Pneumonia

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1 In a patient who presents without the classic respiratory signs and symptoms (e.g., deterioration, delirium, abdominal pain), include pneumonia in the differential diagnosis.

Yes! As part of a delirium work-up I would always order a CXR to look for infection but also other things like pulmonary edema or pneumothorax. Lower lobe pneumonia can cause upper abdominal pain. People can also present with chest pain (usually pleuritic) and vague symptoms such as "feeling off". Keep pneumonia on your differential even if no cough or shortness of breath, it can present atypically!

2 In a patient with signs and symptoms of pneumonia, do not rule out the diagnosis on the basis of a normal chest X-ray film (e.g., consider dehydration, neutropenia, human immunodeficiency virus [HIV] infection).

Dehydrated Patients:

The closest study that looked at a similar question was from 2000 published in the journal of family medicine, and the first line in the abstract states, "Many clinicians believe the radiographic expression of community-acquired pneumonia (CAP) is affected by the fluid volume status of the patient. However, there are very few data to support or refute this concept." I'm not sure who these physicians are ??

The study actually looked at radiographical progression of pneumonia on CXR after admission to hospital and found worsening progression for patients that had a higher BUN (urea) and higher fluid volume administered in the first 48 hours. Can't say I'm overly convinced this a positive result, especially as they don't indicate how many patients initially had a "normal" chest Xray. Regardless, the college of family physicians wants you to be aware of this! (Study link) https://pubmed.ncbi.nlm.nih.gov/11032209/

Neutropenic patients:

Can be a challenging group to diagnose especially when they just present with a fever and no other symptoms. As respirologists we are frequently consulted for febrile neutropenic patients. If there is any doubt if the patient has pneumonia or you think they might and their CXR is negative, these patients often receive CT chest scans as they often present more atypically and can have non-bacterial causes of pneumonia, i.e. fungal or chemotherapy related pneumonitis. And in fact some studies have shown a wide-range anywhere from 10-30% of pneumonias not seen on CXR are then appreciated on CT (http://rimed.org/rimedicaljournal/2014/08/2014-08-20-cont-maughan.pdf)

HIV Positive Patients:

The situation is similar for people with HIV who may also present atypically and if immunocompromised may not mount a robust immune response which is also responsible for causing the infiltrates. Again, CT chest is extremely helpful, and the pattern of infiltration can also help you decide what type of infection the patient may have, if they don't present with the typical bacterial lobular pneumonia.

3 In a patient with a diagnosis of pneumonia, assess the risks for unusual pathogens (e.g., a history of tuberculosis, exposure to birds, travel, HIV infection, aspiration).

Not all pneumonia is what we usually think about in terms of community acquired with the lobular consolidation seen on imaging! Need to ask about other risk factors such as aspiration, TB exposures, travel exposures, and unusual/rare causes like chlamydia psittaci from birds (causes psittacosis). Its good to ask whether the patient has pets like parrots or cockatiels and also poultry like ducks and turkeys (very unlikely though, only about 10-20 cases per year in US of psittacosis).

HIV infection can also predispose people to infections like pneumonia so should think about this if people have severe or recurrent pneumonia with no apparent underlying cause/disease.

Always good to ask about travel and think about exposure to air conditioning towers in hotels or cruise ships which can habour bacteria that causes legionnaire's disease [Another interesting piece of history regarding the name!]. I usually ask if any other travelers or partners/roommates are also sick. Bacterial infections acquired outside of Canada might also have different resistance patterns/causes so might require different abx therefore, its good to know where they have travelled to.

Lastly, when thinking about aspiration I like to ask about risk factors including significant alcohol intake, seizure disorder, severe GERD, vomiting, dysphagia (?post stroke) and altered LOC.

4 In patients with pre-existing medical problems (e.g., asthma, diabetes, congestive heart failure) and a new diagnosis of pneumonia: a) Treat both problems concurrently (e.g., with prednisone plus antibiotics). b) Adjust the treatment plan for pneumonia, taking into account the concomitant medical problems (e.g., be aware of any drug interactions, such as that between warfarin [Coumadin] and antibiotics).

Of course treating the underlying infection is important but its also important to keep the patient's other medical conditions in mind. Do they also have COPD? Do they require steroids? Do they have asthma and are now in an exacerbation because of their infection and need to go up in their asthma action plan? Are they now in heart failure → Shout out to heart failure episode and causes of heart failure exacerbation.

Although less and less patients are on warfarin, its safe to assume there could be potential interactions. Its also important to consider the antibiotic itself and what specific side effects it may have, examples are:

- fluoroquinolones and increased risk of delirium and/or Achilles tendon rupture or
- macrolides and potential QT-prolongation and nausea/vomiting, and
- clindamycin putting patients at higher risk of Cdiff infection.

