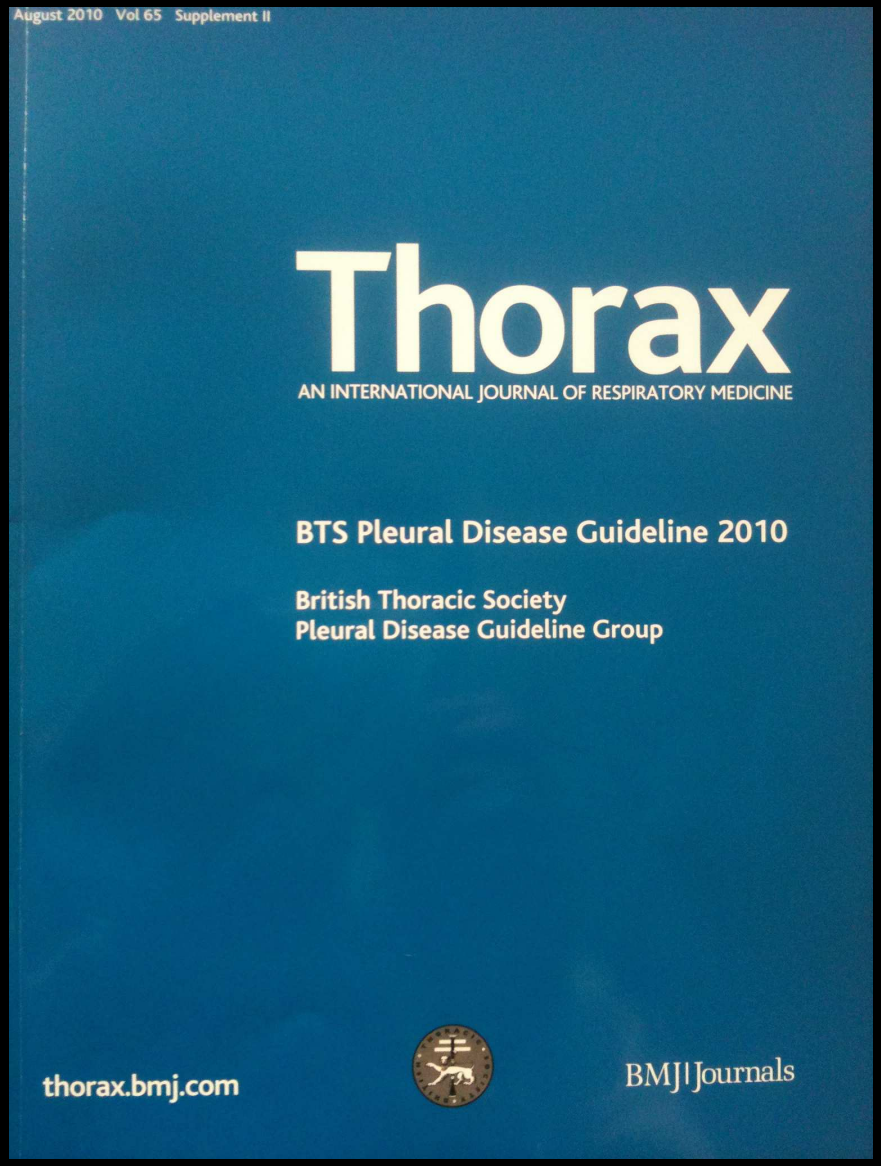
Investigation of an undiagnosed pleural effusion

Dr Nick Maskell

University of Bristol

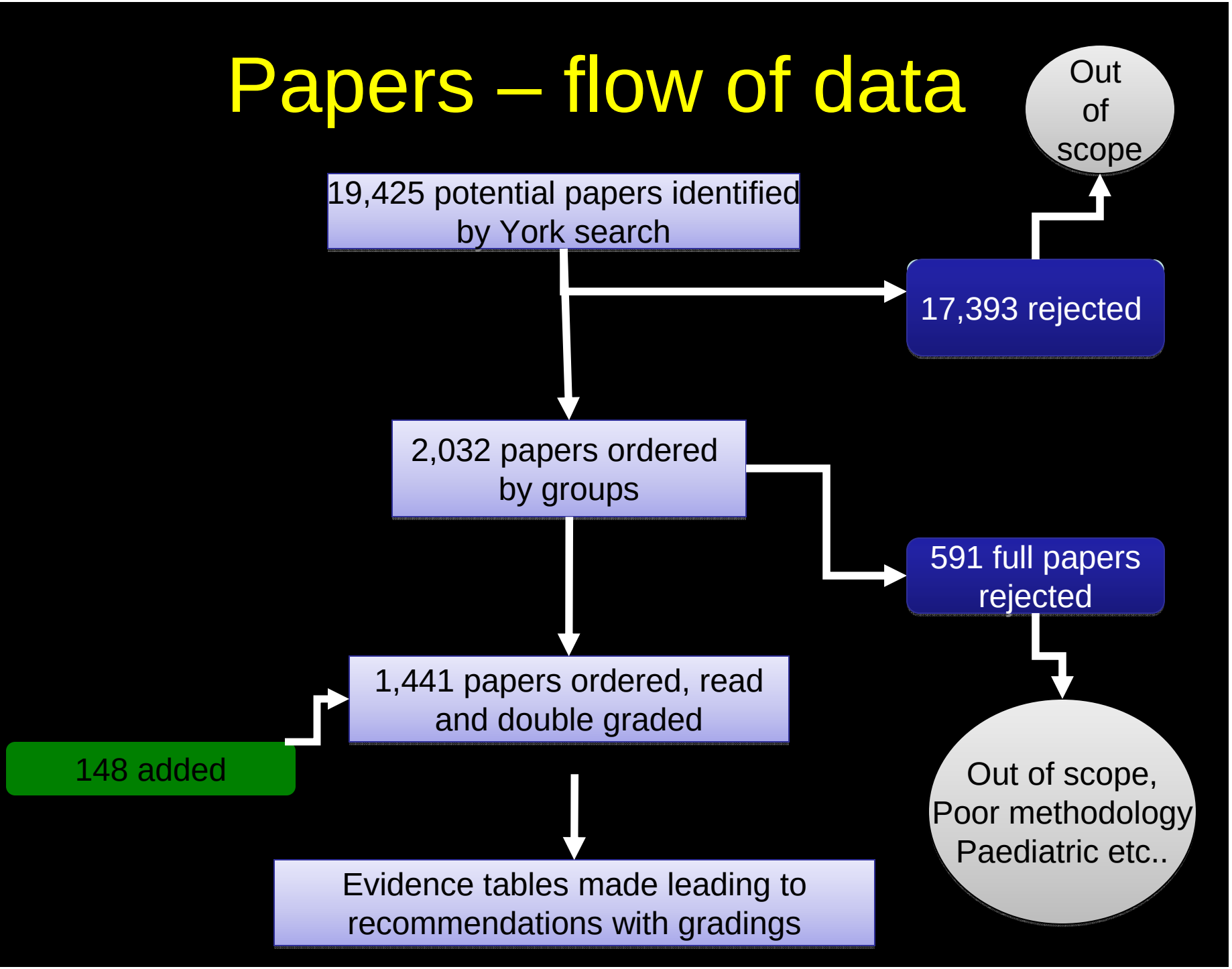
UK

BTS – WORKING FOR HEALTHIER LUNGS



Published
August 2010

Papers – flow of data



NHS
National Patient Safety Agency

Rapid Response Report

NPSA/2008/RRR003

From reporting to learning — 15 May 2008

Risks of chest drain insertion

12 deaths

15 serious harm

US guidance strongly recommended

Issue

Chest drains are used to remove air, blood, pus or fluid from the pleural cavity. They may be used in patients with collapsed lungs, malignancies, chest trauma or after surgery. This is a common procedure, which may be carried out in general wards. Most are planned, but some may need to be done as emergencies. When they are not inserted properly, they may puncture nearby organs such as the lungs, liver and spleen. The National Patient Safety Agency (NPSA) is alerting all healthcare staff to the risks associated with the insertion of chest drains.

Evidence of harm

The NPSA has received reports of 12 deaths relating to chest drain insertion and 15 cases of serious harm between January 2005 and March 2008. A substantial number of these seven incidents have been reported highlighting poor management of inserted chest drains. Many more are likely to be unreported.

The Medicines and Healthcare Products Regulatory Agency (MHRA) have received reports of nine incidents since 2003, all but one relating to the use of Seldinger type drains, which is now the most commonly used technique.

Common themes from a review of incidents reported to the NPSA, MHRA, local investigations and literature include: Supervision of junior doctors; inadequate competence of clinicians inserting chest drains; failure to follow manufacturer's instructions; the site of insertion and poor positioning; excessive insertion of dilator; anatomical anomalies and the patient's clinical condition; inadequate imaging; lack of knowledge of existing clinical guidelines.

Overall there is no clear evidence on the relative safety of different techniques; further research on this would be helpful.

Because of the risks from inserting chest drains, the clinician should question:

- ✓ **Do I need to do this?**
- ✓ **Does it need to be done as an emergency – can it wait?**
- ✓ **Have I had enough training to feel confident to do this? Are senior staff to hand?**
- ✓ **Am I familiar with this equipment?**
- ✓ **Is ultrasound available, with trained staff, to position it safely?**

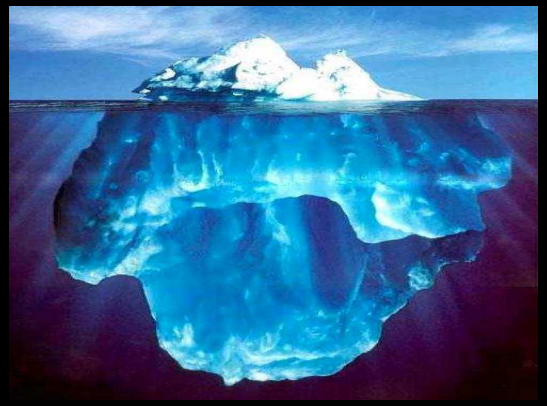
For IMMEDIATE ACTION by the NHS and independent sector
Deadline for ACTION COMPLETE is 17 November 2008

Clinical governance leads in local organisations should audit current practice and develop local policies to ensure:

- Chest drains are only inserted by staff with relevant competencies and adequate supervision
- Ultrasound guidance is strongly advised when inserting a drain for fluid
- Clinical guidelines are followed and staff made aware of the risks, reflecting the questions above
- Identify a lead for training of all staff involved in chest drain insertion
- Written evidence of consent is obtained from patients before the procedure, wherever possible
- Local incident data relating to chest drains is reviewed and staff encouraged to report further incidents

Activity by others

The British Thoracic Society produced guidelines in 2003. These are currently being reviewed and will be updated by 2009. This may include e-learning modules and other practical guidance to improve chest drain insertion technique.



Injury type	No. trusts	No. deaths	No. cases	% fatal
Lung or chest wall injury	35	8	47	17%
Wrong side	5	2	6	33%
Lost wire	3	0	3	0 %
Inserted into organ or major vessel	24	7	31	23%
Total	67	17	87	20%

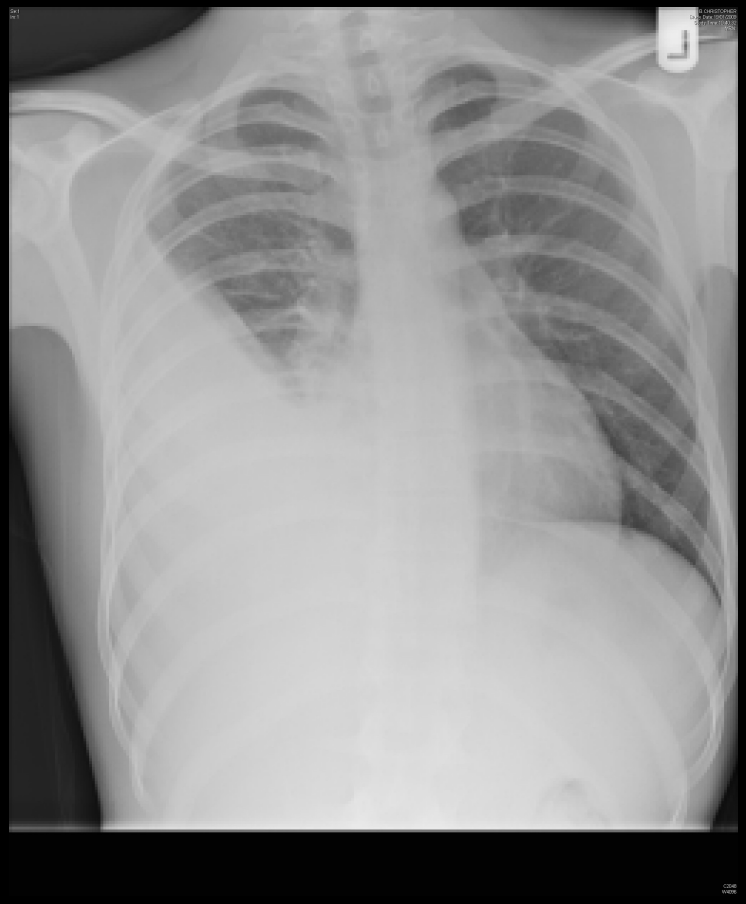
Harris et al. Postgrad. Med. J 2010

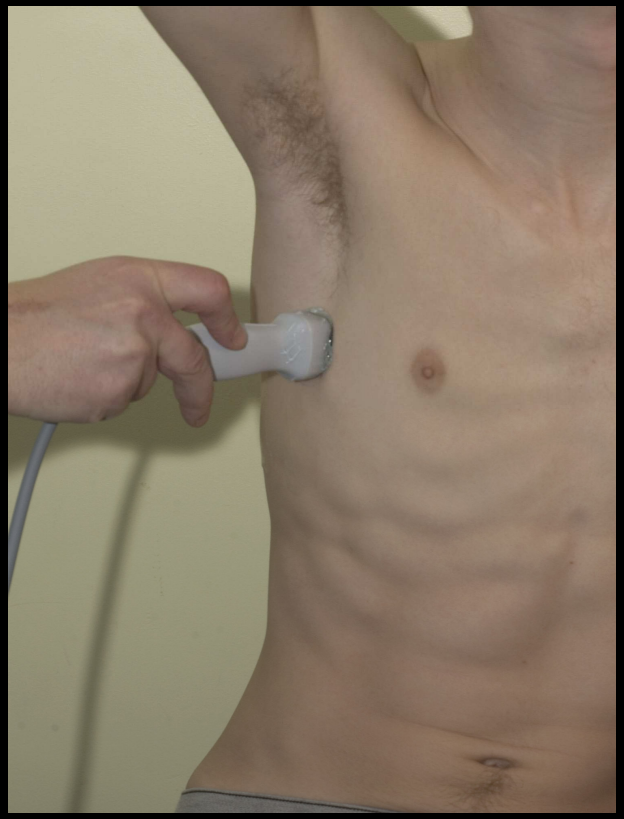
Accuracy of pleural puncture sites: a prospective comparison of clinical examination with US

