



Pleuraerguss: diagnostisches Management Aktuelle Strategie

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Pleuraerguss

- Anamnese/ körperliche Untersuchung
- Bildgebung
- Punktion: Labor und Zytologie
- Thorakoskopie

Pleuraerguss-Ursachen

TABLE 2
Leading Causes of Pleural Effusion in the United States*

Cause	Annual incidence	Transudate	Exudate
Congestive heart failure	500,000	Yes	No
Pneumonia	300,000	No	Yes
Cancer	200,000	No	Yes
Pulmonary embolism	150,000	Sometimes	Sometimes
Viral disease	100,000	No	Yes
Coronary-artery bypass surgery	60,000	No	Yes
Cirrhosis	50,000	Yes	No

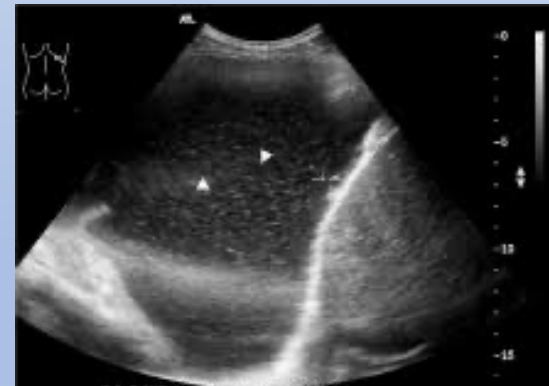
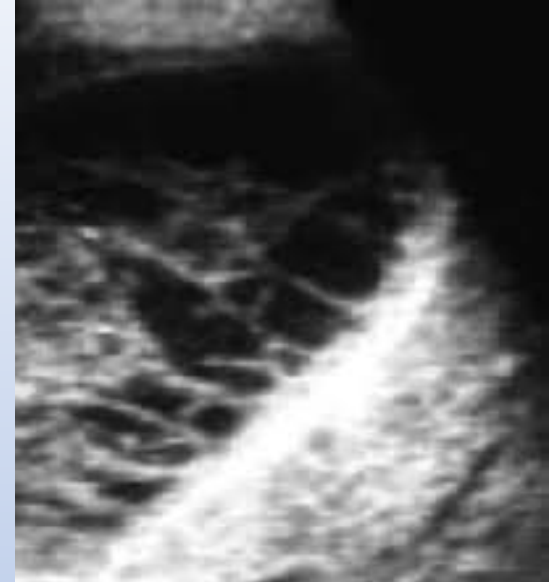
*—Based on analysis of patients subjected to thoracentesis.

Reprinted with permission from Light RW. Clinical practice. Pleural effusion. *N Engl J Med* 2002;346:1971.

- Tuberkulose
- Asbestose
- Gefesselte Lunge
- Rheuma/Lupus
- Medikamentös
- Chylothorax

Sonographie-Exsudat

- Gefangener Erguss
- Echoreich
- Fibrinfäden
- Septiert
- Pleura >3mm



Sonographie-Transsudat

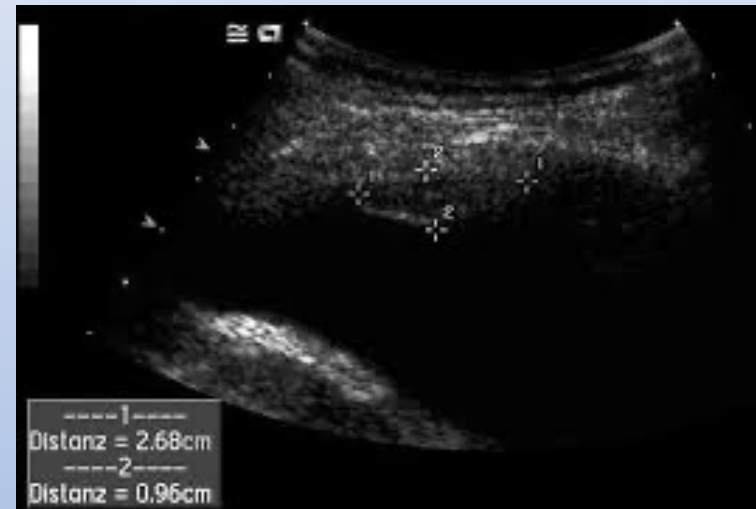
- Bilaterale Ergüsse
- Echofreier Erguss
- Fehlen von Kammern
- Gestaute V. cava



Azam, Owen, A simple score based on ultrasound criteria to distinguish between exudative vs. Transudativ pleural effusions, Eur Resp Journal 2014