5 Identify patients, through history-taking, physical examination, and testing, who are at high risk for a complicated course of pneumonia and would benefit from hospitalization, even though clinically they may appear stable.

There are two prediction scores available, CURB65 which is pretty straightforward but ATS guidelines actually recommend using PSI/PORT score (more intensive) both available on MD Calc (great app by the way).

CURB65:

stands for – Confusion (Y/N), Urea > 7 mmol/L (Y/N), Respiratory rate >/= 30 (Y/N), blood pressure systolic <90 mmH or diastolic <60 mmHg (Y/N) and the 65 is if the patient is 65 years or older (Y/N). Each yes answer gets 1 point. You add up the points and it will predict the patient's 30-day mortality. 0-1 usually outpatient management, 2 outpatient with close follow-up vs inpatient, 3-6 is inpatient treatment with consideration of ICU stay. Score of 6 is associated with a 28% 30-day mortality.

PSI/PORT score:

The pneumonia severity index and includes 20 parameters with a maximum score of 350. It also predicts morality and suggests in vs outpatient treatment. This requires a lot of blood work, so might not be very practical assessment tool in the outpatient setting.

6 In the patient with pneumonia and early signs of respiratory distress, assess, and reassess periodically, the need for respiratory support (bilevel positive airway pressure, continuous positive airway pressure, intubation) (i.e., look for the need before decompensation occurs).

There is some controversy in the field as to whether hypoxic patients with pneumonia should receive continuous high flow oxygen through nasal canula vs continuous positive airway pressure/bilevel positive airway pressure support before needing intubation.

There was a study that looked at this, published in NEJM in 2015 called the FLORALI study that may support high flow oxygen over NIPPV. You can look this up if you are interested. Basically, if you think the patient needs supplemental oxygen, they should be sent to the ED for further assessment.

FLORALI STUDY - https://www.nejm.org/doi/10.1056/NEJMoa1503326?url_ver=Z39.88-2003&rfr_id=ori:rid:crossref.org&rfr_dat=cr_pub%20%200www.ncbi.nlm.nih.gov

7 For a patient with a confirmed diagnosis of pneumonia, make rational antibiotic choices (e.g., outpatient + healthy = first-line antibiotics; avoid the routine use of "big guns").

We want to choose antibiotics that will sufficiently cover the causative bacteria and provide the narrowest coverage. Basically, we don't want to drive resistance patterns in bacteria. In this case, it's a good idea to know what you are treating. The most common cause of CAP is streptococcus pneumoniae. Other causes include hemophilius influenzae, staph aureus, legionella, and mycoplasma pneumonaie. Thankfully, strep is a pretty wimping bug and doesn't need big guns to kill it.

According to the IDSA (infectious disease society of America) and ATS (American thoracic society) guidelines, healthy people without any other comorbid conditions or risk factors for weird and wonderful bugs, which we will get to, there are 3 options for treating CAP as an outpatient:

1) Amoxicillin 1 g TID
2) Doxycycline 100 mg BID
3) A macrolide (usually azithromycin) 500 mg daily 1, then 250 mg for the course

The amoxicillin is essentially treating the strep and h flu, but the other two have atypical coverage for things like mycoplasma. If you are unsure you can look at your local antibiogram to have an idea of local resistance patterns to ensure you are covering the top bacteria appropriately.

If patients have comorbid conditions like diabetes, heart failure, renal disease, lung disease or liver disease you want to step up your guns a little and use 1 of 2 options for outpatient management:

1. Macrolide or doxycycline + cephalosporin or amox-clav
2. Respiratory fluoroquinolone

Bacteria you want to be weary for would be MRSA and pseudomonas as the above won't cover them and the patient may require hospitalization for intravenous vancomycin or pip-tazo for example. Risk factors for this include prior antibiotic use in the last 3 months, high crowding environments (jails, shelters), recent hospitalization or health care environment, and known colonization with these bugs.

8 In a patient who is receiving treatment for pneumonia and is not responding: a)Revise the diagnosis (e.g., identify other or contributing causes, such as cancer, chronic obstructive pulmonary disease, or bronchospasm), consider atypical pathogens (e.g., Pneumocystis carinii,TB, and diagnose complications (e.g., empyema, pneumothorax). b) Modify the therapy appropriately (e.g., change antibiotics)

The patient should be improving if they are on the correct treatment for the right diagnosis. If things aren't improving, you need to reassess whether you have the right diagnosis (i.e. community acquired bacterial pneumonia) or whether you might have something atypical. PCP or PJP (what do we call it nowadays!?!) also known as pneumocystis carinii (OLD) or pneumocystis jirovecii is a fungal organism that is known for causing pneumonia in immunocompromised patients and should be on your differential for patients not improving who keep getting worse! Also, TB is an important one not to miss especially for the public health implications and need to isolate. Sometimes patients can present with post-obstructive pneumonia and may have an underlying mass/cancer driving the infection.