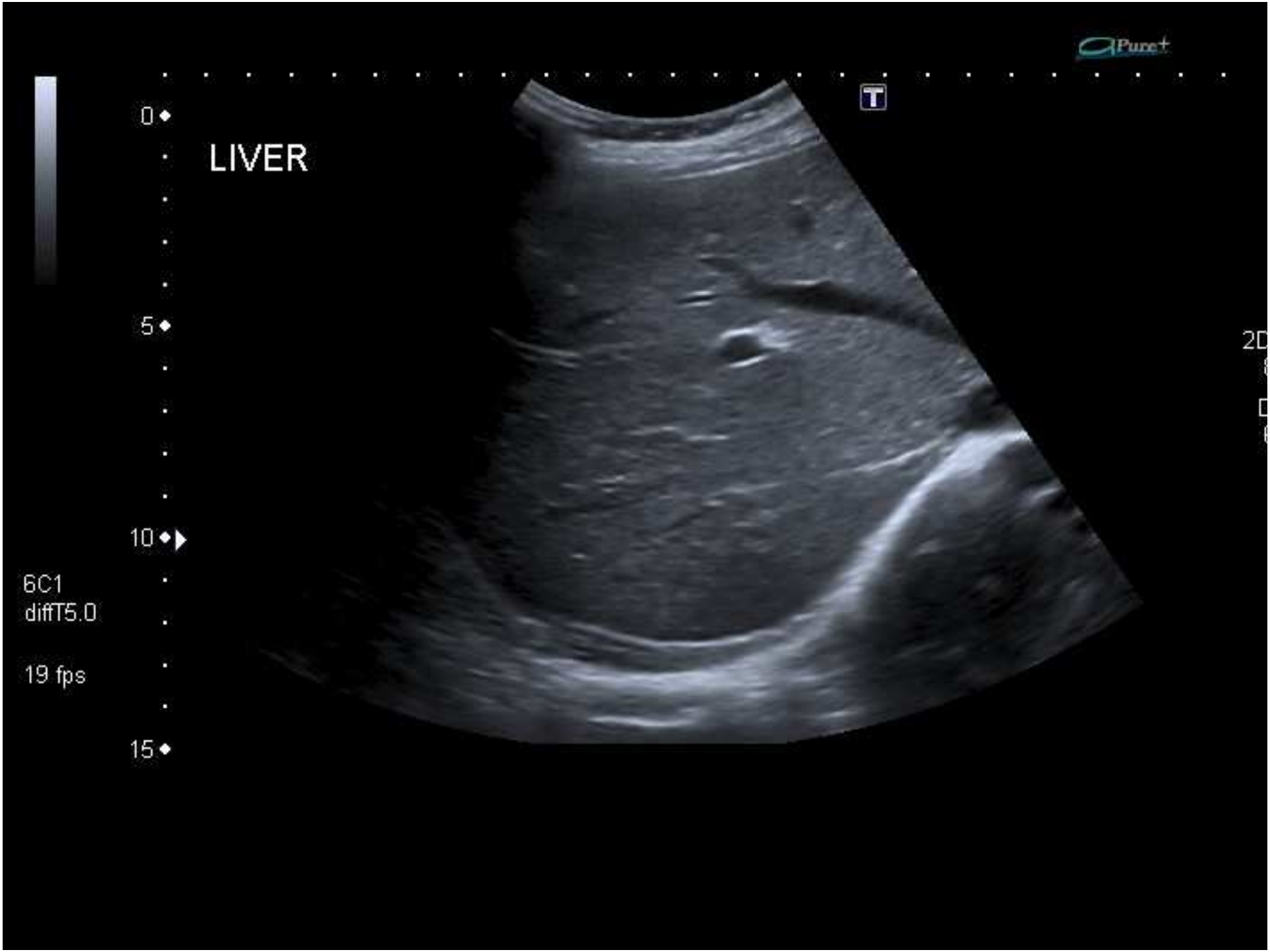
Diacon AH Chest 2003;123:436

- Consecutive patients requiring a diagnostic pleural tap had a proposed site marked by different grades of physicians (CXR and examination) .
- 17/172 (10%) marked sites were over solid organs (liver, spleen and lung)
- Physicians unable to indicate safe site in 83/255 (33%). Ultrasound succeeded in 45/83 of these.
- Summary : reduced risk of solid organ puncture and improved yield with all levels of operator experience

19 yr old male 2 wk Hx fevers, cough ?empyema






LIVER
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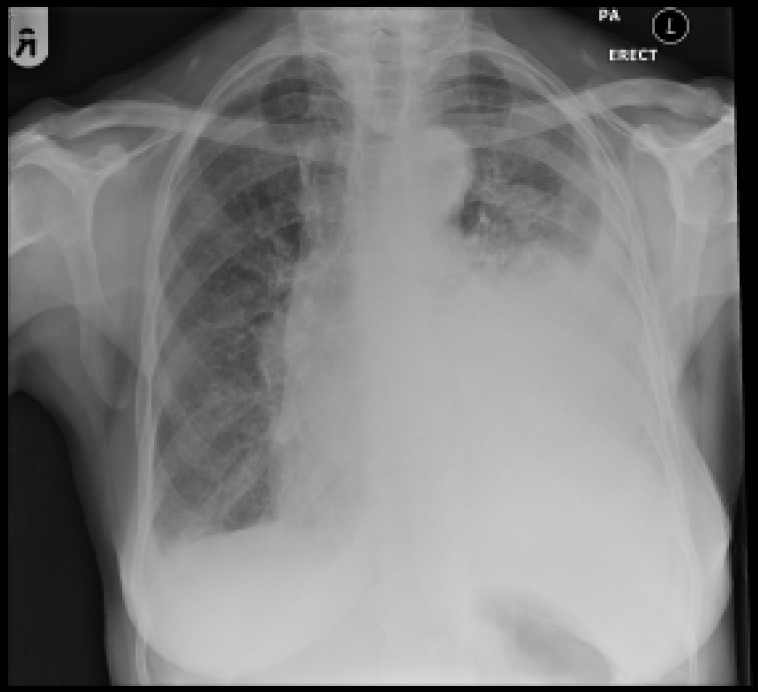
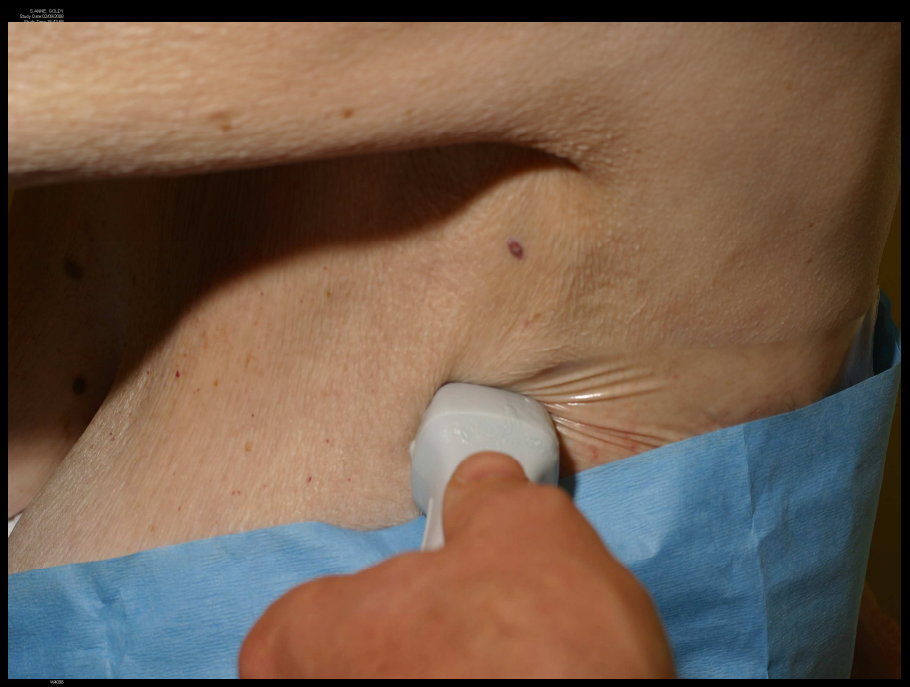
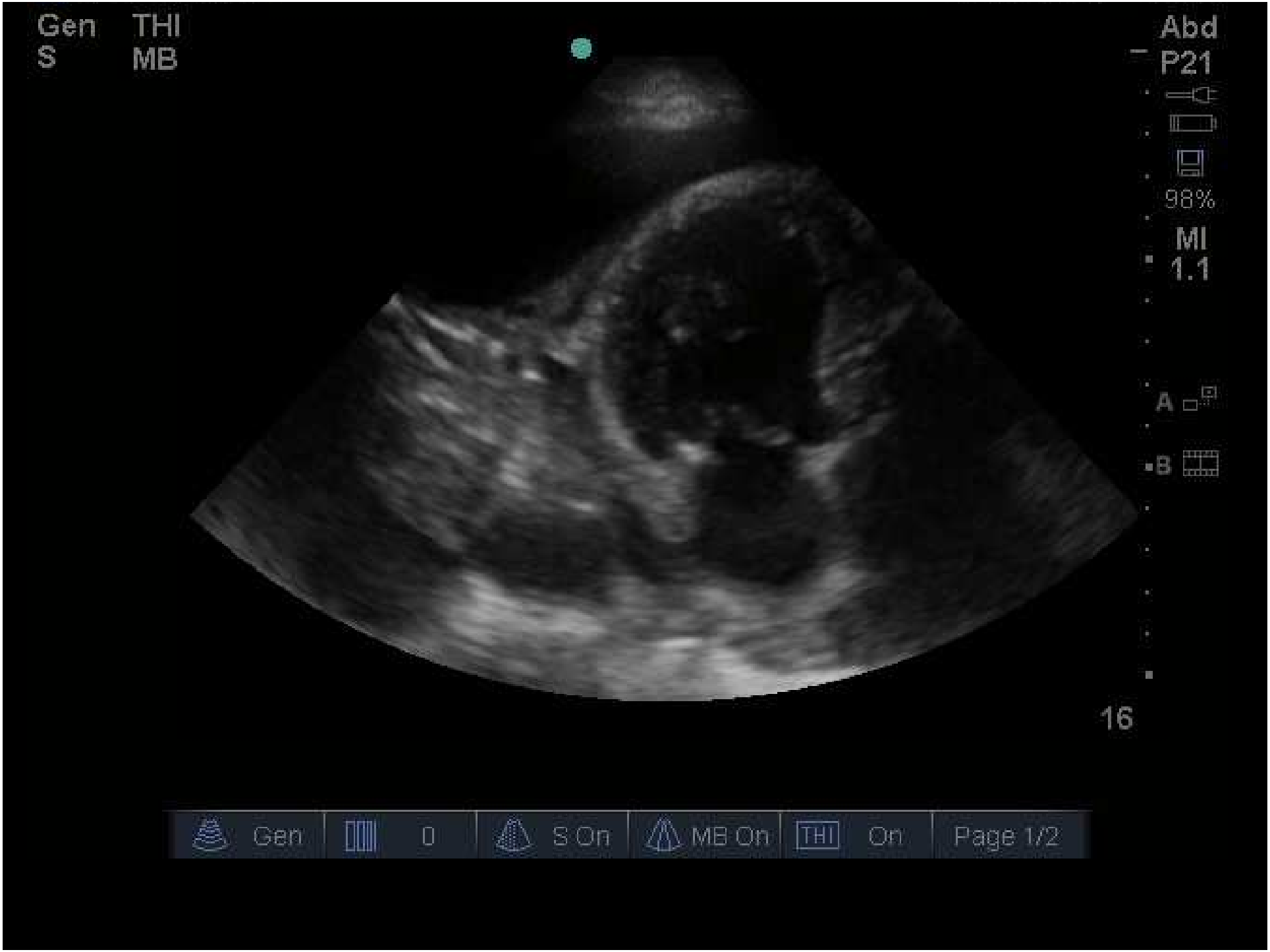
80 yr old woman. Known malignant effusion requiring chest drain



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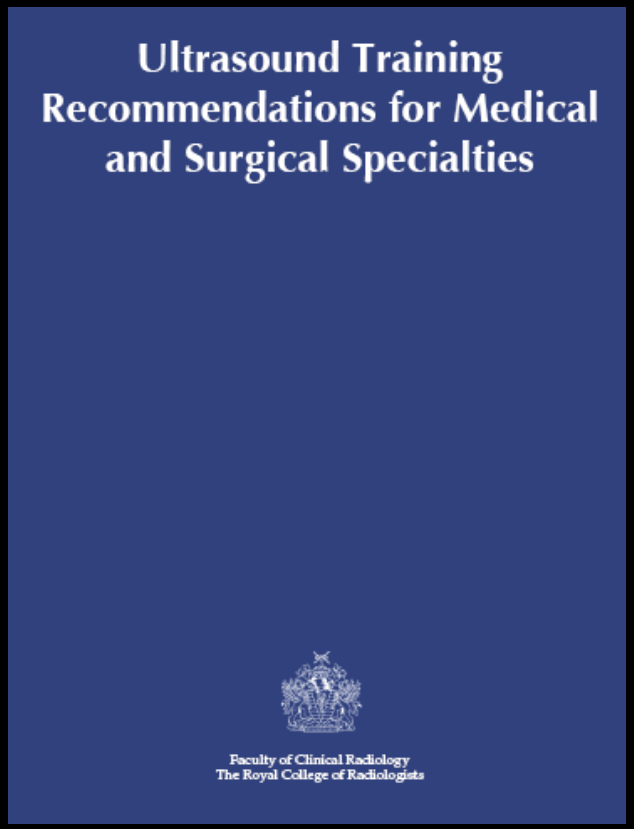
Page 1/2

Thoracic ultrasound

‘Bedside ultrasound guidance improves success rate and reduces complications and is therefore recommended for all procedures involving pleural fluid (B)’

Training in Thoracic US

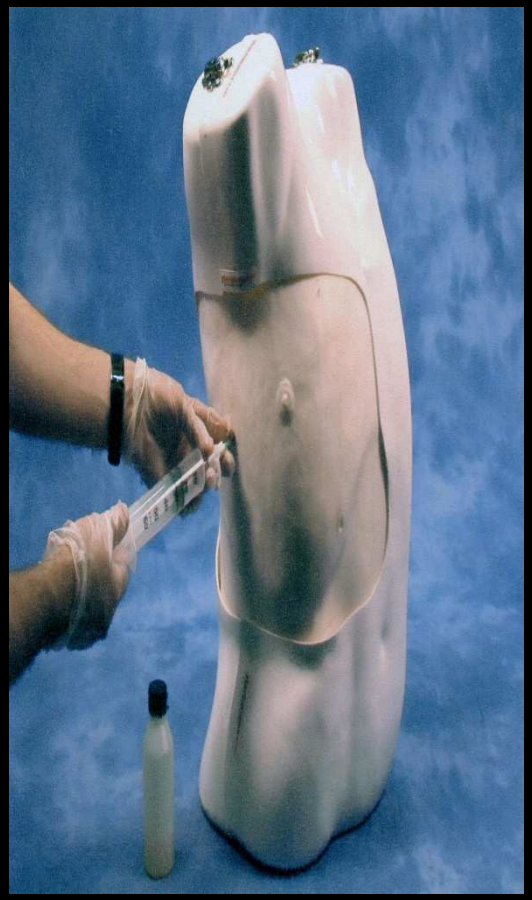


Level 1: Training and Practice

- Practical training should include:
  - observing 20 thoracic ultrasound examinations
  - performing 10 ultrasound examinations on patients with pleural effusions
  - performing 20 examinations on normal patients
  - performing five thoracocenteses or drain placements using both guided and non-guided techniques
- Examinations should encompass the full range of pathological conditions listed below.
- A logbook listing the types of examinations and procedures undertaken should be kept.
- Training should be supervised either by someone who has obtained at least Level 2 competence in thoracic ultrasound or by a Level 1 practitioner with at least 2 years' experience of Level 1 practice.
- Trainees should attend an appropriate theoretical course and should read appropriate textbooks and literature.
- During the course of training the competency assessment sheet should be completed as this will determine in which area or areas the trainee can practise independently.