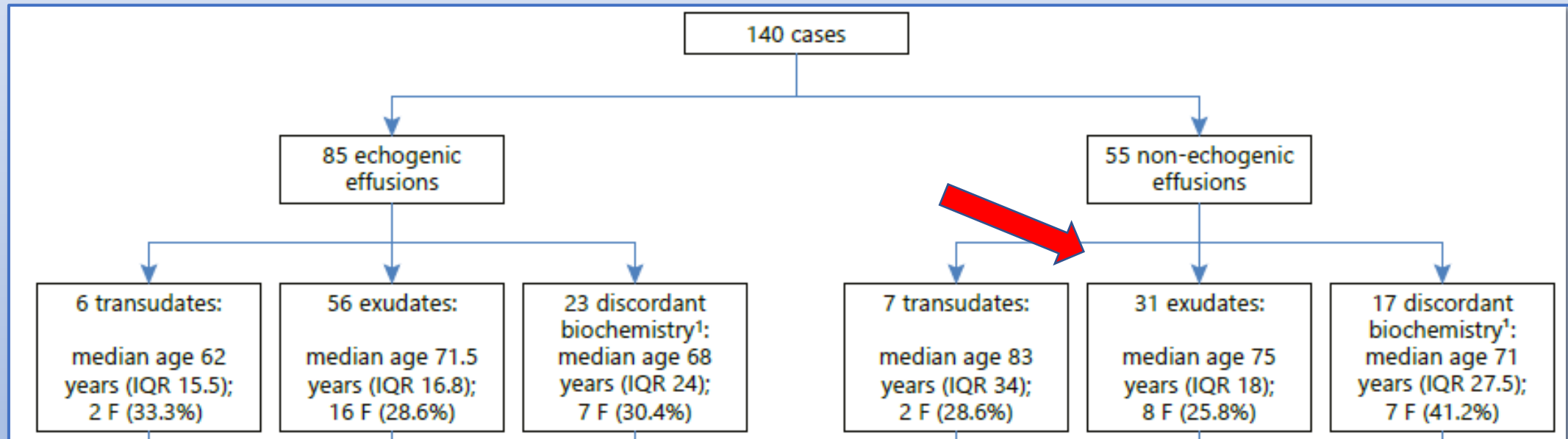
Sonographie-Maligne

- Pleuraverdickung $> 1\text{cm}$
- Noduläre Verdickung
- Zwerchfellverdickung



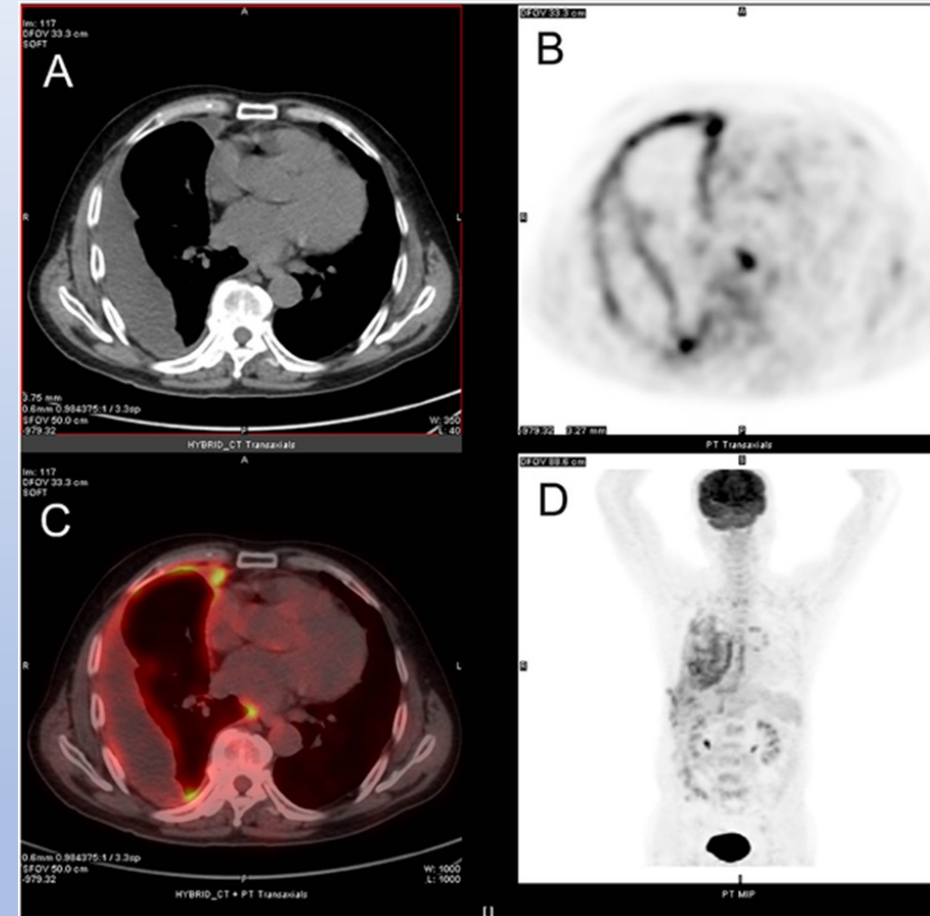
Qureshi, Rahman, Gleeson. Thoracic ultrasound in the diagnostic of malignant pleural effusion, Thorax 2009

Prospektive Analysis of the Predictive Value of Sonographic Pleural Fluid Echogenicity for the Diagnosis of exudative Effusion



FDG PET/CT bei malignen Ergüssen

- 176 Patienten mit definitiver Diagnose (108 maligne)
- CT-Morphologie: Knotige oder irreguläre Pleuraverdickung
- PET: Höheres uptake als Mediastinum (diffus, nodulär, multinodulär)
- 75% Sensitivität für Malignität für CT allein, PET 92%
- 94% Sensitivität für PET/CT (Metastasen und Mesotheliom)
- 93% Spezifität für benigne Ergüsse (falsch pos. bei Tuberkulose)



Sun PLOS one 2016: The role of FDG PET/CT Integrated Imaging in Distinguishing Malignant from Benign Pleural Effusion

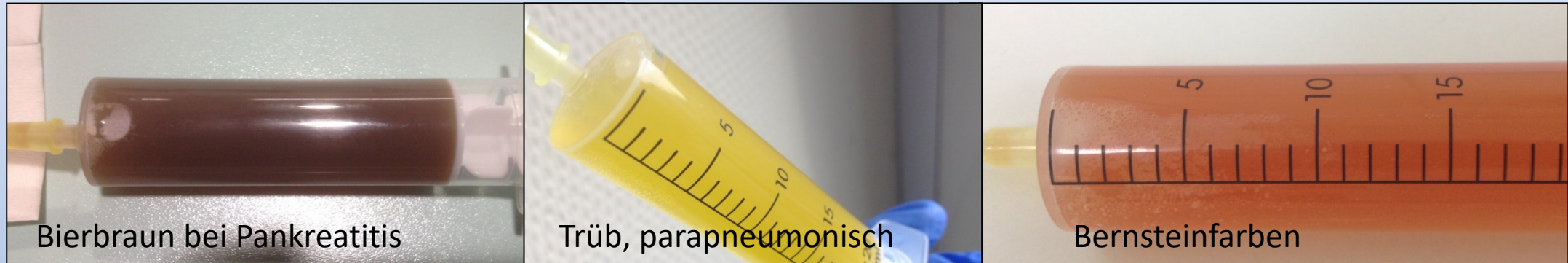
Diagnostische Ergusspunktion?

Empfehlung:

- Jeder Erguss $>1\text{cm}$, außer offensichtliche kardiale Dekompensation
- Punktion ultraschallgestützt

Diagnostische Schritte:

1. Makroskopische Beurteilung



2. Differenzierung zwischen Exsudat und Transsudat

Lights Kriterien 1972: LDH, Protein

3. Ergusszytologie

Lights Kriterien für Exsudat

1. Ergussprotein/Serumprotein $> 0,5$
2. Erguss LDH/ Serum LDH $> 0,6$
3. Erguss LDH $> 2/3$ Serum LDH Grenzwert

Transsudat: Serumalbumin- Ergussalbumin $> 1,2\text{mg/dl}$

Light RW, MacGregor MI, Luchsinger PC, Ball WC. Pleural effusions: the diagnostic separation of transudates and exudates. *Ann Intern Med* 1972;77

Romero-Candeira S, Hernandez L. The separation of transudates and exudates with particular reference to the protein gradient. *Curr Opin Pulm Med* 2004 10

Lights Kriterien

Table 1. Causes of the 150 Pleural Effusions

Effusions	Number
Transudates	47
Congestive heart failure	39
Other transudates	8
Cirrhosis	5
Nephrosis	3
Exudates	103
Malignancy	43
Effusions associated with pneumonia	26
Tuberculosis	14
Other exudates	20
Pancreatitis	6
Pulmonary infarction	5
Postmyocardial infarction (Dressler's) syndrome	3
Systemic lupus erythematosus	1
Rheumatoid pleuritis	1
Pleural actinomycosis	1
Trauma	2
Infectious hepatitis	1

Ergussprotein:

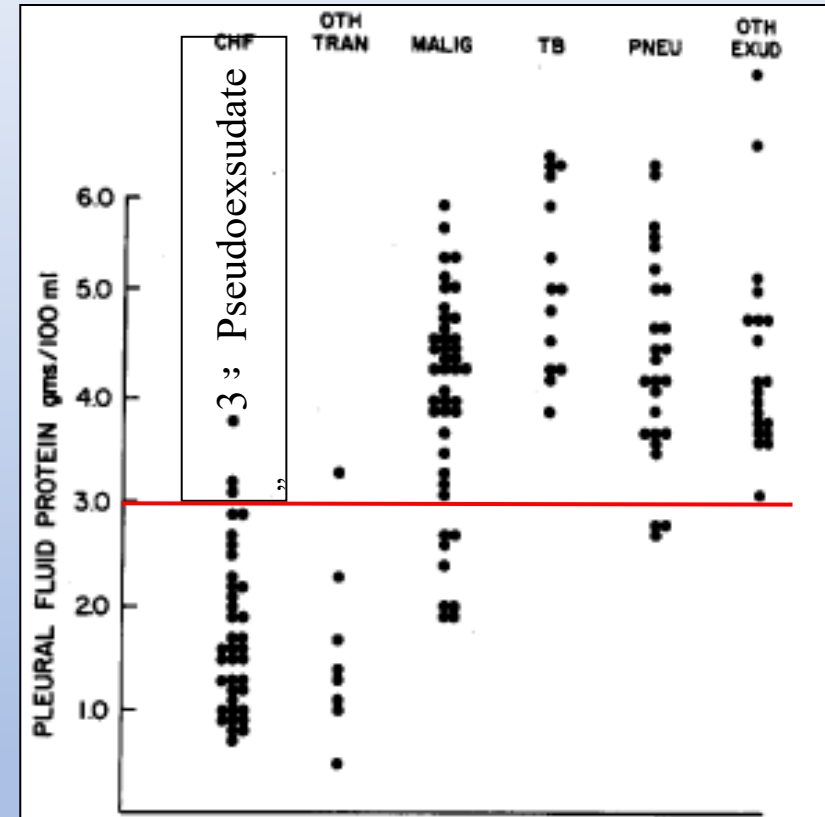
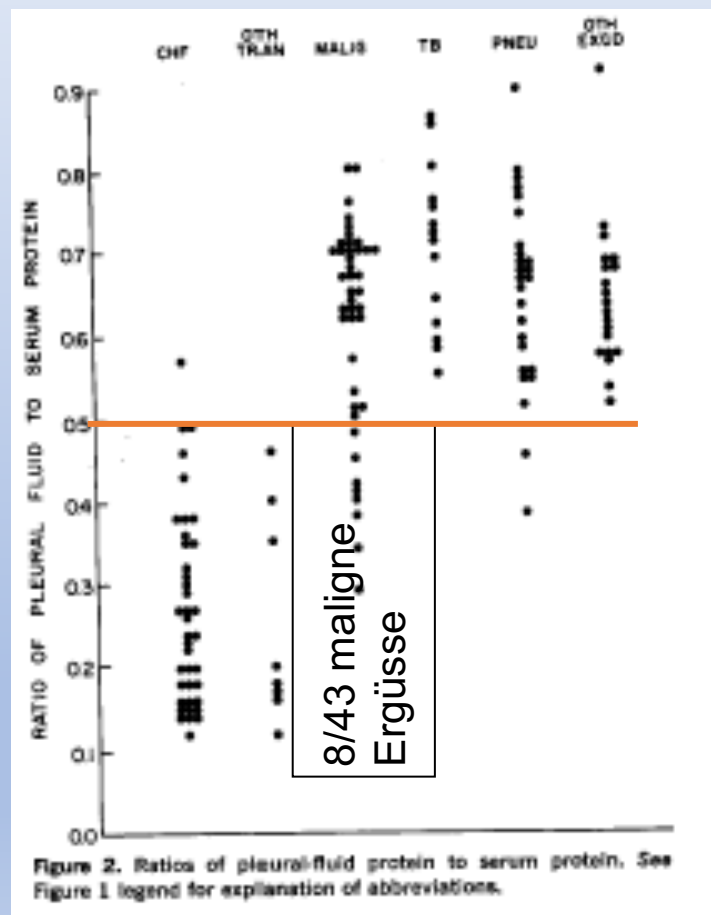


Figure 1. Pleural-fluid protein levels in effusions secondary to congestive heart failure (CHF), other transudates (OTH TRAN), malignancy (MALIG), tuberculosis (TB), pneumonia (PNEU), and other exudates (OTH EXUD). Each point represents one pleural fluid.

Erguss/Serum Protein Verhältnis



- 97% Sensitivität für Exsudate
- 74% Spezifität

Simplified criteria using pleural fluid cholesterol and LDH to distinguish between exudative and transudative pleural effusions

- Kohortenstudie mit 423 Punkttaten
- Höchste Sensitivität für Exsudate (97%):
LDH und Cholesterin
 - **LDH > 0,6 vom LDH-Serum Grenzwert**
 - **Cholesterin > 40mg /dl**
- Cholesterin durch Zelluntergang und Gefäßleckage

Table 1. Final clinical or pathological diagnoses

	Main cohort (n = 311)		Validation cohort (n = 88)	
	n	%	n	%
<i>Exudate</i>				
Post-cardiac injury syndrome	123	39.5	2	1.7
Malignancy	97	31.2	68	60.7
Parapneumonic infection	24	7.7	6	5.6
Connective tissue disease	9	2.9	3	2.7
Hemothorax	6	1.9	0	0
Benign asbestos pleural effusion	5	1.6	4	3.6
Chylothorax	4	1.3	2	1.7
Drug related	1	0.3	0	0
Yellow nail syndrome	0	0	2	1.7
Pancreatitis	0	0	1	0.9
<i>Transudate</i>				
Heart failure	40	12.9	18	16.1
Cirrhosis	2	0.6	4	3.6
Peritoneal dialysate	0	0	1	0.9
Hypoalbuminemia	0	0	1	0.9

Simplified criteria using pleural fluid cholesterol and LDH to distinguish between exudative and transudative pleural effusions

Table 2. Diagnostic accuracy for the diagnosis of exudative pleural effusions – main cohort

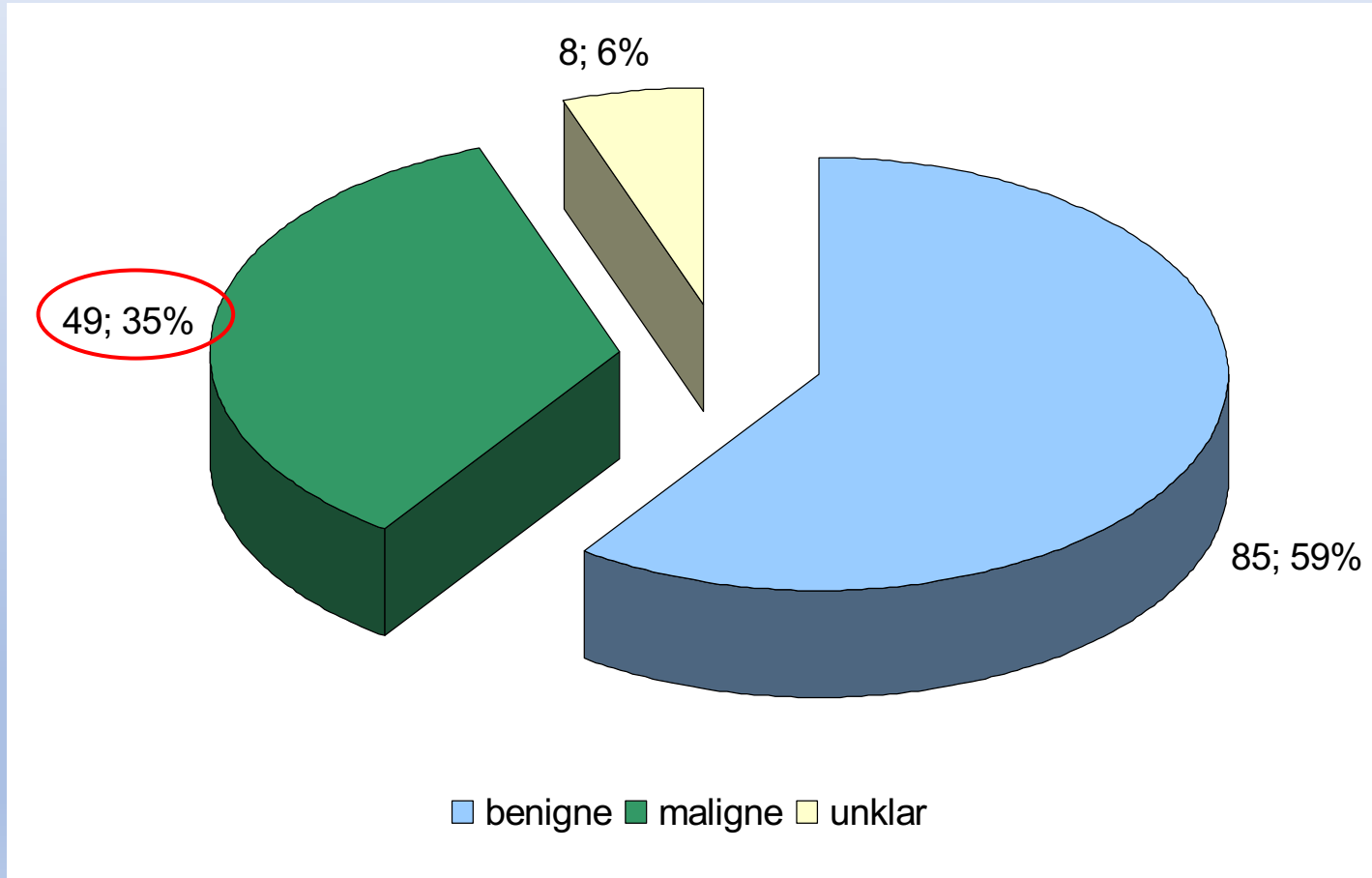
	SE, % (95% CI)	SP, % (95% CI)	LR+ (95% CI)	LR- (95% CI)
Light's criteria ^a	94 (90–96)	76 (61–88)	3.9 (1.8–6.1)	0.08 (0.04–0.12)
Modified Light's criteria ^b	96 (92–98)	76 (61–88)	4.0 (1.8–6.2)	0.06 (0.02–0.09)
Costa's criteria ^c	90 (86–93)	83 (69–93)	5.4 (1.7–9.1)	0.12 (0.07–0.17)
Pleural LDH >0.6 the upper limit of the normal serum OR pleural cholesterol >1.04 mmol/L (40 mg/dL)	97 (94–99)	79 (63–89)	4.5 (2.5–8.1)	0.04 (0.02–0.08)
Pleural LDH >0.6 the upper limit of the normal serum OR pleural cholesterol >1.16 mmol/L (45 mg/dL)	96 (93–98)	81 (66–91)	5.0 (1.9–8.1)	0.05 (0.02–0.08)
Pleural LDH >0.6 the upper limit of the normal serum OR pleural cholesterol >1.42 mmol/L (55 mg/dL)	94 (91–97)	88 (74–96)	7.9 (1.4–14.5)	0.06 (0.03–0.1)

