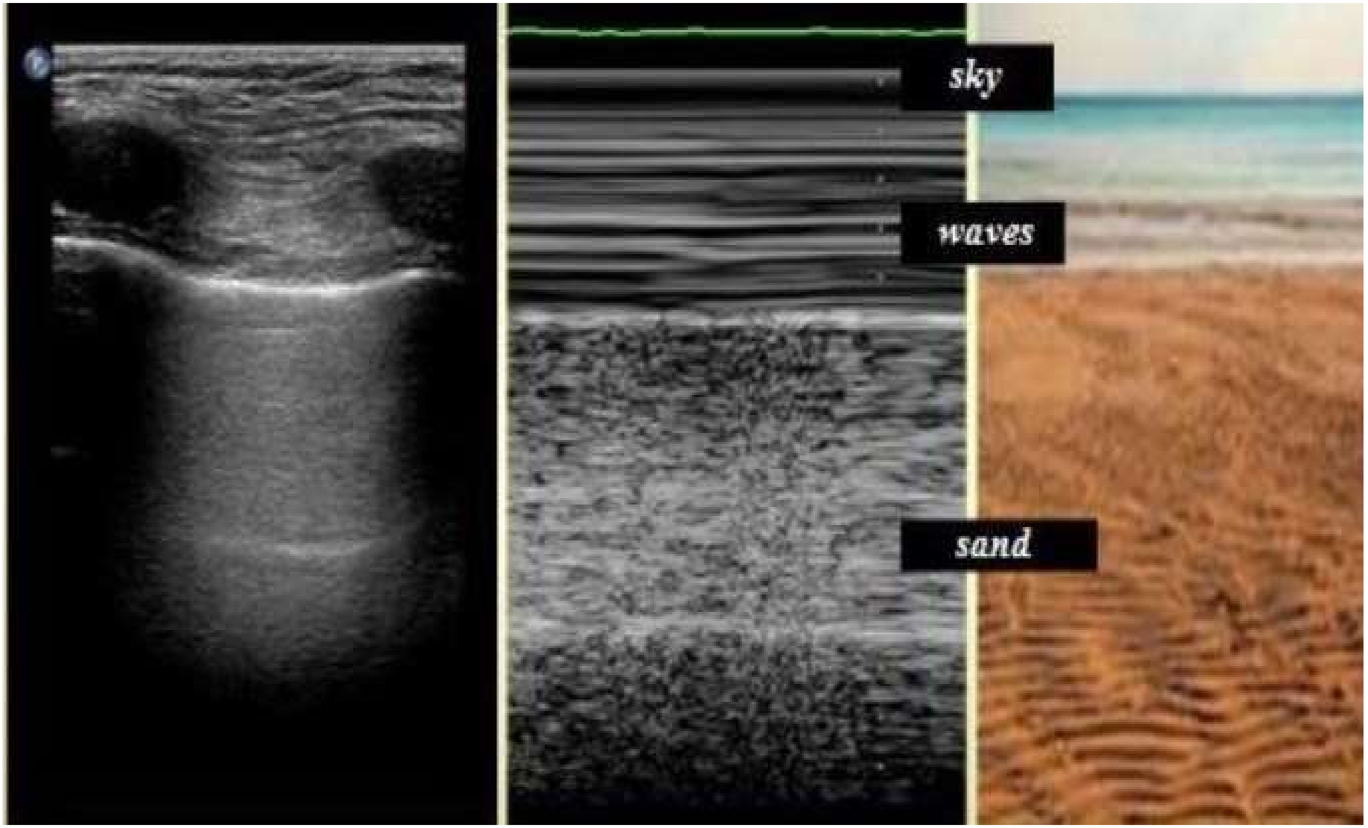

GE
Venue
0
5
10


GE
Venue
0
2
4

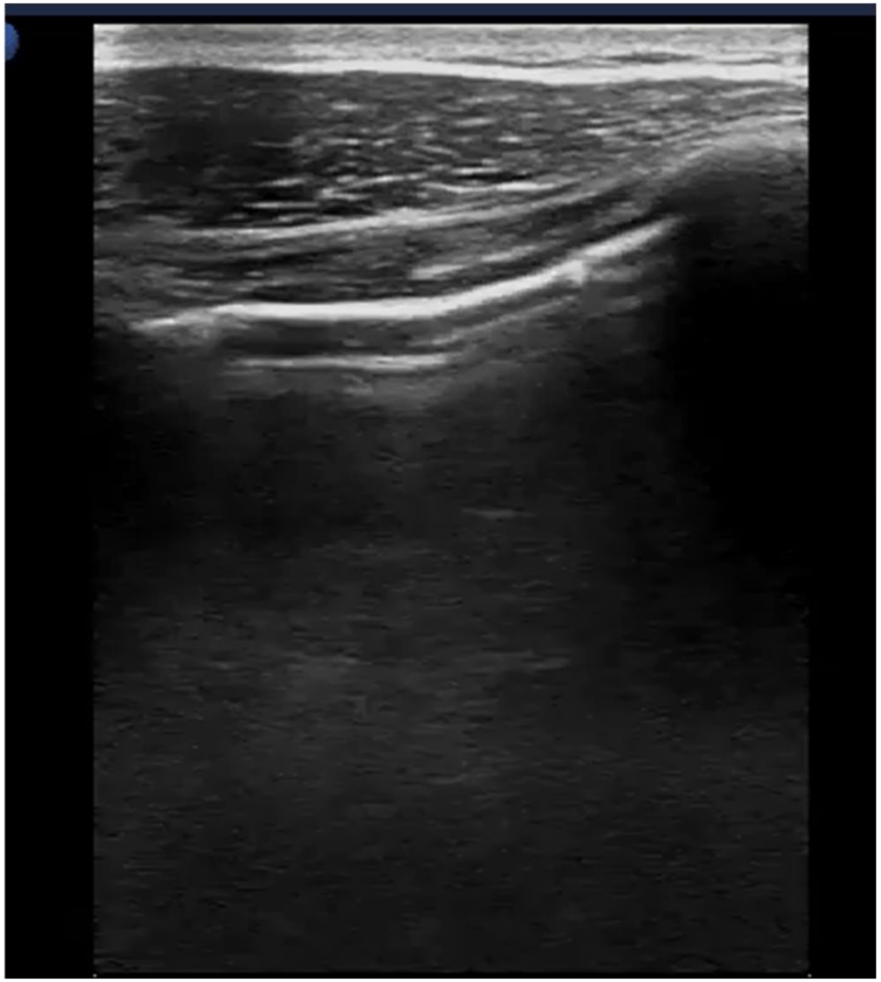
Pleuragleiten im M-Mode
Seashore-sign


sky
waves
sand

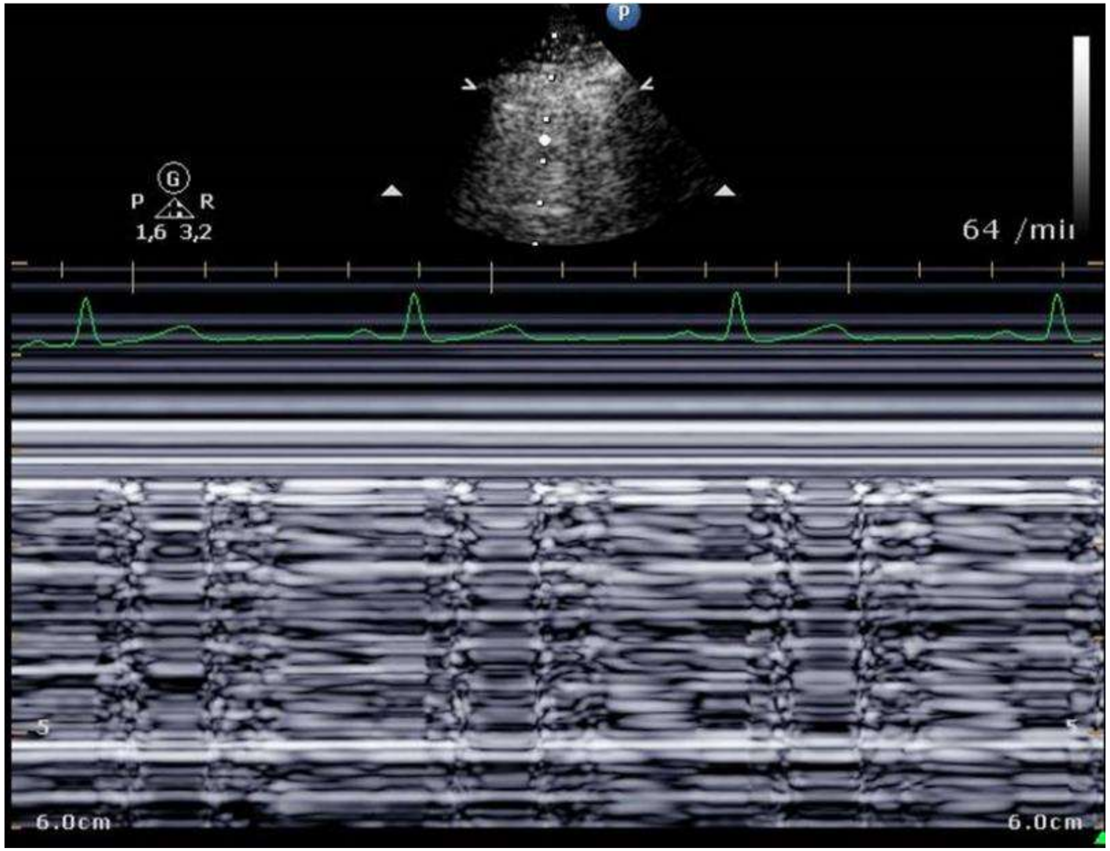
Pneumothorax Diagnostik

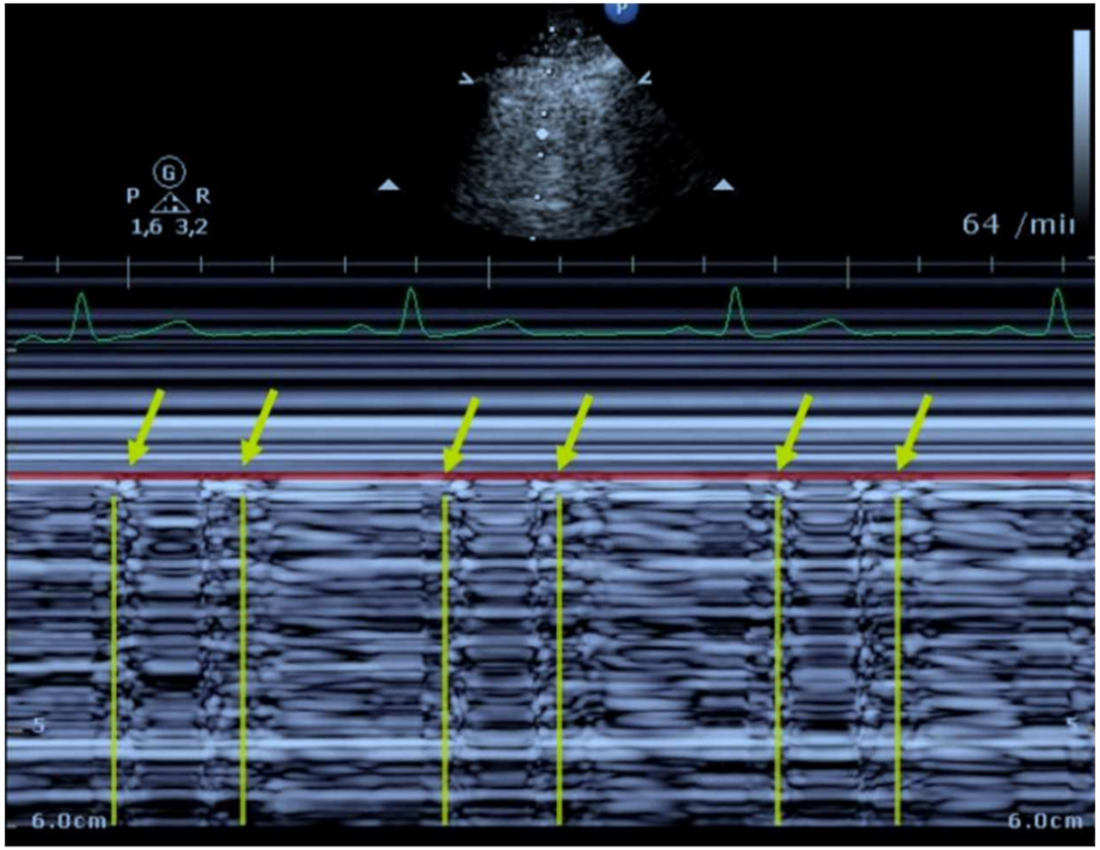
Lungenpuls: Pulssynchrone Bewegung der Pleura aufgrund Herzaktion.

