The Weekly Probe

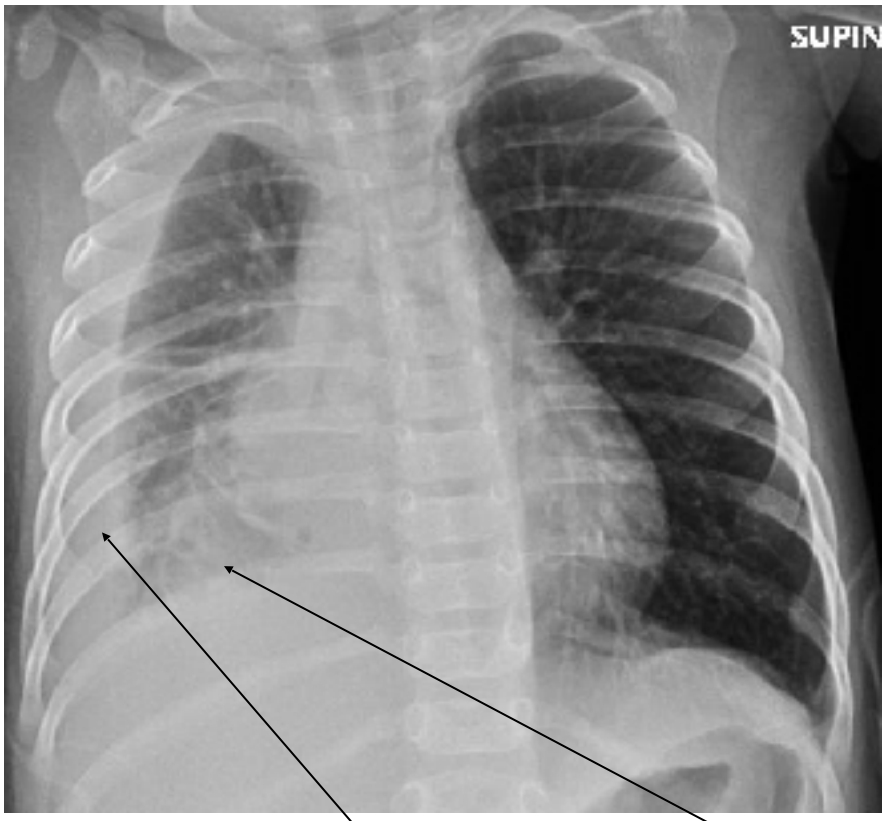
6th June 2017 **Volume 24 Issue 18**

Ultrasound Bookings- There are concerns raised with ED patients being booked for an US and then sent to the ward without letting MID know – last PM x 2 US booking slots lost because of this.
ED should let MID know if any booked case is being sent to the ward – a phone call to **DESK Rad on Ext: 38950** is all that is required prior to them leaving ED.

THIS WEEK

LAST WEEK'S CASE- PARAPNEUMONIC EFFUSIONS & EMPYEMA

A 6 month old girl presents with 1 day history of fevers and respiratory grunting. On exam T 37.9C sats 95% RA RR 55 – decreased AE right side – CXR below – WCC 15.5 Na 132 lactate 2.6



What is going on? **Effusion / empyema** **Consolidation**

The supine AP CXR shows an opacity with air bronchograms (which are difficult to see at this magnification) at the right base obscuring the right hemidiaphragm - this is consistent with a RLL pneumonia. However the most prominent finding is the opacity noted on the lateral aspect of the right

hemithorax consistent with pleural fluid or pus. In this case this would be either a parapneumonic effusion or an empyema.

Progress – she was initially given ceftriaxone, vancomycin and gentamicin in addition to high flow nasal oxygen. After being retrieved on CPAP she deteriorated further with opacification of the whole right hemithorax. After being intubated, an ultrasound confirmed pleural fluid and a drain was inserted. Pus was noted with culture consistent with the blood culture result of MRSA. Drainage of fluid was inconsistent and to break down the loculations, she received multiple doses of intrapleural urokinase. She was discharged home after ~ 2 weeks.

After another case the following week (2yo with strep pneumonia empyema complicating a confirmed RSV infection), it is worth discussing empyema. Adults and kids are obviously different beasts yet we've tried to combine the discussion to include both age groups.

Pneumonias develop through the aspiration, inhalation, direct inoculation or haematogenous spread of organisms. Depending on the location of the infection, the pleura may become inflamed with leakage of proteins, fluid, and leukocytes into the pleural space forming an effusion (ie an exudate). At the time of formation, the pleural effusion is usually sterile.