^a Light's criteria: ratio of pleural fluid protein to serum protein >0.5; ratio of pleural fluid LDH to serum LDH >0.6 or pleural fluid LDH >2/3 the upper limit of normal serum LDH. ^b Modified Light's criteria: Light's criteria or pleural cholesterol >1.42 mmol/L (55 mg/dL). ^c Costa's criteria: pleural LDH >200 U/L or pleural cholesterol >1.16 mmol/L (45 mg/dL).

Ätiologie von Pleuraergüssen mit Eiweißgehalt zwischen 2 und 3g/dl

Modifiziertes Transsudat, z.B.:

- Hypoalbuminämie
- Atelektase



Transsudate bei malignen Ergüssen

- 88 Pat.
- Zytologie und Laborchemie des Punktat
- Komorbiditäten erfasst (Herzinsuffizienz, Leberzirrhose, Nephrot. Syndrom)
- 8% der malignen Ergüsse waren Transsudate
 - ➔ weitere zytologische Aufarbeitung erforderlich

Weitere Diagnostik

Test	Wert	Diagnose	Kommentar
pH	<7,2	Parapneumonischer Erguss, Empyem	Falls Infektion vermutet
ADA	>50 U/l	Tuberkulose	Lymphos > 90%
Interleukin-33	>19,2 ng/l	Tuberkulose (92% Sensitivität, 97% Spez.)	Zeigt Zellschaden
Hämatokrit	> 0,5 des Blutes	Hämatothorax	
Triglyzeride	>110 mg/dl	Chylothorax	Milchiges Punktat
NT-pro BNP	>1500pg/ml	Herzinsuffizienz	
Glukose	<60mg/dl	Infektiös, TBC, RA, maligne (<10%)	Niedriger pH, hohes LDH
Neutrophile	>50%	Parapneumonischer Erguss, Embolie	
Amylase	> Grenzwert	Pankreatitis, Ösophagusruptur, maligne (<20%)	
Rheumafaktor	>1:320	Rheumatoide Arthritis	Lymphos, Exsudat

Alaarag, BMC Pulmonary Medicine 2019: Diagnostik role of IL-33 in the differentiation of pleural effusions especially tuberculous and malignant effusions

Diagnostik von malignen Ergüssen-Tumormarker

CEA, CA 125, CA 15-3, CYFRA 21-1

Vorteil: objektiv, gering invasiv

54% Sensitivität nur Tumormarker, ca. 90% Spezifität

69% Sensitivität Tumormarker plus Zytologie

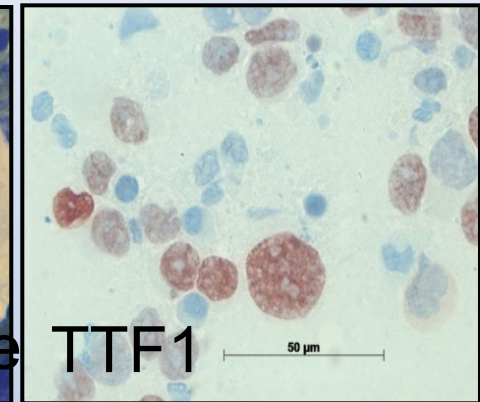
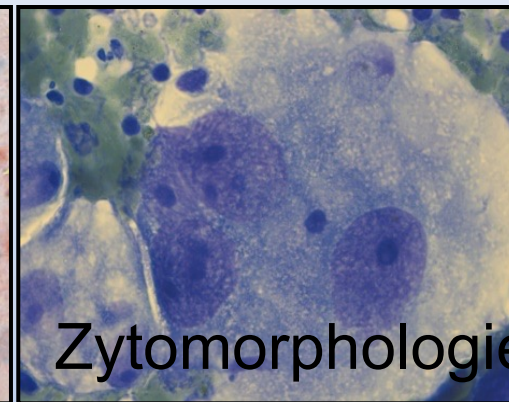
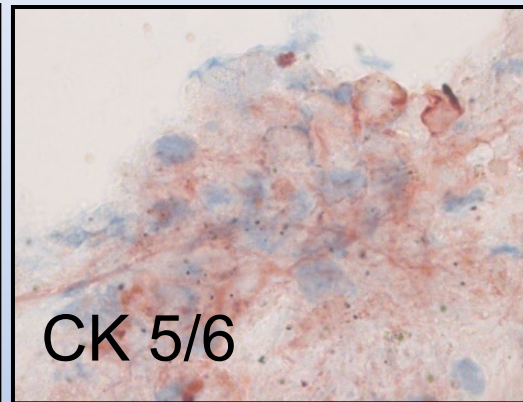
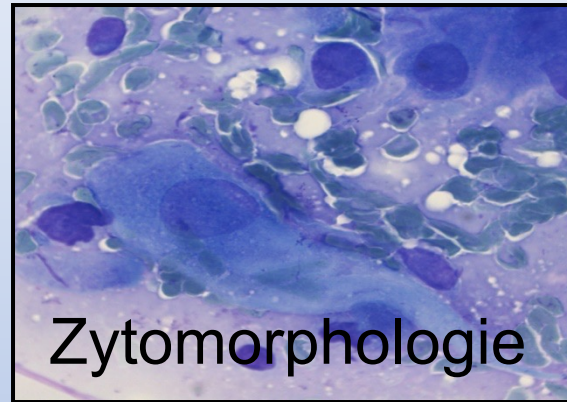
Porcel JM, Vives M, Esquerda A, Salud A, Perez B, Rodríguez-Panadero F. Use of a panel of tumor markers (carcinoembryonic antigen, cancer antigen 125, carbohydrate antigen 15-3, and cytokeratin 19 fragments) in pleural fluid for the differential diagnosis of benign and malignant effusions. *Chest* 2004;126:1757–1763