→ Schliesst Pneumothorax aus wenn vorhanden

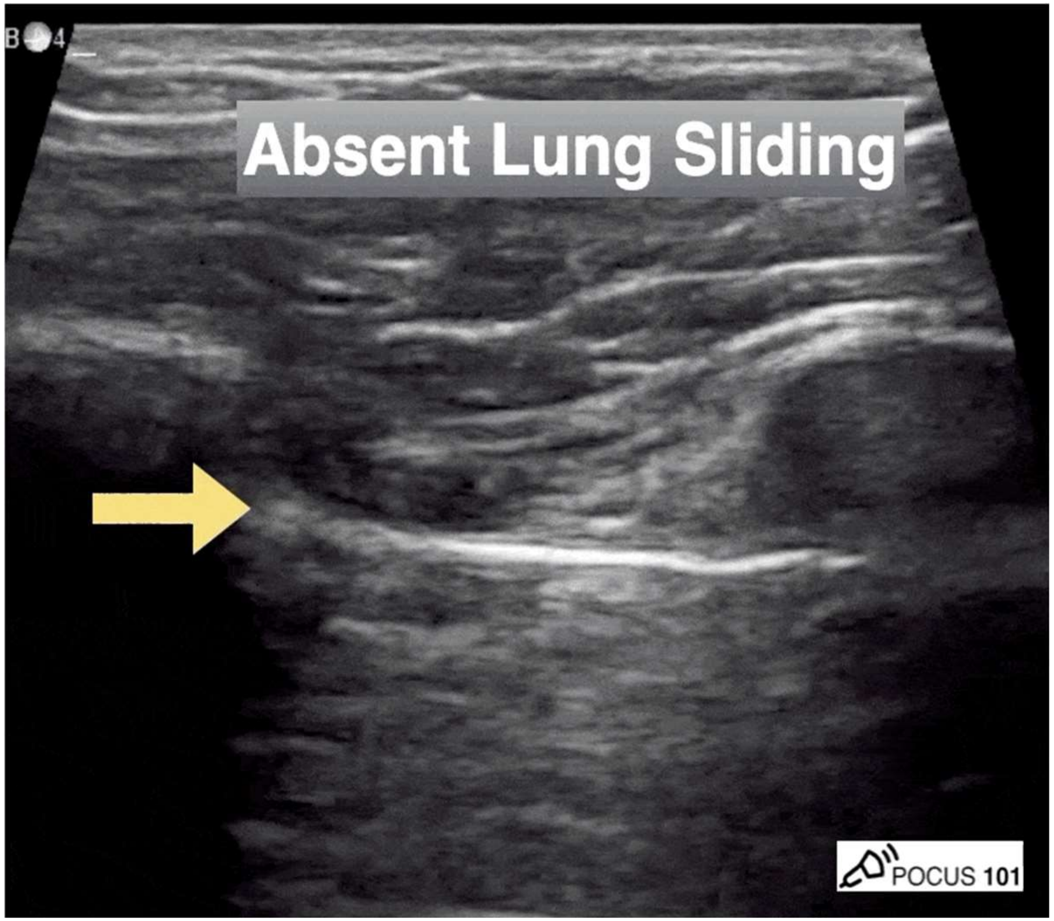


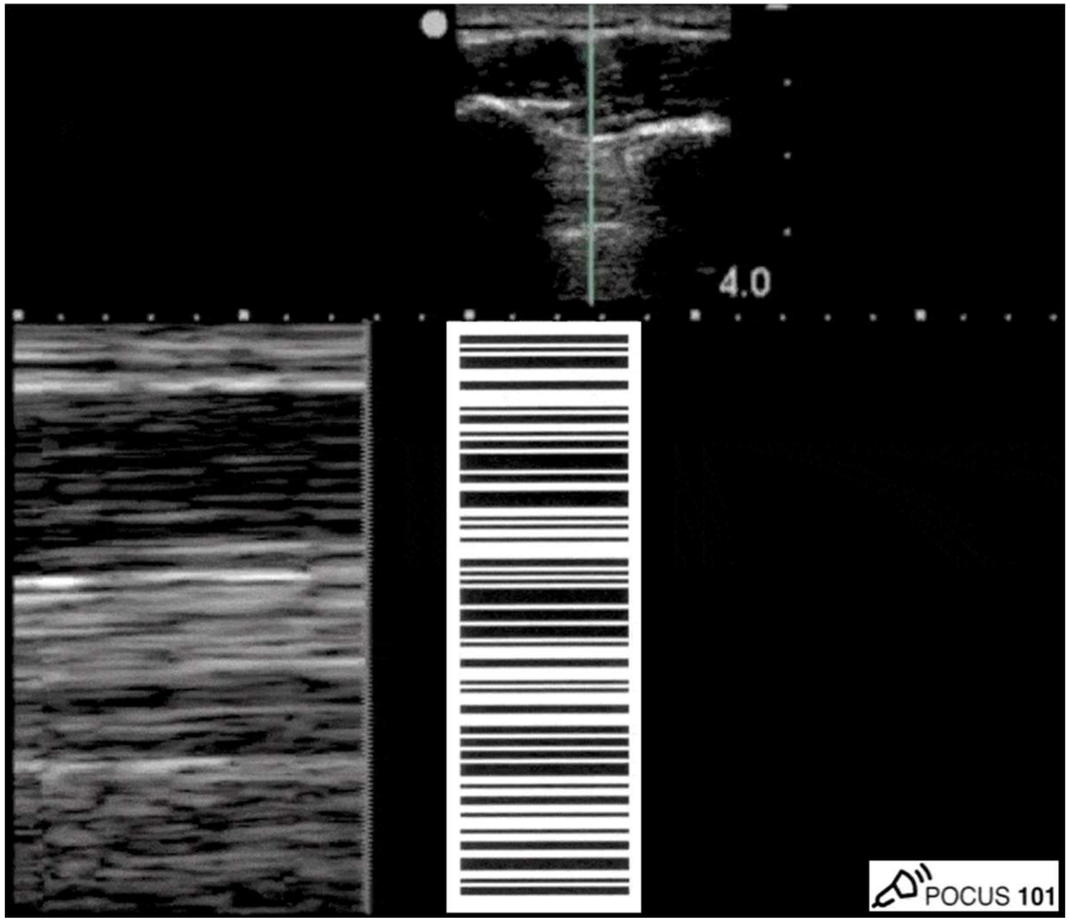
Lungenpuls im M-Mode


P
G
R
1,6 3,2
64 /mi
5
6.0cm
6.0cm

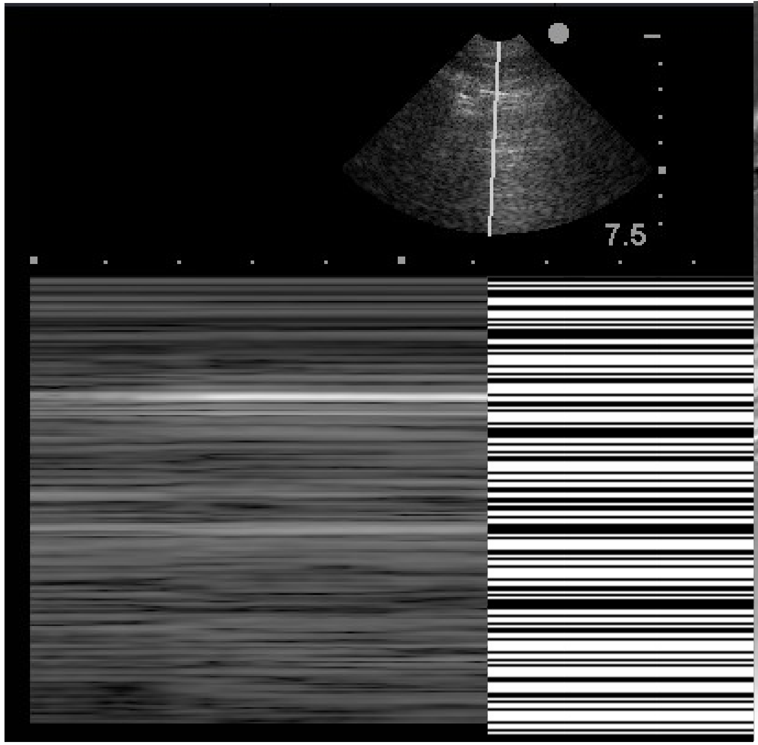

P
G
R
1,6 3,2
64 /mi
5
6.0cm
6.0cm

Pneumothorax Diagnostik


Absent Lung Sliding
POCUS 101


4.0
POCUS 101

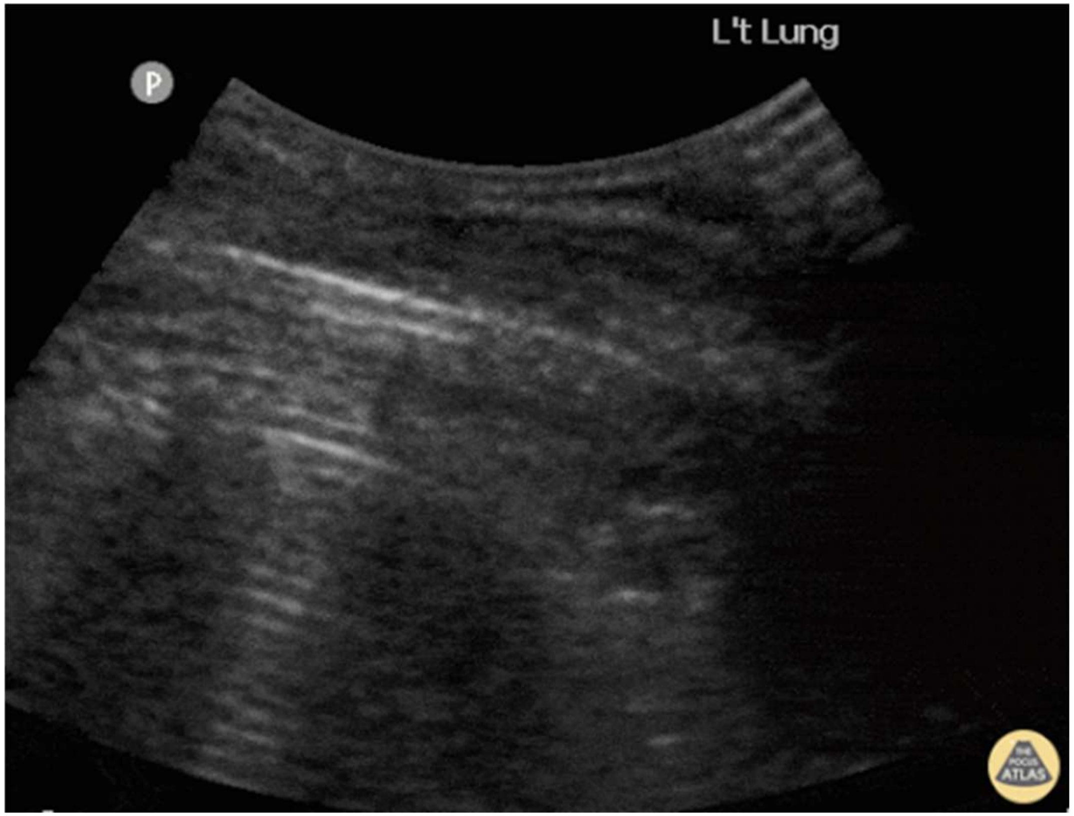
Fehlendes Pleuragleiten im M-Mode
Stratospheric sign – Barcode Zeichen

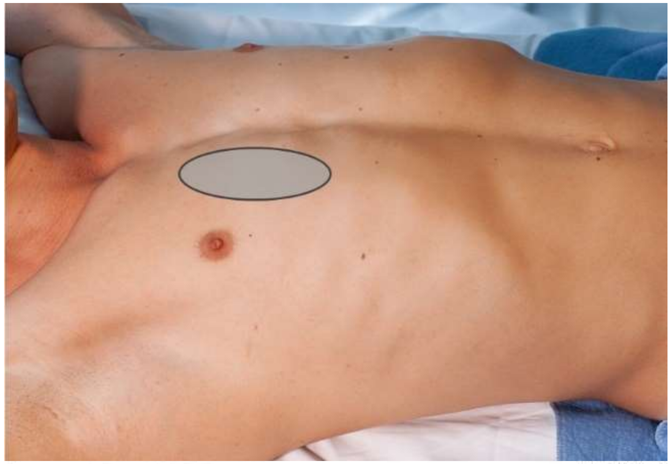


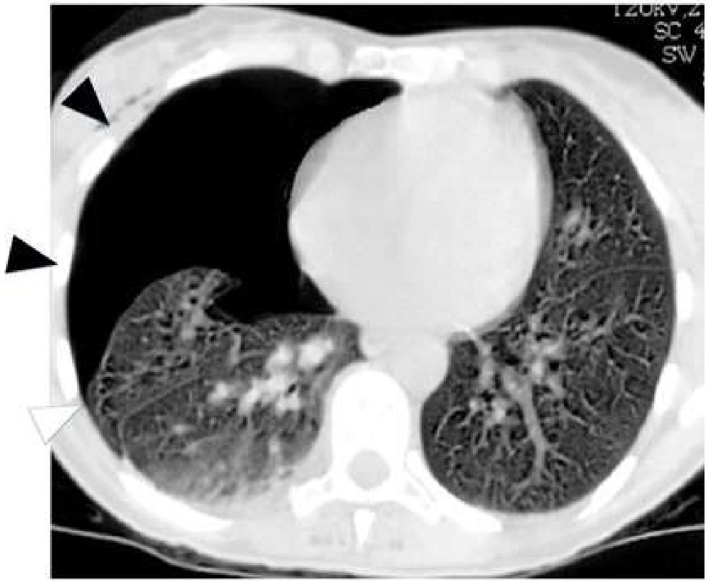
Pneumothorax Diagnostik

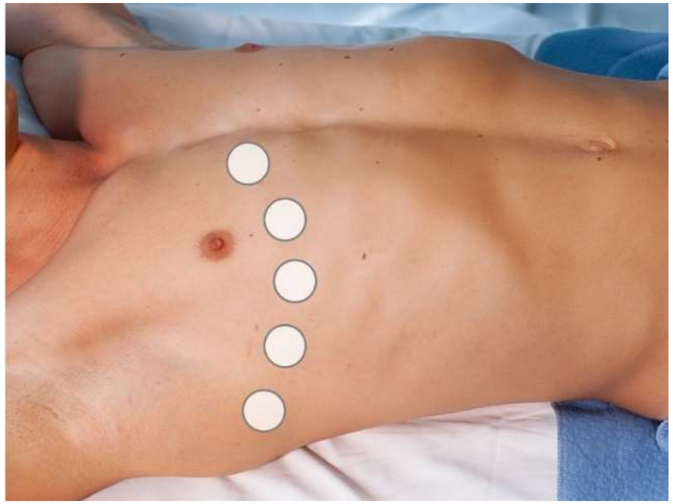
Lungenpunkt: Grenze zwischen ausgebreiteter Lunge und Pneumothorax

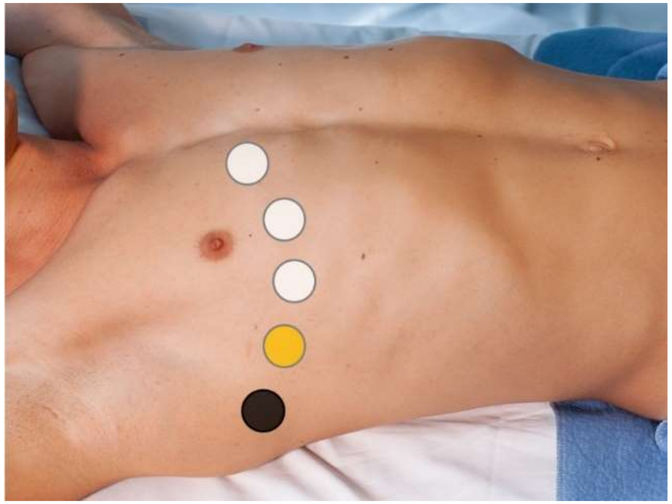
→ Beweist Pneumothorax wenn vorhanden

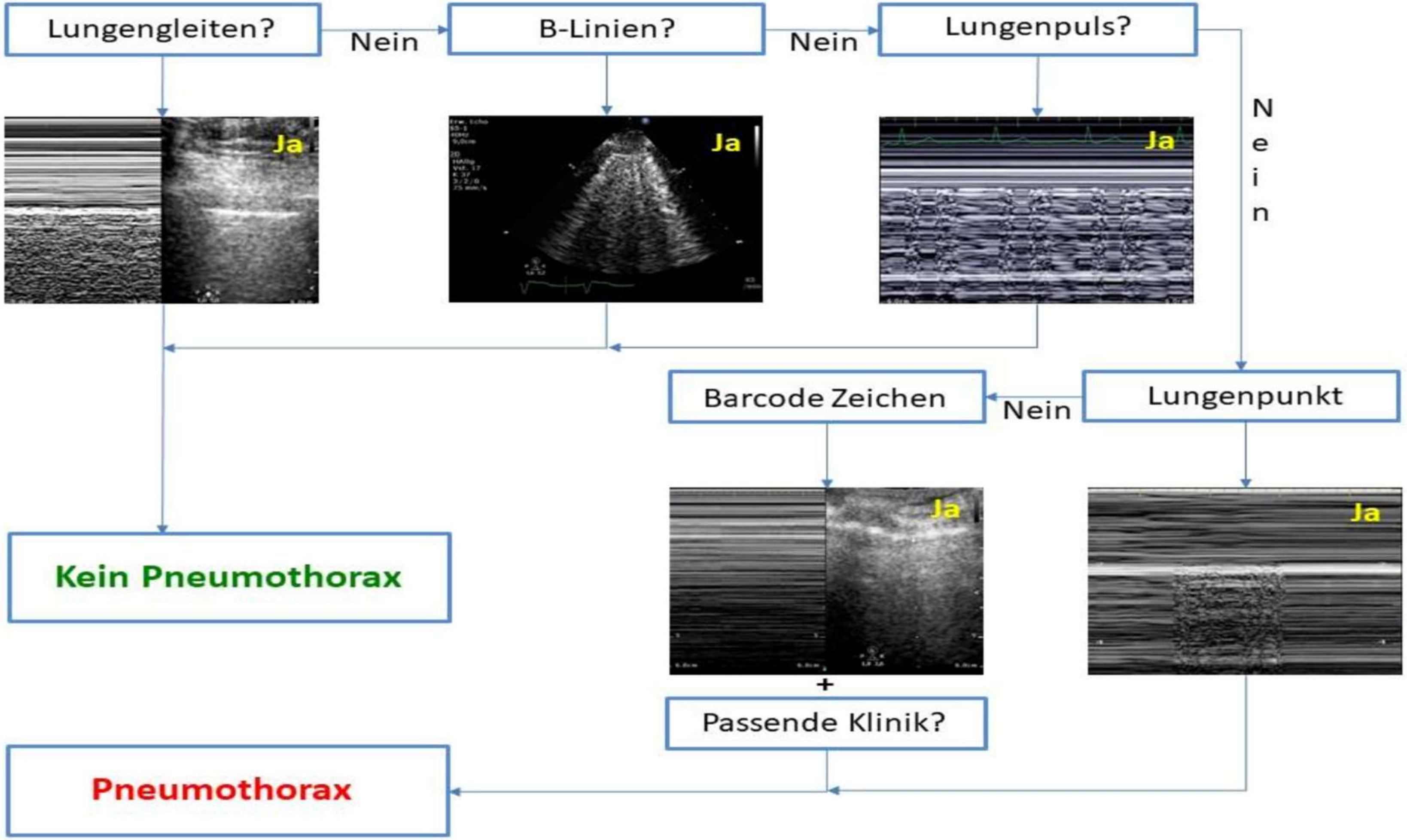

L't Lung
P
THE POCUS ATLAS




120kV,2
SC 4
SW







Lungengleiten?