However bacteria may invade the fluid, resulting in empyema, defined as the presence of grossly purulent fluid in the pleural cavity. The development of pleural empyema is determined by a balance between host resistance, bacterial virulence, and timing of presentation for medical treatment.

This process may also result from infections in other adjacent areas (eg, retropharyngeal, vertebral, abdominal, and retroperitoneal spaces).

EPIDEMIOLOGY

KIDS - There is an increasing incidence of this complication of pneumonia - ~ 2-12 % of community-acquired pneumonia in Europe and US and in up to 28% of admissions. The increase largely attributable to the increase in staphylococcal and other non-strep empyemas, particularly in the 2-4 yo age group. This change may be partially related to the introduction of vaccination for strep pneumoniae.
Certain underlying diseases may increase the risk of empyema in children such as immune deficiencies yet 89% had no underlying illness or condition.

In terms of the adult population, anaerobic organisms are more commonly seen, which may be related to aspiration of oral flora. Note this aspiration may be gross (related to loss or airway reflexes, pharyngeal dysfunction etc) or microaspiration events related to decreased ciliary clearance secondary to smoking.

Organisms:

- S. pneumoniae is the most common pathogen causing para-pneumonic effusions and empyema in kids. In Australia the current recommendation for pneumococcal vaccine is the 10 or 13 valent vaccine at 2, 4 and 6 months then at 12-18 months. In those at risk a 23 – valent vaccine is suggested at pre-school age. Therefore some Strep subgroups are not covered.
- MRSA – increasingly common organism worldwide
- Anaerobic bacteria – more common in adults (~ 36- 75%) – Fusobacterium, Peptostreptococcus sp, and Bacteroides
- Other bacteria – Staph, group A Streptococcus (S. pyogenes), Pseudomonas, Actinomyces, Klebsiella (esp diabetics).
- Effusions may occur with mycoplasma and viral infections yet these rarely require Tx.
- Mixed aerobic and aerobic organisms may be isolated especially in adults.

Stages – initial exudative effusion is seen – this is followed by fibrinopurulent stage which may include loculations – this may be followed ~ 2-4 weeks later by a restrictive organisational stage with development of a restrictive "pleural peel".

PRESENTATION — The clinical presentation of the patient with parapneumonic effusion or empyema depends to the stage of the illness at the time of the illness.
In general, patients with pneumonia and uncomplicated parapneumonic effusion present earlier in the course of their pneumonia; those with empyema typically present later when bacteria from the untreated pneumonia have had time to colonize the pleural space. Infection with less virulent bacteria favours a later presentation; therefore, many empyemas complicate indolent anaerobic pneumonias (more commonly seen in adults), such as those following aspiration.

As this is a potential complication of pneumonia any patient who remains febrile or unwell 24-48 hours after initiation of antibiotic therapy for pneumonia should be reevaluated for potential complications with repeat examination and CXR

Symptoms may be suggestive of a pneumonia with infective, respiratory (fevers and cough in ~ 90%) or systemic features (fever, anorexia, wt loss). Chest pain may be reported in a verbal child or manifest by limited inspiration as in this patient. Some may lie on the affected side to splint the involved hemithorax and provide temporary analgesia.

Look for conditions that may expose the patient to recurrent serious bacterial infections such as immunodeficiency, sickle cell Dx etc

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On examination there is a spectrum of clinical appearances. Tachypnoea with limited inspiratory excursion may be noted. The patient may have a “new”scoliosis secondary to thoracic splinting, dullness to percussion, decreased AE, and possibly a pleural rub, on the side of the fluid collection. Dullness to percussion is a potential feature of lung consolidation from either pneumonia or pleural effusion and is thus not a useful discriminating physical finding. Although clinical findings are helpful when present, they are often absent so imaging is crucial to the complete evaluation.

CXR – Consider PA +/- lateral films looking for blunting of the costophrenic angle, opacification of the hemidiaphragm, a meniscus sign or scoliosis. Other information may be gleaned from the CXR including pneumonia, cardiomegaly, bone lesions, lymphadenopathy. An air fluid level is indicative of a concomitant PTx, gas forming organisms, a perforated viscus or a bronchopleural fistula. Note that the CXR appearance is often underestimates the siz e of the effusion / empyema. A decubitus film may help differentiate pleural thickening from fluid yet in this clinical context and when other imaging modalities are required (ie US) this adds little to the ED assessment. Most importantly the CXR alone also cannot differentiate empyema from parapneumonic effusion.