Diagnostik von malignen Ergüssen-Biomarker

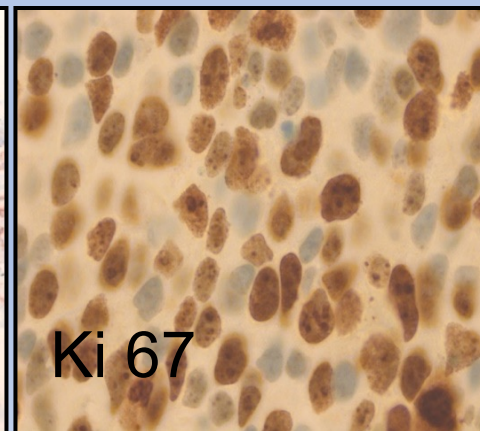
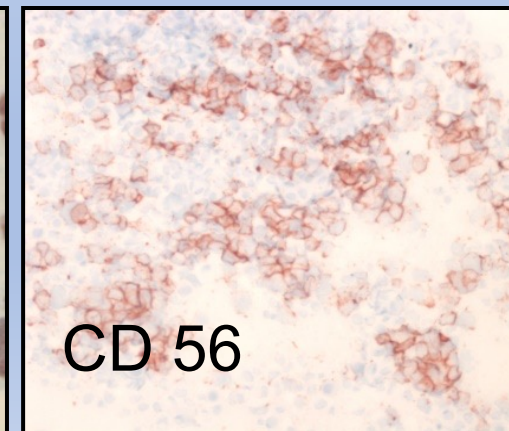
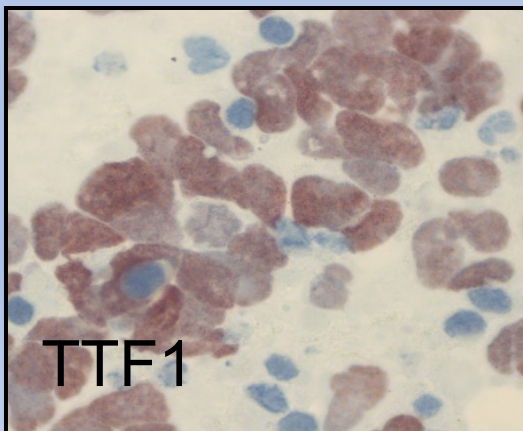
- **CEA+CA 19-9** und **CEA+CA 15-3**: Sensitivität 65%, Spezifität 99%
- Zellfreie **mRNA**, Sensitivität bis 96% bei hoher Spezifität
- Zellfreie **microRNA**, Sensitivität 87%, höher + **CEA und Cyfra 21-1**
- **Cancer ratio**: Serum LDH:Pleura ADA, 97% Sensitivität, 89%Spezifität
- Cancer ratio plus: Cancer ratio: Lymphozyten im Erguss
- Tumor-assoziierte Makrophagen, VEGF,

Zytodiagnostik

Plattenepithelkarzinom



Kleinzelliges Karzinom



Zytodiagnostik/ weitere Diagnostik

- 60% Sensitivität für maligne Ergüsse, fast 100% Spezifität
- Ergebnisse Abhängig von Tumorart, Exfoliation
- Zweite Punktion steigert Ausbeute um 15%
- Blinde Pleurabiopsie steigert um 7-27%
- Vs 87% Ausbeute für CT gesteuerte Punktion
- Pleurabiopsie 93% diagnostische Ausbeute für Tb

Maskell, BTS guidelines for the investigation of a unilateral pleural effusion in adults, Thorax 2003

Local anaesthetic thoracoscopy: British thoracic pleural disease guideline 2010, Thorax

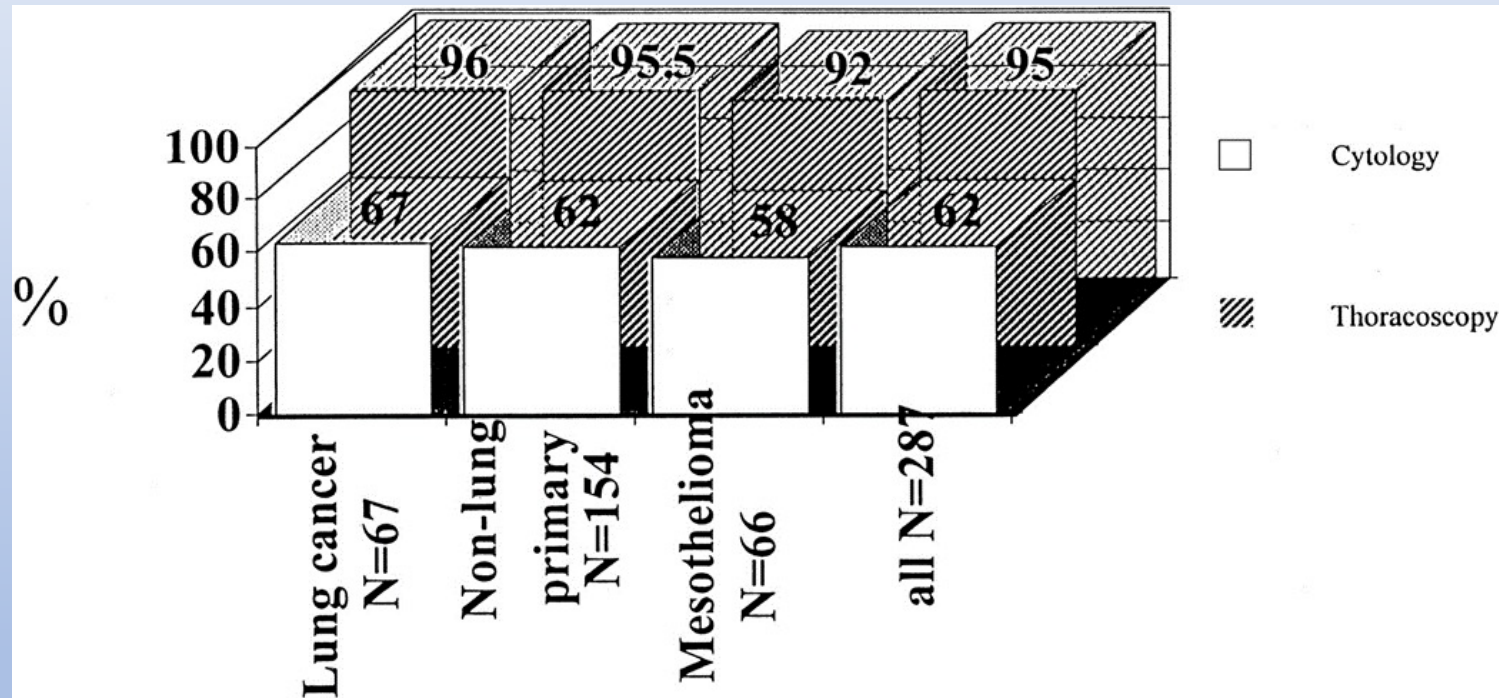
Indikation zur diagnostischen Thorakoskopie

- Exsudativer / ätiologisch ungeklärter Pleuraerguss
- Klärung von M1a beim Lungenkarzinom
- Histologische Diagnosesicherung