Nein

B-Linien?

Nein

Lungenpuls?

Nein

Lungenpunkt

Nein

Barcode Zeichen

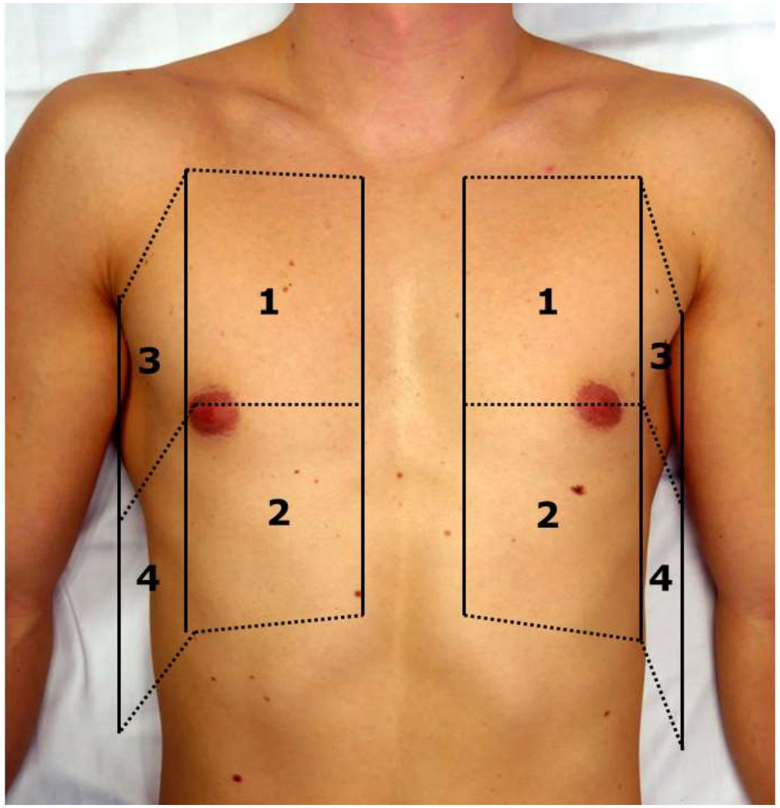
+

Passende Klinik?

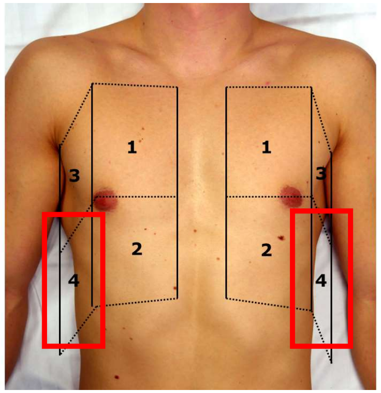
Kein Pneumothorax

Pneumothorax

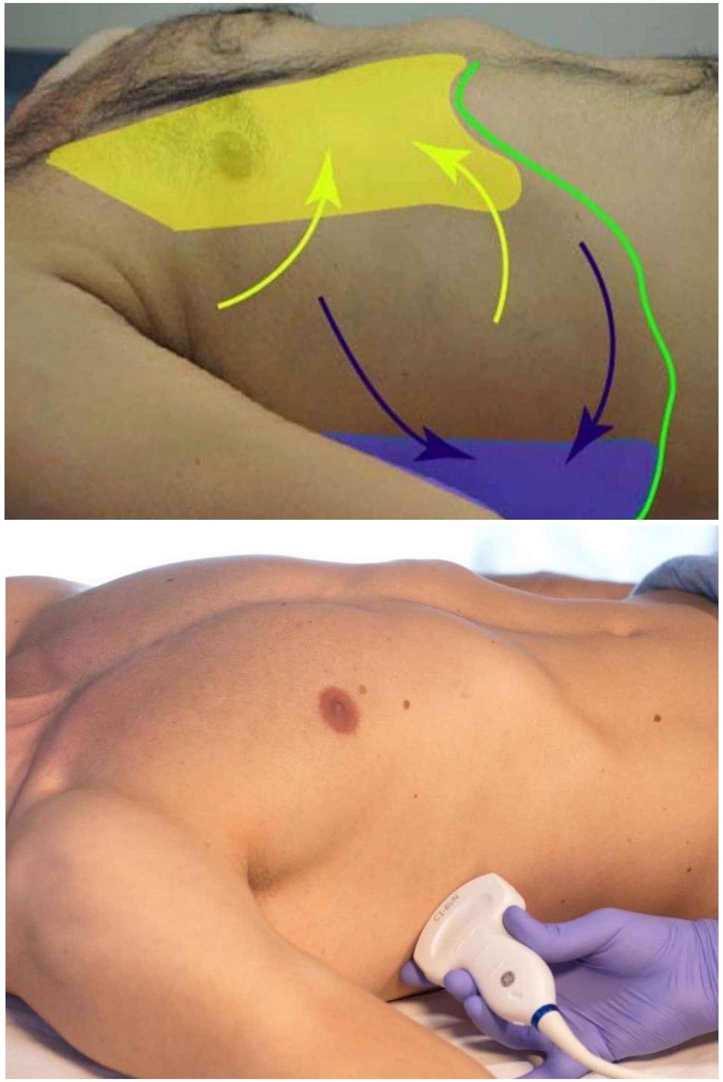
Pleuraerguss

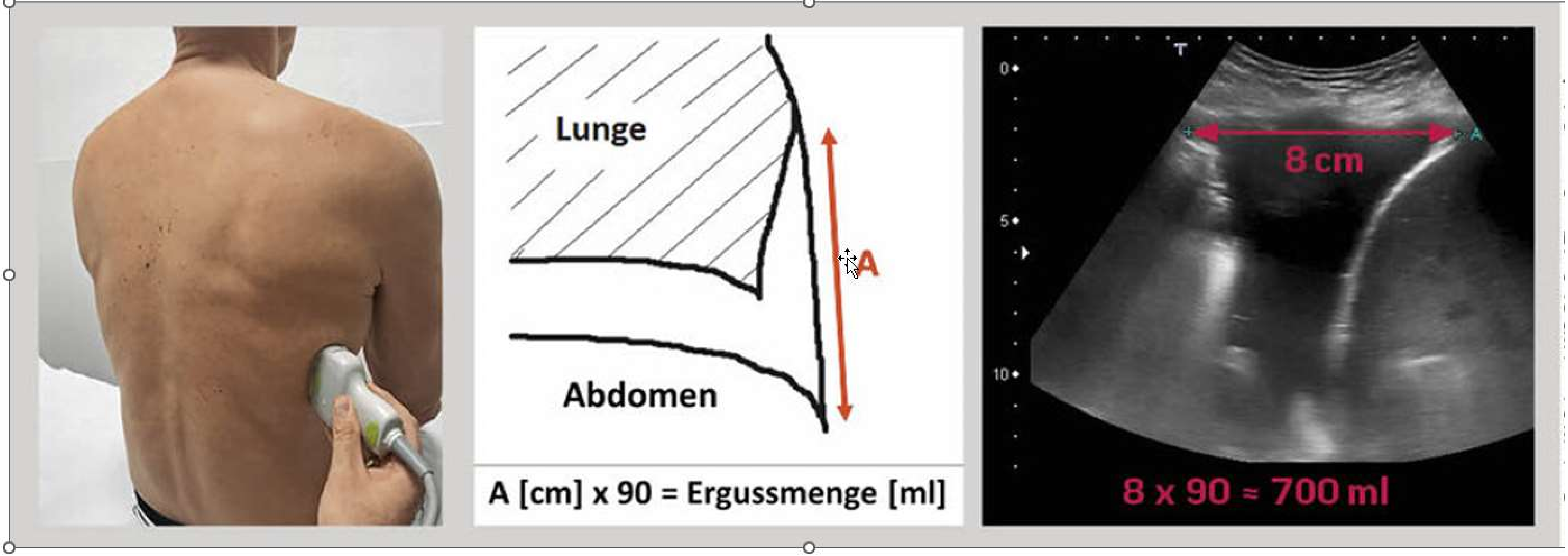


Pleuraerguss



- pathologische Zunahme der Flüssigkeit zwischen den Pleurablättern (>30ml)
- Sonographisch nachweisbar ab 5ml
- Diverse Ursachen (infektiös, maligne, Herzinsuffizienz, Leberzirrhose, iatrogen etc. etc.)
  - ➢ Trans-/Exsudat
- Kompliziert (septiert) vs. Unkompliziert




Lunge
A
Abdomen
A [cm] x 90 = Ergussmenge [ml]
T
0
5
10
8 cm
8 x 90 ≈ 700 ml

Volumetrie (nur im Sitzen ausreichend genug)

1cm kranio-kaudal = 90ml Erguss

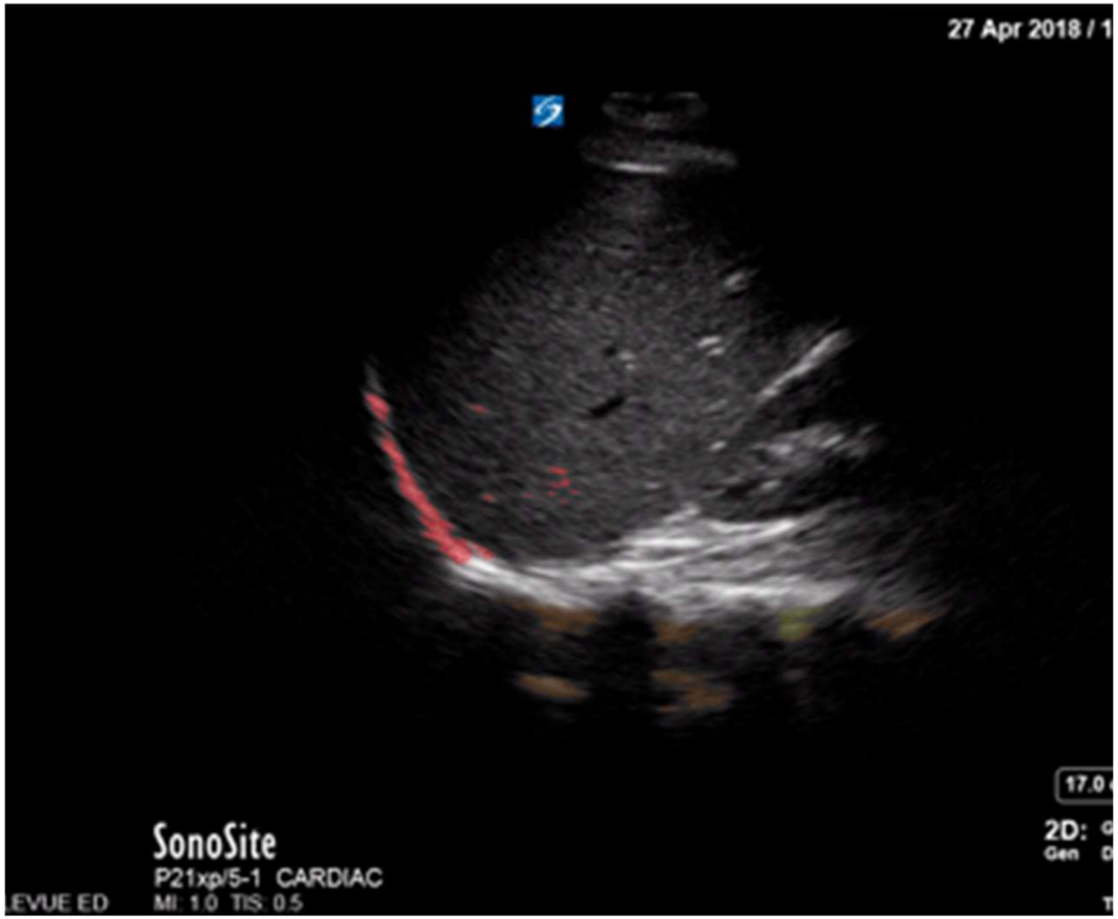
- Vol. (ml) = Distanz (mm) x 90

Vorhangphänomen

- Verschwinden subdiaphragmaler Strukturen bei Inspiration
- Kein Verschwinden bzw. kein «Vorhang» bei Erguss