Chest drain insertion – key points

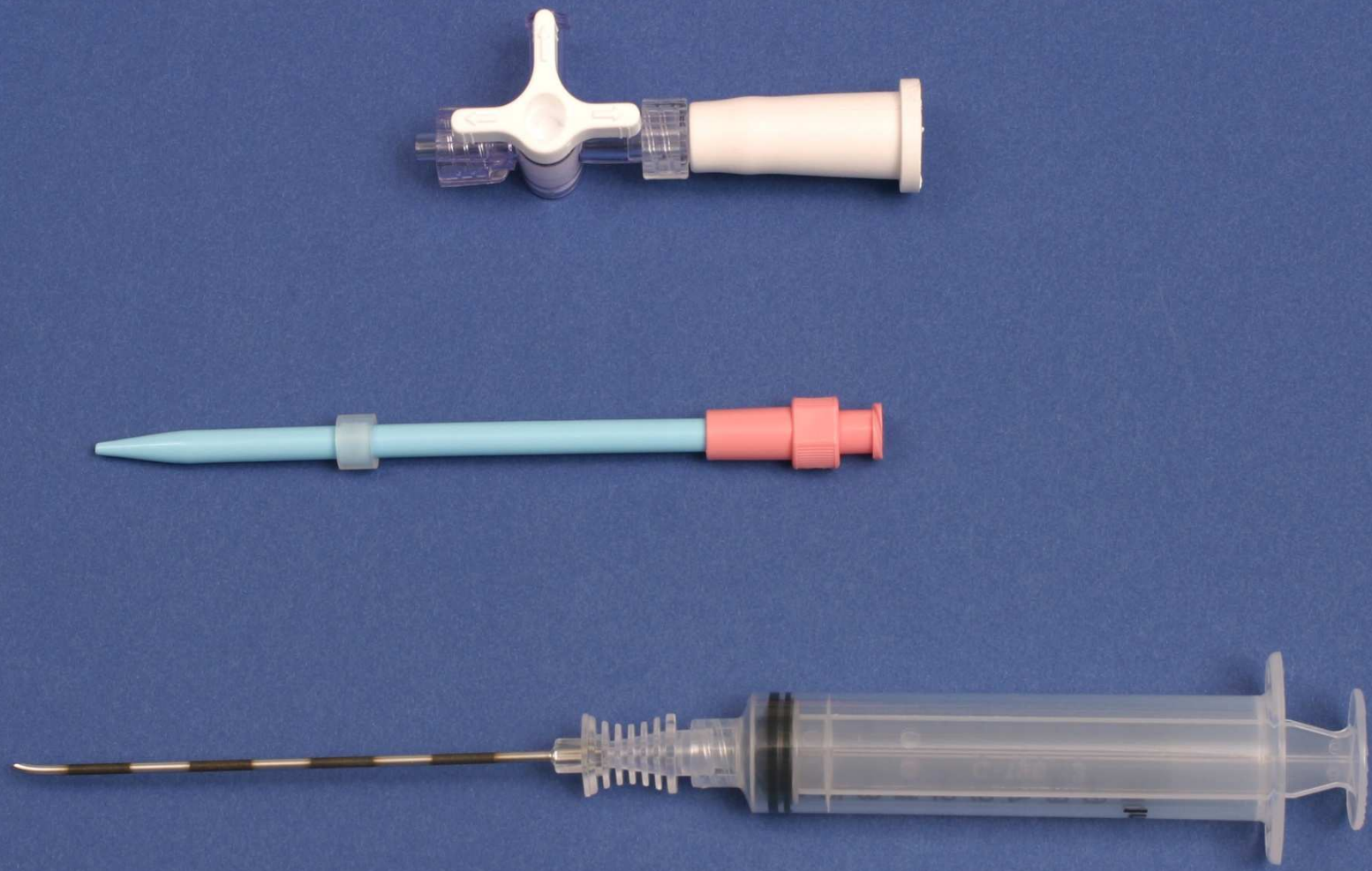
- New patient information sheet included
- Written consent required
- Ultrasound guidance strongly advised
- Sterility – gowns, sterile drapes, setting
- Correct supervision / trained operator
- Avoid out of hours if not emergency

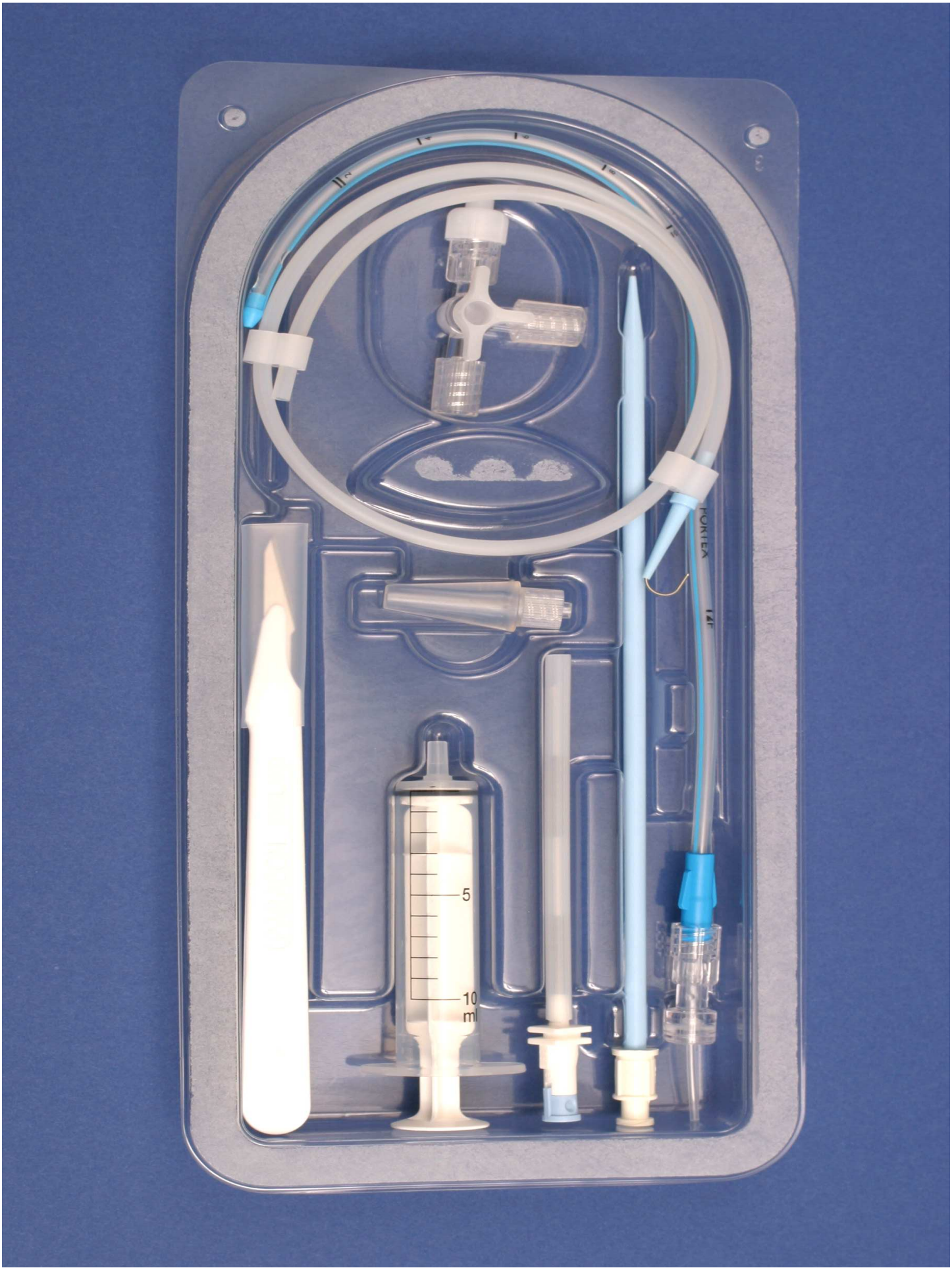


Pharmabotics – CDT100

Sandywell model – D. McLeod

Safety dilator guard

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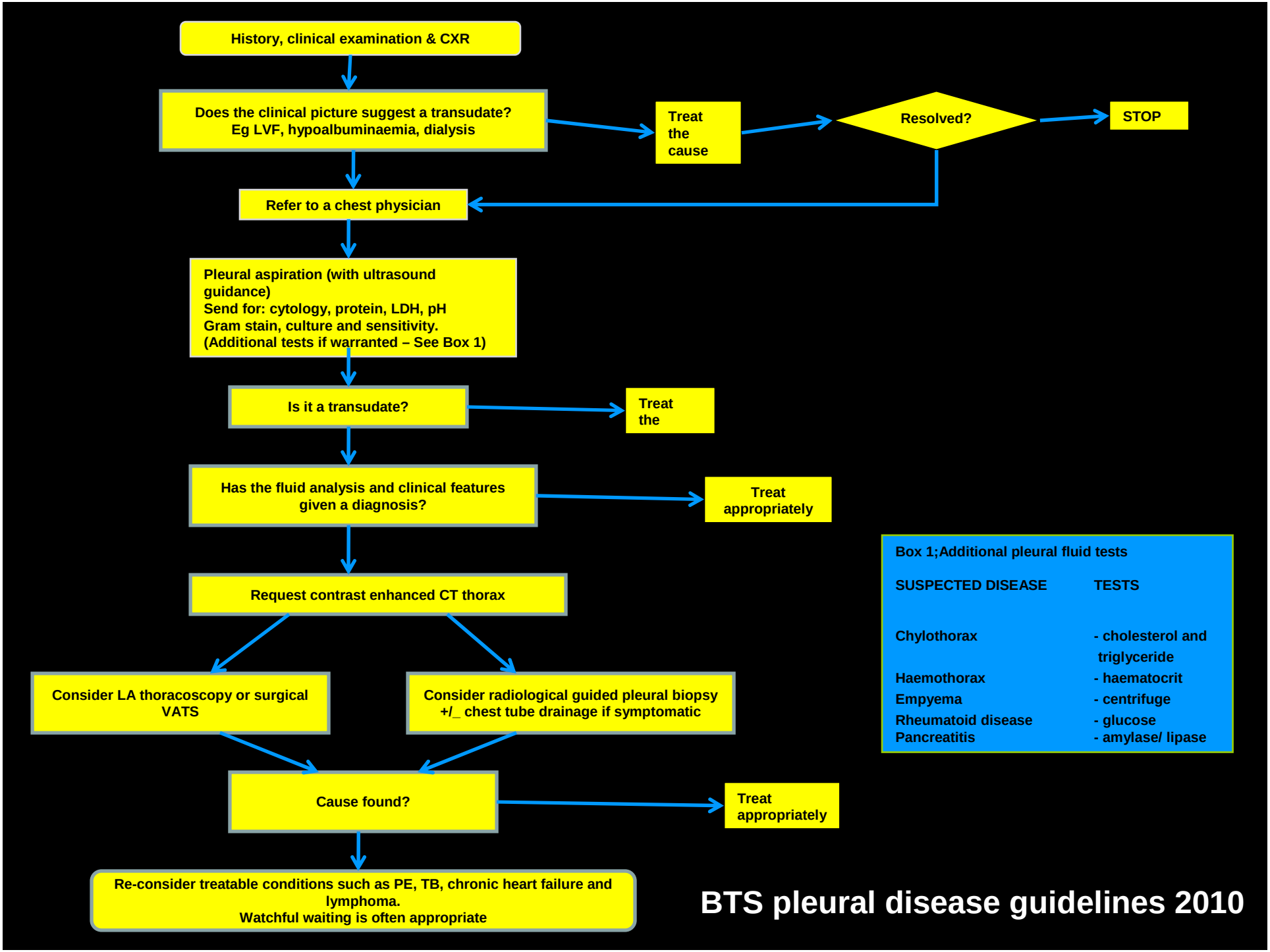
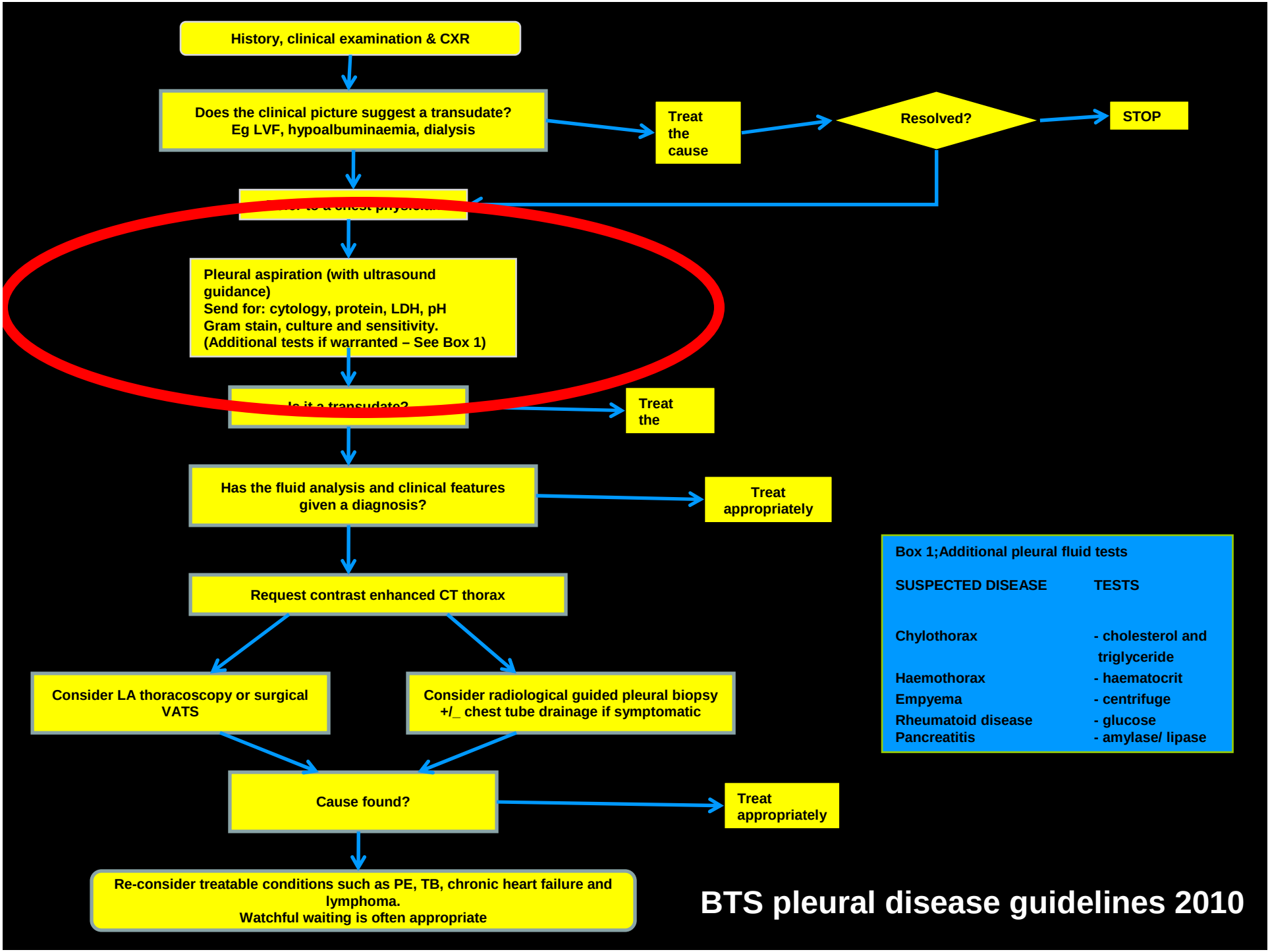