Gezielte und ausreichende PE

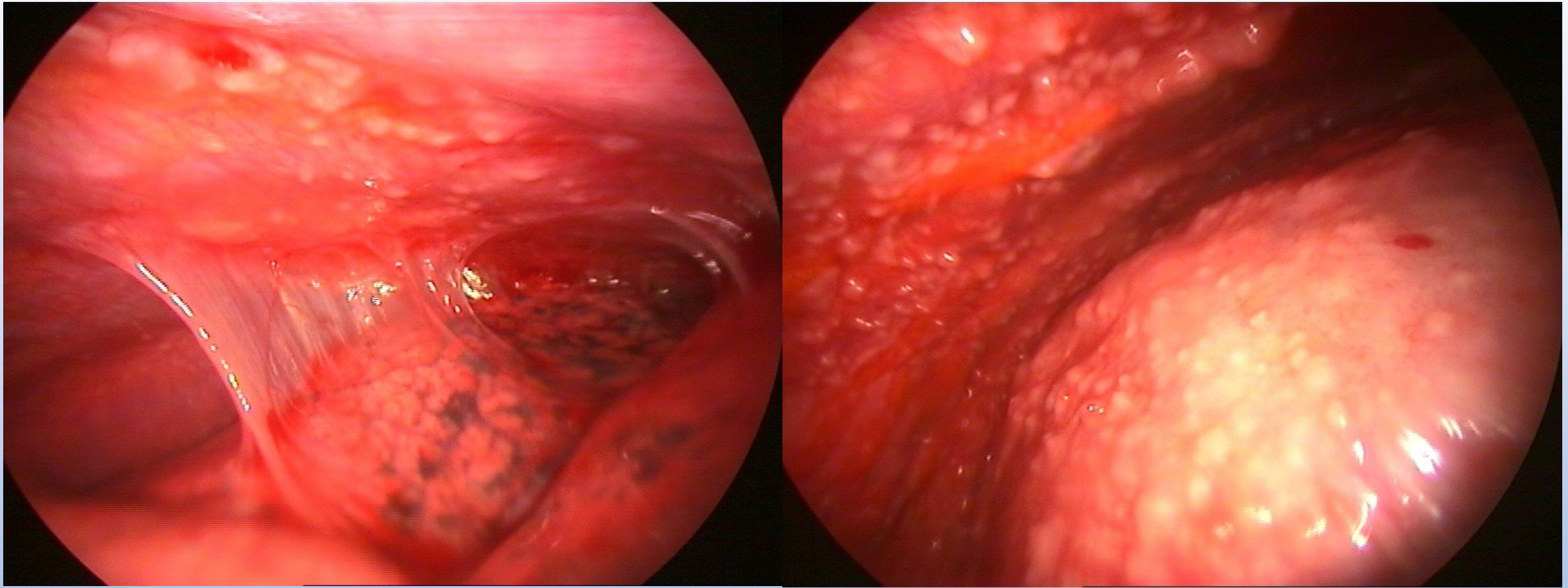
ATS Statement 2000



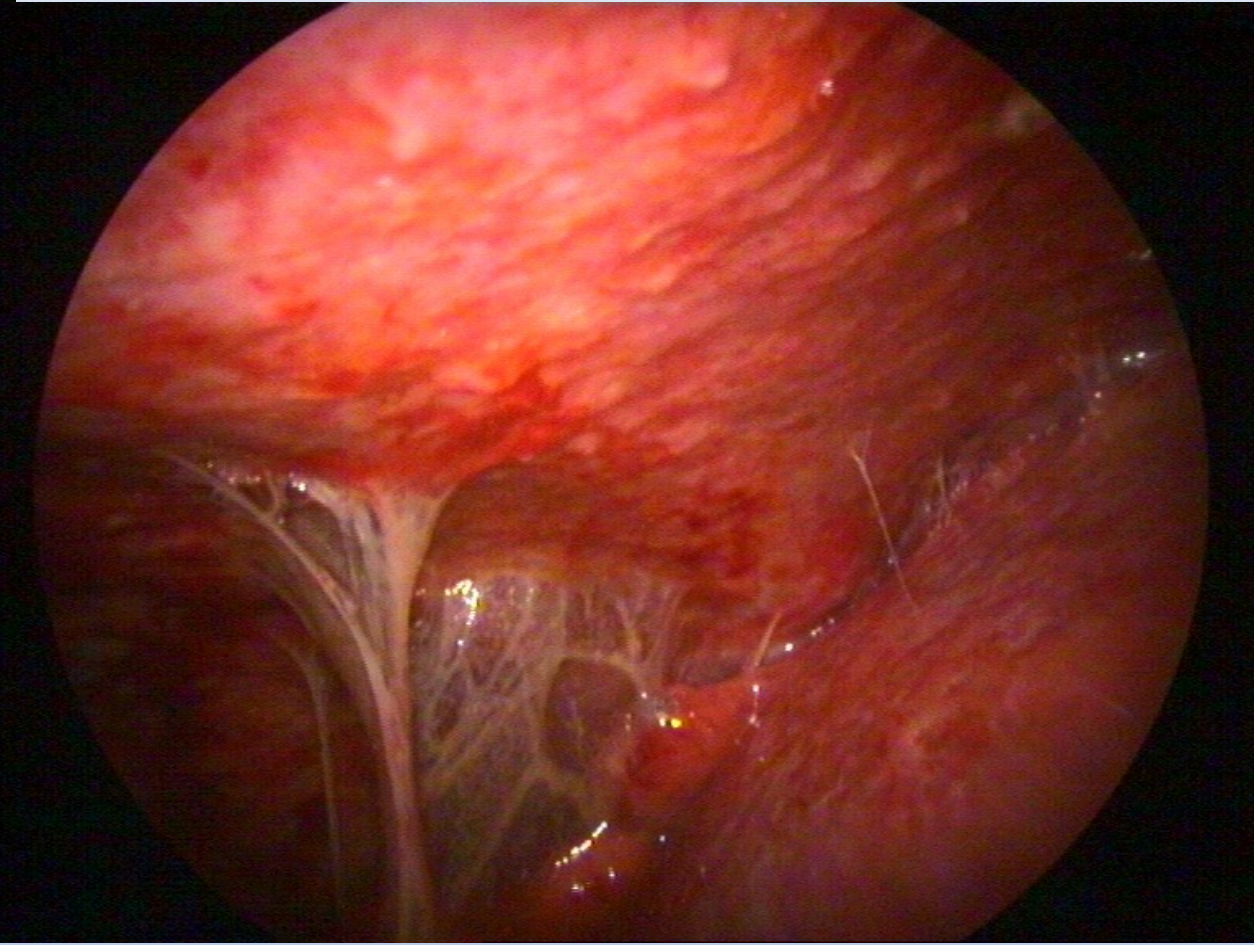
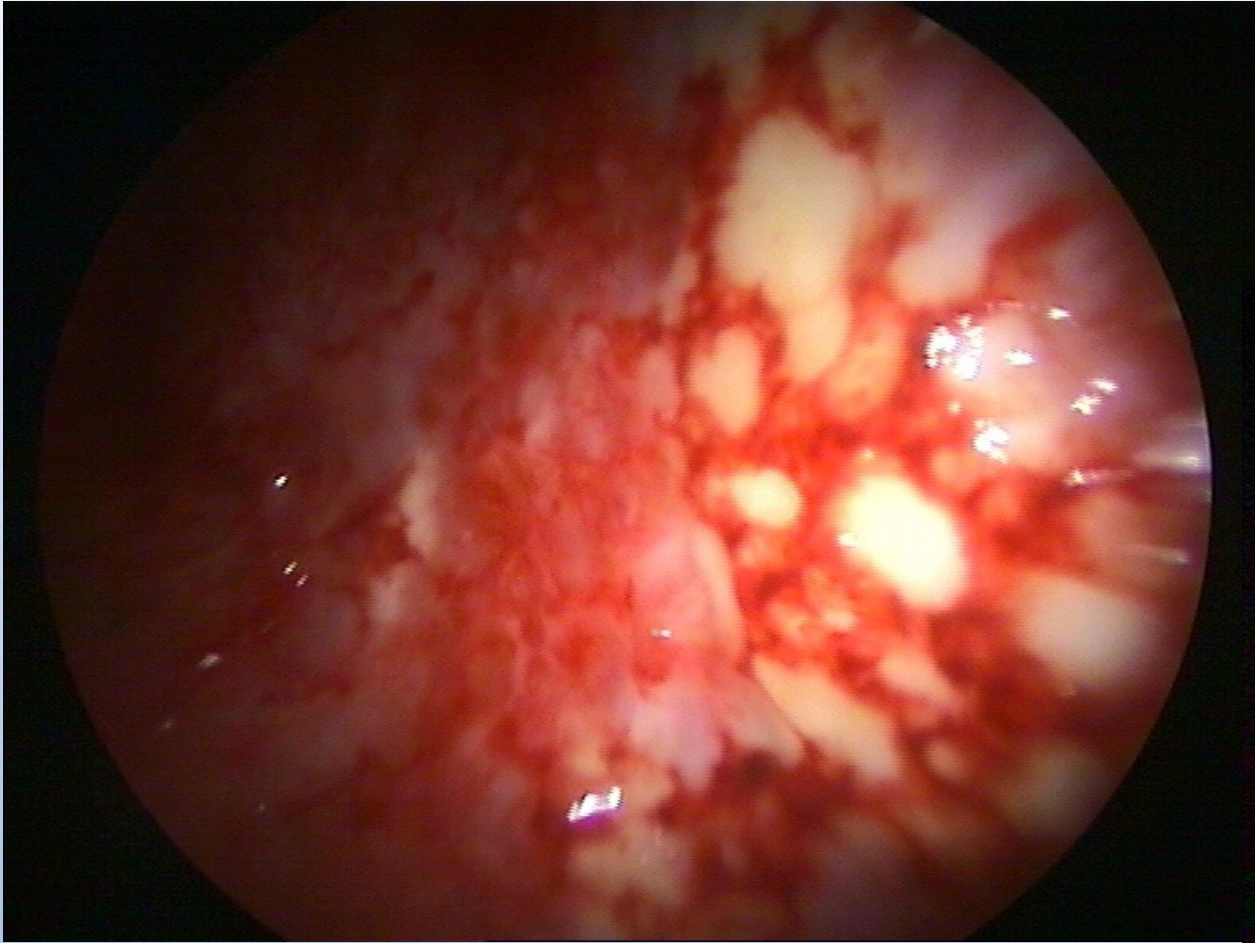
Effektivität der Thorakoskopie