➢ Vorhang sichtbar = kein Erguss

➢ Vorhang nicht sichtbar = Erguss

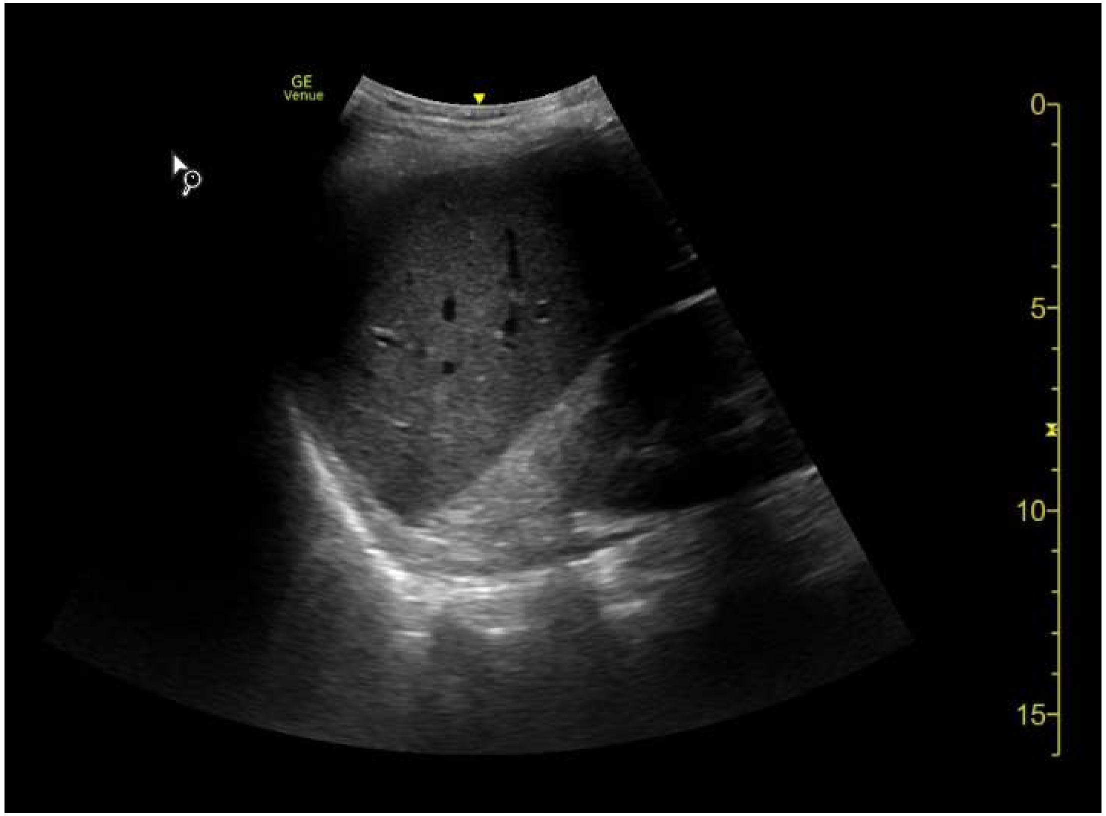

27 Apr 2018 / 1
17.0
2D:
Gen
SonoSite
P21xp/5-1 CARDIAC
MI: 1.0 TIS: 0.5
EVUE ED

Spine-Sign

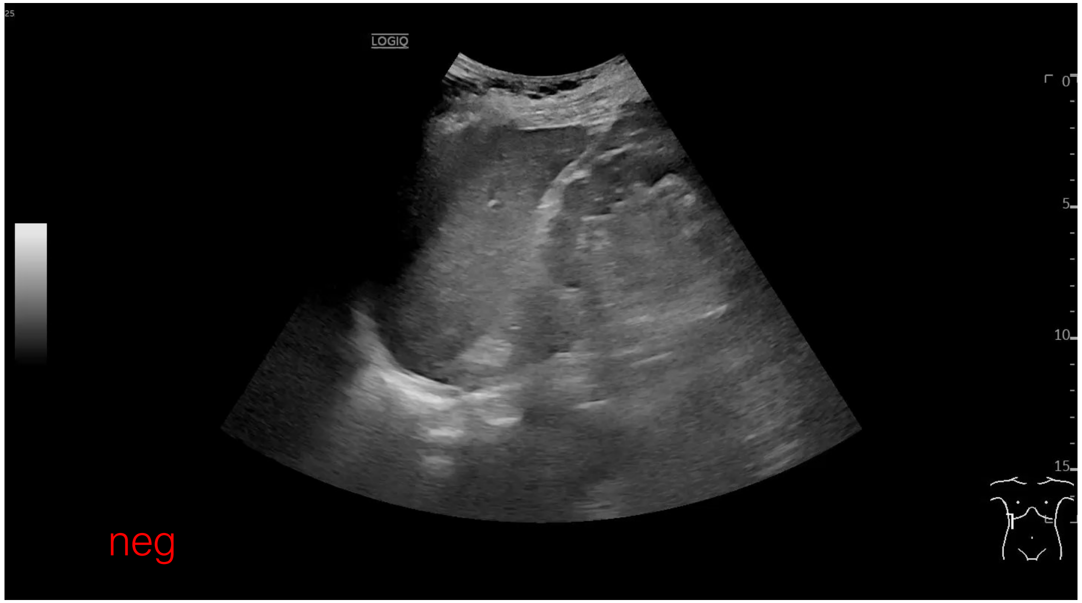
- Indirekter Hinweis auf einen Pleuraerguss/Hämatothorax
- **Frage**: „ist die Wirbelsäule thorakal noch abgrenzbar?“

➢ Wirbelsäule bricht ab = kein Pleuraerguss = Spine-Sign negativ

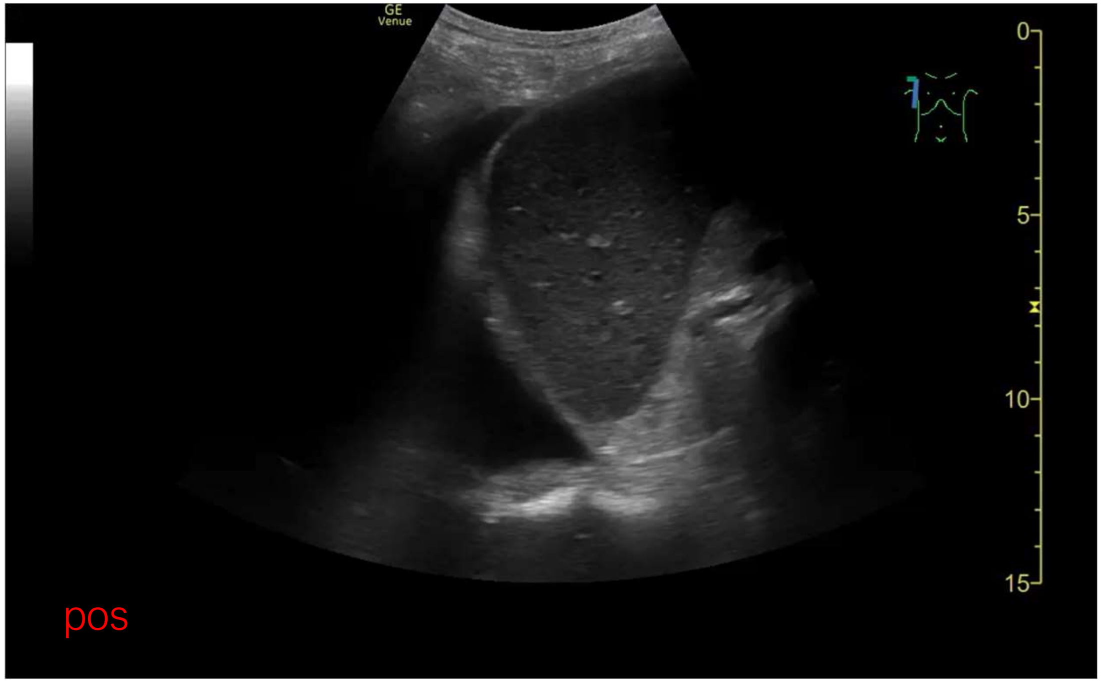
➢ Wirbelsäule verfolgbar = Pleuraerguss = Spine-Sign positiv