History, clinical examination & CXR
Does the clinical picture suggest a transudate?
Eg LVF, hypoalbuminaemia, dialysis
Treat the cause
Resolved?
STOP
Refer to a chest physician
Pleural aspiration (with ultrasound guidance)
Send for: cytology, protein, LDH, pH
Gram stain, culture and sensitivity.
(Additional tests if warranted – See Box 1)
Is it a transudate?
Treat the
Has the fluid analysis and clinical features given a diagnosis?
Treat appropriately
Request contrast enhanced CT thorax
Consider LA thoracoscopy or surgical VATS
Consider radiological guided pleural biopsy +/_ chest tube drainage if symptomatic
Cause found?
Treat appropriately
Re-consider treatable conditions such as PE, TB, chronic heart failure and lymphoma.
Watchful waiting is often appropriate
Box 1;Additional pleural fluid tests
SUSPECTED DISEASE
TESTS
Chylothorax
- cholesterol and triglyceride
Haemothorax
- haematocrit
Empyema
- centrifuge
Rheumatoid disease
- glucose
Pancreatitis
- amylase/ lipase
BTS pleural disease guidelines 2010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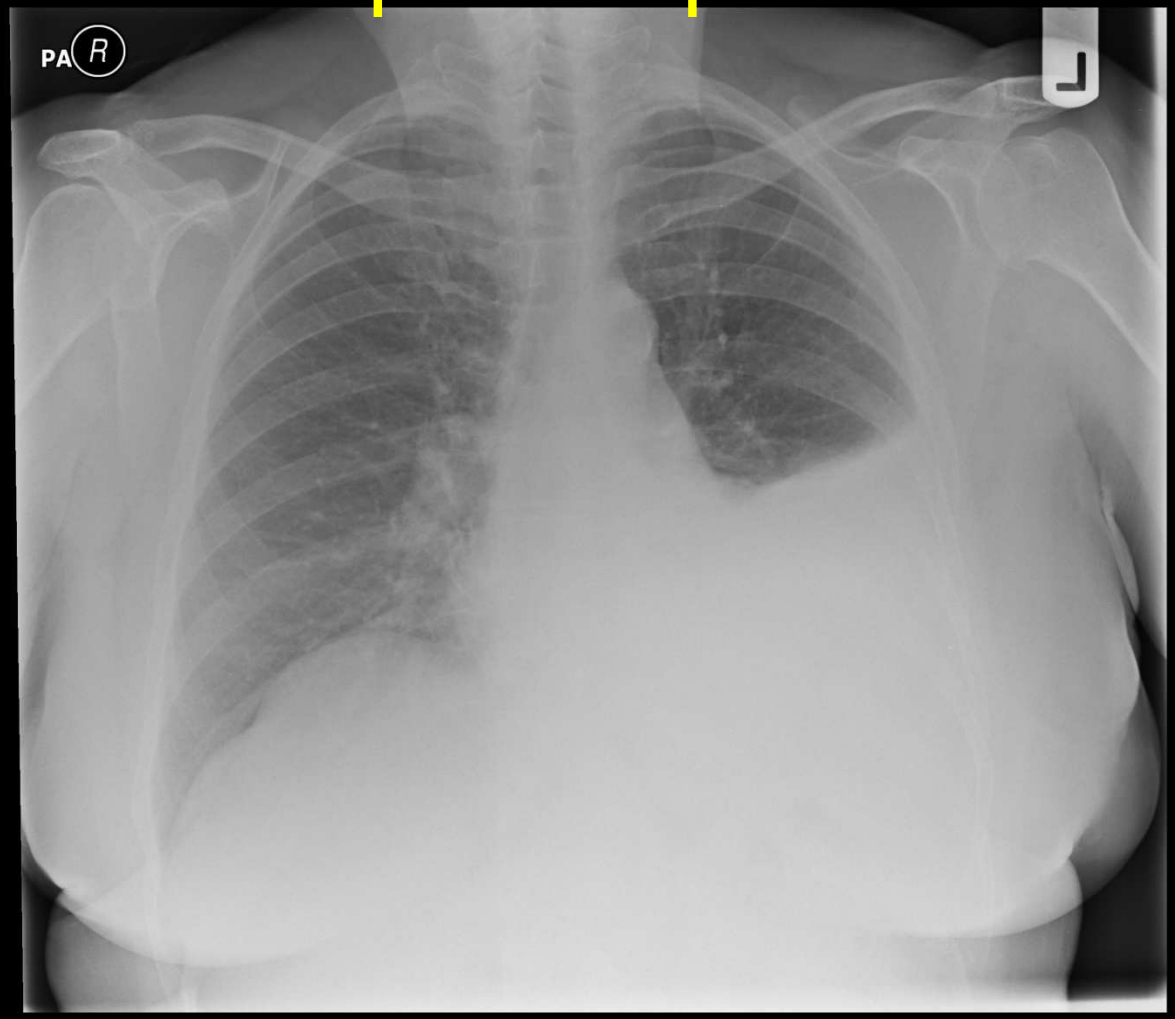
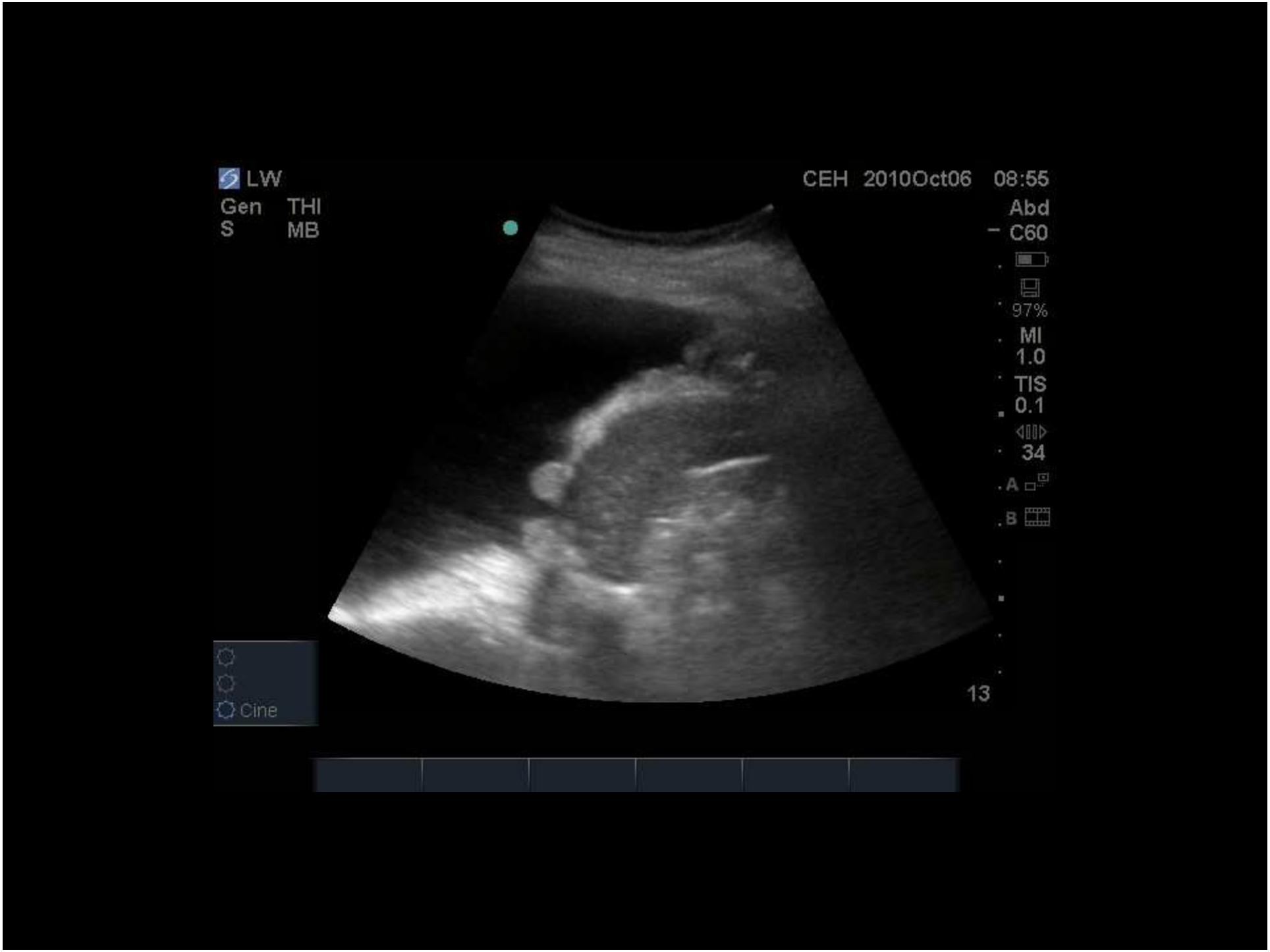
BTS pleural disease guidelines 2010

Cough, sweats, CRP 152, pleural pH 6.9

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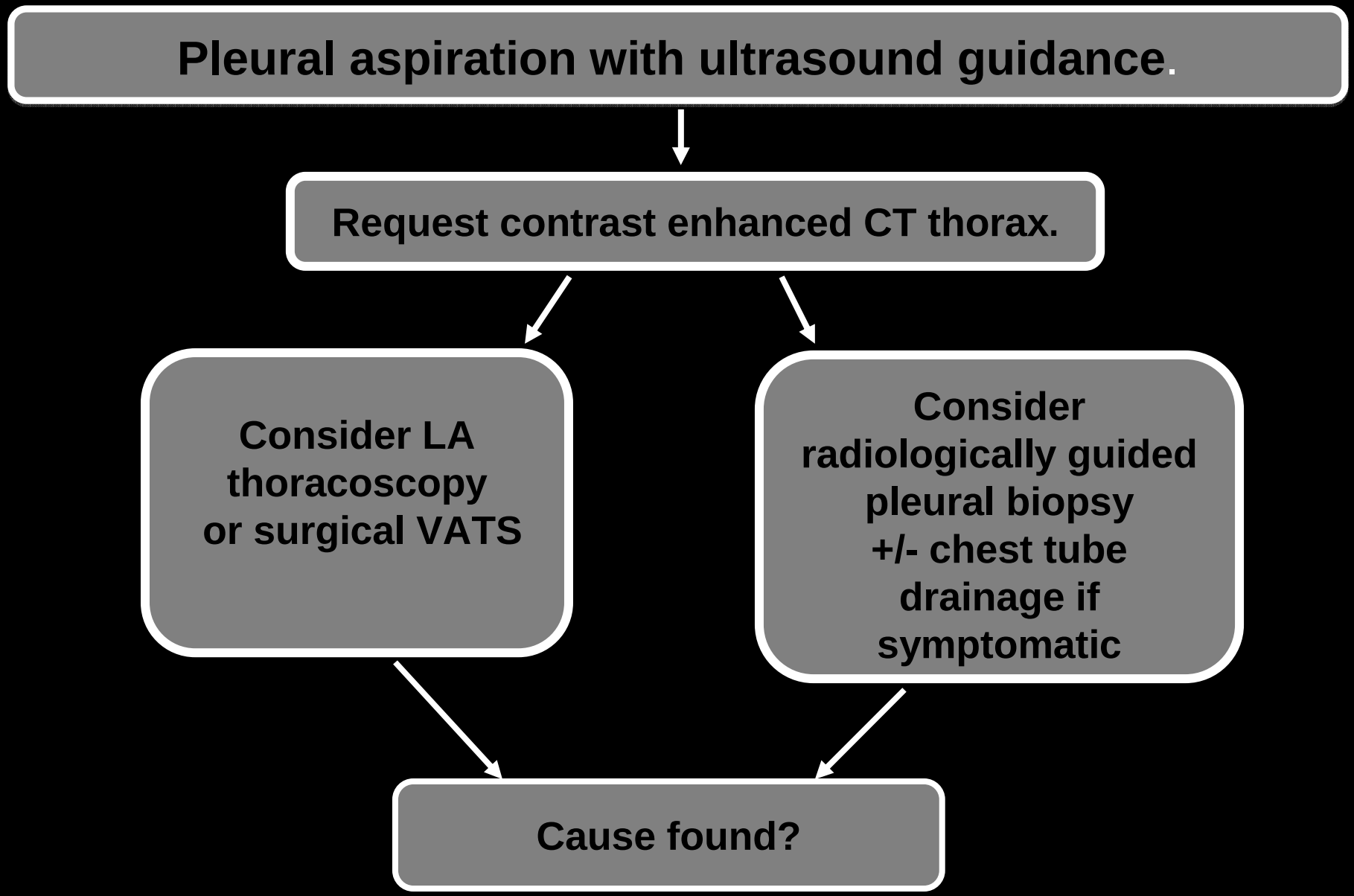
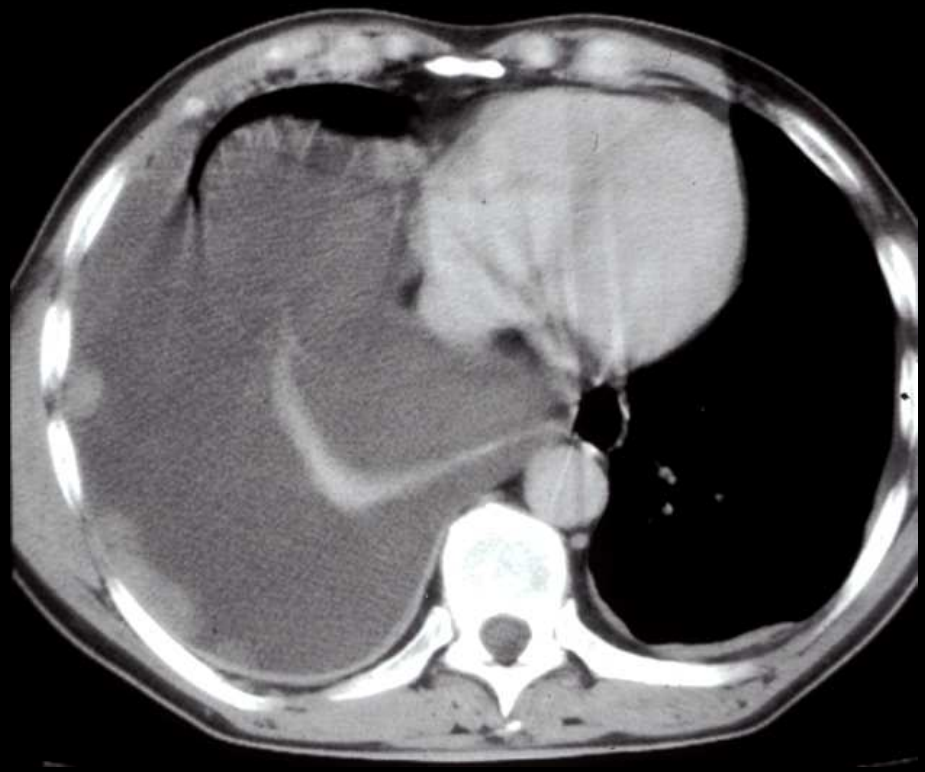
Key changes to the diagnostic algorithm