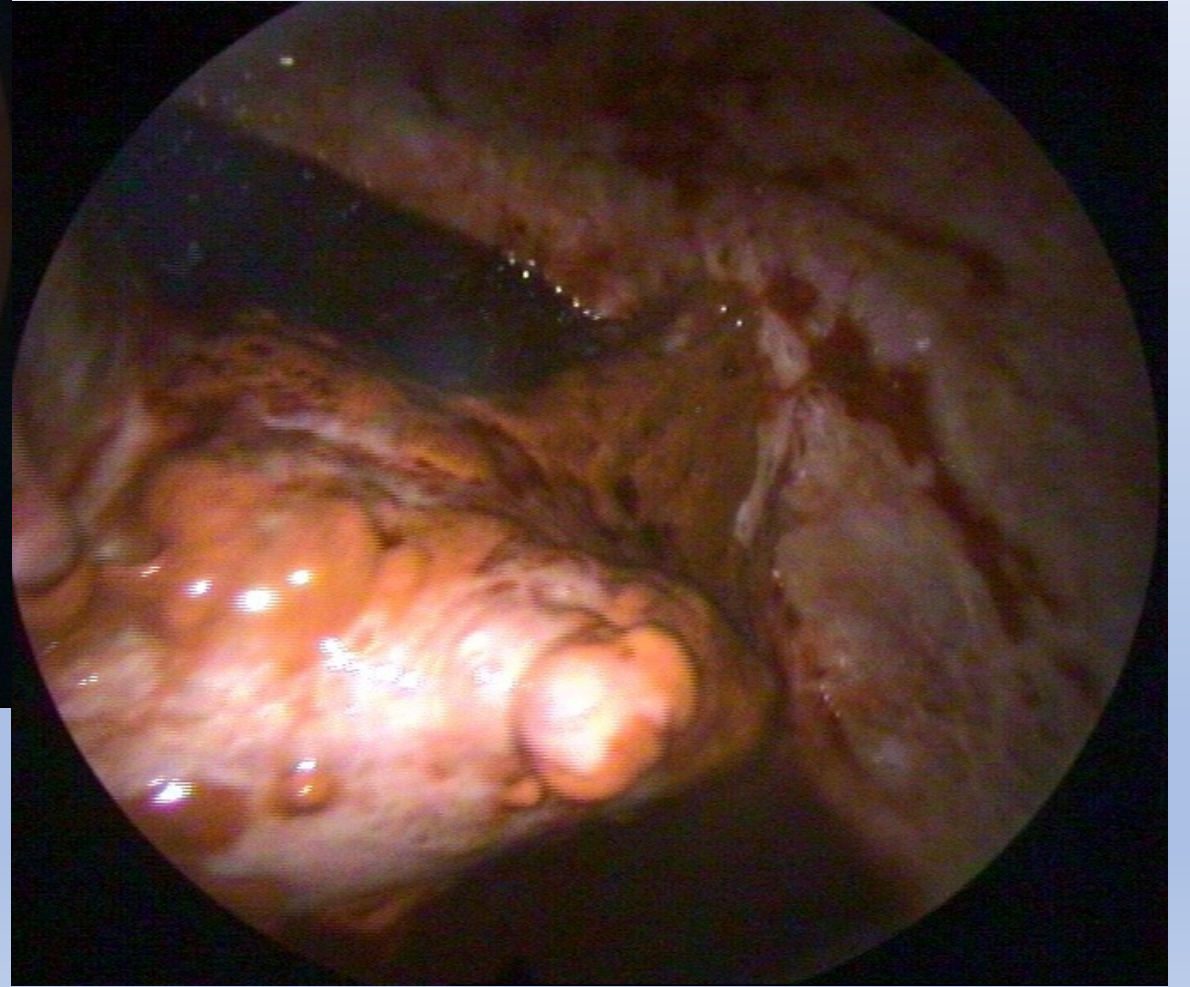
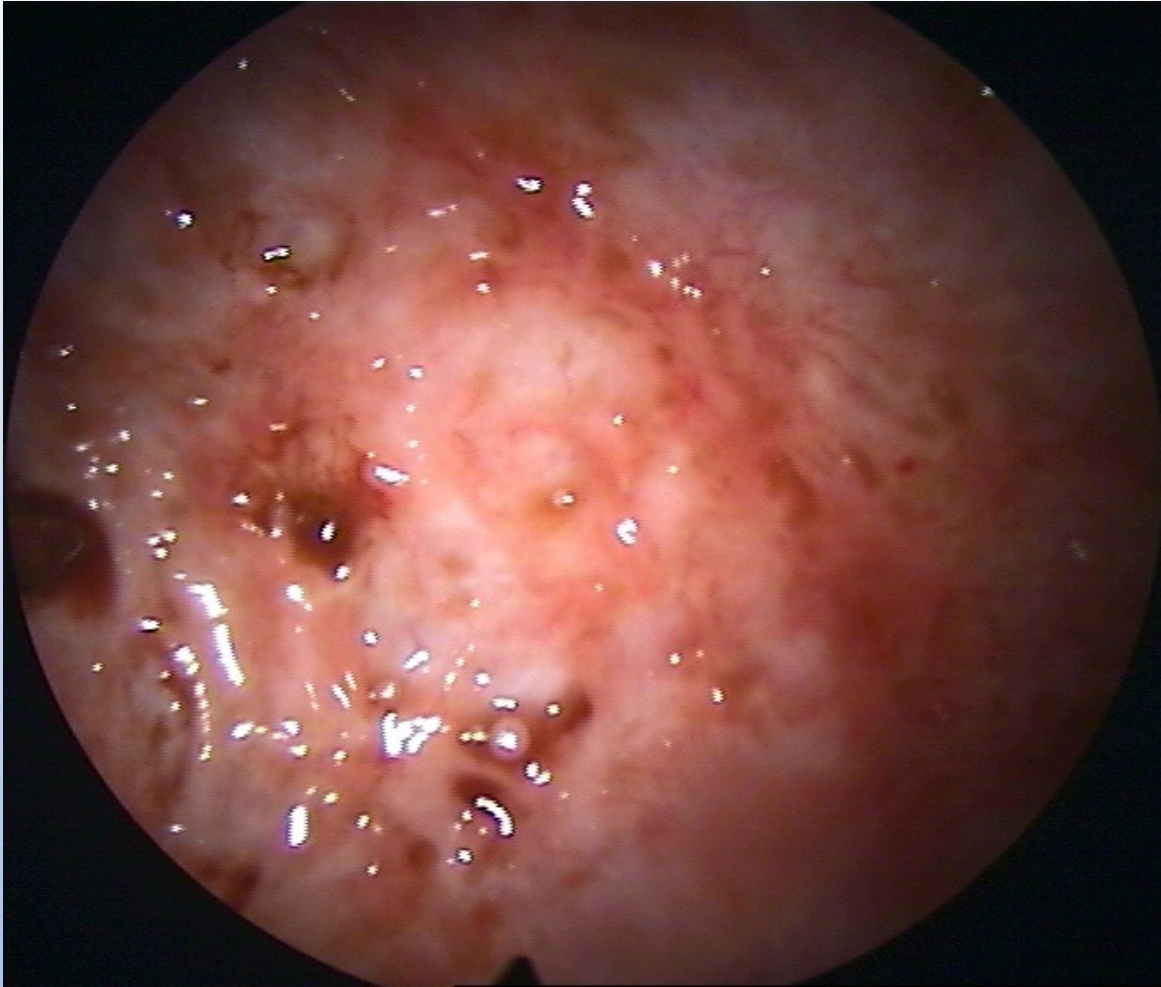
- 833 Patienten
- Zuvor Punktion, teils blinde Pleurabiopsie ohne Diagnose
- TS war diagnostisch bei 771 Patienten (92,6%)
- 41% maligne, 51% benigne
- Komplikation: 0,4% Empyeme