Spine-Sign

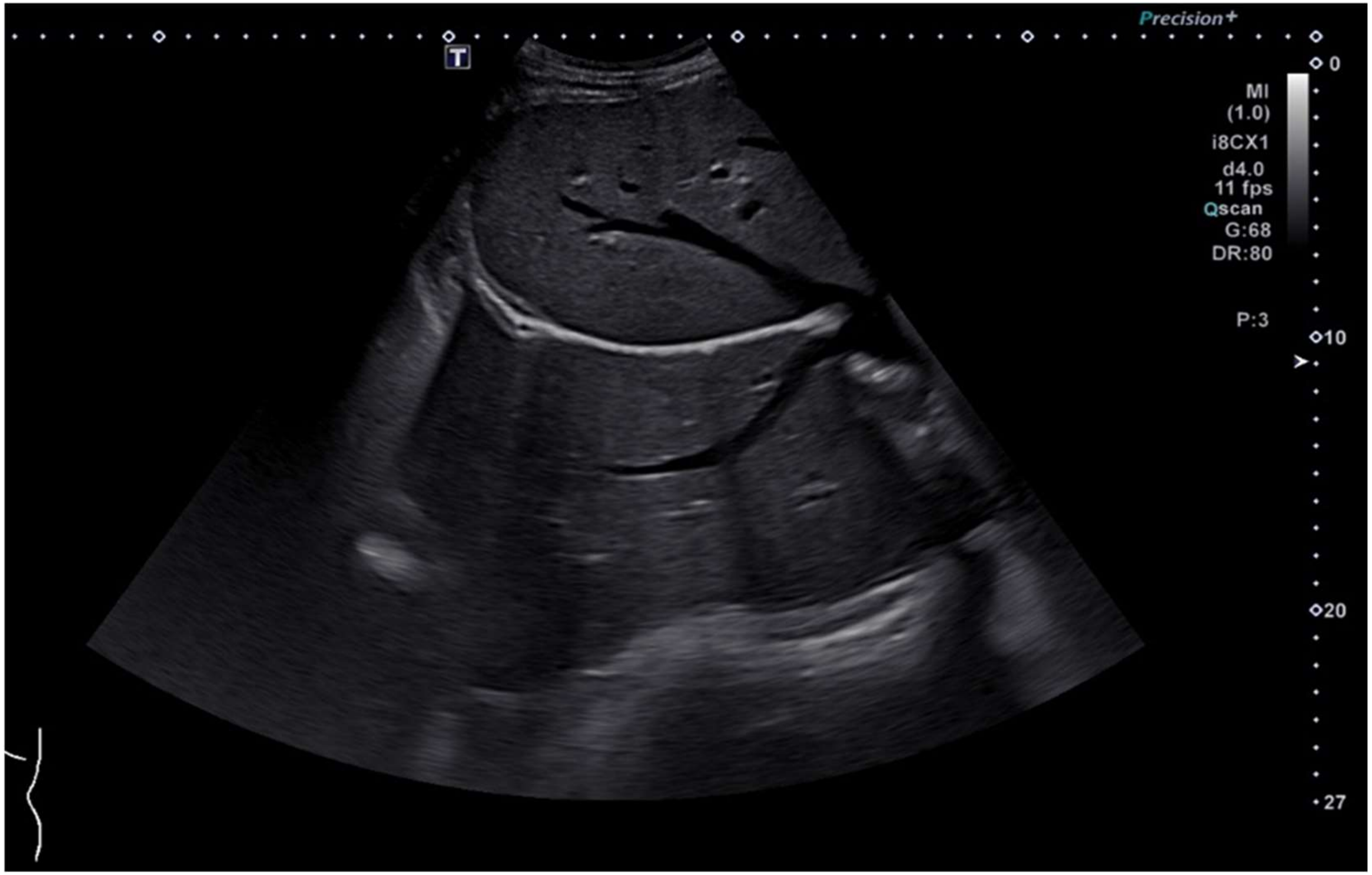

LOGIQ
0
5
10
15

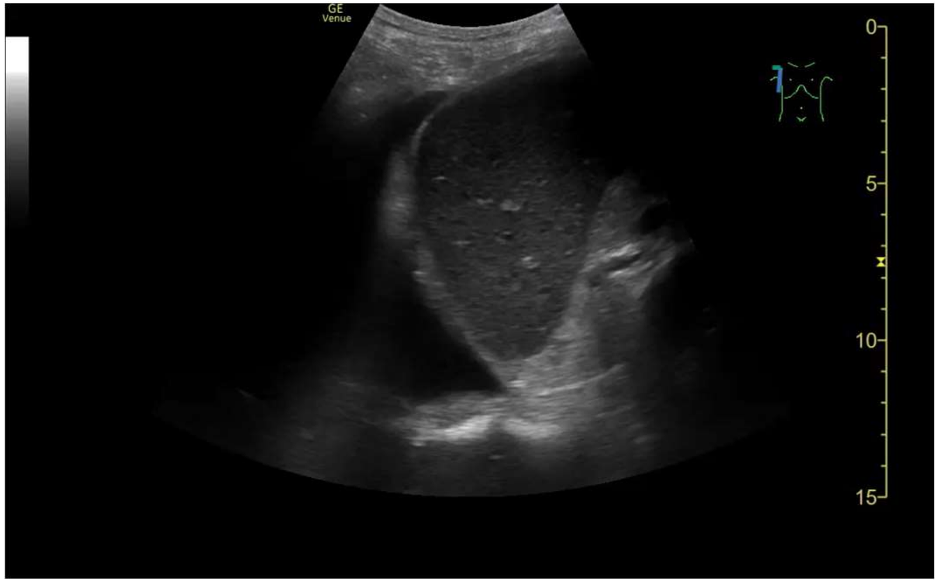
neg


GE
Venue
0
5
10
15

pos

Spiegelartefakt


Precision+
MI
(1.0)
i8CX1
d4.0
11 fps
Qscan
G:68
DR:80
P:3
0
10
20
27


GE
Venue
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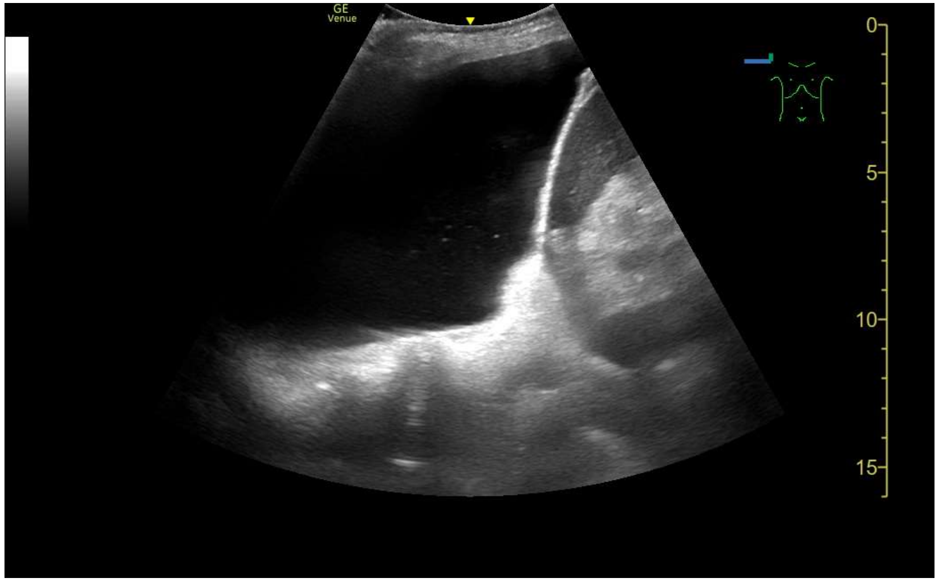
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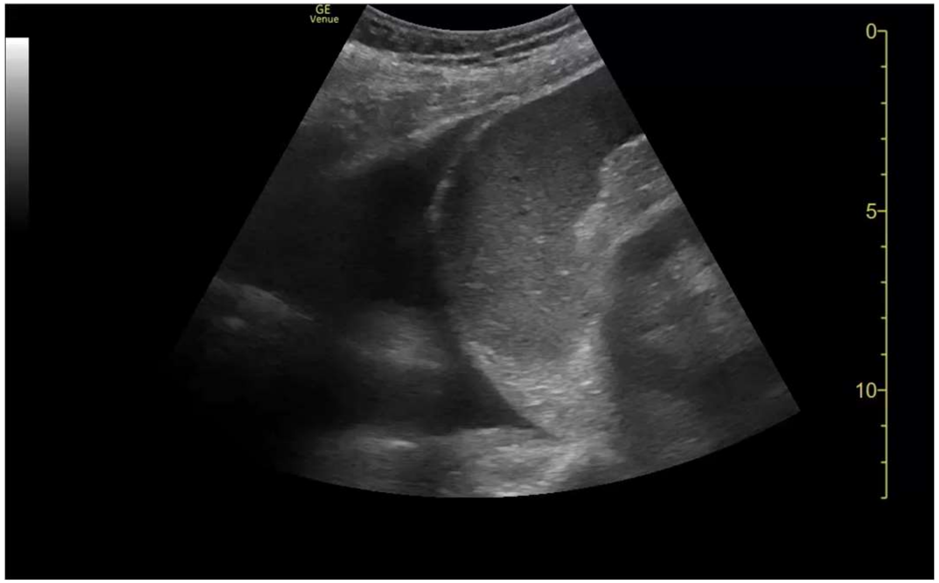
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Venue
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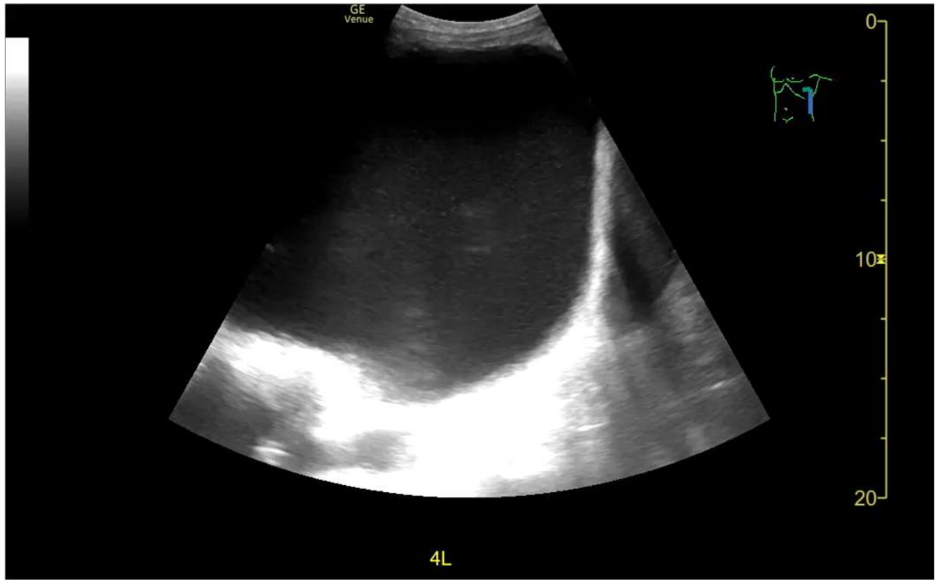
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Venue
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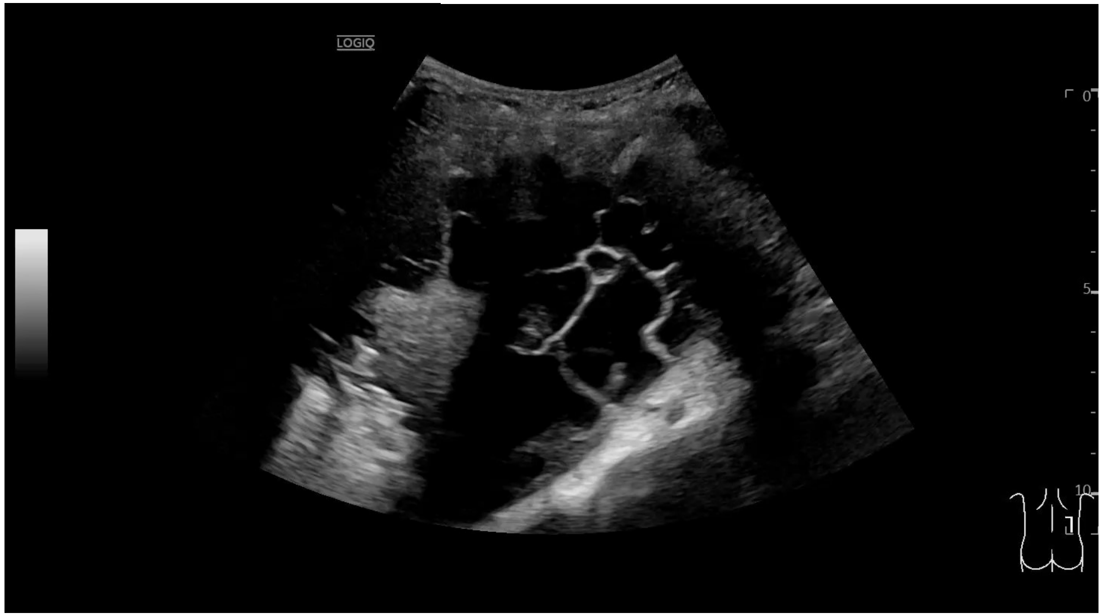
4L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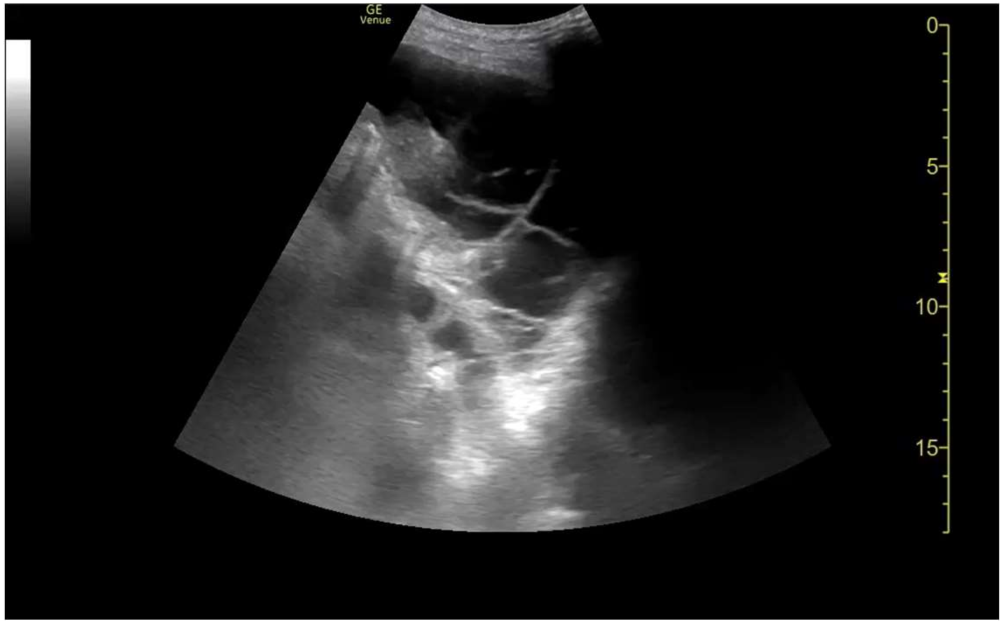
5
10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Venue
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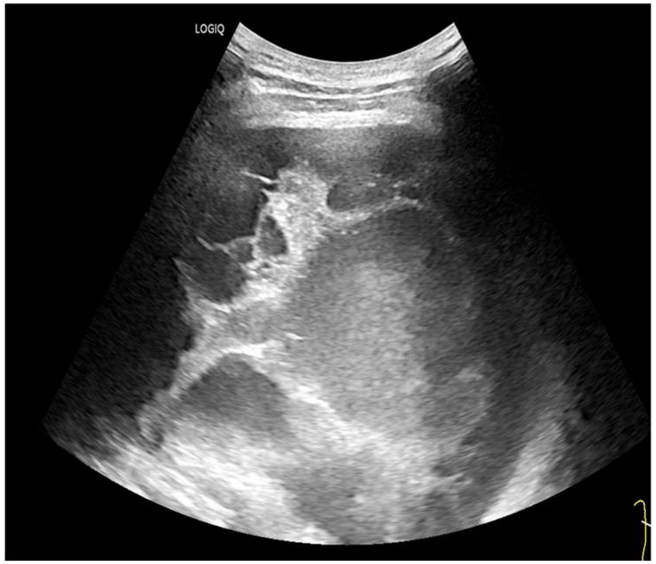
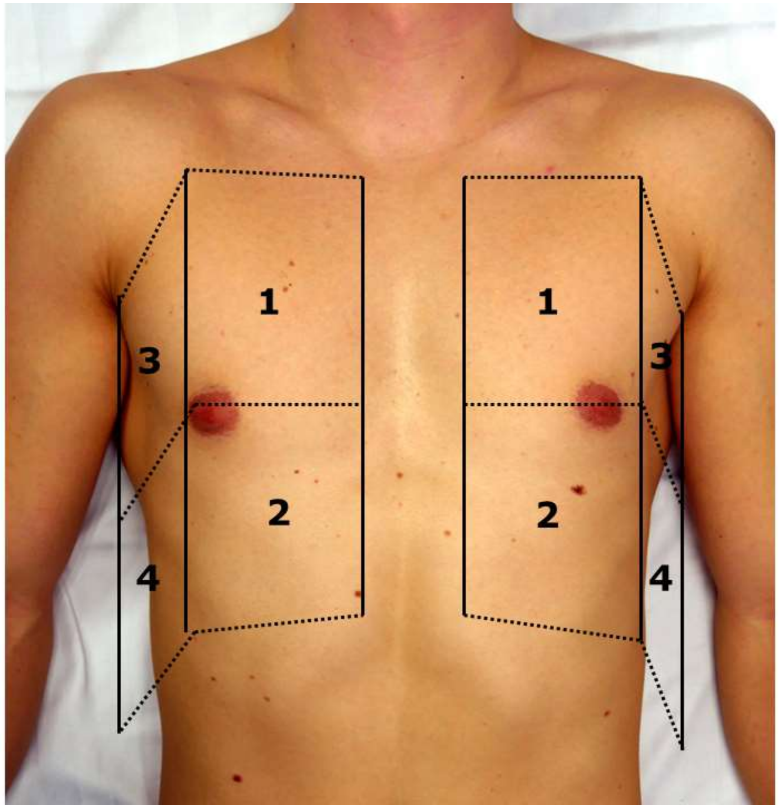
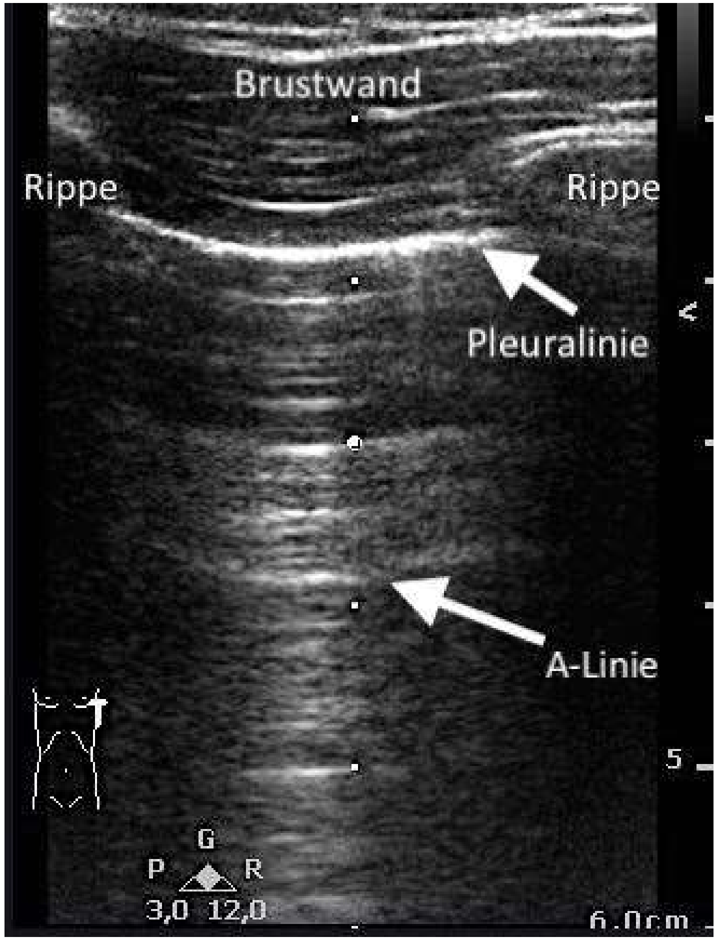
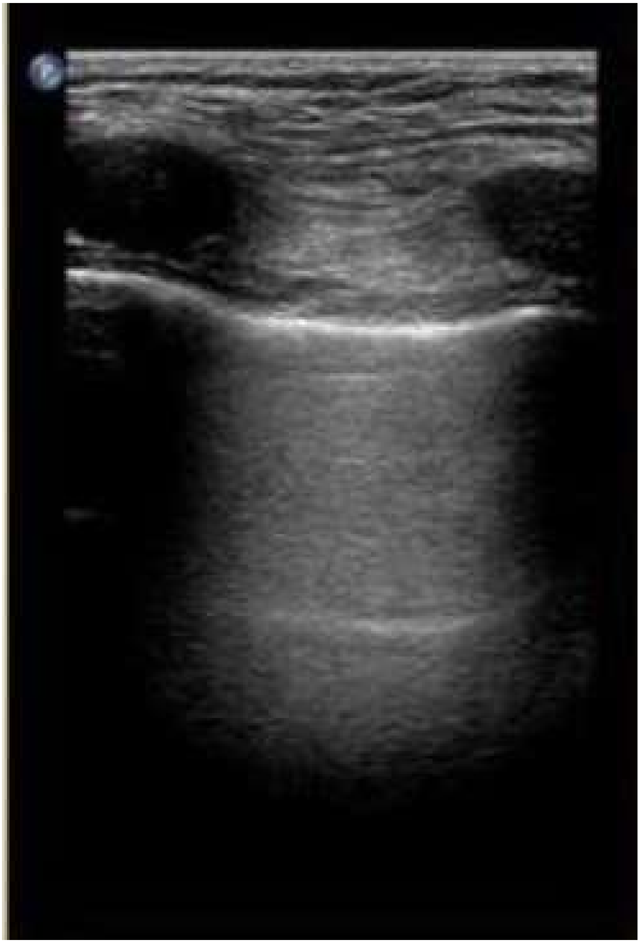

