Pleural Fluid Analysis

Mike Cadogan • Feb 23, 2023

A pleural effusion is a collection of fluid in the pleural space. Pleural effusion are the result of :

- Increased fluid accumulation
- Decreased lymphatic clearance of fluid
  - Obstruction to drainage
  - Increased venous pressure
- Pleural effusions are most commonly caused by CCF, Infection (pneumonia) and Malignancy
- Pleural Fluid may be examined by a pleural tap or thoracocentesis

Common causes

- **Exudate** (*local* disease) (High protein). Local factors influence the accumulation or clearance of fluid.
  - Malignancy – Lung, breast, pleural.
  - Infection – Pneumonia, empyema, pleuritis, viral disease
  - Autoimmune – Rheumatoid, SLE
  - Vascular – PTE
  - Cardiac – Pericarditis, CABG
  - Respiratory – Haemothorax, Chylothorax
  - Abdominal – Subphrenic abscess
- **Transudate** (systemic illness) (Low protein <30g). Imbalance between oncotic and hydrostatic pressures
  - Cardiac – CCF, PTE
  - Liver – Ascites, Cirrhosis
  - Renal – Glomerulonephritis, Nephrotic syndrome
  - Ovarian – Meigs syndrome

- Autoimmune – Sarcoid
- Thyroid – Myxoedema

Differentiation of exudate and transudate fluid

- Aims to identify local from systemic illness. Common causes can then be actively sought and treated
- Use Light's criteria is moderately sensitive for differentiation, further tests are then required to further define the exudate

Pleural fluid from thoracocentesis

Pleural fluid	Test indicated	Interpretation
Bloody	Haematocrit	Comparison to serum Haematocrit • <1% - non-significant • 1-20% - Cancer, PTE, trauma, pneumonia • >50% - Haemothorax
Cloudy or turbid	Triglycerides	>110mg/dL-chylothorax
Putrid odour	MCS	Possible anaerobic infection

Pleural fluid laboratory findings

- **Lights criteria** (High protein and LDH = exudate), determines presence of **exudate** with protein and LDH levels
  - Pleural fluid protein to serum protein ratio >0.5
  - Pleural fluid LDH to serum LDH ratio >0.6
  - Pleural fluid level >2/3 of upper value for serum LDH
- **Additional criteria –** Confirm exudate if results equivocal
  - Serum albumin – pleural fluid albumin <1.2g/dL

Further tests

If exudate is confirmed, further testing required to evaluate cause of exudate

- **Differential cell count** (predominance of white cells)
  - Neutrophils – PTE, pancreatitis, pneumonia, empyema
  - Lymphocytes – Cancer, TB pleuritis
  - Eosinophila – Pneumothorax, haemothorax, asbestosis, Churg-Strauss
  - Mononuclear cells – Chronic inflammatory process
- **Gram stain and culture and cytology**
  - Use blood culture bottles and specimen jars – especially if chronic illness or suspect TB or fungus
  - Cytology useful in cases of suspected malignancy
- **Glucose**
  - Low
    - Common: Infection (pneumonia) and malignancy
    - Rare: TB, haemothorax, Churg-Strauss
- **LDH level –** This is classically **high in exudates**
  - Repeated testing confirms continuation or cessation of process
    - Increasing LDH (ongoing inflammation)
    - Decreasing LDH (cessation of process)
- **Pleural fluid pH** (Low glucose and pH = infection or malignancy)
  - Taken if suspect pneumonic or malignant process (Low glucose)
  - <7.20 with pneumonia...Drain the fluid
  - <7.20 with malignancy ...Life expectancy 30 days
- **Amylase**
  - Useful if suspect pancreatitis as cause

References and Links

- CCC – Pleural effusion
- CCC – Pleural tap

CCC Differential Diagnosis Series	
NEURO	Anosmia, Ataxia, Blepharospasm, Bulbar and Pseudobulbar palsy, Central Pontine Myelinosis, Cerebellar Disease, Chorea, Cranial nerve lesions, Dementia, Dystonia, Exophthalmos, Eye trauma, Facial twitches, Fixed dilated pupil, Horner syndrome, Loss of

	vision, Meningism, Movement disorders, Optic disc abnormality, Parkinsonism, Peripheral neuropathy, Radiculopathy, Red eye, Retinal Haemorrhage, Seizures, Sudden severe headache, Tremor, Tunnel vision
RESP	Bronchial breath sounds, Bronchiectasis, High airway pressures, Massive haemoptysis, Sore throat, Tracheal displacement
CVS	Atrial Fibrillation, Bradycardia, Cardiac Failure, Chest Pain, Murmurs, Post-resuscitation syndrome, Pulseless Electrical Activity (PEA), Pulsus Paradoxus, Shock, Supraventricular tachycardia (SVT), Tachycardia, VT and VF, SVC Obstruction
GIT	Abdominal distension, Abdominal mass, Abdominal pain, Asterixis, Dysphagia, Hepatomegaly, Hepatosplenomegaly, Large bowel obstruction, Liver palpation abnormalities, Lower GI haemorrhage, Malabsorption, Medical causes of abdominal pain, Rectal mass, Small bowel obstruction, Upper GI Haemorrhage
GUT	Genital ulcers, Groin lump, Scrotal mass, Urine colour, Urine Odour, Urine transparency,
MSK	Arthritis, Shoulder pain, Wasting of the small muscles of the hand
DERM	Palmar erythema, Serious skin signs in sick patients, Thickened Tethered Skin, Leg ulcers, Skin Tumour, Acanthosis Nigricans
ENDO	Diabetes Insipidus, Diffuse Goitre, Gynaecomastia, Hirsutism, Hypoglycaemia, SIADH, Weight Loss
HAEM	Splenomegaly
PAEDS	Floppy infant
MISC	Anaphylaxis, Autoimmune associated diseases, Clubbing, Parotid Swelling, Splinter haemorrhages, Toxic agents and abnormal vitals, Toxicological causes of cardiac arrest
IMAGING	**CHEST:** Atelectasis, Hilar adenopathy, Hilar enlargement on CXR, Honeycomb lung, Increased interstitial markings, Mediastinal widening on mobile CXR, Pulmonary fibrosis, Pseudoinfiltrates on CXR, Pulmonary opacities on CXR, **ABDO:** Gas on abdominal X-ray, Kidney mass, **BRAIN:** Intracranial calcification, Intracranial structures with contrast, Ventriculomegaly, **OTHER:** Pseudofracture on X-Ray,
LABS	**LOW:** Anaemia, Hypocalcaemia, hypochloraemia, Hypomagnesaemia, **HIGH:** Bilirubin and Jaundice, Hyperammonaemia, Hypercalcaemia, Hyperchloraemia, Hyperkalaemia, Hypermagnesaemia, **ACID BASE:** Acid base disorders, Resp. acidosis, Resp. alkalosis, Creatinine, CRP, Dipstick Urinalysis, Laboratory Urinalysis, Liver function tests (LFTs), Pleural fluid analysis, Urea, Urea Creatinine Ratio, Uric acid, Urinalysis, Urine Electrolytes

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Critical Care

Compendium

...more CCC

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