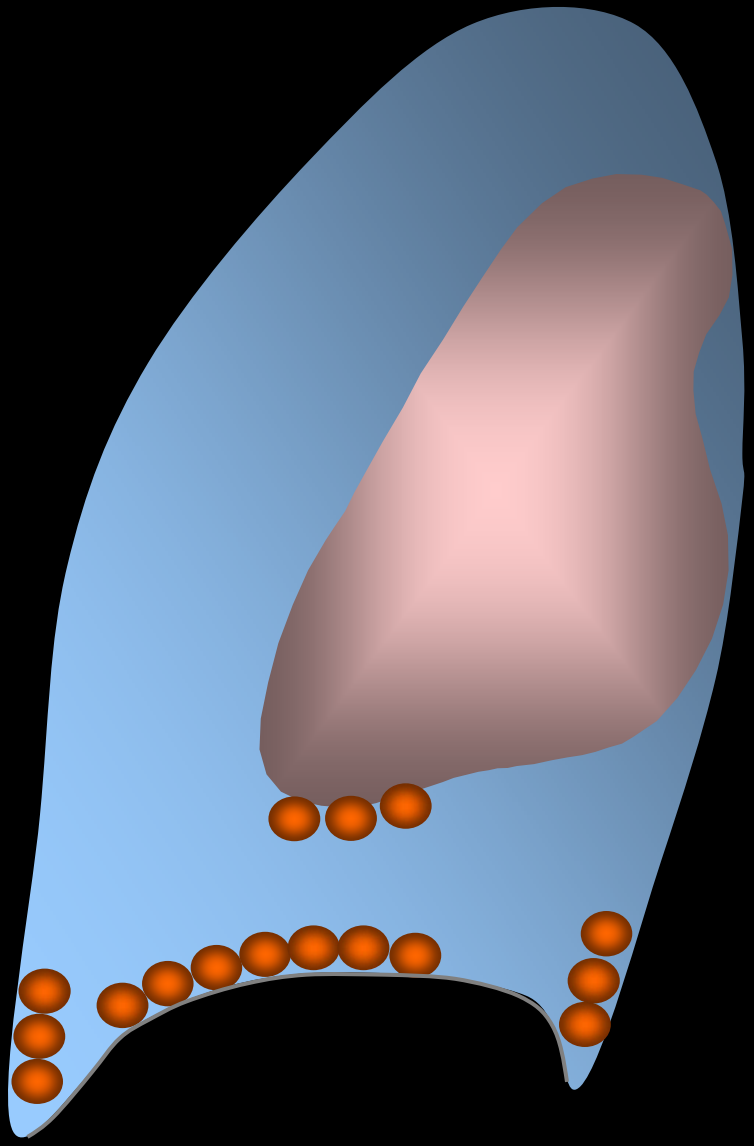
CT with pleural enhancement

Contrast enhanced CT scan

- 5mm sections
- 100ml iv contrast
- 60 second delay
- apices to costophrenic recess



Location of pleural metastatic deposits in early disease



- 214 thorocoscopies studied over
- 39 had ‘early’ tumours (<10 small nodules over pleural)
- The red dots represent the distribution of tumour nodules

Canto et al ; Chest 84:2;176-179

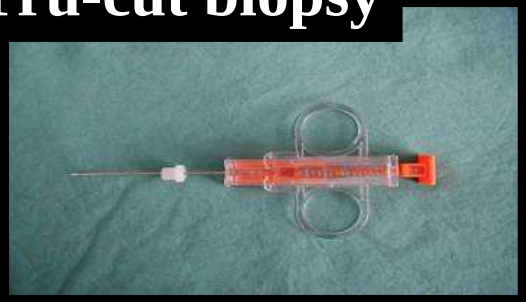
Cytology –ve exudative effusion
Contrast CT & pleural thickness measurement
(n=50)

Abrams' biopsy (n=25)

	Final Dx MALIGN	Final Dx BENIGN
+ve malign	8	0
-ve malign	9	7

Sensitivity 47%

18 G Tru-cut biopsy (n=25)

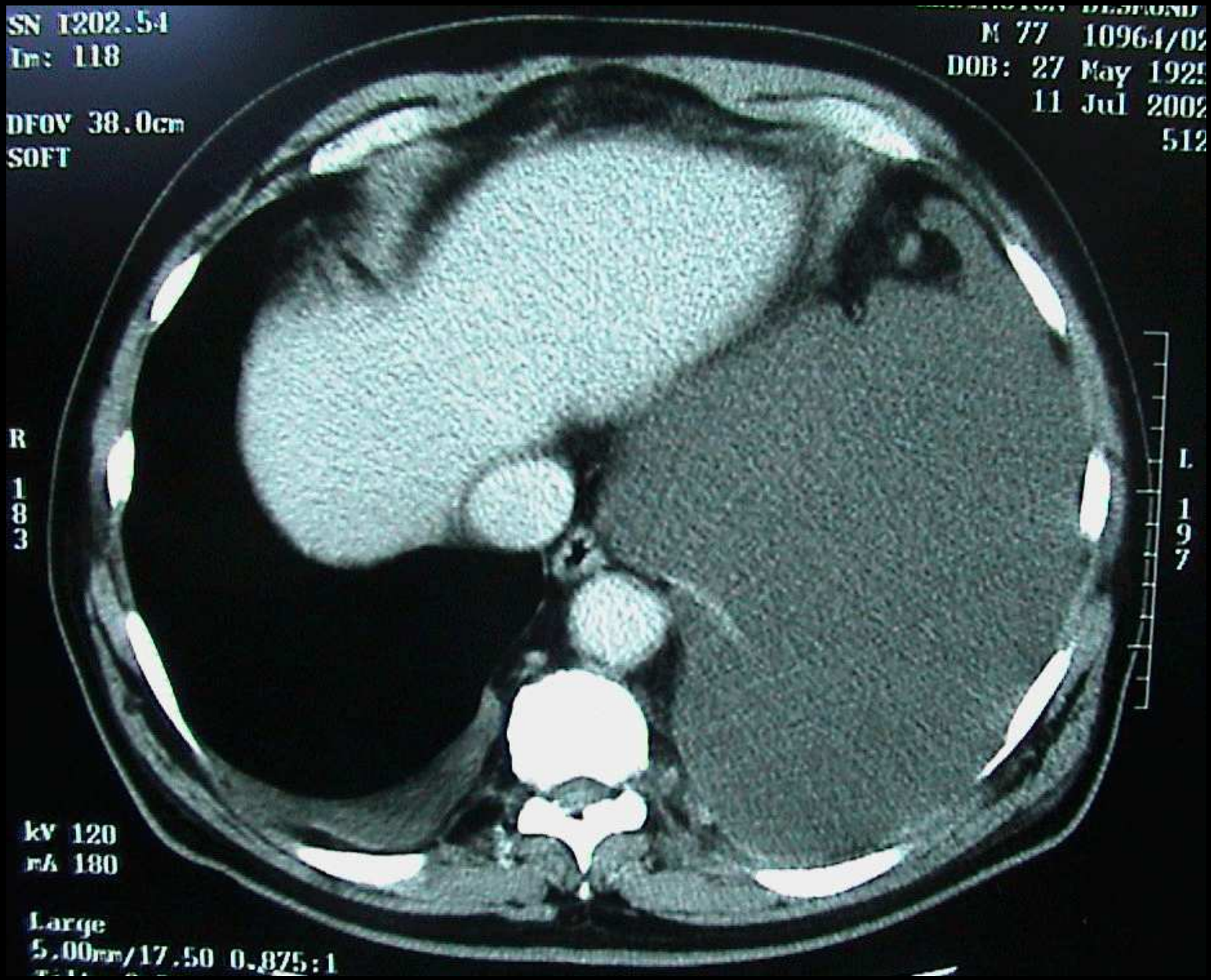


	Final Dx MALIGN	Final Dx BENIGN
+ve malig	13	0
-ve malig	2	8

Sensitivity 87%

***p*= 0.02**

Lancet 2003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LA thoracoscopy

Diagnostic rate for MPE:

- 22 studies
- 1494 patients
- Diagnostic rate = **93.3%**
- 95% CI = 92 to 95

Poudrage for MPE:

- 10 studies
- 645 patients
- Overall efficacy at 1 month = **84.6%**
- 95% CI = 82 to 87