LOGIQ

A/B/C Profil



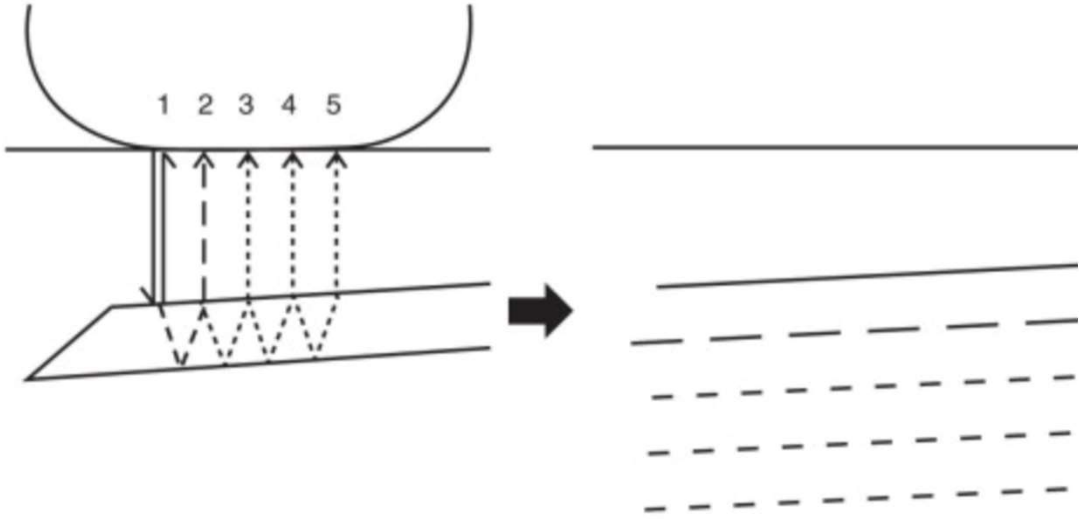
A – Linien

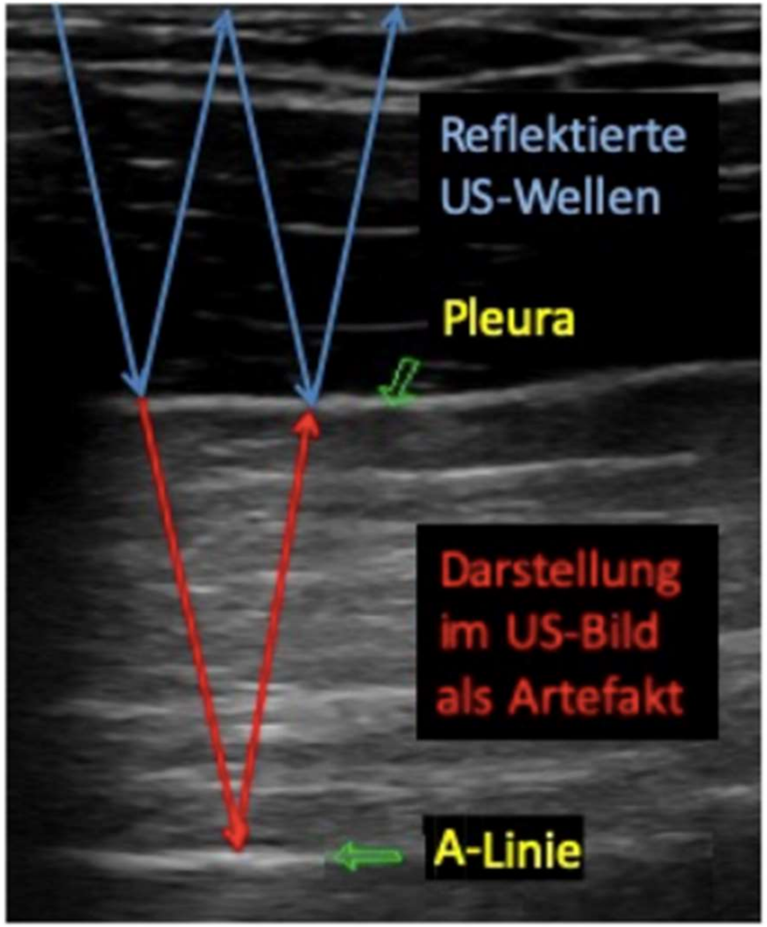

Brustwand
Rippe
Rippe
Pleuralinie
A-Linie
5
G
P
R
3,0 12,0
6,0cm

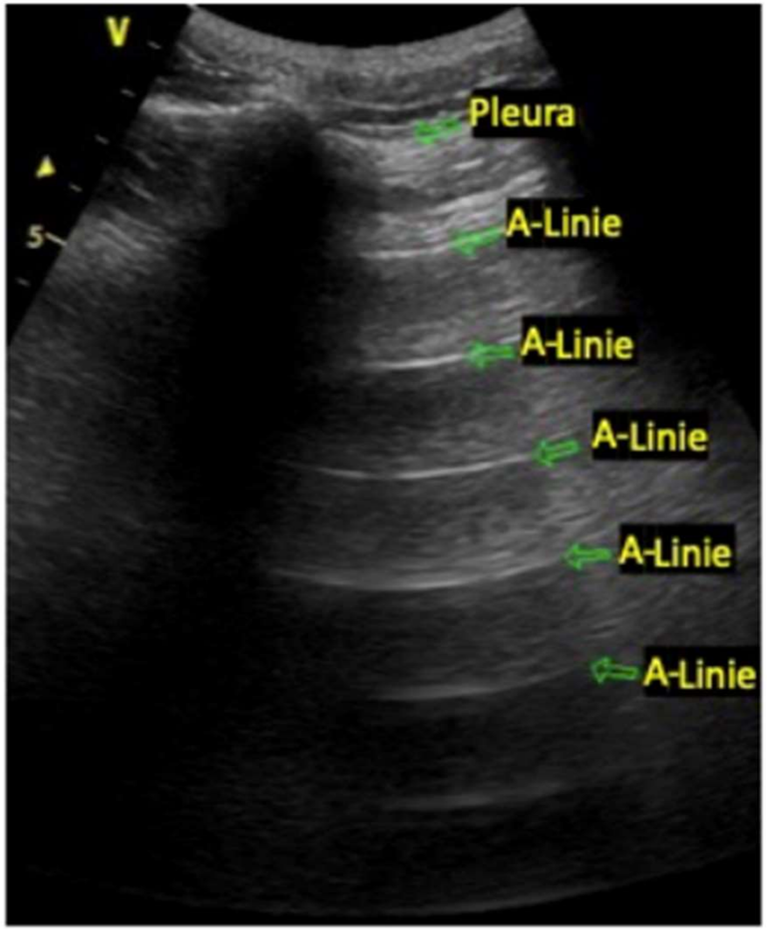


A-Linien (A-Profil)

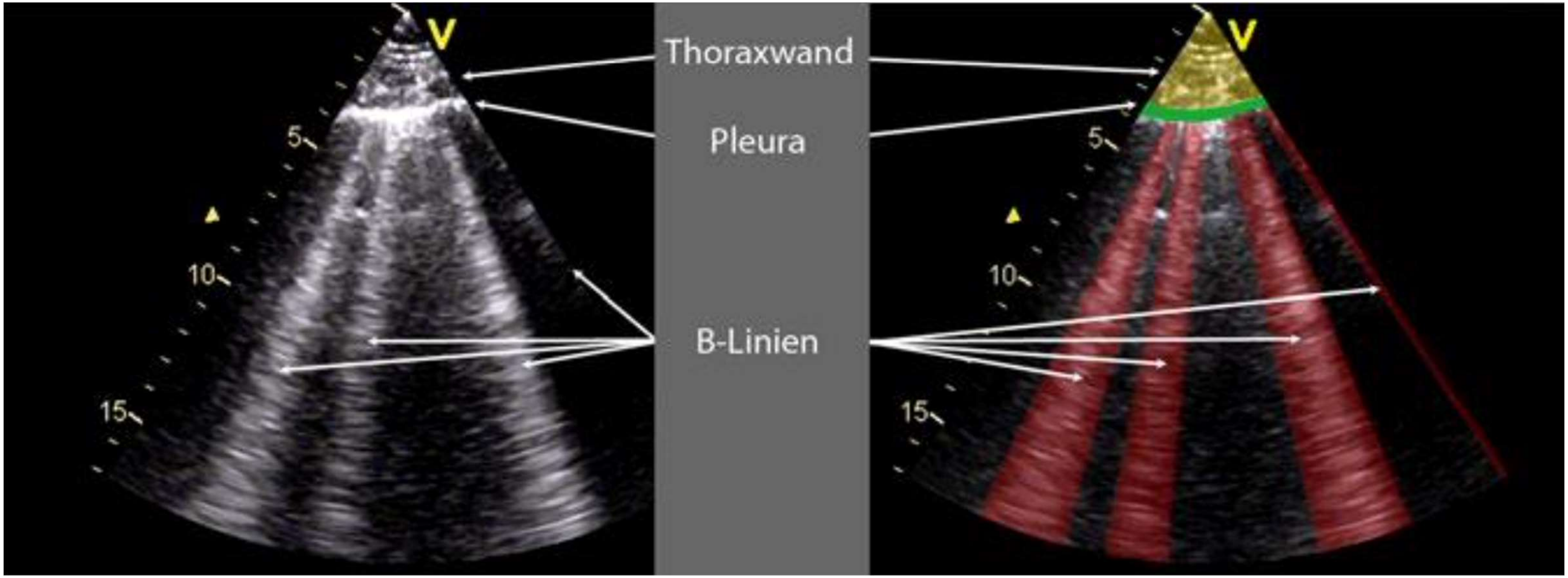
- A Linien sind Reverberationsartefakte (= Wiederholungsartefakte)
- Entstehen wenn Echos zwischen parallel liegenden Gewebeschichten hin- und zurückreflektiert wird
- Reverberationen brauchen mehr Zeit bis zum Schallkopf und werden mit jedem Reverberationszyklus in tiefere Gewebe projiziert.




Reflektierte US-Wellen
Pleura
Darstellung im US-Bild als Artefakt
A-Linie


V
5
Pleura
A-Linie
A-Linie
A-Linie
A-Linie
A-Linie

B-Linien


V
5
10
15
Thoraxwand
Pleura
B-Linien
V
5
10
15

B-Lines (B-Profil)

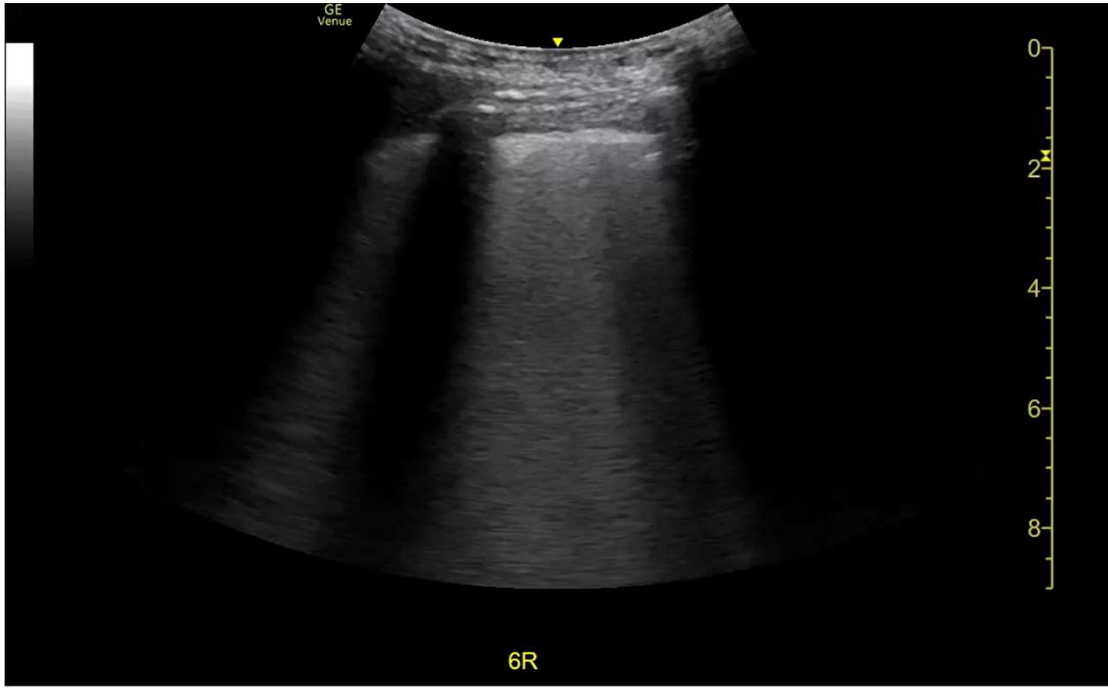
- Bereits 1997 von Intensivmediziner Daniel Lichtenstein Gebrauch der B-Lines als Zeichen einer pulmonalen Flüssigkeitseinlagerung

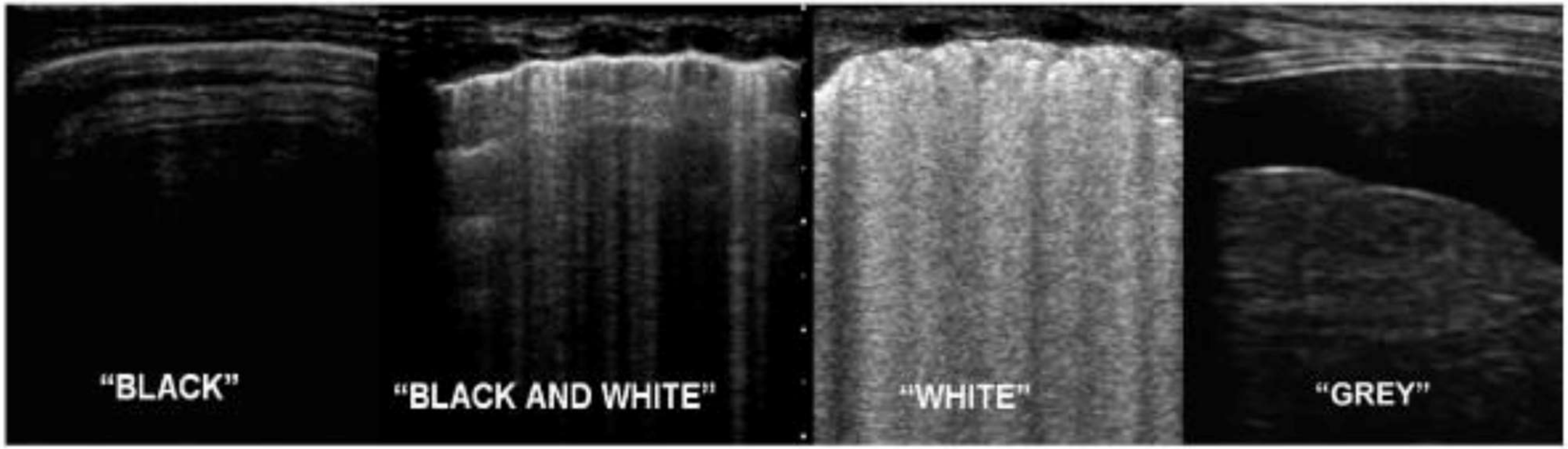
- Genauer Mechanismus unklar, vermutet wird:
  - Mit zunehmendem Wassergehalt & Verdickung Interlobärsepten kommt es zu multiplen, lokalen Reflexionen

  - Summation dieser Reflexionen = B-Lines

B-Linien (B-Profil)

- Echoreich, laserstrahlartig, vertikal, bis an Bildunterrand reichend, mindestens 8 cm lange
- Ausgehend von intakter Pleura
- Pathologisch ab 3 B-Lines pro Intercostalraum (sagittal)
- Pro Seite >/= 2 positive Quadranten = Lungenödem/pulmonale Stauung /ARDS (auch interstitielles Syndrom)



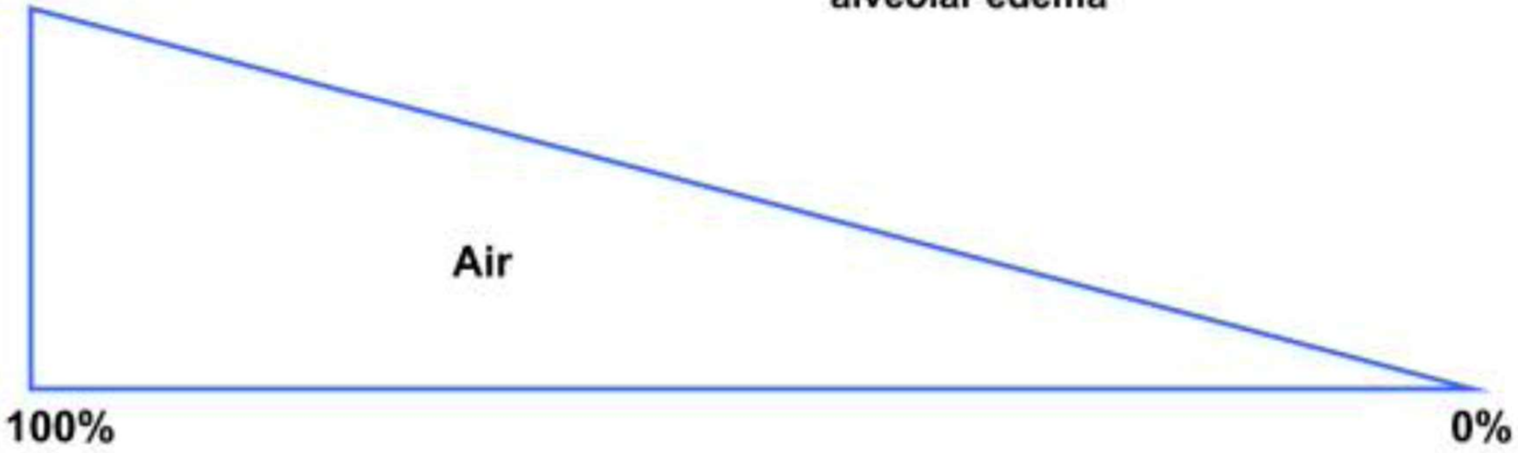

"BLACK"
"BLACK AND WHITE"
"WHITE"
"GREY"