Its good to know what the complications for untreated pneumonia are which includes necrotizing pneumonia, empyema (pus in the pleural space), and potentially pneumothorax. These conditions might require a chest tube and intravenous antibiotics, so if this is occurring would highly recommend either an ED visit for further assessment or referral to respirology!

9 Identify patients (e.g., the elderly, nursing home residents, debilitated patients) who would benefit from immunization or other treatments (e.g., flu vaccine, Pneumovax, ribavarine) to reduce the incidence of pneumonia.

Respirology has 4 types of vaccinations we recommend

- Covid19,
- seasonal influenza,
- pneumococcal, and now, excitingly
- RSV!

The guidelines recommend anyone above 6 months of age can receive both the Covid19 and influzena vaccine. We are currently recommending repeat Covid19 vaccine 6 months after last vaccine, or 6 months after contracting covid19. Influzena is yearly, around October/November.

For pneumoncoccal vaccine, Currently there are two main/common types of pneumococcal vaccines – -

1. the polysaccharide vaccine called pneumovax 23 which covers 23 serotypes of strep pneumo and the
2. conjugate vaccine called Prevnar 20 which covers 20 serotypes of strep pneumo.

The difference is the conjugate vaccine induces a strong immune response and is therefore likely to last longer and provide a more robust antibody response, whereas the polysaccharide coverage for immunity tends to wane after 5-10 years. Currently, the government of Canada recommends all people regardless of health status above the age of 65 receive x1 pneumococcal vaccination. Pneumovax 23 is currently covered by the government whereas, at least in Ontario, Prevnar 20 isn't. It will cost patients approx. $150 out of pocket cost to receive Prevnar.

For RSV vaccine, sadly as of 2023 it is not covered by the government unfortunately and costs around $200-300 however, we are recommending it for our at risk patients which include those with COPD, asthma, bronchiectasis, etc … basically any lung condition.

Other treatments for non-bacterial pneumonia include – Paxlovid for patients diagnosed with Covid19 and symptom onset within the past 5 days, Tamiflu for patients diagnosed with influzena A or B with symptoms in the past 2 days, and lastly, you can use ribavarine for treatment of RSV. Traditionally it is a treatment for Hep C and the only place I ever saw use this was Toronto because apparently it is $$$ and not easily accessible for RSV specific treatment, and it was only to treat a patient who also had HIV and was presumed to be immunocompromised.

10 In patients with a diagnosis of pneumonia, ensure appropriate follow-up care (e.g., patient education, repeat chest X-ray examination, instructions to return if the condition worsens)

If you think the patient can get away with avoiding hospitalization, it would be a good idea to ensure the patient has proper supports at home and is aware of when to seek out medical attention for reassessment. In the era of covid19 some people have bought pulse oximeters so you can encourage them to check their oxygen levels and if they become hypoxic, confused, run into breathing issues, or are very weak, they will likely need to be reassessed and potentially be admitted to hospital.

There is some controversy on when and if a repeat CXR or CT chest is necessary. As we know, imaging data can significantly lag behind clinical resolution. Apparently, they used to recommend repeat CXR after improvement from pnuemonia to ensure there was no evidence of underlying malignancy leading to the pneumonia. In general, patients should have radiographical resolution in 2 (50% of patients)-4 (75% of patients) weeks. Risk factors for needing longer time for radiographical resolution - smoker, older, severe PNA. I checked "Choosing Wisely Canada" but they don't make a specific mention of whether to repeat CXR or not, but do state it shouldn't be used as a screening tool in otherwise healthy patients. I would say, use clinical judgement in this regard.

11 In patients with a confirmed diagnosis of pneumonia, arrange contact tracing when appropriate (e.g., in those with TB, nursing home residents, those with legionnaires' disease).

If you identify a causative agent for the pneumonia, would do a double-check in your mind to determine if it needs to be reported to public health or not. You can search online for your provincial or territory health service and see a list of reportable communicable diseases. The list is quite long but does include the things you would expect - any large institutional outbreak of respiratory illness, tuberculosis, legionellosis as well as weird and wonderful things like tuleremia and Q-fever.

That's a wrap!