Diagnostic yield - similar

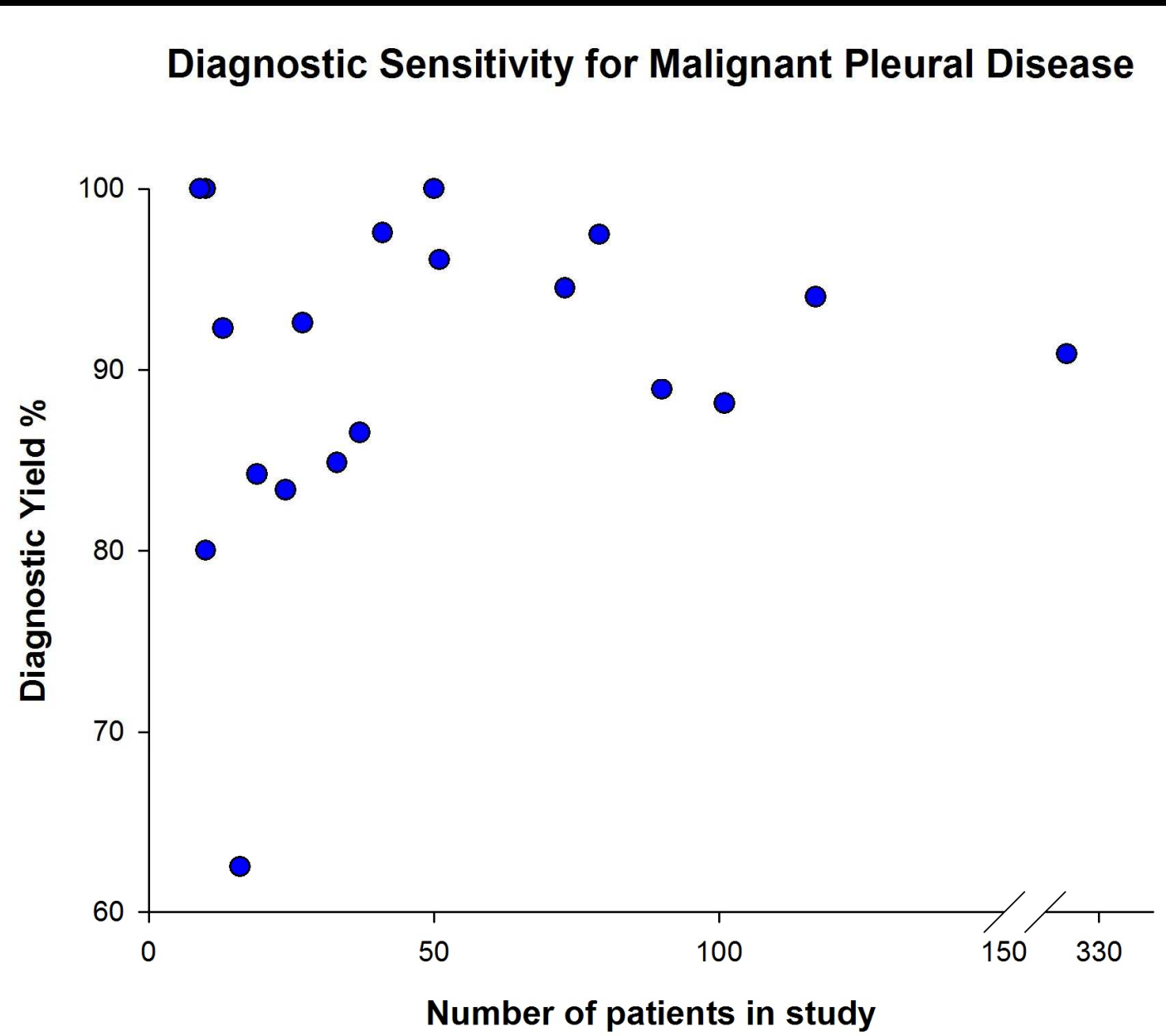
LA thoracoscopy / Pleuroscopy

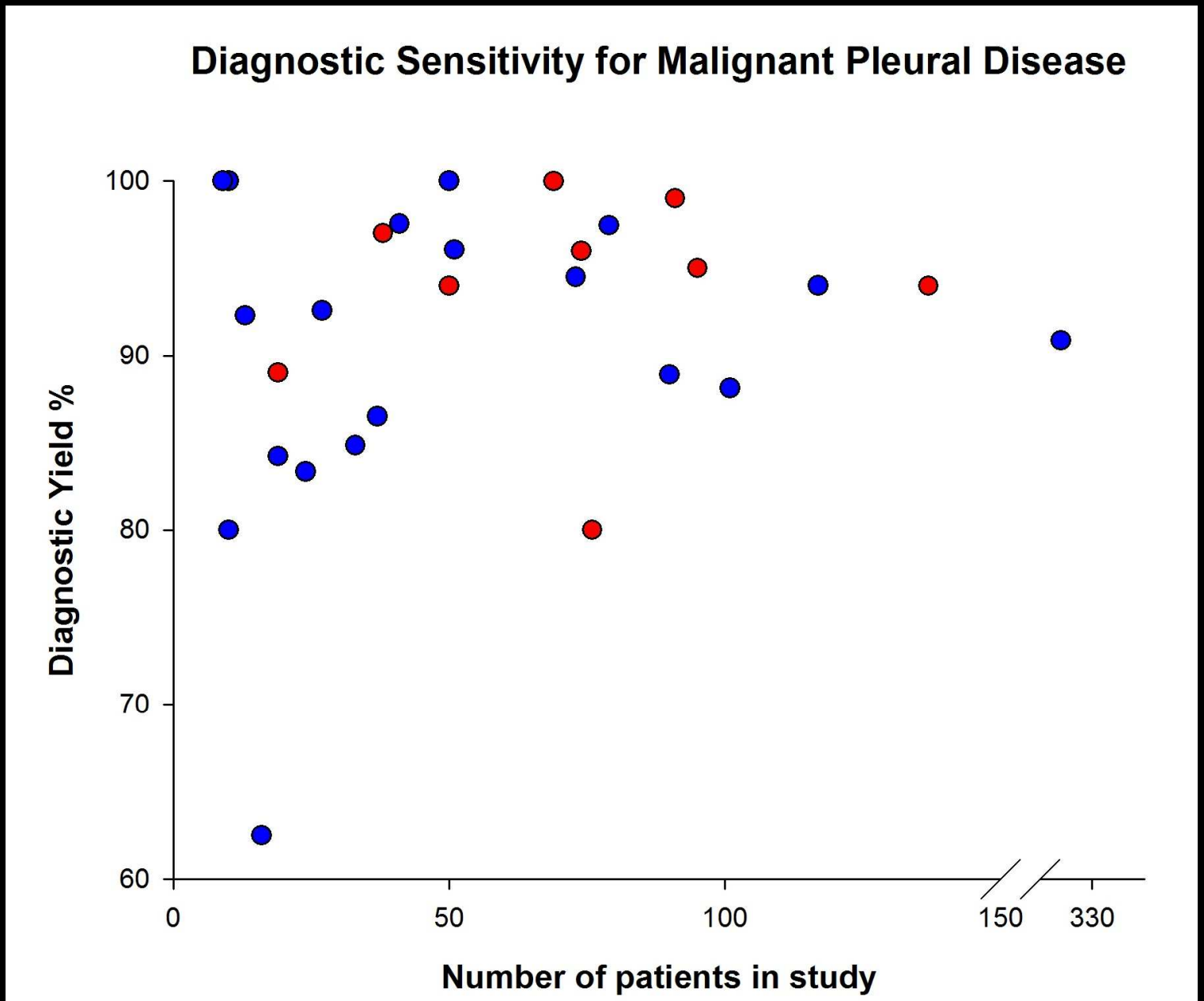
- 22 studies total patients 1494
- Diagnostic rate = **93.3%**
- 95% CI = 92 to 95

Surgical VATS

- 9 studies total patients 649
- Diagnostic rate = 94.6%
- **95% CI = 92.6 to 96.2**

Rahman et al BTS guidelines 2010


Diagnostic Sensitivity for Malignant Pleural Disease
Diagnostic Yield %
100
90
80
70
60
0
50
100
150
330
Number of patients in study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Diagnostic Yield %
100
90
80
70
60
0
50
100
150
330
Number of patients in study

Thoracoscopy: role in TB diagnosis

Histology and AFB stain

Thoracos: True positive 42/42 pts (100%)
Sensitivity 100%
Specificity 100%
NPV 100%

Abrams: True positive 28/42 pts (67%)
Sensitivity 67%
Specificity 100%
NPV 39%

p = 0.01 the Chi squared

Diacon *et al.* Eur Respir J 2003; 22: 589-91

Thoracoscopy: role in TB diagnosis

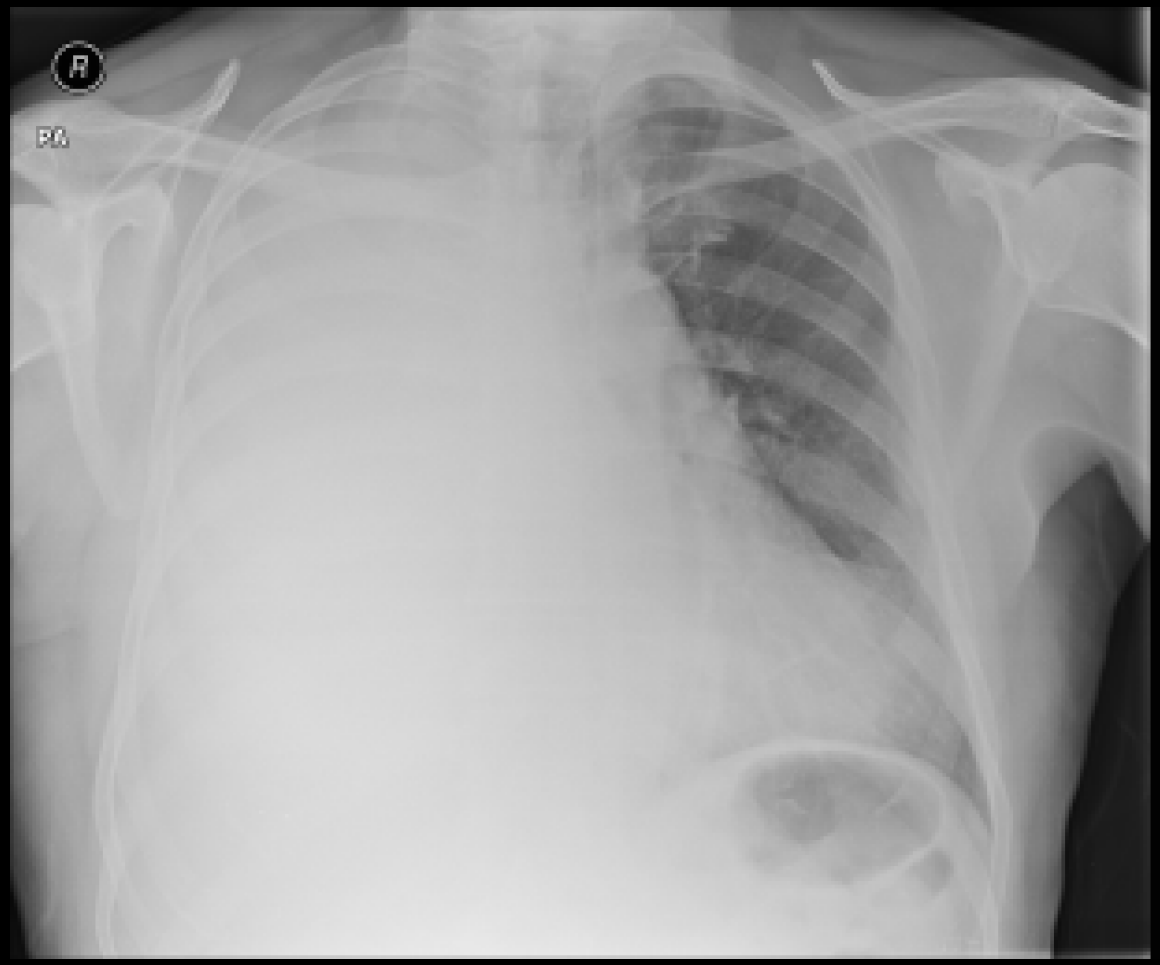
Histology and AFB stain **and culture**

Thoracos: True positive 42/42 pts (100%)
Sensitivity 100%
Specificity 100%
NPV 100%