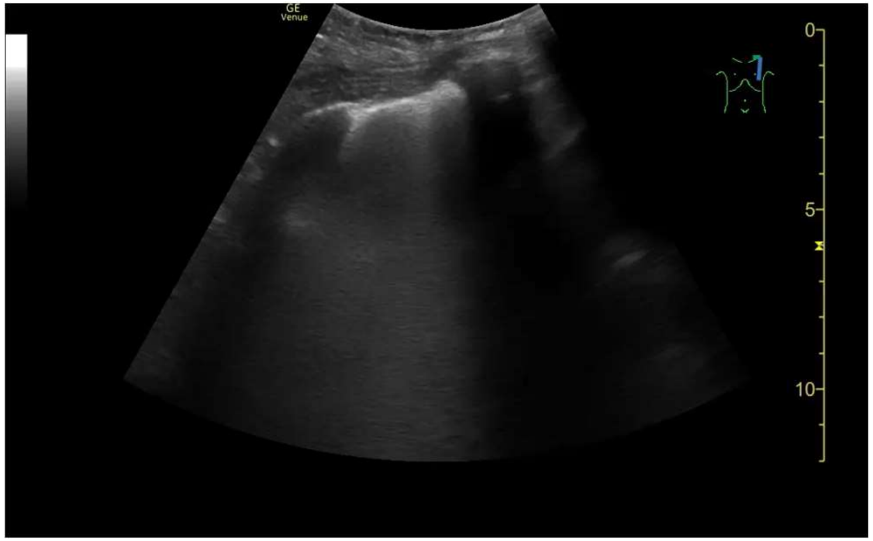
Normal

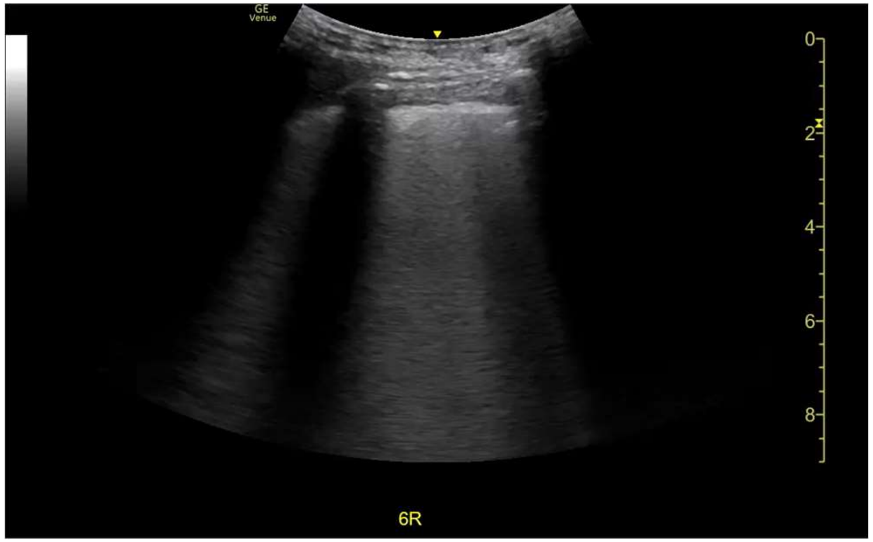
Mild/moderate interstitial edema

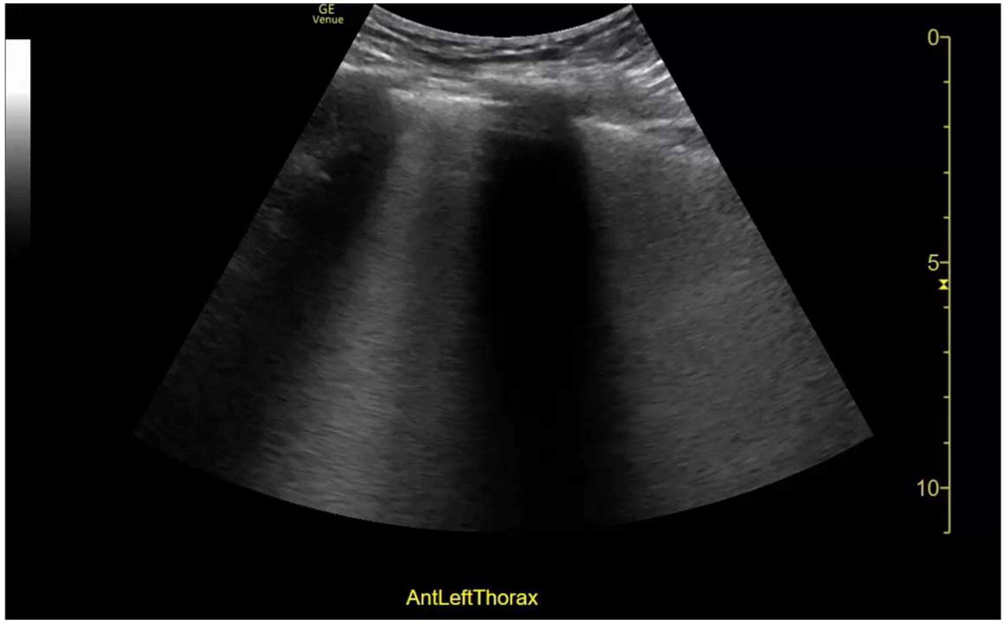
Severe interstitial edema/ alveolar edema

Consolidation



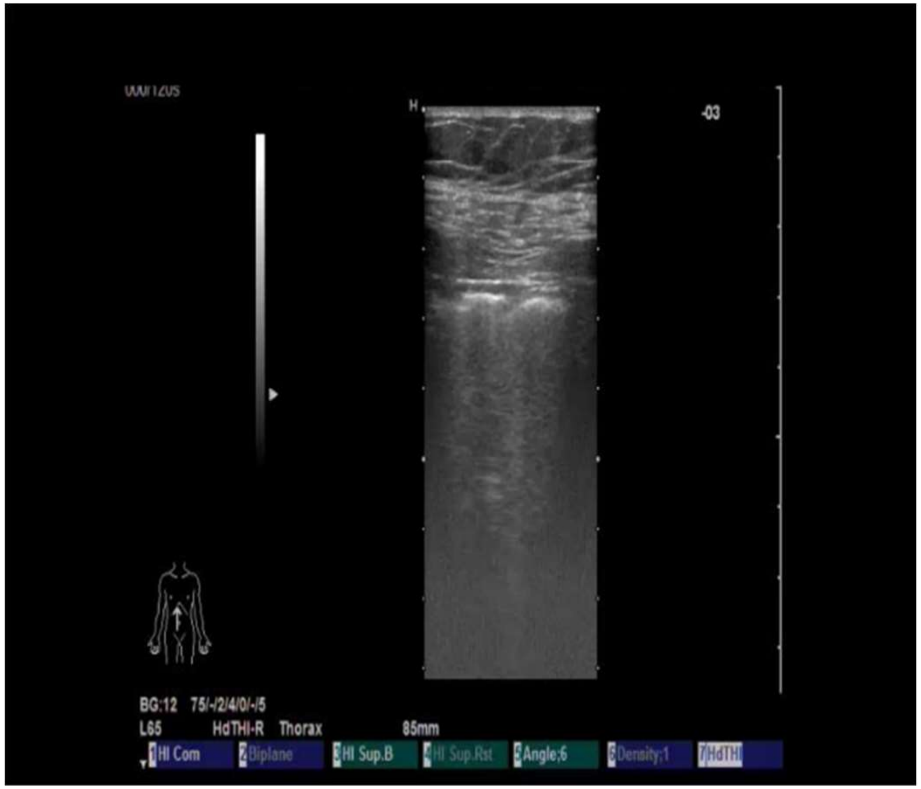

GE
Venue
0
5
10


GE
Venue
0
2
4
6
8
6R


GE
Venue
0
5
10
AntLeftThorax

Kometenschweifartefakte (pneumogene B-Linien)

- Vertikale, gleichmässige Artefakte mit breiter Basis (1-2mm) und abnehmender Intensität
- weniger lang als B-Linien
- von einer irregulären Pleuralinie mit reduziertem Lungengleiten oder vom Rand von Konsolidierungen ausgehend
- häufig zusammen mit kleinen subpleuralen Konsolidierungen
- Bronchitis, kleinere Konsolidierungen

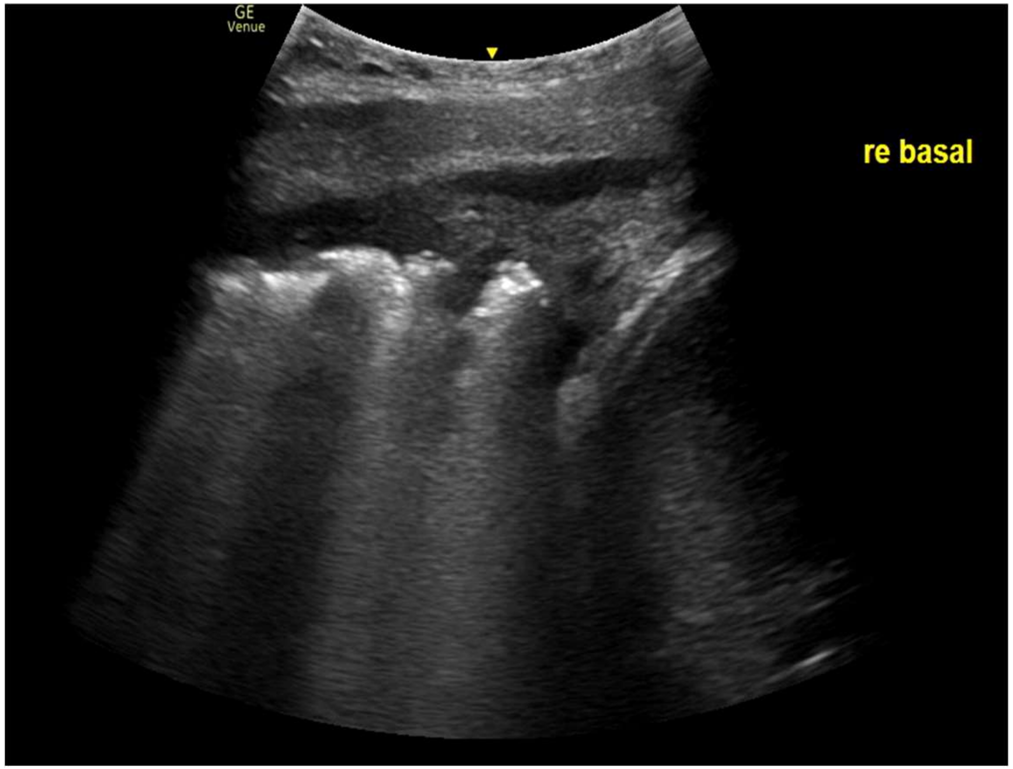

H
-03
BG:12 75/-/2/4/0/-/5
L65 HdTHI-R Thorax
85mm
1HI Com
2Biplane
3HI Sup.B
4HI Sup.Rst
5Angle;6
6Density;1
7HdTHI

Konsolidierung (C-Profil)

- = echoarmer subpleuraler Bereich mit leber- oder gewebeähnlicher Struktur

- Mit **Aerobronchogramm:** Luftgefüllte (=echoreiche) Bronchien in Konsolidation

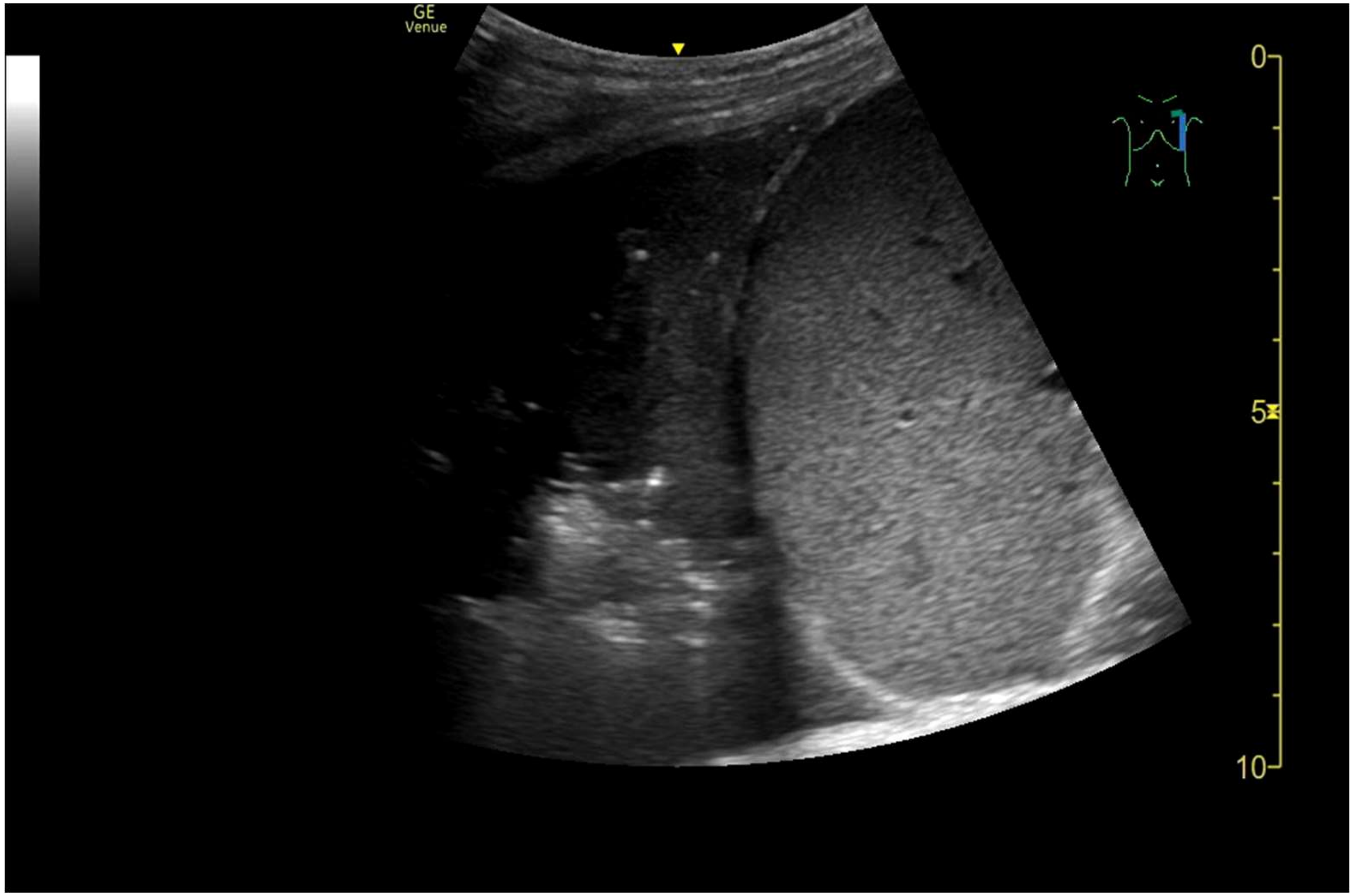
- Mit **Fluidobronchogramm**: Flüssigkeitsgefüllte (echoleer) Bronchien in Konsolidation