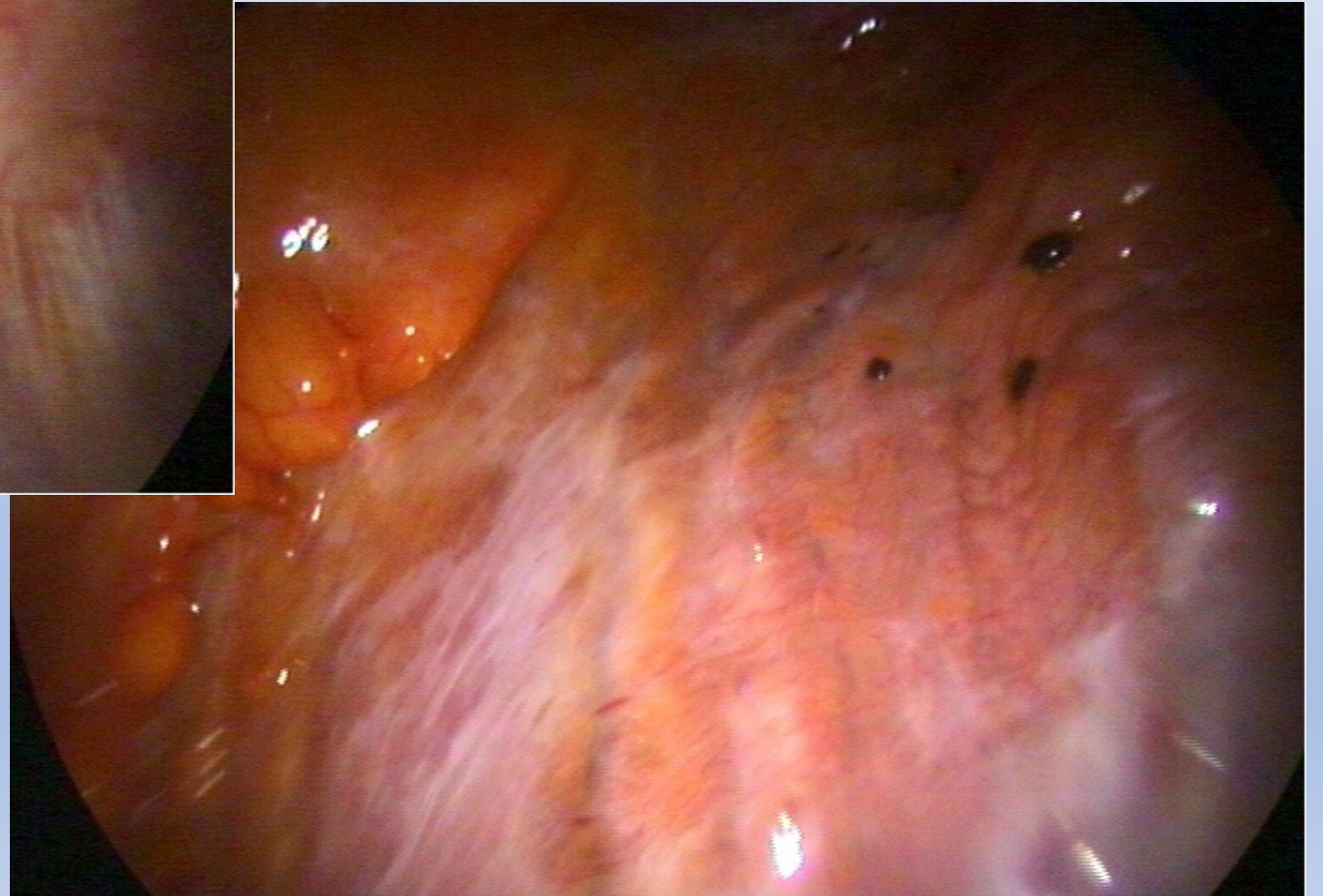
Wang, Efficacy and safety of diagnostic thoracoscopy in undiagnosed pleural effusions Respiration 2015



PCR und Mikroskopie negativ
Kultur und Histologie positiv







Fazit

- Pleuraerguss gehört abgeklärt
- Diagnostische Schritte einhalten
- Thorakoskopie liefert hohe diagnostische Ausbeute

Vielen Dank

ENDE

A large, three-dimensional sculpture of the word 'ENDE' in bright yellow, block letters. The letters are mounted on a low concrete base. The sculpture is situated on a paved promenade overlooking the ocean. In the background, a few people are visible near the water's edge, and the sky is clear and blue.