Ultrasound — this is user dependent yet ultrasound is useful in confirming the presence of fluid in the pleural space (especially when there is "white out" – it is also more sensitive than CXR in detecting the presence of an effusion), determining the nature of the effusion (including loculations or septations), quantifying the amount of effusion, and identifying optimal sites for thoracentesis or chest tube insertion.

CT – This is more relevant in adults. CT helps quantitate the size of the effusion / empyema, looks for an underlying causes or complications while contrast enhances visualization of the pleural surfaces and assists in delineating pleural fluid loculi. Pleura thickening may also be seen. These factors will help determine the treatment path.

Labs:

Other abnormalities seen may include:

- Blood culture - +ve in 10-22% with complicated effusions- note that some organisms, particularly anaerobic species, may be difficult to isolate by culture of fluid and/or blood
- Blood gases – reflective of systemic perfusion and respiratory compromise / compensation
- White cell count – does not differentiate between parapneumonic effusions and empyema
- Hyponatraemia from SIADH
- Hypoalbuminaemia
- Thrombocytosis- secondary to inflammatory state
- Pleural fluid analysis
    - Cultures +ve in < 25% - ? related to prior Abs- use blood culture bottles including anaerobic especially in adults
    - Cell count – more suggestive if neutrophils > 50, 000/ microL yet can be lower in early empyemas
    - Consider pneumococcal PCR
    - Pleural fluid pH (<7.2) , glucose (< 2.2) , lactate and LDH (> 1000) - often sent yet rarely alter management
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Treatment

Kids – considering the need for potential interventions as described below, a child needs to be transferred to a tertiary paediatric unit.

General

- Simple parapneumonic effusions (free flowing / not loculated) should be treated with antibiotics and drainage

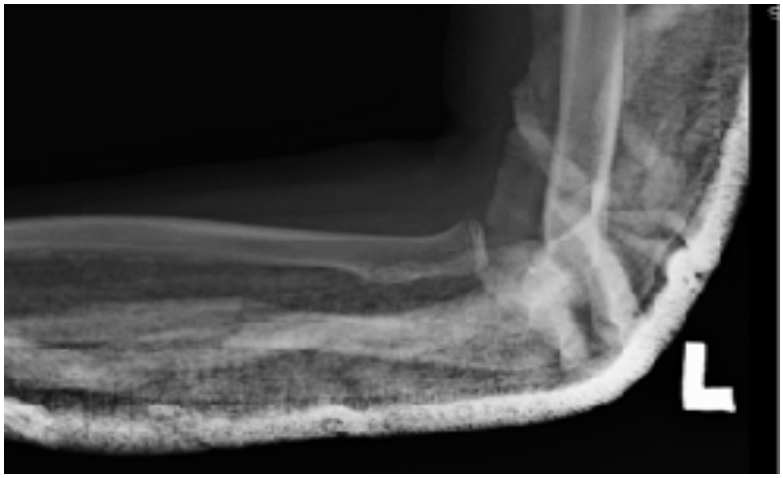
    - Antibiotic choice is dependent on suspected or cultured organism – IV followed by 2-4 weeks of oral once settled
    - ETG recommends empirical treatment of pleural infection complicating **community-acquired pneumonia**. They recommend:
        - Augmentin PO Bd or if if gram –ve organisms are not suspected then clindamycin
        - If orals aren't tolerated or if persistent fever post drain then use:
            - Tazocin or Timentin