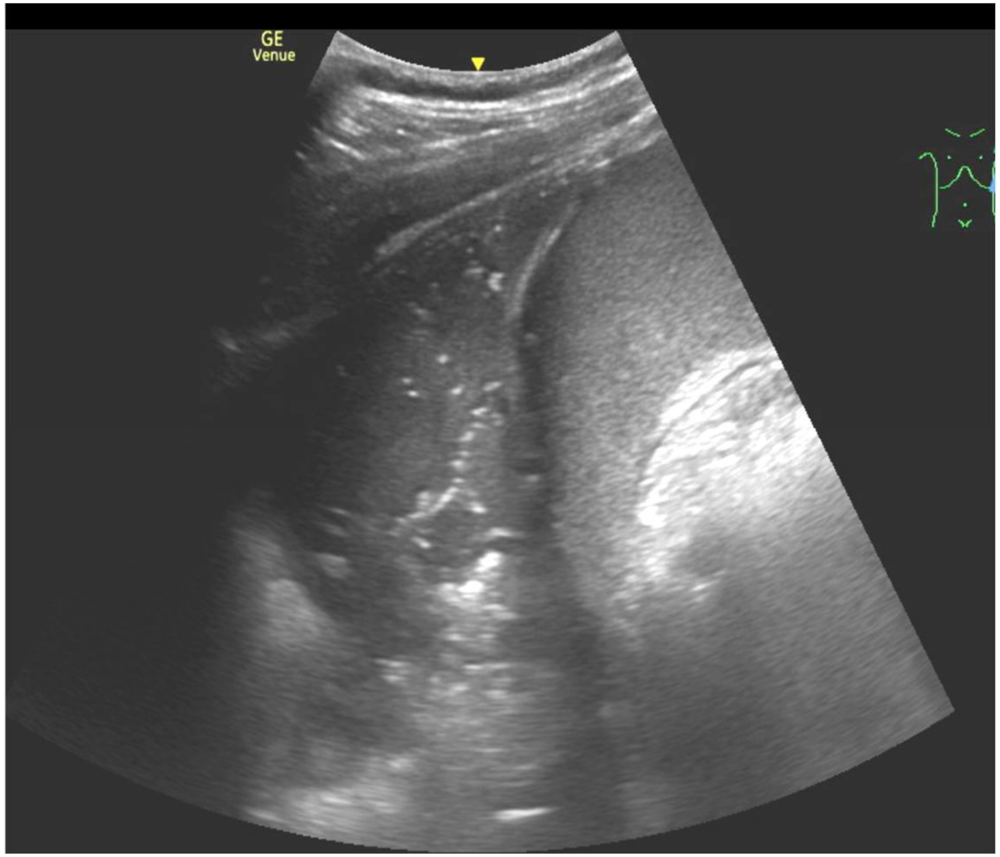


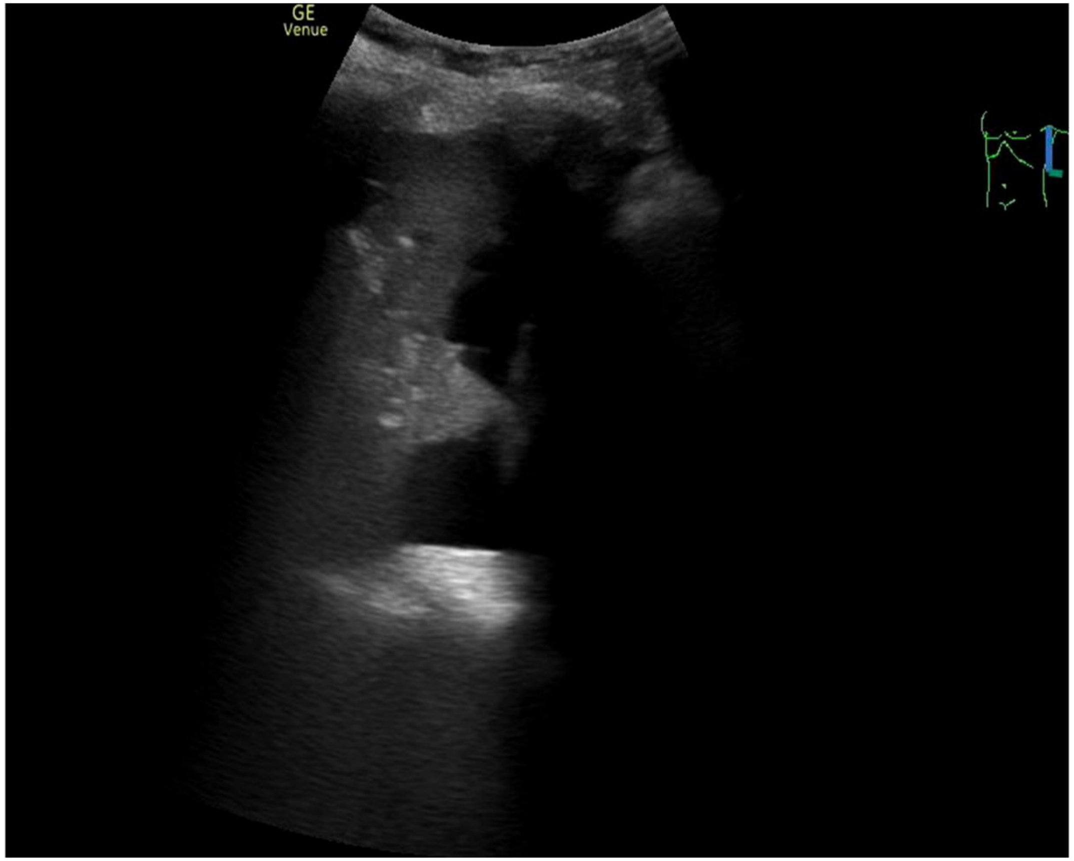
C-Profil

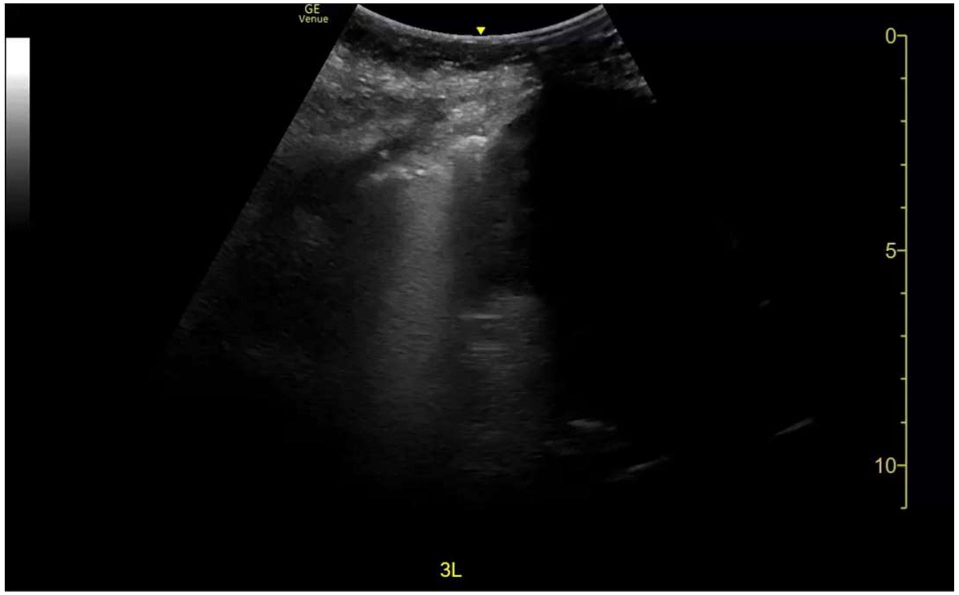
Vorkommen bei:

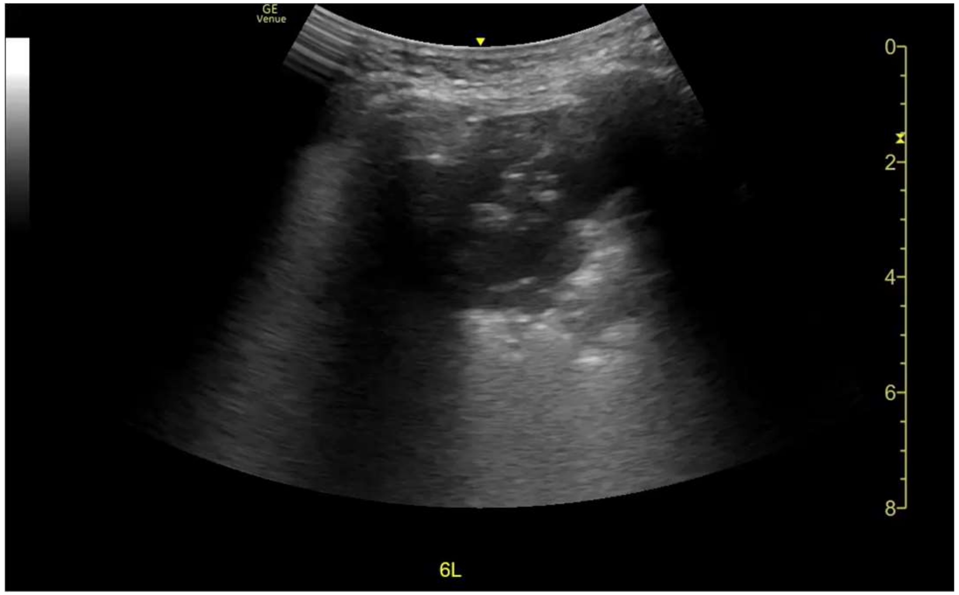
- Pneumonie
- Lungenembolie
- Tumor
- Atelektase
- Kontusion

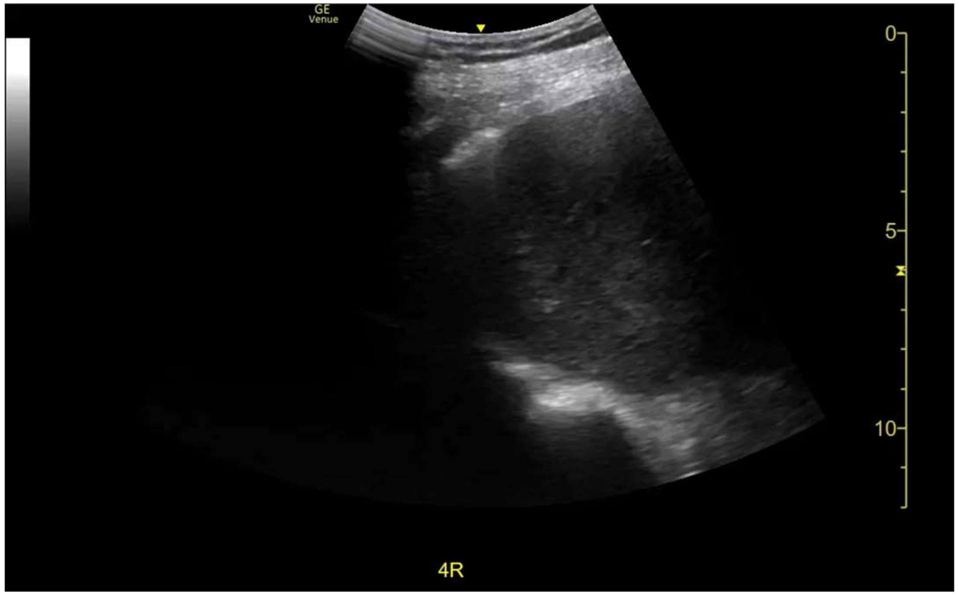

GE
Venue
0
5
10

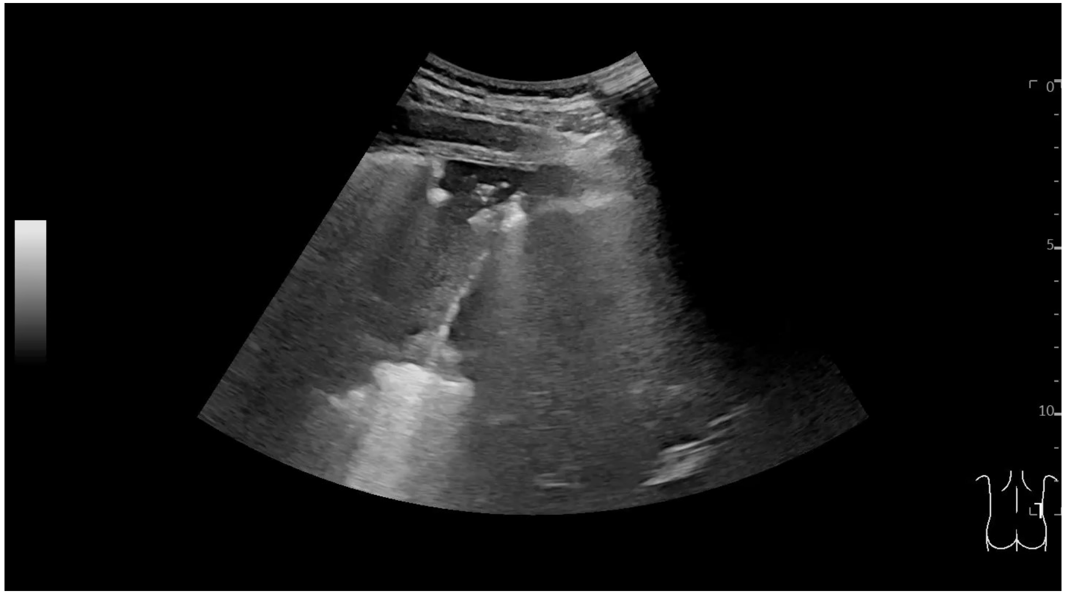

GE
Venue


GE
Venue


GE
Venue
0
5
10
3L


GE
Venue
0
2
4
6
8
6L


GE
Venue
0
5
10
4R


0
5
10

luzerner kantonsspital
LUZERN SURSEE WOLHUSEN

Take home

- Lungensonographie nutzt Artefakte, gesundes Lungengewebe ist sonographisch nicht darstellbar
- Pneumothorax Algorithmus (Pleuragleiten? Lungenpuls? Lungenpunkt?)
- M-Mode in unklaren Fällen Thoraxgleiten (Lungenpuls? Seashore sign? Barcode sign?)
- Ohne M-Mode: Videos!
- Pleuraerguss: kompliziert/unkompliziert, ganz dorsal suchen, Vorhangphänomen, spine sign
- A-Linien: Wiederholungsartefakte (Normalbefund, auch vorhanden bei PTX)
- B-Linien: Summation multipler Reflexionen (Entzündung, Flüssigkeit, nicht vorhanden bei PTX)
- >/= 3 B-Lines/Thoraxquadrant signifikant
- C-Profil: Konsolidierte (hepatifizierte Lunge), v.a. Pneumonie, Atelektase