Abrams: True positive 33/42 pts (79%)
Sensitivity 79%
Specificity 100%
NPV 50%

p = 0.05 the Chi squared

Diacon *et al.* Eur Respir J 2003; 22: 589-91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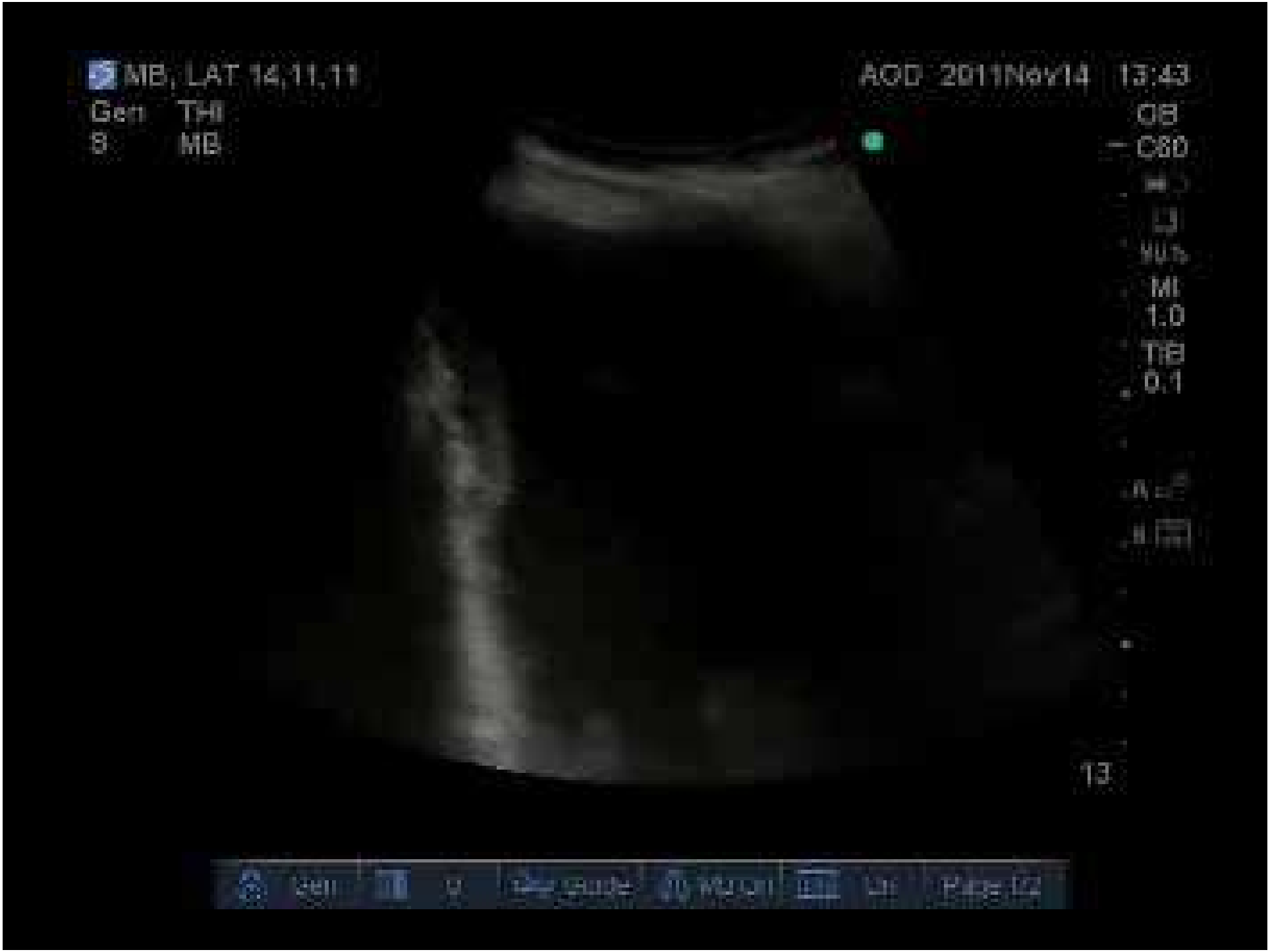
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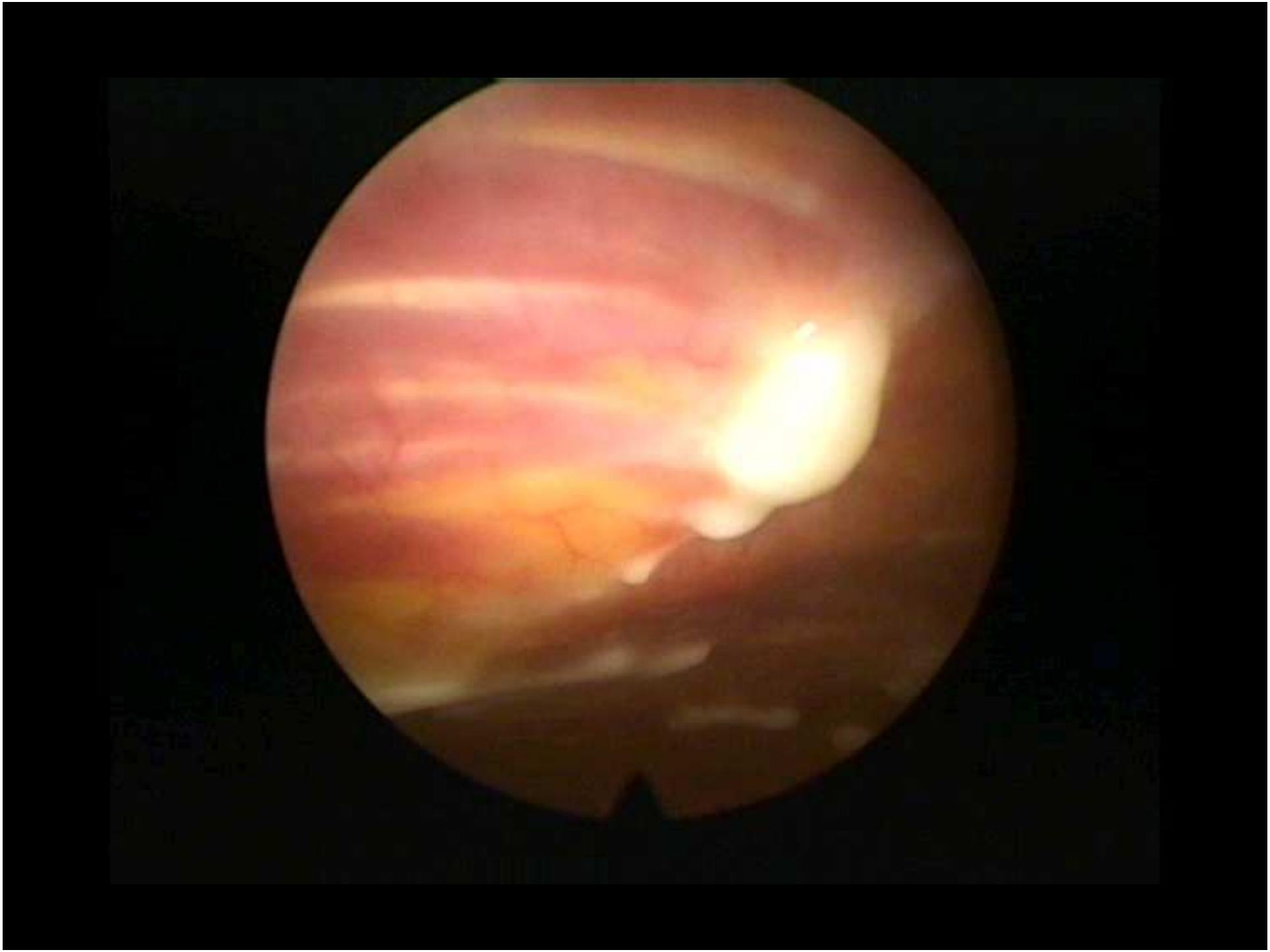
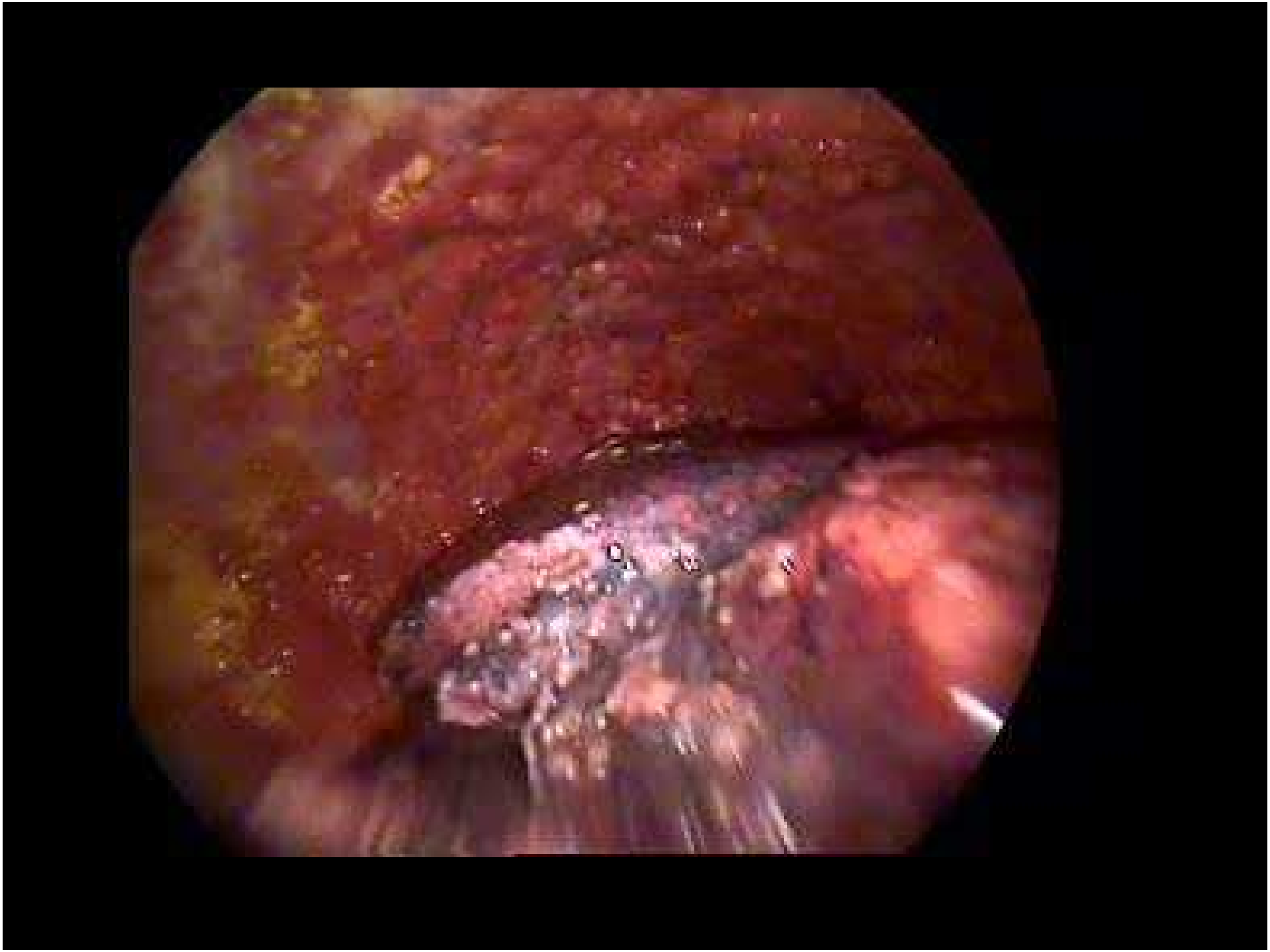
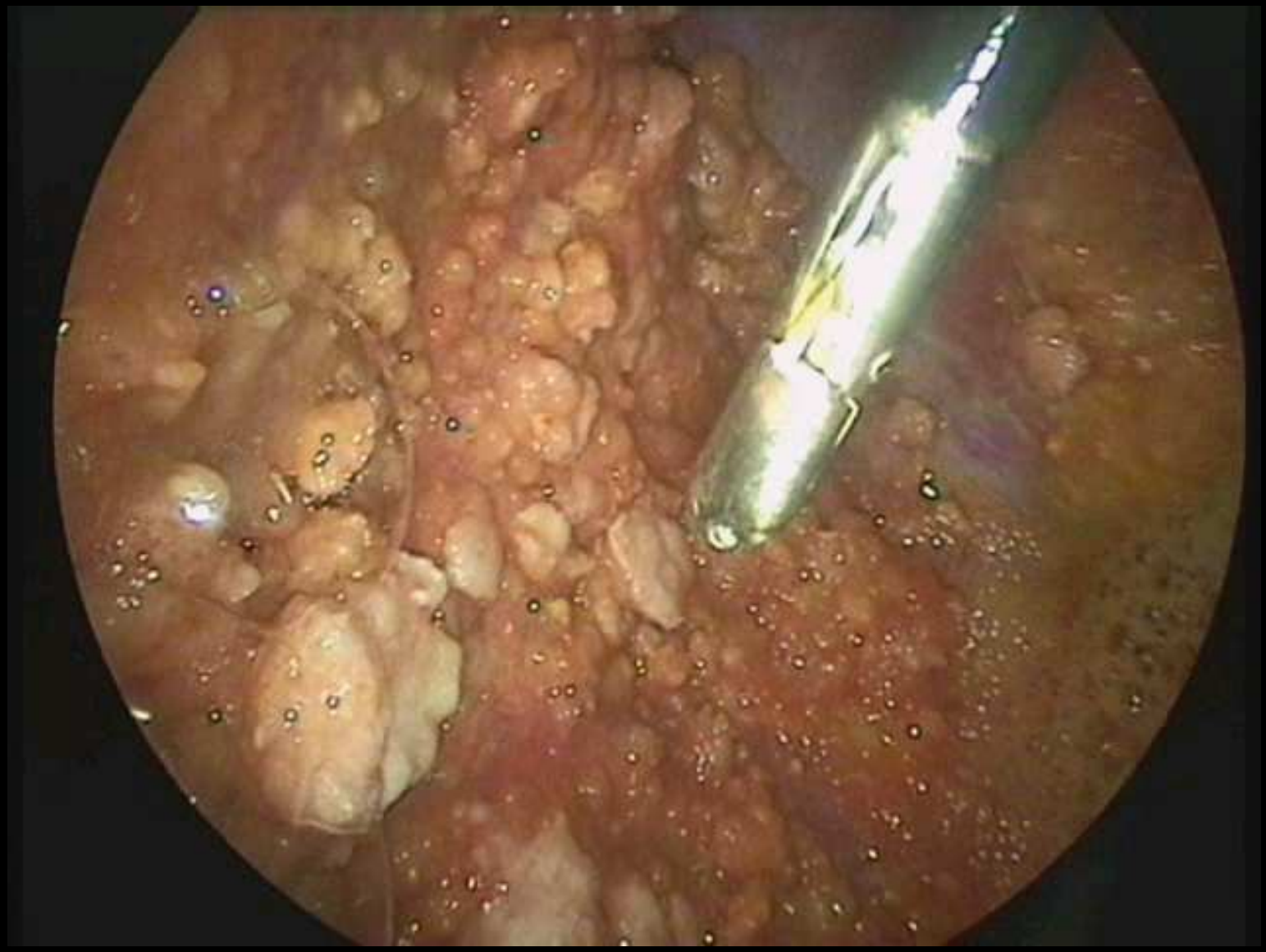
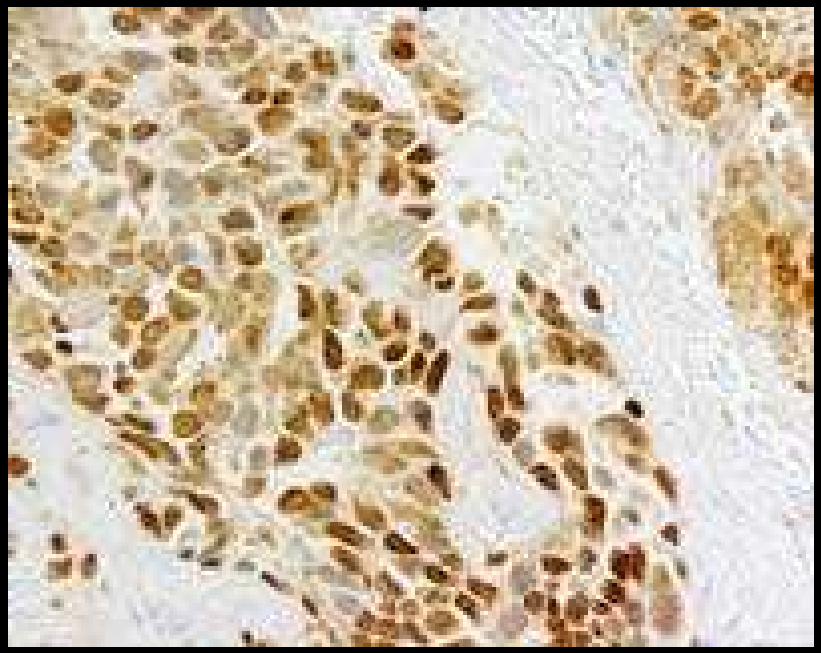