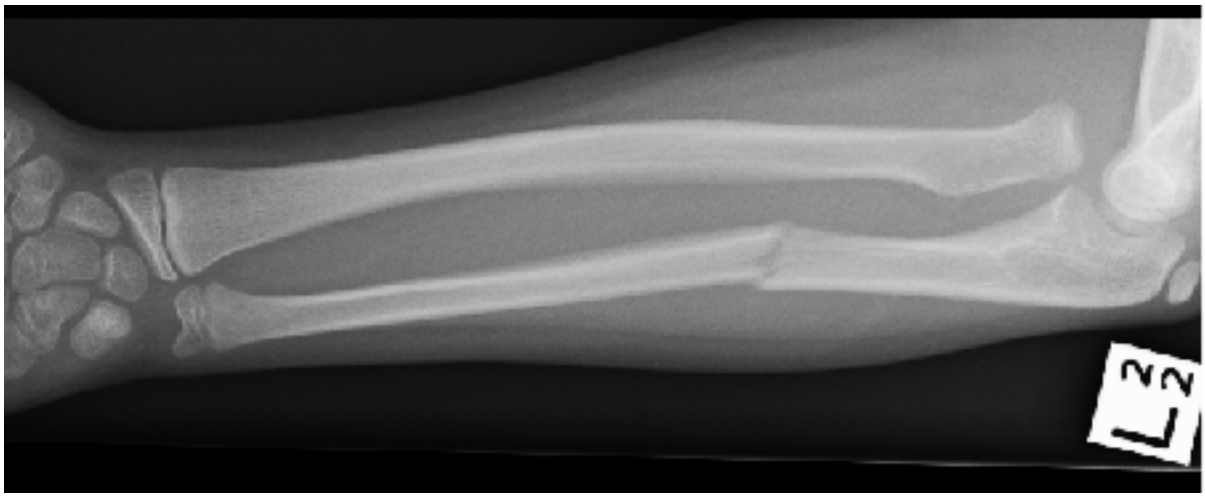
      (PS considering the rapidity of progression and potential prolonged course, consult early regarding early aggressive IV treatment)
    - For empirical treatment of pleural infection complicating **hospital-acquired pneumonia** is the same as for yet with the addition of coverage for MRSA

- Empyema / Complicated effusions – antibiotics plus chest drain and fibrinolysis, or early surgical drainage (video-assisted thoracoscopic surgery [VATS])
    - The purpose is to breakdown the loculations and optimise drainage of the empyema- often multiple treatments are provided (6 in this case) – urokinase is the agent most commonly used in Australia
    - Recombinant human DNase (dornase alfa) has been shown to reduce intrapleural pus viscosity and can be used with the fibrinolytic Tx – standard of care in Australasia

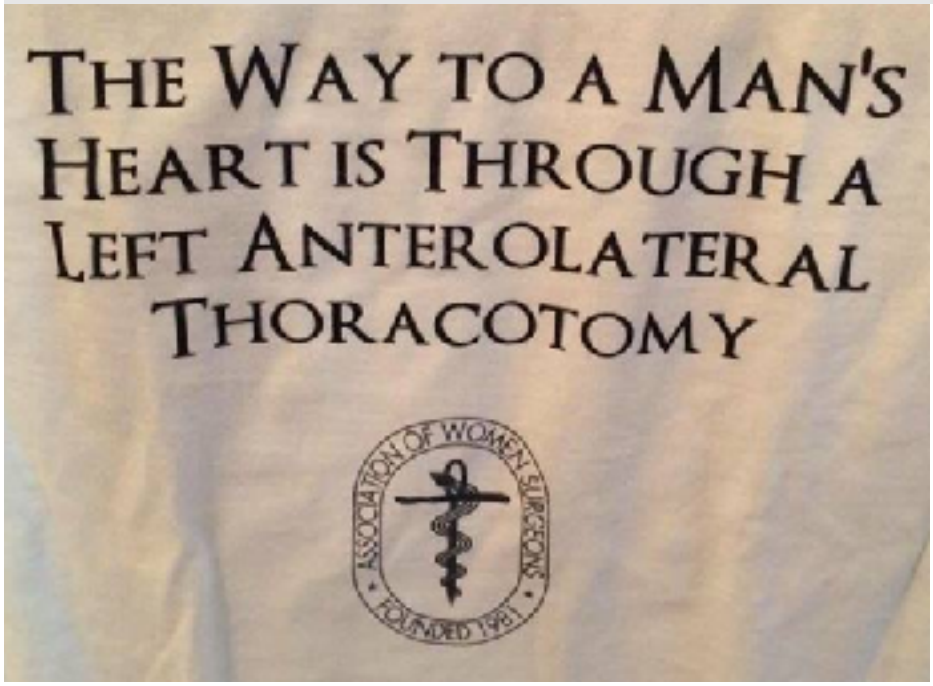
NEXT WEEK'S CASE

A 7yo girl presents with forearm pain post fall. Slab and home?





JOKE / QUOTE OF THE WEEK



Please forward any funny and litigious quotes you may hear on the floor (happy to publish names if you want)

THE WEEK AHEAD:

Thursday: JMO Education, midday in the Auditorium, Level 2
ECGs - Dr Nilshan Ariyarathna, Cardiology Advanced Trainee,

Editor: Peter Wyllie