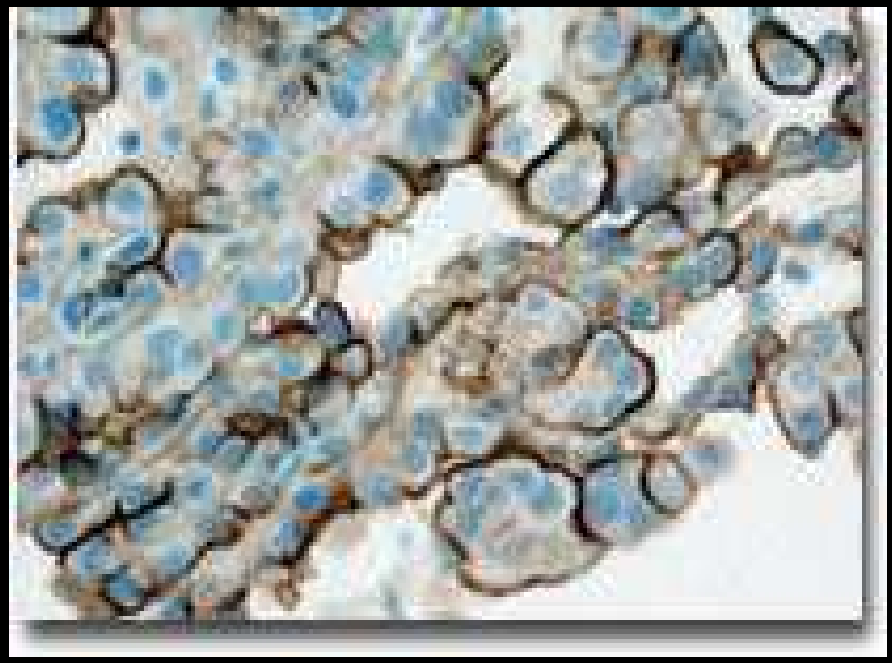




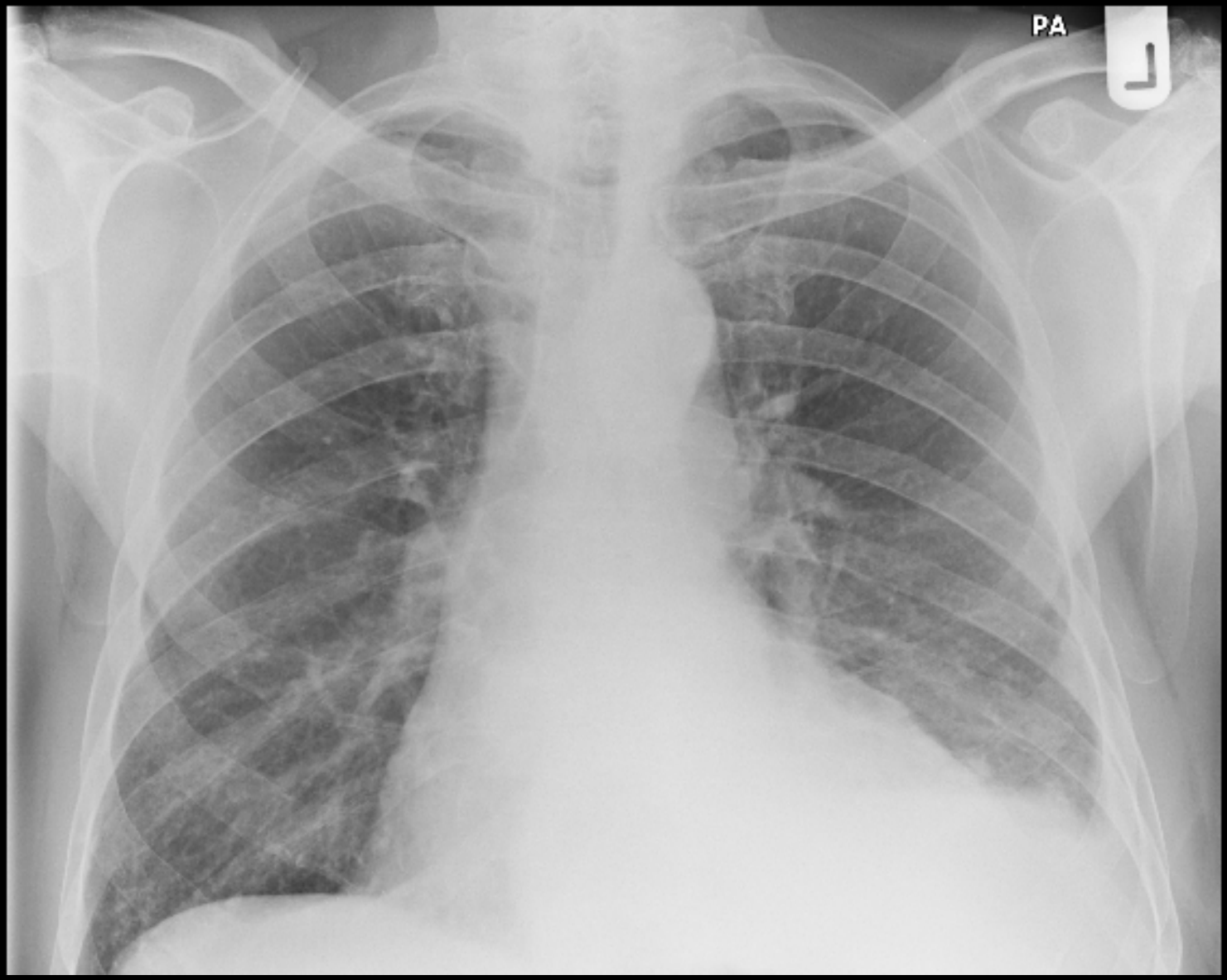
Immunohistochemistry and good pathologist vital



Adenocarcinoma: TTF1



Mesothelioma: Mesothelin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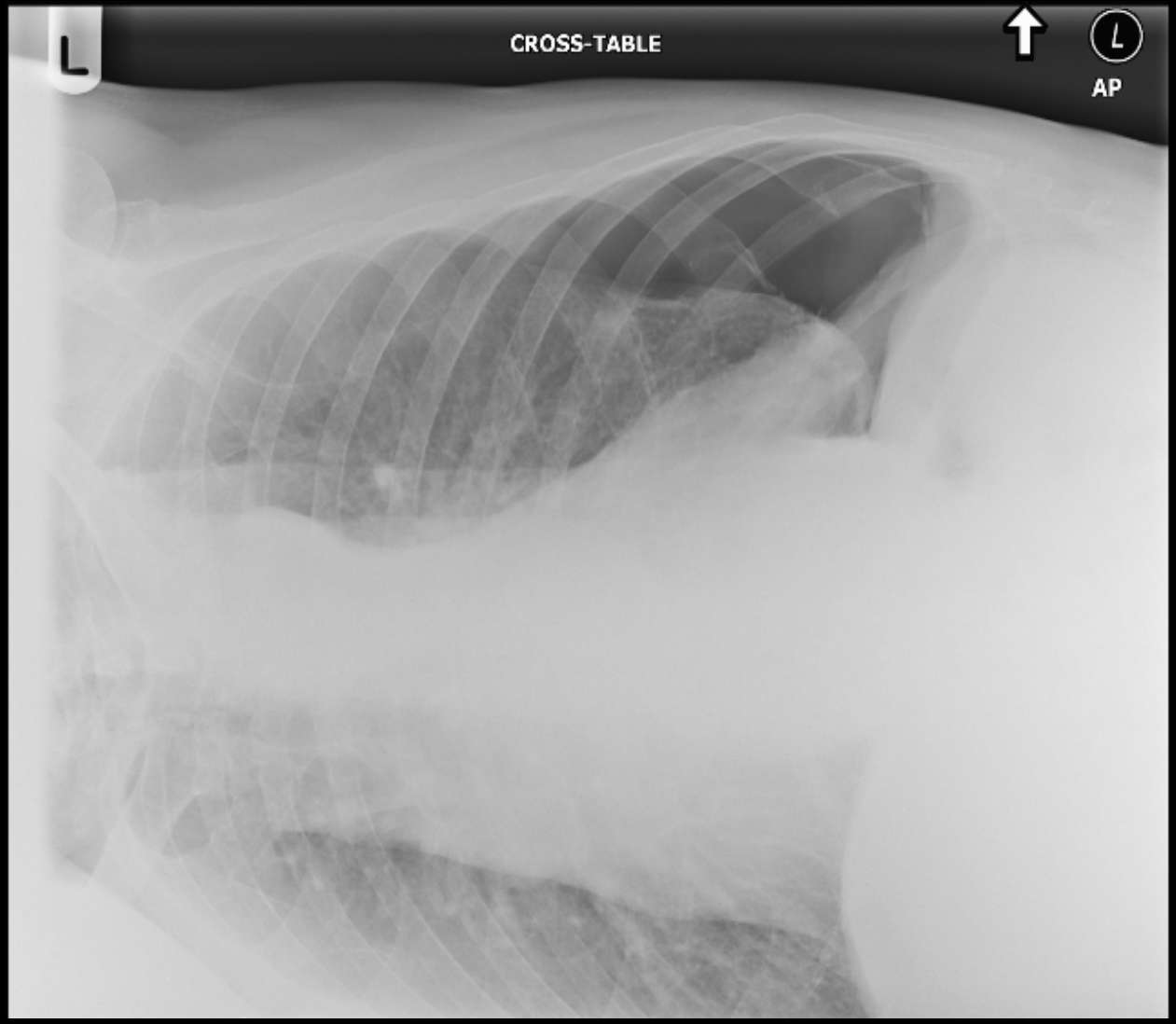
L
CROSS-TABLE
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NBT pleural service

A & E

GP/MAU

Patient with undiagnosed pleural effusion on CXR (pleural infection thought unlikely)

Referral to next day pleural out-patient service – Fax referral to 'HOT' clinic (if in A&E /MAU and symptomatic remove 1-1.5 L pleural fluid)

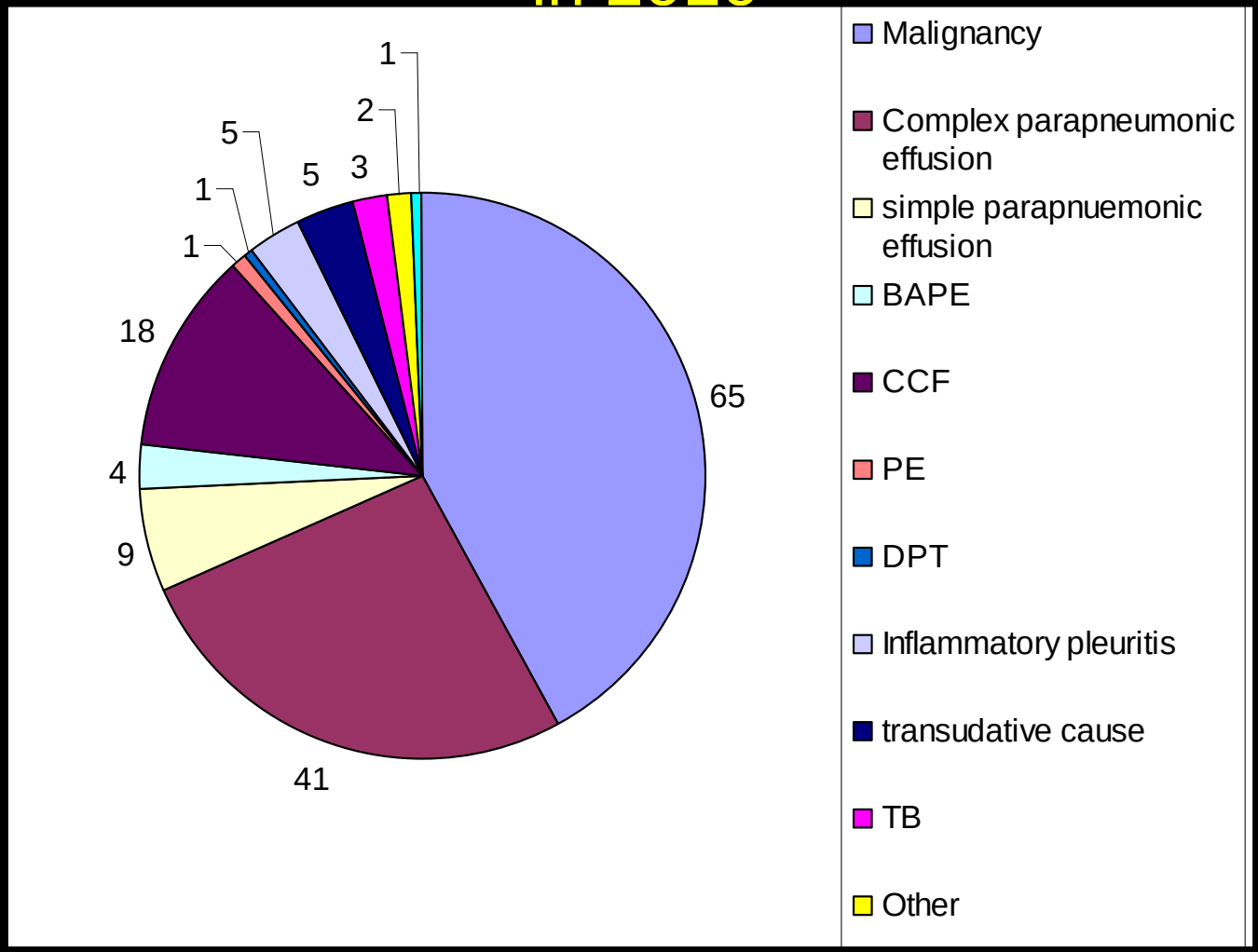
Seen at 9am next day
History and examination
Pleural US performed on all

Diagnostic +/- therapeutic tap of 1 litre

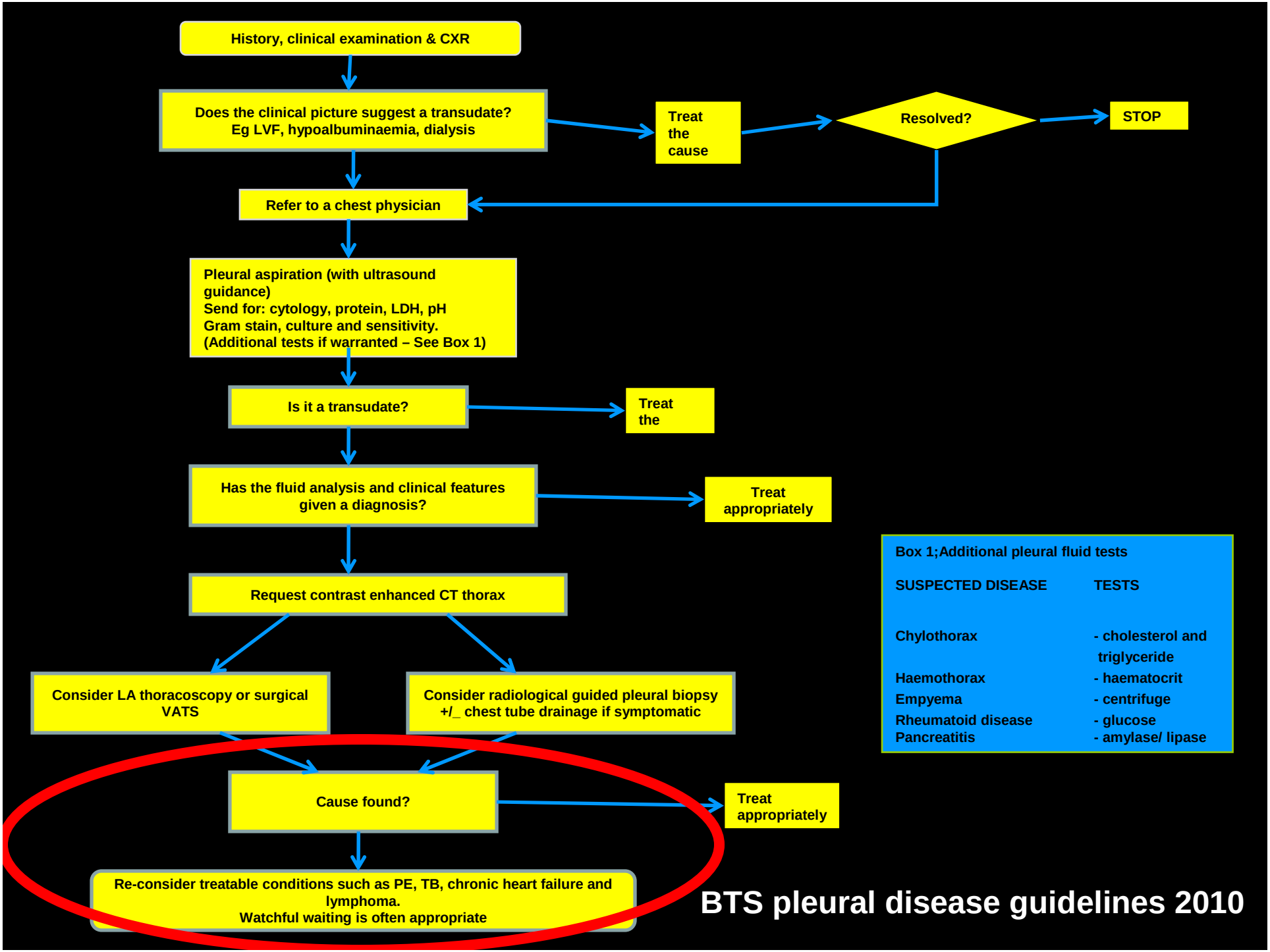
O/P CT thorax with pleural contrast within 7 days and review with results in weekly pleural clinic

Improving diagnostic pathways for pleural effusions

Primary diagnosis of 155 patients with undiagnosed effusions seen in the pleural service in 2010



NBT pleural investigation trial 2010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Pancreatitis
- amylase/ lipase
BTS pleural disease guidelines 2010

Thank you

Any questions?